# Internet speed measurements in the gigabit range

| | |
|---|---|
| **Document-ID** | Speedtest |
| **Version** | 1.0 |
| **Status** | Final |
| **Publishing date** | 05.2018 |

swisscom

# Content

# Speedtest with G/bit Speed

## 1.1 Need

You would like to measure the speed of your internet connection in the range of one Gbit / s.

## 1.2 Description

The speed test measures d the speed end-to-end between your computer through your network to a reference system on the Internet. The analysis of speed test measurement data makes it possible to make a statement on the performance of the Internet connection operated by Swisscom.
With the free-of-charge Speedtest program of the independent company cnlab information technolgy AG (www.cnlab.ch), upload and download speeds, as well as response times from one's own device to reference systems can be tested on the Internet. For each measurement, further details can be called up via the UserID, which is displayed on the top right of the user interface, such as the network interface used for the measurement (WLAN, Ethernet) or observed packet losses during the measurement.

## 1.3 Prerequisite/Restrictions

Prerequisites:

- The router is switched on and the power LED is white

- Further points required for the speed test can be found in the subchapter 1.5 Checklist for the speed test

Einschränkungen:

- Swisscom does not guarantee a minimum bandwidth. The specified transmission speeds are the best possible and cannot be guaranteed. Detailed information can be found in the Special Conditions Internet.

## 1.4 Carry out a Speedtest

The "CNLAB" applications can be downloaded at https://www.cnlab.ch/speedtest/.

### 1.4.1 CNLAB Speedtest

In order to guarantee test results that are as trouble-free as possible, Swisscom has made available a dedicated test server.
In the application, go to settings, reference system and set manually the reference system filter to Swisscom or IP-Plus.

1. Measure Internet Speed up to 1Gbit/s : 1 Swisscom

2. Measure Internet Speed using a **fix IP Adress** : 2 IP-Plus
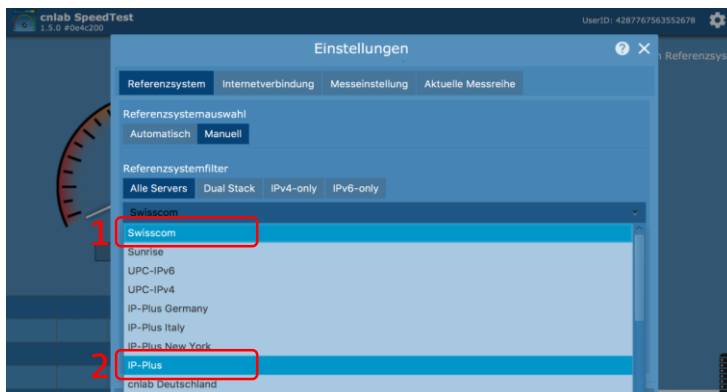


### 1.4.2 TCP Settings

The CNLAB Speedtest has 4 download streams and 2 upload streams as standard. Depending on the test device or connection type, it may be useful to perform measurements with only one and with 8 parallel download streams. More detailed information about the TCP streams can be found under "1.6.8 Response times and packet losses".
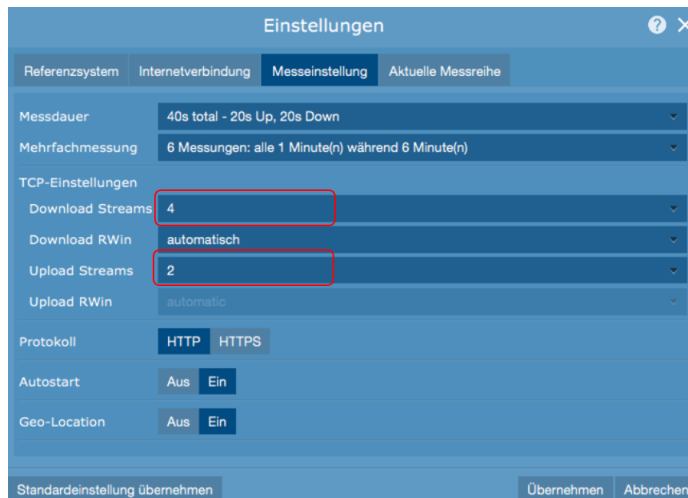
# 1.5 Checklist for Speedtests up to 1 Gbit/s

Don't you come to the desired speed of 1 Gbit / s? Note possible sources of error:

o   Have you downloaded and installed the Speedtest from CNLAB? There are also speed tests that can be played directly in the browser. However, the performance of such tests depends strongly on the particular computer and browser.

o   Did you use the IP-Plus Speedtest server for measurements with fixed IP?  In addition, it can help to increase the TCP streams with fluctuating values. Go to the settings of the CNLAB speed test.

o   Is your end device (PC / laptop) directly connected to the router via the network cable? Measurements on network components (older switches, routers, PowerLine adapters, firewalls) may affect the performance. Measurements via network components are therefore not meaningful for determinations about your Internet access speed.

o   Are all other devices separated from the router ?? Caution: TV and IP telephony, as well as all devices connected via WLAN should be disconnected from the router for a meaningful speed test.

o   Does the hardware CPU and the network card support 1 Gbit/s? Especially with the network card, there are some big qualitative differences which significantly affect the result. 5 to 10 year old devices usually cannot reach gigabit speeds.

o   Are all programs that are on your PC / laptop closed?

o   Is the power saving mode on your laptop / PC turned off?? Attention! Even if your charging cable is plugged in, the device may still be in sleep mode and slowing down CPU performance.

o   Does the laptop have an Ethernet / LAN port? Caution with tablets and MACs: A USB dongle / USB network adapter for Ethernet cable significantly affects the measurements. For example, network adapters with USB 2.0 interfaces never reach gigabit speed.

o   Are virus scanner software firewall / windows firewall turned on? If so, turn it off for the speed test at short notice, as software firewalls can also affect speed test measurements.

o   Do you use a cat. 7 network cable? ? Cat. 6 and Cat. Although 5e are Gigabit-capable, they can negatively influence the measured values after a certain cable length.

o   Are BNS and other VPN tunnels disabled? The encryption used in the Business Network Solution Tunnel and other traditional VPN (Virtual Private Network) tunnels slows down the sending and receiving of data packets, significantly impacting the speed test.

o   Is the latest firmware installed on your router? The firmware is continuously improved. It may be that older firmware can also have a negative impact on measurement results.

o   Is the operating system and the driver up to date?

o   Is IPv6 disabled on the laptop / PC?

## 1.6 Influencing factors

### 1.6.1 General information on measurement and measurement results

In order to obtain a correct statement of the speed test, it must be ensured that only one device is connected to the router with which the correct speed test is carried out. All other devices (including TV and IP phones) should be disconnected during the measurement.
Cabling starts from your computer's network card and ends at the yellow Gigabit Ethernet ports on the Centro Business Router. The cnlab Speedtest specifies the user data rate for http or web transmission. With a speed profile of 1 Gbit/s, the user data rate is about 930 Mbit/s, because in addition to the user data, address, protocol and correction data are also transmitted per data packet. These additional data can be compared with a box when shipping parcels. Although the addressee is only interested in the content of the data, the carton is required to transport the actual goods. Sometimes the net data rate is also referred to as the net data rate compared to the gross data rate, which indicates the basic line speed.
Make sure your cabling and devices support 1 Gbps if you want to measure high speeds. In addition, we recommend in each case directly on the router to measure to obtain representative values. It may indeed be that devices such as switches, firewalls, etc. Although written at 1 Gbit/s, but this is only a theoretical value, which is not achieved in practice.

### 1.6.2 Test device Hardware

Pay attention to the performance of the test device (laptop/PC) which you used during the speed test. It may well be that the hardware used, for example the processor chip or the network card of your laptop or computer, is too weak for measurements up to 1 Gbit/s. Measure with a higher speed profile only slightly less than 100Mbit/s, so a network card or the power cord is usually only 100 Mbit/s-suitable. Information about this can usually be found in the system settings of your computer. Obtain further information directly from the manufacturer of your device or contact our paid support at Swisscom's My Service.

If your network card is working at 1 Gbps or not, you can check it out as follows: Windows:

Go to Control Panel > Device Manager > Network Adapters, often referred to as Gigabit.

Mac:

Click the Apple logo at the top left> About This Mac> Further information> Support> specifications. On the web page that will be loaded, you can see if your Mac's Ethernet port is capable of 1000BASE-T.

Ebenfalls kann es sein, dass ein Laptop, welcher im Batterie-Modus betrieben wird, die Leistung so drosseln, dass der Datendurchsatz massiv tiefer ist. Auch PCs haben einen Energiesparmodus, welche die Netzwerkkarte auf 100 Mbit/s herunter regeln kann.

### 1.6.3 Test Device Software & Settings

Virus scanners and firewalls can influence the received and sent traffic. Therefore switch off these applications at short notice for the speed test . Other programs and processes on the computer can also affect measurement results by loading the CPU. The CPU cannot respond to network requests fast enough and can not process them in the required time. Therefore, congestion on the network card causes the speed to drop. Also make sure that your operating system and all drivers of your computer are up-to-date. In rare cases, IPv6 can cause lower speeds to be measured, which can have very different reasons. Deactivate IPv6 for the test for a short time.

### 1.6.4 Measurement from PC / Laptop to Router

Always measure directly from the PC / laptop Ethernet interface to the router. Laptops and newer MACs do not have the Ethernet interface, so no reliable speed measurement in the gigabit range is possible. If you use it as an Ethernet USB adapter, it will affect the measurement considerably. For example, network adapters with USB 2.0 interface never reach the gigabit speed.
So do not measure via a switch. Although some switches support 1Gbps, the additional obstacle between router and PC / laptop can affect the measurement result.

### 1.6.5 Cable

 Used Ethernet cable:
* Always use the last available wiring accessories. This ensures that no unnecessary restrictions on the service occur.
* Use cables of optimal length so you do not have to roll them up.
* Check your cables for defects (kinked, crushed, torn) and replace any defective cables.
* Ethernet cables come in different categories. Pay attention to the cable label Cat. XY. To perform high speed measurements, always use a Category 7 cable, as this cable is sure to support 1 Gbps throughput. Cat. 6 and Cat. 5e are capable of gigabit, but can negatively affect the measured values from a certain cable length.

### 1.6.6 VPN / BNS

With active BNS and conventional VPN tunnels, part of the available bandwidth is used to encrypt the data packets. In addition, the CPU of the router is heavily used for the encryption, which also has a big influence. That's why speed measurements via VPN are much lower.

### 1.6.7 Network utilization

Differences in the utilization of different networks and components can have an influence on the measurement results. So it may well be that the network utilization is very different depending on the time of day. It is recommended to take several measurements at different times. You can also carry out automated measurements in the settings of the cnlab application under the item Measurement Settings Multiple Measurements.

### 1.6.8 Response times and packet losses

To download a single record (e.g., a PDF file or video) from a web page, a TCP stream is normally used. When a web page is called up to four parallel TCP streams are usually used. Also in the cnlab Speedtest basic setting four parallel TCP streams are used. With response times of less than 20ms and correct Receive Windowsize adaptation in the receiving computer, a download data rate of 1 Gbit/s should be achieved even with a TCP stream. But as soon as there are packet losses or slower response times, it may be that only with several parallel TCP streams 1 Gbit/s can be achieved.

### 1.6.9 WLAN

Speed measurements in the gigabit range over WLAN are not meaningful, since too many interferences limit the data transmission.