

# Finland 2024 H1 benchmarking drive test campaign results

SERVICE RELIABILITY

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## 1. Summary

### Overview

Commsquare measured the Service Reliability of voice and data services of the Mobile Radio networks in Finland, by means of a comparative drive testing campaign.

### Campaign Data

The benchmarking campaign took place between 29/05/2024 and 25/06/2024 in 6 major cities and 35 selected smaller towns; all major roads across Finland were also covered. A total distance of 14,200 km was driven reaching above 70% of the population.

### Conformance

Commsquare conforms with international standards (ETSI TS 102 250 series, ETSI TR 103 559) and follows industry best practices in measurements execution, post processing, analysis, scoring and reporting, ensuring the reliability of the produced results.

### Methodology

Commsquare executed dedicated measurements while driving outdoors with a Samsung Galaxy S23 Plus phone, using for each operator in Finland commercial subscriptions that offered the highest available “promised” Quality of Service profile.

Voice tests concerned mobile-to-mobile calls between 2 cars. Apart from calls in VoLTE preferred mode, the campaign also included WhatsApp and MS Teams calls.

Data tests were performed in 5G/NSA preferred mode and concerned: downlink and uplink file transfers and throughput speed tests; eGaming simulation; web browsing using a selection of 6 popular web pages; on-demand and live YouTube streaming; and WhatsApp messaging.

### Results

Elisa achieved the highest Blended Reliability Score among competitors with 961 points out of 1000, in a market where all three operators offer top class Service Reliability with scores above 950 points.

### Disclaimer

Please note that the results and conclusions of this study concern the snapshot of mobile network performance in Finland in May-June 2024 and are valid within the conventions and limitations of the methodology applied.

We reserve the right to amend errors. The results in this document cannot be used for publication without prior approval by the Managing Director of Commsquare.

## 2. Commsquare company information

Commsquare offers expert services, which include independent network benchmarks; end-to-end network audits & root cause analysis and 5G & technology validation.

Commsquare also offers managed services to complement the local teams of mobile network operators or run a complete remote or hybrid team for them in radio planning, optimisation, quality assurance or benchmarking.

In Commsquare Product's line, DataMon, a passive monitoring solution for network and service assurance, is highly efficient on required resources and supports open interfaces and DAP, an active test solution, implements a smart test schedule to detect network issues before they impact mobile network operators' customers.

Founded in 2002 Commsquare has a team of 80 employees, mainly software and telecoms engineers, hosted in our headquarters in Mechelen, Belgium and our offices in Athens, Greece and Amman, Jordan.

## 3. Introduction

Commsquare has measured Service Reliability of the three mobile network in Finland, in the scope of a country wide benchmarking drive test campaign.

This report contains the results, explains the methodology and gives an overview of the Finland 2024 measurements campaign on customer experience.

## 4. Campaign methodology

The purpose of the mobile benchmarking exercise is to understand what customers experience when they watch a video, visit a website, download a file, or make a phone call on a mobile network, using a 5G smartphone.

### 4.1. Drive tests information

The campaign was conducted between 29/May/2024 and 25/June/2024 and included drive tests. The measurements were performed by driving 2 identical cars with Rohde & Schwarz equipment. Smartphones were installed in car on phone-mounting-wall in the back seats, such that the measurements represent in-car and indoor performance (i.e. as experienced by a user in a building or house, close to a window). Over 260 hours of drive tests were conducted.

### 4.2. Geographical scope and locations

Commsquare selected the cities and towns to be measured, based on their importance, population and the country landscape and characteristics. The input for the selection was based on Finland's national statistical institute.

A total distance of roughly 14,200 km was driven during the tests; over 3,900 voice calls were made on each network; and over 6,000 data tests were conducted per test type and network operator.

Approximately 29% of the measurements were conducted in cities, whereas 28% were conducted in towns and the remaining 43% on connecting roads.

The testing was carried out in areas inhabited by more than four million inhabitants, reaching above 70% of the population.

The detailed geographical scope as well as the list of cities and towns can be found below:



Category	List
City	Helsinki*, Tampere*, Turku*, Oulu, Jyväskylä, Kuopio
Town	Lahti, Pori, Kouvola, Joensuu, Lappeenranta, Vaasa, Hämeenlinna, Seinäjoki, Rovaniemi, Mikkeli, Porvoo, Salo, Kotka, Kokkola, Hyvinkää, Järvenpää, Lohja, Nurmijärvi, Kirkkonummi, Rauma, Kerava, Kajaani, Vihti, Riihimäki, Imatra, Lempäälä, Raahe, Sastamala, Hollola, Siilinjärvi, Tornio, Mäntsälä, Valkeakoski, Lieto, Iisalmi, Hyrylä, Kemi, Ekenäs+Hanko, Sodankylä, Nikkilä

*\*Helsinki: downtown, Vantaa, Espoo and East Helsinki areas*

*\*Tampere: Tampere, Nokia, Ylöjärvi, Kangasala, Pirkkala*

*\*Turku: Turku, Kaarina, Raisio, Naantali*

### 4.3. Voice telephony tests

The Samsung Galaxy S23 Plus on Android 14 was used for the voice tests; 6 devices in total – 3 per car. The voice calls were made between phones of the same mobile network operator placed in each car, i.e. a phone in the first car calling the phone in the second car.

To evaluate customer experience, modern voice calling applications were tested in addition to the traditional voice calls over VoLTE. The voice sequence which was applied consisted of: VoLTE – VoLTE – WhatsApp – VoLTE – VoLTE – MSTeams.

A new voice call was made every 2 minutes: the call duration was 90 sec, with a 30s pause between test calls. During the call, the phones could make unrestricted and non-user-initiated data activity, as is typically the case for a smartphone.

### 4.4. Data tests

The Samsung Galaxy S23 Plus was used for tests in 5G-preferred-mode; 6 devices in total – 3 per car. This means the phone tries to use the 5G in parallel with an existing 4G connection, but in its absence, continues service on the 4G, 3G or 2G data network.

The data tests included a series of different tests: throughput speed tests in downlink and uplink (conducted as a down- or upload during 7s); a file transfer of 10MB in download and 5MB in upload; eGaming simulation using Interactivity test; a selection of 6 popular web pages in the web browsing tests; three YouTube streaming videos (two on-demand and one live streaming), each one with 45s duration; and a WhatsApp messaging test.

### 4.5. SIM subscriptions

Commercial subscriptions for each operator in Finland were used, that offered the highest available “promised” Quality of Service profile, at the time of this study. The exact SIM subscriptions are listed below:

- Elisa 5G+ Premium (<https://elisa.fi/kauppa/puhelinliittymat>)
- Telia Unlimited 5G 1000M (<https://kauppa.telia.fi/yksityisille/tuotteet/puhelinliittymat.aspx>)
- DNA Unlimited 5G 1000M (<https://www.dna.fi/5g/puhelinliittymat>)

### 4.6. 5G information

#### **5G smartphone for testing**

The mobile network benchmark was conducted with 5G-capable phones. Measurements in 2024 use the Samsung Galaxy S23 Plus smartphone model for both voice and data tests, running on Android 14. This is a recent and popular 5G smartphone offered by all 3 mobile network operators.

#### **5G technology**

All 3 Finnish operators offer 5G in Non-Stand-Alone mode (5G/NSA) to the general public. For data tests, this means that 5G-capable phones will firstly connect to the 4G network, and optionally and in parallel connect to 5G, if it is locally available.

This approach allows operators to already offer some of the benefits of 5G in a gradual way, in areas with combined 4G-5G coverage. The main benefits of 5G (NSA mode) are increased capacity and performance, which mainly comes with the roll-out of 3.5 GHz spectrum.

Soon, 5G is expected to evolve to Stand-Alone mode (5G/SA), whereby mobile phones will connect directly to the 5G network, without relying on a parallel 4G connection. This 5G/SA mode will lead to further performance improvements, for instance faster response times.

### **5G service indicator versus 5G performance**

Operators follow different strategies when deploying 5G. One approach for operators is to assign new spectrum to 5G. If the bandwidth of the new spectrum is significant, as is the case for the new 3.5GHz frequency band, this will result in major performance improvements especially in download applications. All operators in Finland adopt this approach; more than 70% of data tests usage on the new 3.5GHz spectrum is observed on all networks.

Another or a complementary approach is to shift a limited amount of spectrum from an existing radio technology (e.g., 4G) to 5G, to provide contiguous 5G coverage or improved performance in upload applications. The mobile phone will indicate “5G” service, but the performance gain for download applications compared to 4G will be small. The mobile networks have adopted different strategies in this complementary approach.

As a result of the different 5G deployment strategies, the 5G indicator on your mobile phone may result in either substantial or small performance gains, in either download or upload applications. The true indicator of 5G is rather in running a performance test.

### **4.7. Conformance details**

Commsquare is a member of the European Telecommunications Standards Institute (ETSI), actively participating in Speech and multimedia Transmission Quality Mobile committee (STQm).

Commsquare conforms with and applies the recommendations and standards by ETSI and additionally brings its 15 years of expertise in conducting benchmarking measurements of mobile networks.

For the Key Performance Indicators (KPIs) Commsquare conforms with the ETSI TS 102 250 series (“QoS aspects for popular services in mobile networks”), whereas for the scoring Commsquare applies the ETSI TR 103 559 (“Best practices for robust network QoS benchmark testing and scoring”).

Additionally, Commsquare follows industry best practices in the field of measurements execution, validation of the measurements, post processing, analysis and reporting.

### **4.8. Results reliability & statistical significance**

When comparing mobile networks, through benchmark metrics and scoring means, it is important that the statistical significance of the outcome is considered. In general, the larger the sample set the less the uncertainty of the results, and the better representation of the population distribution of measurement results. Therefore, it is necessary that the sample set is selected to include samples from the various different environments that exist for the overall population.

In this study, like in other similar studies, Commsquare followed the industry best practices and collected more than 1,000 samples per test and network, well spread within Finland, which is considered a representative for the population distribution of the measurement results.

### **4.9. Known limitations**

The approach follows industry best practices as well as the relevant technical recommendations on mobile network benchmarking, but nevertheless has some inherent known limitations.

The results in this report are a snapshot of mobile network performance measured in Finland in May-June 2024. Mobile networks evolve and undergo changes, which might lead to different performance in the future.

All tests are conducted whilst driving a car. This is a best-practice approach to conduct tests across an entire country. However, most mobile users use their phone in static conditions, i.e. when not moving. It is generally assumed the average static user experiences better performance than a moving user in the same radio conditions.

The test setup measures customer experience in indoor conditions, e.g. for a user in a building close to the window or seating in a train next to the window. When using a mobile phone in deep-indoor locations (e.g. indoors far away from a window, in highly insulated houses, or concrete buildings or in basements), performance will be worse.

Tests were conducted using high-end smartphones running on one of the newest Android operating system versions. As mobile phones themselves impact user experience, users with older or less-advanced phone models or with a different operating system might experience a different performance.

The tests were conducted with 5G-capable phones. Users with smartphones not supporting 5G yet, will experience a different performance.

Users with phones not supporting VoLTE yet, or with SIM cards without VoLTE provisioned, will experience worse voice quality.

The results for voice are based on test calls with a duration of 90 seconds. Mobile phone users making calls with a (much) longer duration, especially when driving or in a train, will eventually experience worse performance, such as temporary poor speech quality issues or more dropped calls.



## 5. Scoring Principles

### 5.1. Blended Reliability Score

An assessment of the reliability of the networks can be achieved by taking a deeper look into the success rate KPIs. Based on the methodology specified in ETSI TR 103 559 (*“Best practices for robust network QoS benchmark testing and scoring”*), Commsquare applies a blended reliability score, using as input the following success rate KPIs:

#### Voice reliability KPIs

- Call Setup Success Ratio (CSSR): answers the question “Can I make a call?” in other words, “is my call connected after I pressed the dial button”?
- Call Drop Ratio (CDR): answers the question “Can I complete a call without a drop?” (expressed as Call Completion Ratio = 100% - Call Drop Ratio)
  - Note Completion Ratio depends on call duration, which is 90s in the case of our tests.

#### Data reliability KPIs

- HTTP Transfer Download Success Ratio: answers the question “Can I download a file?”
- HTTP Transfer Upload Success Ratio: answers the question “Can I upload a file?”
- Video Streaming Success Ratio: answers the question “Can I complete the playout of a streaming video?”
- Web Browsing Success Ratio: answers the question “Can I load a web page?”
- Latency Interactivity Success Ratio: answers the question “Can I make an interactive service like a live video game?”
- Social Media Success Ratio: answers the question “Can I send a social media message?”

Combining the above KPIs, representative of how easily a customer can initiate and maintain voice and data services, the Blended Reliability Score is calculated as a measure of the fundamental performance a mobile network offers to its subscribers.

### 5.2. KPIs Scoring weights

The data collected in the benchmarking are aggregated individually and then weighted and further aggregated for each application like telephony, video and data services.

The application fields are then in turn weighted and aggregated over the different areas where the data is collected. Finally, calculation of the overall Blended Reliability Score is performed.

In this study, the voice service KPIs weight that was applied was 40%, whereas the data one was 60%. The table below contains the weights per individual KPI used for the Blended Reliability Score:

Category	KPI	Weight in voice/data	Weight
Voice	Call setup success ratio (CSSR)	50%	40%
	Call drop ratio (CDR)	50%	
HTTP Transfers	HTTP DL success ratio	20%	60%
	HTTP UL success ratio	10%	
Video streaming	Video success ratio	25%	
HTTP Browsing	Browsing success ratio	25%	
Latency - Interactivity	Interactivity success ratio	10%	
Social Media	Social media success ratio	10%	

### 5.3. Geographical scoring

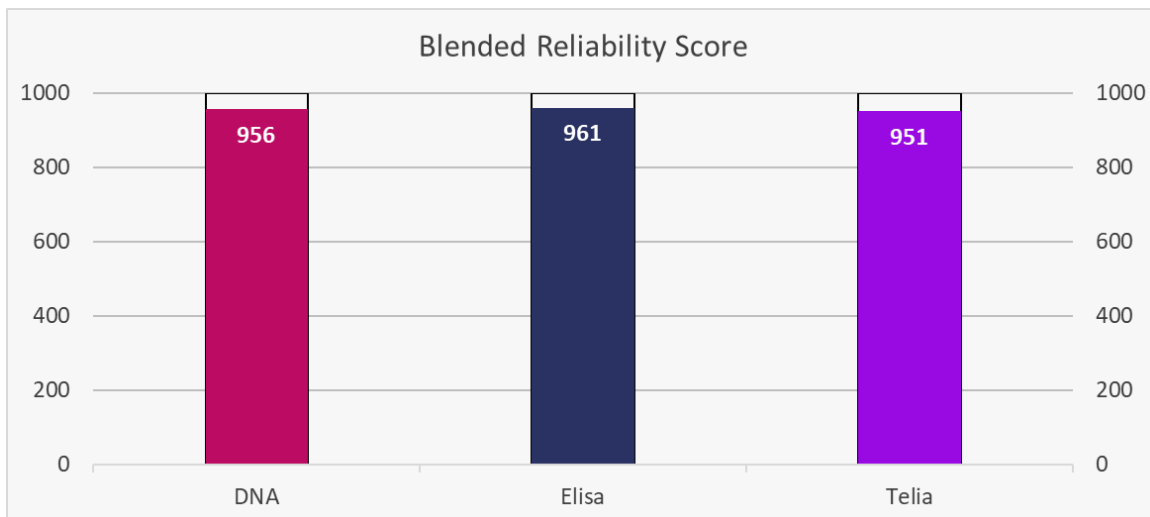
The geographical and topological properties of Finland were considered in this study. Due to the long distances needed to reach the whole geographical extend of Finland, the time spent on roads was disproportional to the population of the non-urban areas traversed. Hence, the following geographical weights have been applied for the 3 geographical categories:

- Cities 40%
- Towns 30%
- Roads 30%

This methodology follows the ETSI TR 103 559, where geographical weighting is recommended to consider the population distribution in a more representative manner.

## 6. Campaign Scoring Results

The graph below contains the Blended Reliability Score calculated for the Campaign.



Considering Voice and Data Reliability, Elisa achieves the highest Blended Reliability Score among competitors with 961 points out of 1000.

## 7. Conclusions

In the benchmarking measurement campaign Commsquare conducted in 2024 in Finland, Elisa achieved the highest Blended Reliability Score, with 5 and 10 scoring points ahead of DNA and Telia respectively.

This means that Elisa offers the highest probability of successfully initiating and maintaining a service.

It should be noted that with all three Finnish operators scoring above 950 points, the offered Service Reliability in the Finnish market can be considered top class.