

CERTIFICATE

ROHDE & SCHWARZ

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Rohde & Schwarz SwissQual AG, as the issuer of this document, certifies that



Bell
5099 Creekbank Rd, Mississauga, ON
L4W 5N2

attained the

Best 5G Network Performance Score

for Canada, assessed during the 2021 mobile network benchmarking campaign from April 20 to October 22, 2021.

We congratulate **Bell** for ranking first with a score of

859 out of 1000 points on the Rohde & Schwarz Network Performance Score in line with ETSI TR 103 559.

- Network Performance Score for voice service: 357 out of 400
- Network Performance Score for data service: 502 out of 600

Hanspeter Bobst

CEO Rohde & Schwarz SwissQual AG



Link to benchmarking
campaign details



Scoring methodology in
line with ETSI TR 103 559

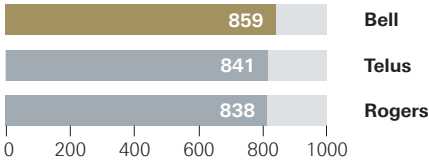


NETWORK PERFORMANCE SCORE

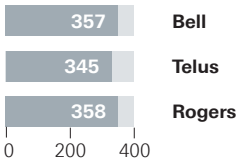
Rohde & Schwarz SwissQual AG performed a mobile network benchmarking campaign assessing the quality and performance of Canada's leading mobile operators. The drive-test based data collection campaign was implemented from April 20 to October 22, 2021 and covered Canada's major cities.

During this mobile network benchmarking campaign, over 50,000 voice calls and over 680,000 individual data service tests were performed to calculate a Network Performance Score in line with ETSI TR 103 559.

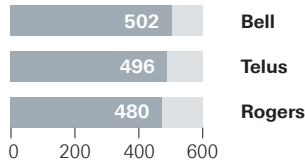
Network Performance Score



Voice Service Score



Data Service Score





Measurement campaign overview

- ▶ **Driven kilometers:** 95,000 km (ca. 59,000 mi)
- ▶ **Time period:** April 20 to October 22, 2021
independently selected by Rohde & Schwarz SwissQual AG
- ▶ **Test routes:** Covering >70 % of Canadian population,
routes selected independently by Rohde & Schwarz SwissQual AG
based on population and population density
- ▶ **Network operators:** Bell, Rogers, Telus

MEASUREMENT CAMPAIGN METHODOLOGY

Rohde & Schwarz SwissQual AG applied a fully transparent, harmonized and end-user centric scoring methodology as described in ETSI TR 103 559 and calculates a single overall Network Performance Score in line with this integrative methodology.

The scoring methodology includes essential aspects of popular mobile services and the resulting Network Performance Score reflects user's perceived performance of a mobile network in daily use regardless of the available technologies. The overall Network Performance Score is an aggregation of rated service performance over different regions covered by mobile networks with a state-of-art mobile phone.

- ▶ Data collection and analysis follows established standards and rules as defined in ETSI and ITU-T.
- ▶ The performance assessment uses tests of popular services in mobile networks, such as voice telephony, data transfer, video and app-specific services.
- ▶ The applied methodology provides insights into dedicated service classes and individual KPIs as well as for individual pre-defined geographical or morphologic categories.
- ▶ The entire measurement campaign used state-of-the art smartphones supported by all operators in Canada.
- ▶ Data collection and analysis used Rohde & Schwarz SwissQual AG de-facto industry standard benchmarking equipment that supports the Network Performance Score methodology.
- ▶ All measurements were performed in 5G/4G preferred mode.

MEASUREMENT CAMPAIGN CONFIGURATION AND SETUP

VOICE SERVICE TESTING

Measurement device used for voice telephony testing: Samsung S21+ 5G



- ▶ Mobile-to-mobile voice calls between two smartphones, VoLTE enabled
- ▶ Call length 120s in line with ETSI TS 102 250-2 and TR 102 506
- ▶ Alternating speech transmission in both directions using a speech sample in line with ETSI TR 103 138 and defined in ITU-T P.501 Annex D
- ▶ Speech Quality measurement in line with ITU-T P.863 POLQA v3
- ▶ Success, setup time and speech quality evaluated in line with ITU-T E.804.1

DATA SERVICE TESTING

Measurement device used for data service testing: Samsung S21+ 5G



Data transfer

- ▶ Successful upload and download of data files to a local cloud server (2MB upload and 5MB download)
- ▶ Maximal bitrate measurements in upload and download



Video streaming

- ▶ YouTube streaming test in line with ETSI TR 101 578 and ITU-T E.804.1
- ▶ Receiving video on demand and live streams for 60s
- ▶ Video Quality measurement in line with ITU-T J.343.1
- ▶ Success, access time and video quality evaluated



Web Browsing

- ▶ Accessing and retrieving different websites
- ▶ Testing of locally popular dynamic sites in different sizes
- ▶ Time for complete download
- ▶ In line with ITU-T E.804.1, success and download time evaluated



Post to Internet / Social Media

- ▶ Uploading data content (images) to WhatsApp / DropBox (1MB size)
- ▶ In line with ITU-T E.804.1, success and transfer time evaluated

About Rohde & Schwarz SwissQual AG

Together with teams from the global Rohde & Schwarz group of companies, our employees in the Swiss Rohde & Schwarz SwissQual AG subsidiary develop and market integrated solutions and managed services to test and improve the quality and performance of mobile networks.

Our experts for global benchmarking campaigns plan and run large-scale optimization and benchmarking campaigns and empower customers to make QoE centric business decisions with confidence, to deliver better services with higher quality for their end users, to reduce time to market for new technologies and services and to safeguard and increase the value of their business.

For more information about Rohde&Schwarz products visit:

www.rohde-schwarz.com/mnt

For more information about mobile network testing managed services visit:

www.rohde-schwarz.com/mnt/managed-services

Contact

Rohde & Schwarz SwissQual AG
Riverside Business Park
Allmendweg 8
CH-4528 Zuchwil
Switzerland

Tel +41 32 686 65 65
sq-info@rohde-schwarz.com

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Bell sponsored an independent evaluation of its mobile network performance that was conducted by Rohde & Schwarz SwissQual AG. Bell was ranked with the leading performance score in Canada based on ETSI approved methodology.