SIGNALTEK QT

CLOUD CONNECTED
10 GIGABIT COPPER & FIBRE
QUALIFICATION TESTER

USER GUIDE

TREND NETWORKS
CLOUD CONNECTED TESTERS

Depend On Us

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Table of Contents

1. General Information

This Manual contains information for the SignalTEK QT and SignalTEK QT Pro qualification testers.

There are warnings, cautions and notes as described below displayed throughout this manual. Please follow all warnings and cautions for your safety and the protection of the equipment.

Warning

A warning alerts to situations that could cause personal injury.

Caution

A caution alerts to situations that may cause damage to the equipment or produce poor operation conditions resulting in poor results.

Note

A special annotation that will assist the user with operational features.

Copyright Notice

- Publication ref: 166823
- Rev 1 - 01/25

Other Languages

- To view user manual in other languages please visit www.trend-networks.com and use following procedures.

1. Select your desired language by hovering the flag icon in the top right if the website does not load in your desired language.
2. Go to top menu bar and hover over "**SUPPORT**" and then select "**MANUALS, SOFTWARE AND BROCHURES**".
3. Once the "**DOWNLOADS**" page has loaded select the product filter and tick "**SignalTEK QT"**.
4. 4. This will load all documents related to the SignalTEK QT series.

1. General Information

1.1 Introduction

SignalTEK QT and SignalTEK QT Pro are handheld testers for use in testing twisted pair and fiber optic cables, network connectivity, Power over Ethernet and Wi-Fi networks. These applications are for cable installers, system integrators, network maintenance and troubleshooting.

The tester is primarily operated through its integrated touchscreen and can be remotely controlled on a LAN via VNC or through the internet via TeamViewer.

Tests are stored on internal non-volatile memory (data remains when the battery is removed) and can be uploaded to TREND AnyWARE Cloud via a Wi-Fi or wired internet connection for project management and reporting.

Twisted pair cables are performance qualified by performing a frequency sweep up to 400MHz and measuring various parameters to determine the ability of links to support Ethernet speeds from 10Mb/s to 10Gb/s. Qualification can be performed on cables that are not connected to a live network and only when a remote terminator is connected to the far end of the cable.

Fiber optic cables are performance qualified by measuring insertion loss (dB loss) and length of the cable using high-performance SFP+ modules and comparing the results to Ethernet standards. Qualification can be performed on cables that are not connected to a live network and only when a remote loopback device is connected to the far end of the cable, looping the transmit signal down one fiber and back on the second fiber of a pair.

The tester can be connected to live copper, fiber and Wi-Fi networks to perform a variety of tests including network switch information, ping/traceroute network connection tests, device discovery, PoE load testing and more.

1. General Information

1.2 Models

	SignalTEK QT Pro The ultimate copper, fibre and Wi-Fi qualifier	SignalTEK QT 10 gigabit cloud connected copper qualifier
Feature	**R166001**	**R166002**
Copper cable length and TDR fault location with support for up to 12 remotes	COPPER	COPPER
Fibre cable length	FIBRE	×
Copper qualification - 10Mb/s, 100Mb/s, 1Gb/s, 2.5Gb/s, 5Gb/s, 10Gb/s	✓	✓
Fibre attenuation (dB loss)	✓	×
Integrated visual fault locator (VFL) with 2.5mm connector and 1.25mm (LC) adapter. Steady and flashing operating modes	✓	×
Fibre optic connector inspection microscope Pass/Fail testing to IEC 61300-3-35	Optional	×
Switch port info: speed, name, port number, address	COPPER FIBRE	COPPER
Wi-Fi AP scan with conflict check and Wi-Fi signal strength	✓	✓
Wi-Fi site scan with AP information, channel map, Tx/Rx rates, channel utilization, AP location with external antenna	✓	×
Live Wiremap	✓	✓
Network diagnostics: ping, traceroute, device discovery, switch port info, number, port utilisation history	COPPER FIBRE WI-FI	COPPER
Identify Port VLAN	✓	✓
PoE load test: 802.3 af/at/bt up to 90 watts	✓	✓
Interface ports	RJ45 test port, ext. Wi-Fi antenna, SFP+, VFL, wired Ethernet, 2 x USB A, USB C	RJ45 test port, wired Ethernet, 2 x USB A, USB C
Touchscreen	✓	✓
Internal storage for 2,500 test results	✓	✓
Project management, test pre-configuration, results storage and upload/download, PDF reporting	TREND AnyWARE CLOUD Wi-Fi/RJ45	TREND AnyWARE CLOUD Wi-Fi/RJ45
TeamViewer® and VNC remote control	✓	✓
Bundles offering and trade-in options	✓	✓

1. General Information

1.3 Front and Rear

Number	Description
1	Power button and charge indicator White = Tester ON, not charging / Tester ON, fully charged Green flashing = Charging Green solid = Tester OFF, charging complete
2	Capacitive touchscreen
3	Cooling fan exhaust
4	Battery cover
5	Folding kickstand (optional accessory)

1. General Information

1.4 Top and Side Connectors

Number	Description
1	USB-C charging and data port. The end-user purchased PSU shall be certified and meet the requirements of IEC 62368-1 and 60950-1 with output power of less than 100 watts. 5V/3A DC with PD capability.
2	1Gb/s Ethernet management port for cloud sync, VNC or TeamViewer
3	2 x USB-A data ports
4	Lanyard attachment slot
5	SFP+ optical slot (Pro model)
6	RJ45 test port
7	Visual Fault Locator (Pro model)
8	External Wi-Fi antenna connector, RP-SMA female (Pro model)
9	RJ45 socket remote, ID# 1 included, kit of 12 optional
10	RJ45 plug remote, ID# 1 included, kit of 12 optional

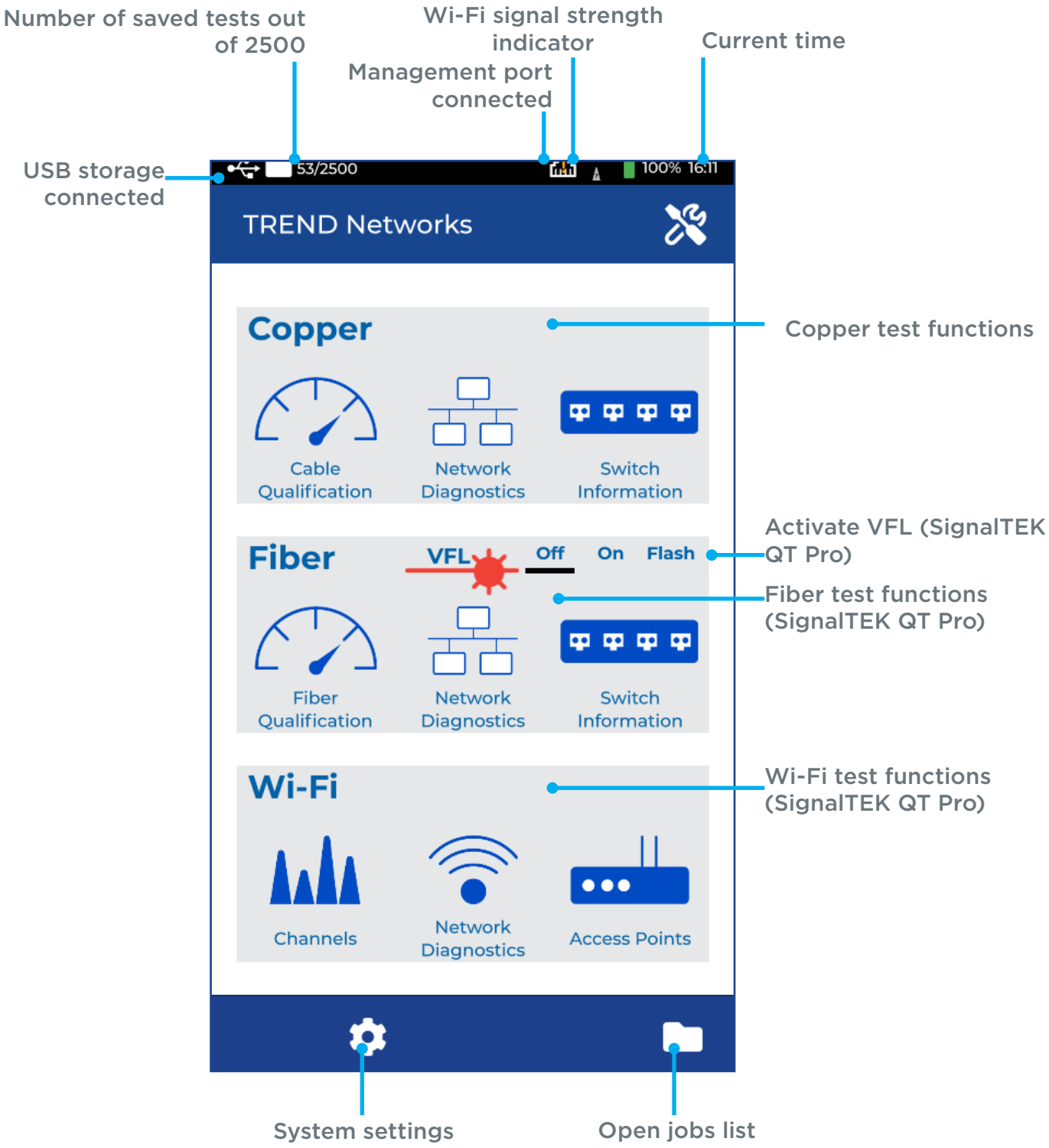
1. General Information

1.5 Specifications

Dimensions	218 x 109 x 50 mm / 8.6 x 4.3 x 2.0 inches
Handset weight	772 g, 27.2 oz including battery
Battery	Lithium polymer ternary, 7.4 VDC, 7250 mAH (53.28 Wh typical) Lithium mass: 35.5 g, 2-cell, series configuration Dimensions: 122 x 62 x 15 mm, Net Weight: 230 g
Input power	5 V/3 A DC USB-C with PD (Power Delivery) capability. 15 watt minimum for continuous operation. End-user purchased, must be IEC 62368-1 and IEC 60950-1 compliant. TREND Networks replacement P/N R166030
Display	IPS 5.0 inch (diagonal) capacitive touch screen, 480x854 resolution with white LED backlight. User adjustable brightness
CPU module	RaspberryPi CM4, ARM Cortex A72, 4 core, 1.5 GHz/core System memory: 2GB RAM, Storage: 32GB microSD (not user accessible)
Connectivity	1 x USB-C (USB 2.0), 2 x USB A (USB 2.0), 1 Gb/s Ethernet, integrated Wi-Fi (2.4/5 GHz bands)
Test ports	SignalTEK QT: 1 x RJ-45 SignalTEK QT Pro: 1 x RJ-45, 1 x SFP+, 1 x Visual Fault Locator (2.5mm universal connector with FC connector and LC adaptor), 1 x RP-SMA fermale Wi-Fi connector
Data transfer	Network transfer to cloud via Wi-Fi or wired Ethernet. Export to USB flash drive. Supports drives up to 256 GB (FAT32 format required)
Measurements	Twisted Pair Copper Cabling: RF sweep to 410 MHz measuring near-end crosstalk, return loss, insertion loss delay/length, wire map. Fiber Optic Cabling: Insertion loss, delay and length. Insertion loss wavelength measurement with TRENF Networks SFP+ modules. Wi-Fi: channel scan with number of access networks, channel utilization, number of access points per channel. Supported SFP+ Modules: TREND Networks 10 Gb or 1 Gb. 850 nm, 1310 nm, 1550 nm. Insertion loss and length accuracy specified with TREND Networks supplied modules
Supported cable types	2-pair or 4-pair unshielded/shielded twisted pair cabling, 100-ohm nominal impedance OM1-OM5 multimode and OS1-OS2 single-mode fiber optic cable
Supported connectors	Copper cabling: UTP/STP RJ-45, 8P8C Fiber cabling: LC duplex, multimode/single-mode, UPC end-face
Wiremap & copper length	Length measurement 0.3-450 m, 1-1476 ft, display resolution 0.5 m/1.0 ft, NVP range 59-89%, accuracy +/-5%, +0.5 m
Fiber length	0-10 km/0-32,808 ft, display resolution: 0.5 m/1 ft, accuracy: +/-5%, +1 m/0.3 ft
Operating temp	0°C to 45°C, non-condensing
Storage temp	-20°C to 70°C, non-condensing
Vibration/shock	MIL-PRF-28800 F, Class 3 (met by design)
Performance	IEC 62368-1:2023: Audio/video, information and communication technology equipment - Part 1: Safety requirements. EN61326-1:2020, EN55011:2016 + A11:2020, EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5:2006, EN61000-4-6, EN61000-4-11, FCC Part 15, Class-A, Battery: DOT 49 CFR 173.185, UN Part IV – section 38.3

1. General Information

1.6 Homescreen Icons

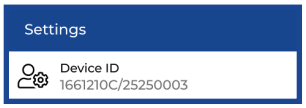


2. Setup & Configuration

2.1 System Settings

Device ID

- Used to pair the SignalTEK QT to a user's AnyWARE Cloud account. This is also the serial number of the device should it be required for service requests.



Default Test Settings

- Set the test parameters to be used when running tests in a new job.

IPv4/IPv6 Targets

- Set the IP address or URL for ping and traceroute targets.

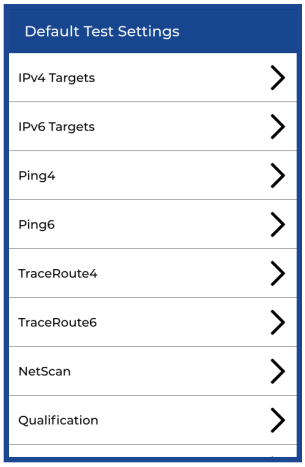
Ping4/Ping6

- Set the number of packets, pause between packets, size of packets and select the target(s) to ping.

TraceRoute4/TraceRoute6

- Set the target IP/URL, set maximum number of hops, set time to wait for response, choose ICMP or UDP and enable/disable Name Lookup.

Note: enabling Name Lookup can add several minutes to the test time.

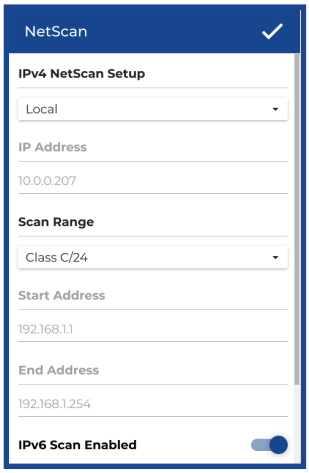


Netscan

- Netscan detects all devices in the specified network range by IP address, MAC address and chipset vendor (if available).
- Local/Custom network range. Local uses the IP range of the current network, Custom allows a specific IP range to be scanned.
- Scan Range defined the portion of the IP address that is the network prefix and the portion that is assigned to devices. Class C/24 = 256 device addresses, C/20 = 4096 device addresses, B/16 = 65,536 device addresses.

Note: Class C/24 is most often used. Selecting C/20 or B/16 will add significant time to the test.

- Custom allows a user defined IP range to be scanned.



Qualification

- Set the default test parameters for copper cable qualification tests.

PoE Load

- Toggle PoE testing to IEEE 802.3 standard or to a custom minimum wattage for the test to pass.

Fiber Qualification

- Set the default test parameters for fiber optic cable qualification

2. Setup & Configuration

PDF Reports

- Configuration options for PDF reports that are created onboard the tester.

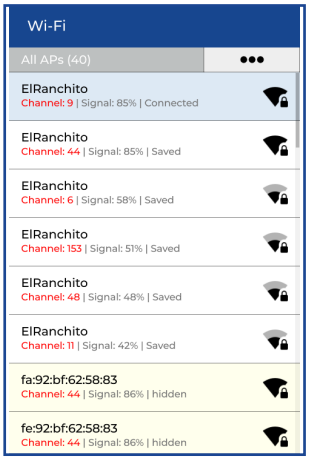
Set Language

- Set the language of the user interface.
- A prompt may appear when changing between certain languages to change the date format between DD/MM/YYYY and MM/DD/YYYY.

Management Port

- Configure the Ethernet port on the side of the tester. This port can be used to sync the tester to AnyWARE Cloud or to a LAN for remote control via VNC.
- The port can be configured for Dynamic (DHCP) or Static connections to the network.
- The IP address of the tester is displayed when connected to a network.

Wi-Fi



- Displays the status of the Wi-Fi connection. This wireless connection is used to sync the tester to AnyWARE Cloud and to perform ping, traceroute and netscan tests on wireless LANs.
- Tap to view the available wireless networks. Tap the ••• button to choose 2.4GHz, 5GHz or all Wi-Fi bands.
- Network names are shown when the SSID is broadcast. Hidden networks will display the BSSID (MAC address) of the access point. Connected network is shown in blue, hidden networks are shown in yellow.
- Channel numbers shown in red indicate multiple networks operating on the same channel.
- "Connected" is displayed when the device is connected to a network and "Saved" is displayed for networks where the password is save but the device is not connected.
- Tap on a network to view additional details.
  - The deivce's IP address is displayed when connected to a network.
- Long-press options menu.
  - Long-press on a network to connect, disconnect or forget a network.

Device Settings

Regional Settings

- Set date, time, unit format and measurement units.

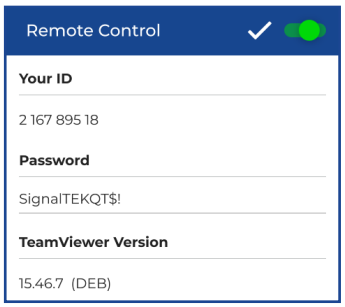
Sound Settings

- Enable or disable device sounds.

Display Brightness

- Adjust brightness of the backlight.

Remote Control Settings (TeamViewer)



- Enable the SignalTEK QT TeamView server by toggling the switch on. TeamViewer allows remote viewing and control of the SignalTEK QT from any computer, tablet or smartphone running the TeamViewer application.
- TeamViewer is free to use for non-commercial applications. Customers connecting to multiple testers from a single computer, using multiple computers to connect to a single tester, or any combination may be subject to TeamViewer's commercial licensing requirements and associated subscription fees. TREND Networks makes TeamViewer available on certain devices but has no control on how TeamViewer determines use of the service is commercial or non-commercial.
- The TeamViewer ID of the device is displayed. Enter the device ID into the TeamViewer application on a computer or tablet to connect to the SignalTEK QT.
- Password: TeamViewer security policy does not allow devices to be set with a default password. Enter a password then tap the ✓ button. The system will check with TeamViewer's server to ensure the password meets their security requirements. The password must contain at least 10 alpha-numeric characters.

2. Setup & Configuration

VNC Settings

- Toggle VNC (Virtual Network Computing) remote control on or off. VNC is a service that allows remote viewing and control of the device over a local area network connection. Unlike TeamViewer, VNC connections are generally not available across the Internet.
- VNC is connections are available through the Ethernet management port on the side of the SignalTEK QT.
- Enable VNC by toggling the switch and pressing the ✓ button.
- Connect your VNC application on the computer to the tester by entering the IP address shown on the Management Port line of the system Settings menu.

Fiber Inspection Microscope

- Use a TREND Networks USB fiber optic microscope (P/N R163-VIP) to inspect connectors prior to testing or for troubleshooting fiber network issues.

Fiber Inspection Results

- Saved images from the Fiber Inspection Microscope can be viewed and exported to a USB drive.

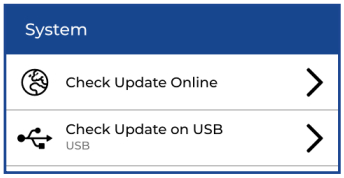
Factory Reset

- Clears all settings and stored data. Restores the tester to the factory default condition.
- Performing a Factory Reset cannot be undone. Ensure all stored tests have been sync'd to AnyWARE Cloud before using this function.

Set Reference

- Sets the copper length measurement to 0m/0ft when no cable is connected.
- Use this function if the length measurements are repeatedly different than expected.
- Disconnect any cables from the RJ45 test port and press Start to perform the reference.

System



Check Update Online

- Check for available Over-the-Air (OTA) software updates using either Wi-Fi or the wired Ethernet port.

Check Update on USB

- Check for available update file on attached USB drive.
- If updating from a USB drive, the update folder named "debs" must be in the root directory of the USB drive.

About

Serial Numbers

- Displays the serial number (Device ID) of the SignalTEK QT.

Software Version

- Displays the currently installed software version.

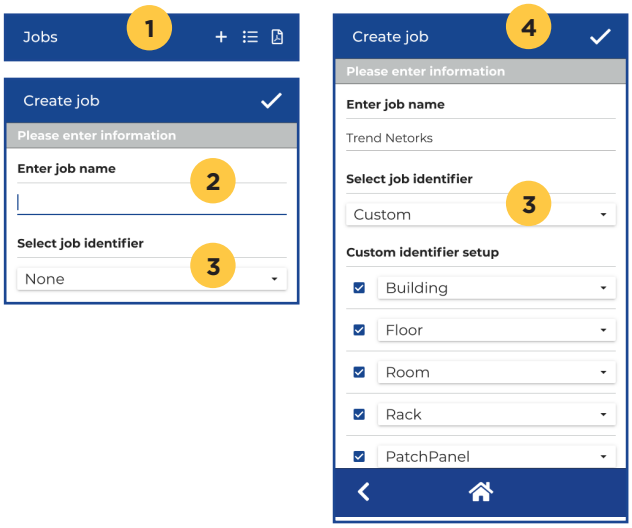
Export Diagnostics

- Export a Diagnostics file to an attached USB drive if requested for technical support purposes.
- The Export Diagnostics button is visible only when a USB drive

2. Setup & Configuration

Tap from the Home screen

1. Tap + to create a new job.
2. Enter a job name for the job.
3. Leave the job identifier set to None when only a simple job name is required. Or set to Custom and select the box beside each location level and choose a location type from the drop-down menu. Jobs uploaded to AnyWARE Cloud using Custom identifiers will automatically create a folder hierarchy to organize test results for large projects.
4. Tap ✓ to proceed. New tests will be saved into this job.

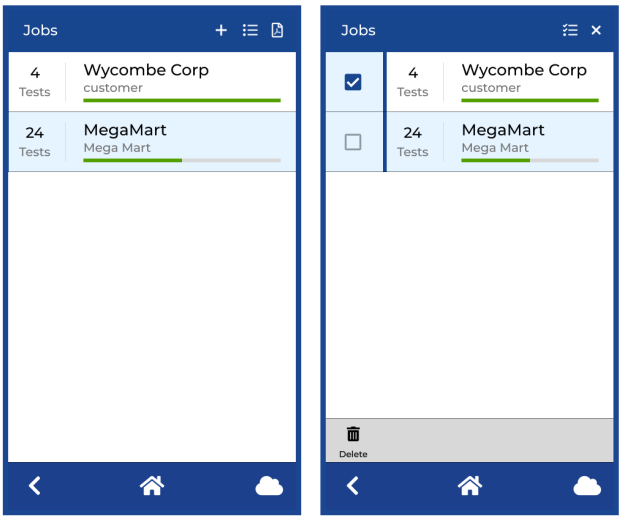


Long-press a job for options

- View tests: Open the list of tests in the job.
- Clear sync status: Makes the entire job available for upload to AnyWARE Cloud. Normally only newly added tests will be uploaded. Use this function to reupload a job that has been deleted from AnyWARE Cloud
- Set as current: New tests will automatically be saved to this job when selected.
- Delete: Permanently delete the job and included tests. The current job cannot be deleted. If Delete is greyed-out, make a different job Current and then delete the desired job.

Tap to select multiple jobs

- Allows selection and deletion of multiple jobs for deletion.



3. AnyWARE Cloud

3.1 AnyWARE Cloud Introduction

AnyWARE Cloud is TREND Networks cloud-based project management and reporting system. It is run on a web browser from a computer or tablet. Projects and test can be created on AnyWARE and downloaded to AnyWARE enabled testers, and completed tests are uploaded to AnyWARE for management and reporting.

AnyWARE Cloud accounts are free to create and use. AnyWARE enabled testers are registered to an organization and tests are uploaded and downloaded between an AnyWARE organization and testers registered to it. A tester must be removed from one organization before it can be added to a different one.

3.2 Login or create a new account

Go to anyware.trend-networks.com

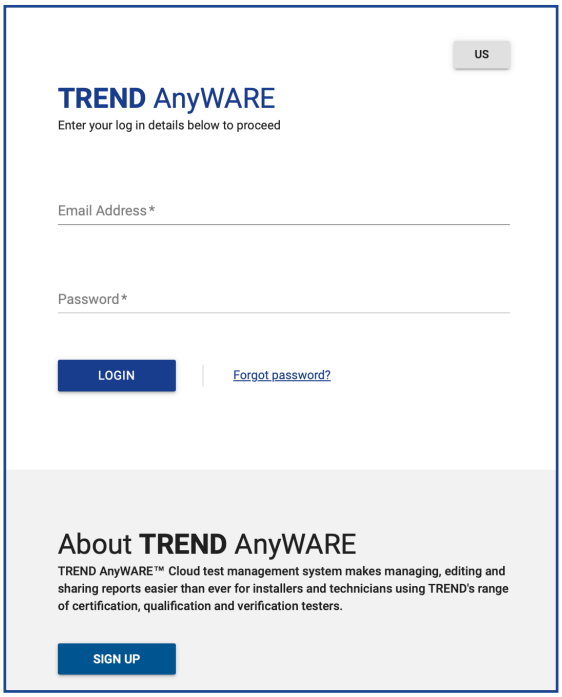
Choose your language (UK, US, DE, FR, IT, ES, PT, CN, RU, PL)

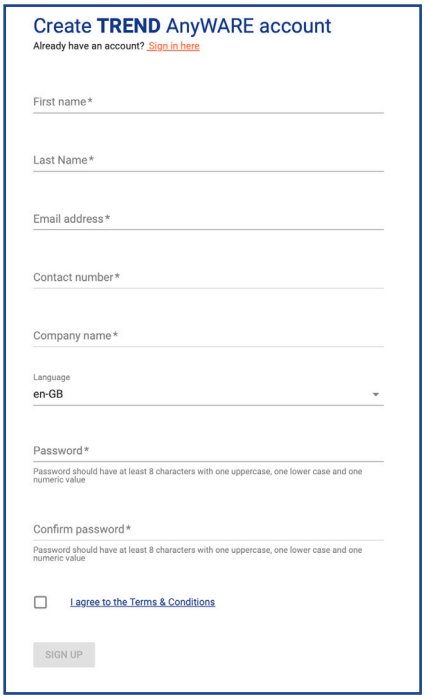
Enter your E-mail and password to login.

Or click **SIGN UP** to create a new account by completing the required fields in the registration form.

The E-mail address used to create an account will be the main administrator login. Additional admin, manager and user level

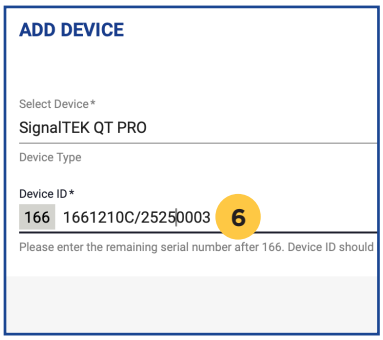
log-ins can be added after the account is created.

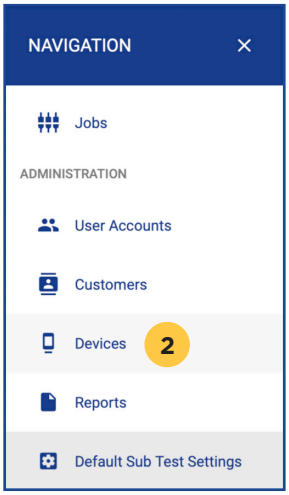


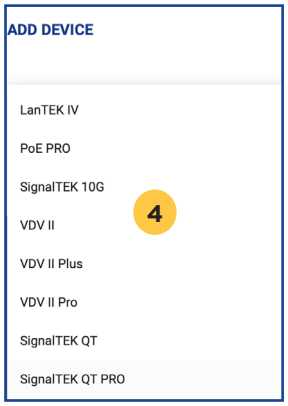


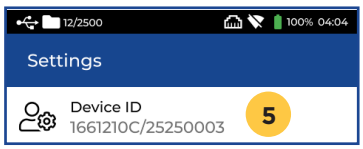
3.3 Register SignalTEK QT to your AnyWARE account

1. Click the menu ☰ icon.
2. Click Devices.
3. Click the add + icon.
4. Select SignalTEK QT or SignalTEK QT PRO from the drop-down menu.
5. Tap ⚙ on the SignalTEK QT to open the Settings page. Note the Device ID at the top of the page.
6. Enter the Device ID into the ADD DEVICE window then click SUBMIT. A message noting that the device has been added will appear. *Note: Letters O and I are not used in the Device ID. Characters that look like an O or I are the numerals 0 or 1.*





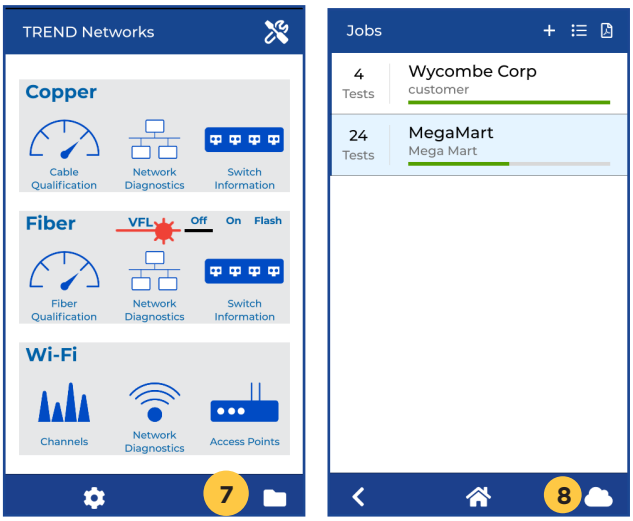




3. AnyWARE Cloud

From the SignalTEK QT Home screen, tap to open the Jobs page.

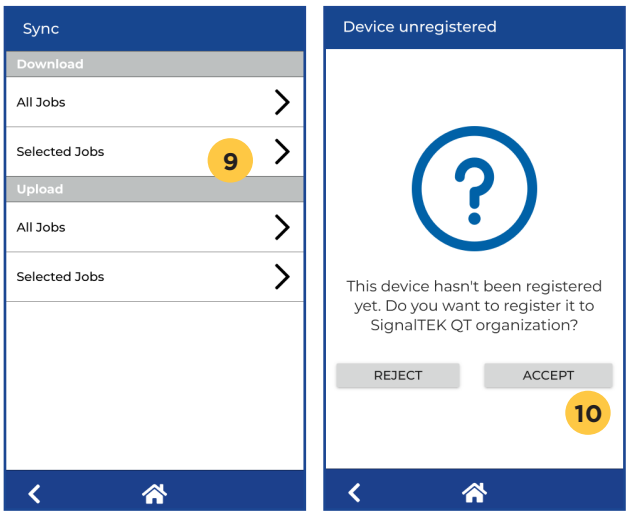
Tap to open the Sync menu.



Tap Selected Jobs in the Download section to initiate a sync process.

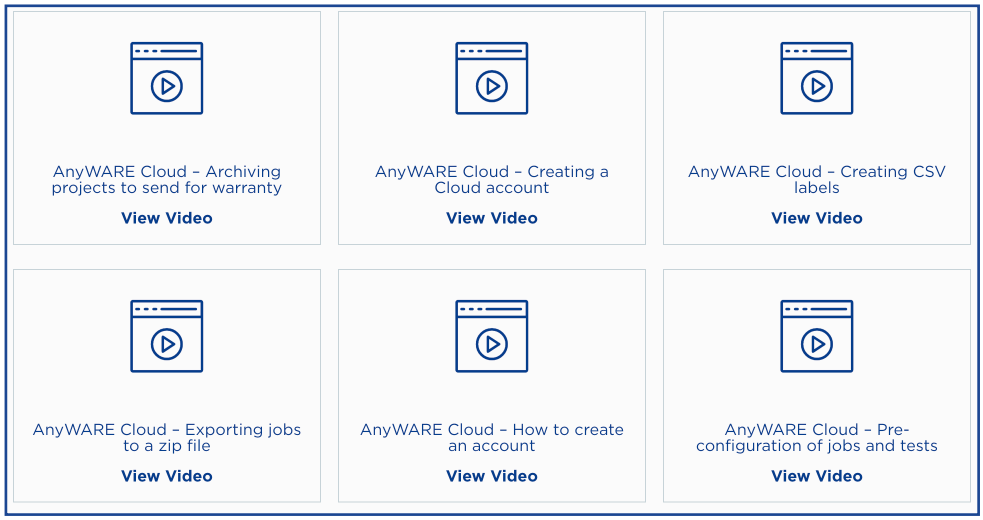
The tester will display a message asking for confirmation to register it to your account. Tap ACCEPT to complete the registration.

Press the button to return to the Home screen.



A series of instructional videos for AnyWARE Cloud is available at:

https://www.trend-networks.com/us/learning-hub/videos/



4. Copper Cable Qualification

4.1 Copper cable qualification introduction

SignalTEK QT performs a series of tests to measure characteristics of the cable under tests to determine whether it's performance meets the criteria for the selected qualification speed. The measurements include crosstalk, return loss, insertion loss, propagation delay and delay skew.

Wiremap and length are measured using time domain reflectometry (TDR) to identify the location of shorts and opens in the cable.

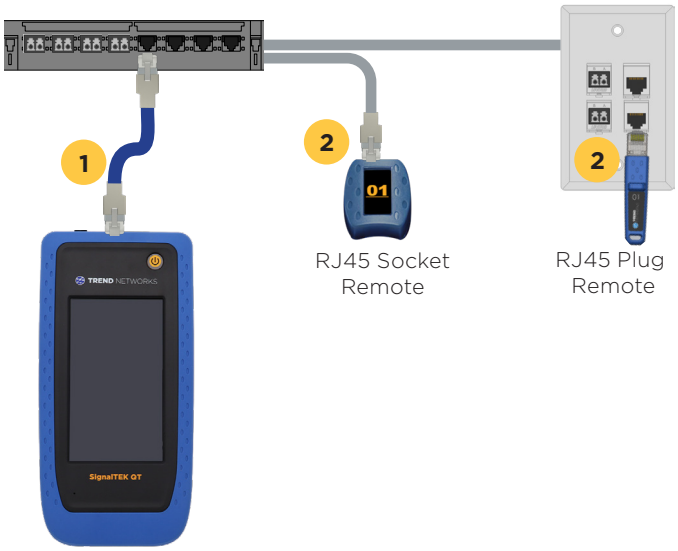
The far end of cable under test must be terminated with a plug or socket remote. SignalTEK includes one of each style remote with ID 1. Accessory kits of 12 plug or socket remotes are available to improve productivity. SignalTEK QT is compatible with TREND Networks VDV II series socket remotes, and SignalTEK QT plug remotes are compatible with VDV II series cable verifiers.

Warning: Avoid Tester Damage

- Copper qualification can be performed on de-energized cables only. Do not attempt to qualify cables that are connected to a network device.
- Do not connect the remotes to cables with active PoE, the remote will be permanently damaged.
- Do not connect or disconnect cables while a test is running.
- Avoid testing network cables that are installed along electrical cables. High voltages can couple from the electrical cable to the network cable and damage the tester.
- SignalTEK QT checks the line for voltage before starting a qualification test and internal protection circuitry will protest the tester from PoE damage. Once the test is started the protection circuitry is bypassed so the RF circuit can test the cable. Connecting to a circuit with active PoE while the test is running will damage the tester.

4.2 Copper cable qualification settings

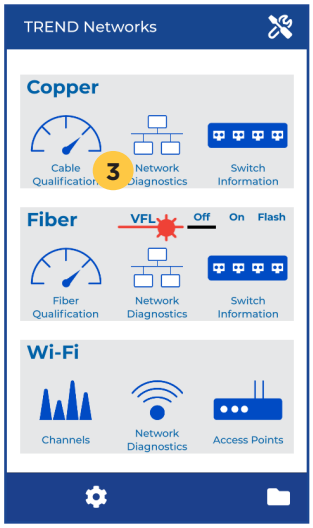
1. Connect the SignalTEK QT handset to one end of the cable under test.
2. Connect a plug or socket remote to the other end of the cable under test.

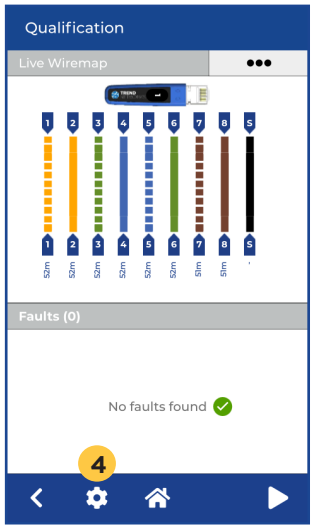


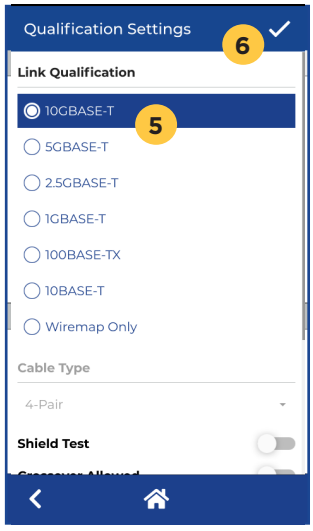
4. Copper Cable Qualification

3. Tap Cable Qualification in the Copper section of the Home screen
4. Tap the Settings button to open Qualification Settings.
5. Qualification Settings
   a. Tap the desired qualification speed.
   b. Enable or disable the Shield Test.
   c. Allow crossover cables to pass. Crossover cables reverse pairs 12/78 and 36/45.
   d. Set desired wiremap color code.
   e. Set the NVP to best match the cable under test.

   Typical NVP values
   Non-plenum UTP: 67-69%
   Plenum UTP: 72-74%
   STP: 75-79%
6. Tap the tick mark to save the settings.



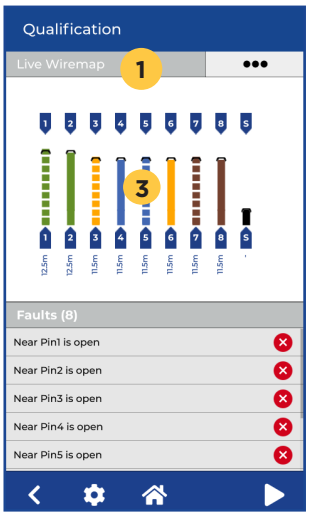


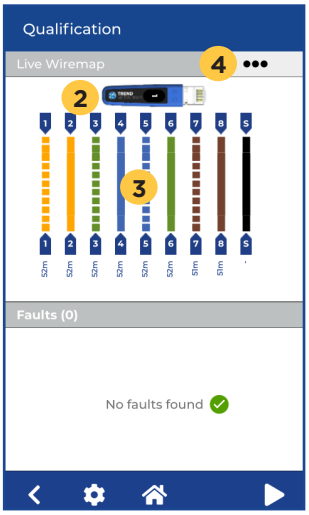


4. Copper Cable Qualification

4.3 Live Wiremap Display

1. Live Wiremap displays a real-time test of the connected cable. With no remote connected the length of each pair is shown with warnings that each pair is open. Faults caused by shorts are identified without a remote connected and the distance to the short
2. When a remote is connected the display updates with the remote ID and no fault messages if the cable is properly terminated.
3. Live Wiremap checks shielded continuity if the Shield Test is enabled in Qualification Settings.
4. Tap ••• to change the wiremap color code.

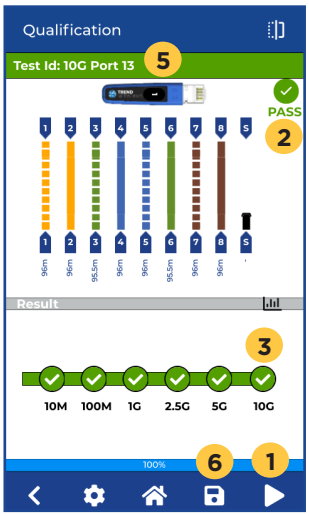


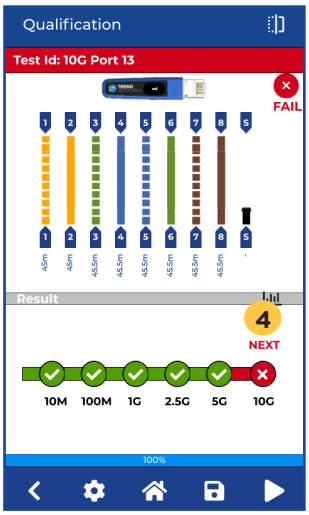


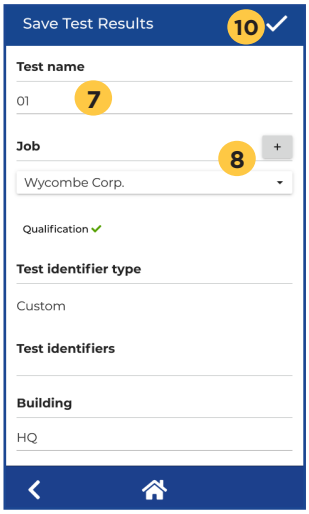
4.3 Copper Qualification Testing

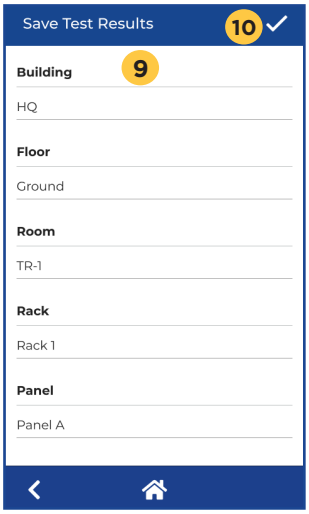
1. Configure the qualification test as shown above.
2. Tap the start icon to run the test.
3. The overall PASS/FAIL result is shown at the top of the screen.
4. The green tick marks indicate individual speeds that pass qualification.
5. A red X indicates speeds that failed the test. The cause of the failure, NEXT or Return Loss is displayed.
6. Note: The test always runs up to 10G regardless of the selected qualification speed. If the selected speed is 1G and the cable performs at 2.5G the result will pass and the higher qualification speed is displayed.
7. The next test ID is shown at the top of the screen. Each new test increments the last number or letter in the ID by one.
8. Tap the save icon to save the current result.
9. Enter a different name in the test name field is required.
10. The current job is shown in the pull-down list. Select a different job or press + to create a new job if needed.
11. If Custom job identifiers was selected when the job was created (“4.2 Jobs list” on page <?>) enter a description in each field.
12. Tap ✓ to save the test.

- The screen tester returns to Live Wiremap mode after saving a test and is ready to perform another test.









5. Fiber Cable Qualification

5.1 Fiber cable qualification introduction

Fiber optic cables are qualified by measuring insertion loss (attenuation) and length of the fiber cabling. The results are compared to a limit defined by the IEEE for each Ethernet speed or to a manual limit set by the user. The IEEE Ethernet limits define the attenuation and length for each grade of optical fiber from OM1-OM5 for multimode and OS1 or OS2 for single-mode.

SignalTEK QT Pro measures attenuation and length with optical SFP modules in a loopback mode. The first step is to perform a calibration with a patch cord and loopback plug to set the reference power level and zero the length measurement.

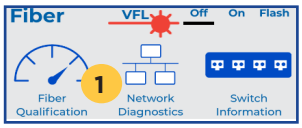
Attenuation is the difference in power measured during the test from the reference level measured during calibration. Length is calculated by the time a light pulse takes to travel from the transmit port to the receive port of the SFP module. The round trip time is divided by 2 to claculate the length of the installed cabling.

Three wavelengths of SPF modules are supported. 850 nm for testing multimode fiber, 1310 nm and 1550 nm for testing single-mode fiber

Note: 1310 nm modules may also be used to test multimode fiber although the attenuation reported may be higher than expected.

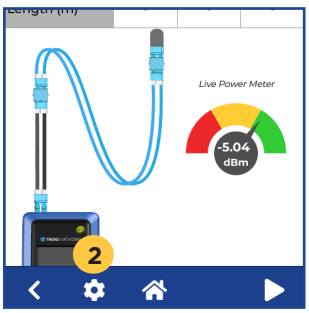
Measurement precautions

- Measurement accuracy is dependant on the stability of the SFP light source.
- TREND brand SFP modules are stable to ±0.05 dB after a 15 minute warm-up.
- Other brands of SFP modules can be used and the accuracy of the attenuation measurements is affected by the source stability. Check the manufacturer's specifications before using for fiber qualification testing.
- Clean all connectors and the SFP ports prior to calibration and testing. A fiber optic microscope can be attached to the SignalTEK QT Pro for inspection to ensure all connections are clean.
- Most failures are caused by dirty connectors. Clean and inspect connectors in the event of a failure.

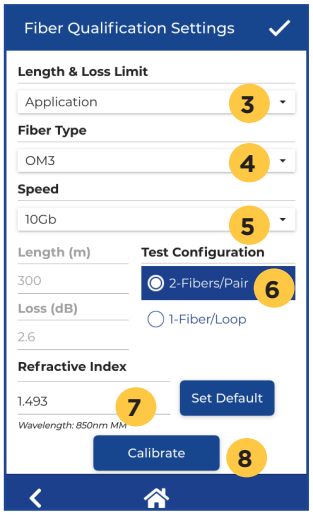


5.2 Fiber cable qualification setup

Insert the SFP module into the tester and allow the temperature of the module to stabilize for 15 minutes prior to calibration and testing.



1. Tap Fiber Qualification on the Home screen.
2. Tap the setting icon to open Fiber Qualification Settings.
3. Choose Application or Manual from the Length & Loss Limit menu. Application will qualify the fiber using IEEE Ethernet limits, Manual allows the user to specify a loss and length limit.
4. Set the Fiber Type to match the fiber being tested.
5. Set the Speed to the desired qualification speed. The range of speeds available depends on the Fiber Type selection, ranging from 100 Mb to 100 Gb.
   - The Length and Loss values update to reflect the limits based on the Fiber Type and Speed settings.
6. Select 2-Fibers/Pair if testing a pair of fibers with a loopback plug at the far end (typical testing mode). Select 1-Fiber/Loop if connecting one fiber between the Tx and Rx ports of the SFP (both ends of a single fiber connecting to the SFP).
7. Set the Refractive Index to match the specifications of the fiber being tested. This setting adjusts the length measurement similar to the NVP setting for copper cables.
8. Tap Calibrate to begin the referencing process.



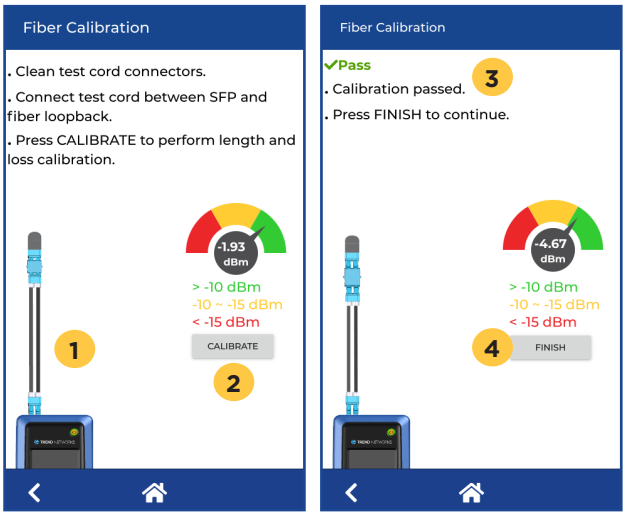
5. Fiber Cable Qualification

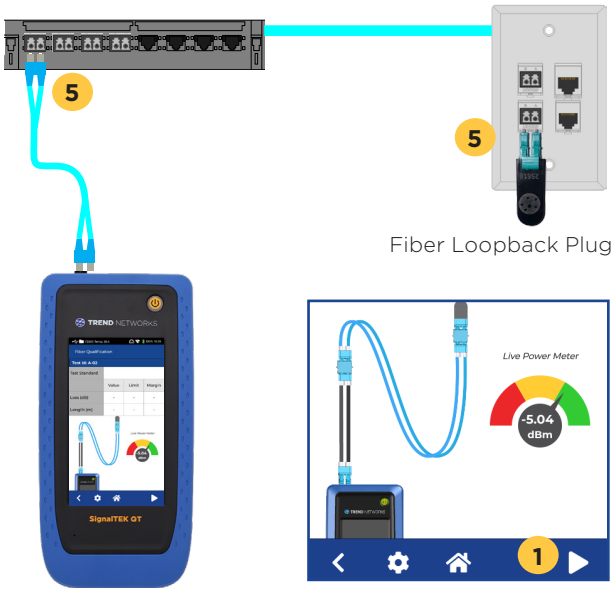
5.3 Fiber cable calibration

Before performing a qualification test the loss and length of the loopback plug and test jumper must be measured so the results can be subtracted from the final test result. The live power meter displays the absolute power in dBm detected by the SFP receiver. The meter should read from 0 to -10dBm if the SFP ports, jumper connectors and loopback plug connectors are clean. 0 to -3 dBm indicates very clean connections.

1. Connect the fiber jumper and loopback plug to the tester. Test LC cables with the LC-LC jumper and LC loopback or test SC cables with the LC-SC jumper and SC loopback.
2. Tap CALIBRATE if the pointer and dBm value is in the green range.

   Clean the test cord, loopback plug and SFP connectors if the power level is in the yellow or red range.
3. A pass message is shown if the loss is within limits.
4. Tap FINISH to complete calibration.
5. Disconnect the loopback plug from the jumper. Connect the jumper to one end of the cable under test and connect the loopback plug to the other end of the cable.



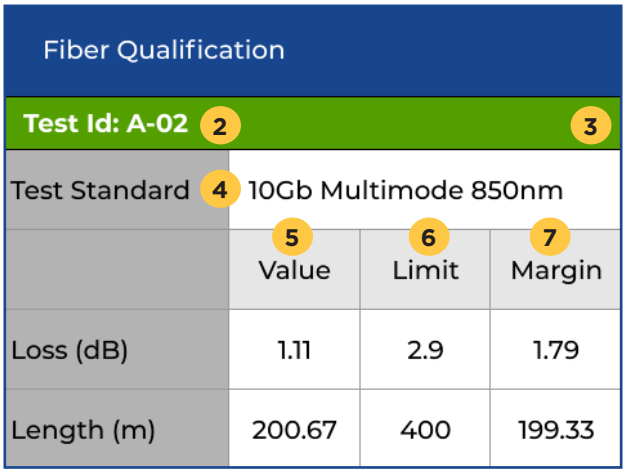


5. Fiber Cable Qualification

5.4 Fiber qualification test and results

- Set the qualification settings described in “Fiber Qualification Setup”.
- Allow the tester and SFP to warm up for 15 minutes then perform the calibration described in “Fiber cable calibration”. Connect the tester and loopback plug to the cable under test.
- The live power meter will display -- dBm when the loopback is not connected to the same fiber pair as the tester. When properly connected the live power meter will update to display the power level detected by the receiver.

1. Tap the start button to run a test, the results screen updates when the test is complete.
2. The last number/letter in the ID automatically increments from the previously saved test.
3. A green bar represents pass, a red bar indicates fail.
4. Selected test standard.
5. Value
   - Loss (dB) = measured attenuation
   - Length (m) or (ft) = measured length of the cable.
6. Limit - the maximum loss and length allowed by the selected test limit.
7. Margin - The “headroom” between the Value and Limit. Positive numbers pass, negative numbers fail.



6. Switch Information

6.1 Introduction

SignalTEK QT and QT Pro can be connected to live network ports to display information about the switch to which they are connected. SignalTEK QT can check copper ports only, SignaTEK QT Pro can check both copper and fiber ports. To check fiber ports the fiber optic SFP installed in the tester must be the same wavelength and speed as the optical port in the switch. TREND Networks 10Gb SFPs operate at a line rate of 1Gb for network testing and switcvh information.

Collecting switch information is a passive process where the tester “listens” for LLDP (Link Layer Discovery Protocol) and CDP (Cisco Discovery Protocol) packets that are periodically broadcast by the switch. The time between LLDP/CDP broadcasts depends on the switch and may be as infrequent as 30-60 seconds. The tester must wait for a LLDP/CDP packet to be received for the switch information to data to update on the screen.

The Ethernet chip (PHY) in SignalTEK QT can link at up to 1 Gb/s. This is the data rate at which LLDP, CDP, Ping, TraceRoute and other packets are transmitted. When connecting to a switch the tester detects the link pulse advertisements of the switch to determine its maximum connection speed from 10 Mb/s to 10 Gb/s (copper mode).

The information presented depends on the abilities and configuration of the switch.

Caution

- The RJ45 test port is protected from PoE damage when the tester is connected to the network before activating the Switch Information test mode.
- Do not connect the RJ45 test port to a network while the Switch Information test is running, always return to the Home Screen before connecting to a network port to ensure the protection is enabled.

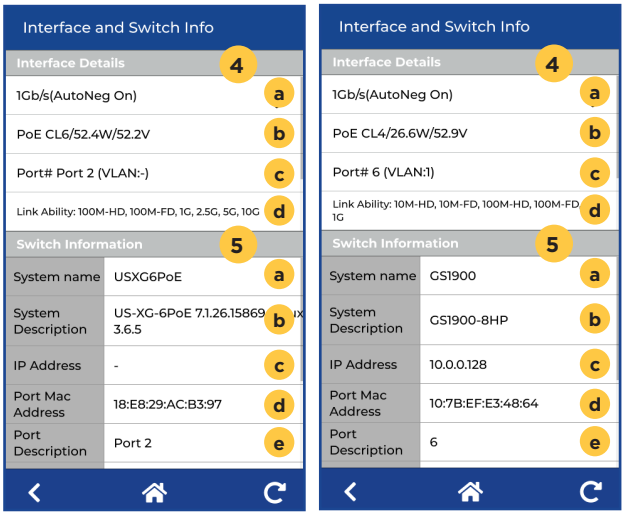
6. Switch Information

6.2 Checking copper switch information

- The tester will detect the available link speeds from the switch up to 10Gb/s. The maximum speed the tester will connect to the network is 1Gb/s.
- Confirm the RJ45 test port configuration in **Home > Settings > Network > RJ45**. Set the Link Speed to Auto. Enable PoE Classification if desired to detect report the advertised Class of the switch.
- The PoE classification process can take more than 1 minute. Disable PoE Classification if you need only the network information.

1. Go to the Home screen.
2. Connect the RJ45 test port to the network port.
3. Tap Switch Information in the Copper interface area.

4. Layer 1 and 2 interface details. Determined by decoding electrical link signals.
   a. Speed that the tester is connected to the network (up to 1Gb/s). Tap for additional details.
   b. Class, power and voltage of detected PoE. This is determined by hardware negotiation with the PoE switch. Tap for additional details.
   c. Number of the switch port to which the tester is connected and the advertised Port VLAN (if available). Tap for additional details. Multiple switches may be detected.
   d. Advertised link speeds from the switch, up to 10Gb/s.
   e. Scroll down to see the IP address assigned to the tester. A green ✓ mark indicates an Internet connection is available (background ping to Google).
5. LLCP/CDP details. Available information is switch dependent.
   a. Switch name.
   b. Detailed switch description.
   c. Switch IP address.
   d. MAC address of the switch.
   e. Switch port number



Two different switches shown for comparison.

6. Switch Information

6.3 Checking fiber switch information

SignalTEK QT Pro can be connected to optical switches via the SFP interface. The optical interface on the switch must be the same wavelength as the SFP installed in the tester.

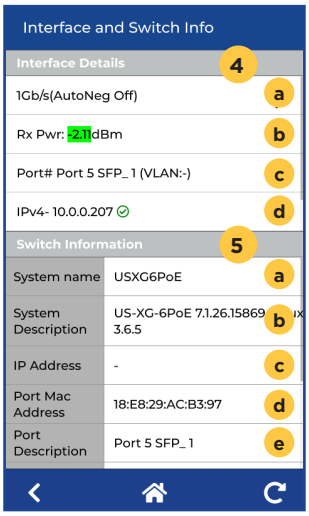
Collecting switch information is a passive process where the tester “listens” for LLDP (Link Layer Discovery Protocol) and CDP (Cisco Discovery Protocol) packets that are periodically broadcast by the switch. The time between LLDP/CDP broadcasts depends on the switch and some may be as infrequent as 30-60 seconds. The tester must wait for a LLDP/CDP packet to be received for the switch information to data to update on the screen.

The information presented depends on the abilities and configuration of the switch.

The SignalTEK QT Pro will link to the network at up to 1Gb/s, even with 10Gb SFP modules installed. This does not affect decoding of the LLDP/CDP packets.

1. Go to the Home screen.
2. Connect the SFP test port to the network port.
3. Tap Switch Information in the Fiber interface area.

4. Physical Interface Details
   a. Link speed.
   b. Power level received by the tester’s SFP module. Green indicates strong level. Tap to view details about the SFP module installed in the tester.
   c. Port on the switch to which the tester is connected.
   d. IP address assigned to the tester. A green ✓ mark indicates an Internet connection is available (background ping to Google).
5. Switch LLDP/CDP details. Available information is switch dependent.
   a. Switch name.
   b. Detailed switch description.
   c. Switch IP address.
   d. Switch MAC address.
   e. Switch port number.



7. Copper/Fiber Network Diagnostics

7.1 Introduction

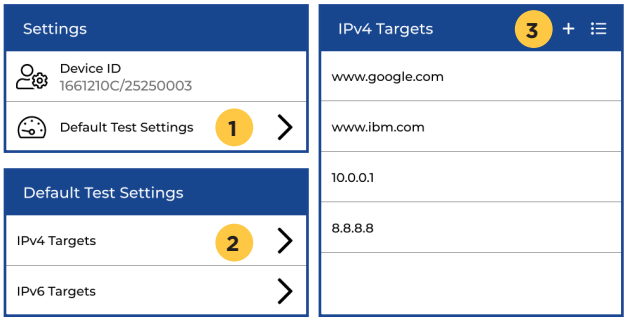
SignalTEK QT can perform several diagnostic tests on active networks to validate connectivity and check for potential problems.

The available diagnostic tests are Ping, TraceRoute, Netscan and PoE Load. SignalTEK QT can perform these tests on the RJ45 test port and SignalTEK QT Pro can perform the tests on the RJ45, SFP and Wi-Fi ports (PoE Load is available on RJ45 only).

Network diagnostic tests are run against a Target. Targets can be a device on the LAN or internet. The default target set in the tester is www.google.com. Targets can be modified in **Settings > Default Test Settings**. Targets can also be specified on a test-by-test basis. The Ping test supports up to **three** Targets allowing the user to check connectivity to different devices/servers from the network port the tester is connected to.

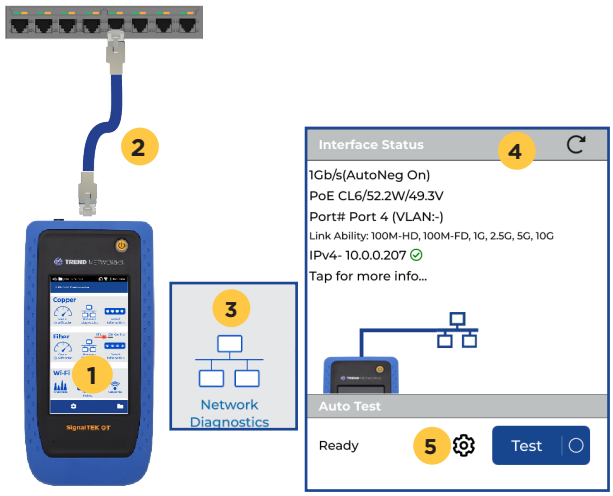
7.2 Selecting targets for network diagnostics

1. From the Home screen tap ⚙ then Default Test Settings.
2. Tap IPv4 or IPv6 Targets.
3. Tap **+** to add a new target to the list.
   - Long-press on a target to edit or delete it from the list.

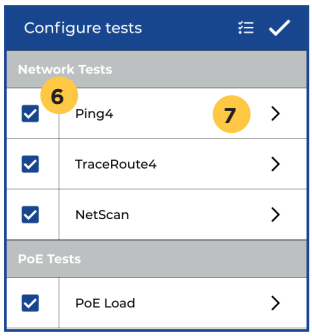


7.3 Copper network diagnostics setup

1. Go to the Home screen.
2. Connect the RJ45 test port to the network port.
3. Tap Network Diagnostics in the Copper interface area.
4. The tester will begin detecting the network information and display the Interface Details.
   - Link speed up to 1Gb/s. The Ethernet port in the tester can connected to the network at 100 Mb or 1 Gb in copper mode even with a 10 Gb switch. This will not affect diagnostic tests.
   - PoE class and available power. This is enabled/disabled in **Settings > Network > RJ45**.
   - Port number of the switch the tester is connected to.
   - Link Ability: Advertised link speeds of the switch port from 100 Mb/s to 10 Gb/s.
   - IP address assigned to the tester if in DHCP or manually configured IP address. A ✓ indicates the tester is connected to the Internet (pings Google in the background).
5. Tap the ⚙ icon to configure the test.
6. Tap ✓ next to sub-each test to perform.

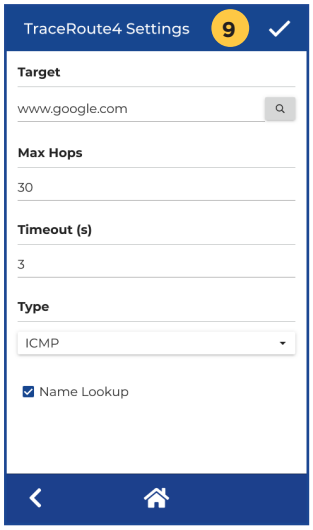


7. Copper/Fiber Network Diagnostics

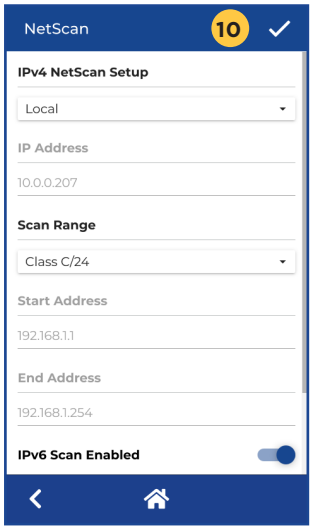


7. Tap the name of each test to configure the measurement parameters.

8. Ping – Tests the round trip time between the tester and the Target. Useful for detecting delays on the network to specific servers or websites.
   - Count: The number of packets to send during the test.
   - Pause (ms): The delay between each packet in milliseconds. 1000 ms = 1 second. Cannot be adjusted when more than one target is selected.
   - Length: The number of bytes (size) of the packet.
   - Target (s): Tap **+** to add a new target or tap 🔍 to select a Target from the saved list. Tap **-** to remove a target.
   - Tap ✓ to save the settings.



9. TraceRoute – Identifies the number of routers between the tester and the target. Useful for detecting congested routers on the network that are causing transmission delays.
   - Enter a Target URL or IP address, or tap 🔍 to choose a target from the list. Only one Target is allowed for TraceRoute.
   - Max Hops: The maximum number of router hops allowed before the test aborts.
   - Timeout (s): The maximum time the test will wait for a router to respond with to the request before skipping and reporting “Unknown”.
   - Type: Specify whether the test should use ICMP (Internet Control Message Protocol) or UDP packets.
   - Name Lookup: attempts to resolve the IP address to a user identifiable name. Name resolution depends on the router configuration.



10. Netscan – Discovers devices connected to the network by IP and MAC address.
    - Local / Custom: Local = scan the same local network that the tester is connected to. In this example the tester has been assigned an IP address of 10.0.0.207. Selecting Local will scan for devices in this subnet.
      Custom allows the user to set an IP address in a different subnet.
    - IP Address: Displays the IP address assigned to the tester when in Local mode. Allows the user to input an IP address when in Custom mode.
    - Scan range: Sets the subnet mask - which part of the IP address identifies networks and which part identifies devices.

      Class C/24: Subnet mask 255.255.255.0. The first 24 bits of the 32 bit address are the network address, the last 8 bits are device addresses (2^{8}). Scans for 256 devices.

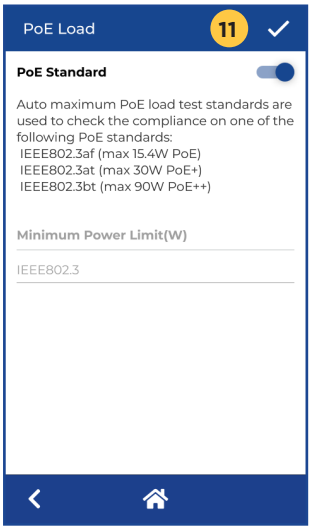
      Class C/20: Subnet mask 255.255.240.0. The first 20 bits are the network address, the last 12 bits are device addresses (2^{12}). Scans for 4,096 devices.

      Class B/16: Subnet 255.255.0.0. The first 16 bits are the network address, the last 16 bits are device addresses (2^{16}). Scans for 65,536 devices.
    - Custom Scan Range: Manually enter the starting and ending IP address range to scan for devices.
    - IPv6 Scan Enabled: Perform NetScan on IPv6 networks if the tester is assigned an IPv6 address.

7. Copper/Fiber Network Diagnostics

Note

- Selecting small network ranges/large device ranges (C/20, B/16) significantly increases the time to perform the network scan.

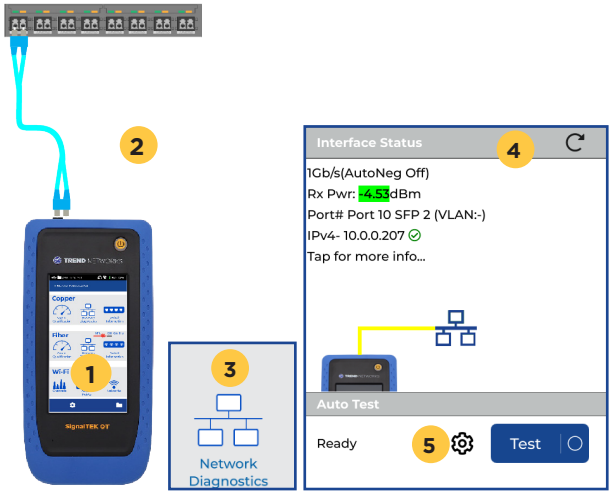


11. PoE Load – Select how much power should be supplied to pass the PoE test.
    - Enable to test PoE power to the IEEE 802.3 standard. The tester will determine the class of the PoE switch/PSE and draw the amount of power defined by the standard.

      Each PoE Class (0-8) has a defined power range. Low is the power that should be available at the end of a 100 m/328 ft cable. High is the power that should be available directly at the switch/PSE port. Select Low/High in Settings > Network > RJ45.

      Low should be used when testing from the end of an installed cable, as this is the power a device should be able to operate on. High should be used only when connected directly to a switch/PSE for troubleshooting faulty ports or miss-configured switches.

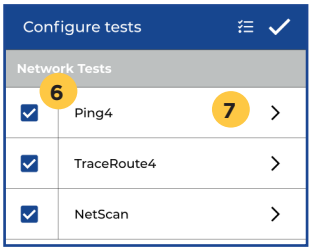
7.4 Fiber network diagnostics setup

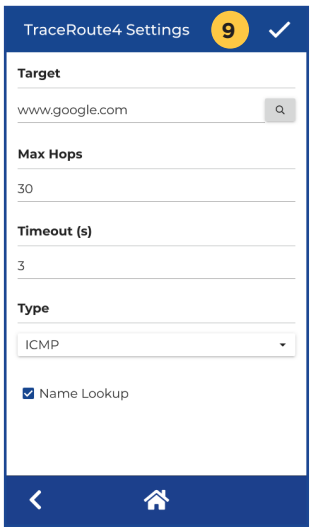


1. Go to the Home screen.
2. Connect the SFP test port to the network port.
3. Tap Network Diagnostics in the Fiber interface area.
4. The tester will begin detecting the network information and display the Interface Status.
    - Link speed up to 1Gb/s. The Ethernet port in the tester can connected to the network at 100Mb or 1Gb in fiber mode even with a 10Gb SFP installed. This will not affect diagnostic tests.
    - Rx Pwr: The power measured at the Rx port of the SFP module in the tester. TREND SFP modules are accurate to ±1.5 dB. Other brands of SFP modules may be less accurate or may not communicate the power level to the tester.
    - Port number of the switch the tester is connected to,
    - IP address assigned to the tester if in DHCP or manually configured IP address. A ✓ indicates the tester is connected to the Internet (pings Google in the background).
5. Tap ⚙ to configure the test.

7. Copper/Fiber Network Diagnostics

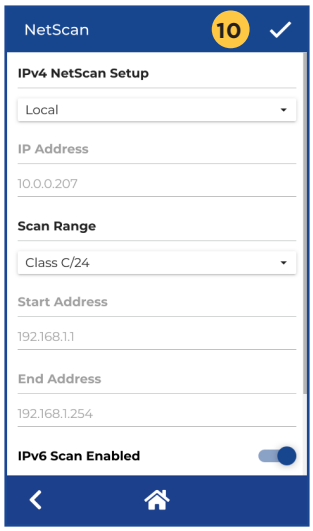
6. Tick the boxes next to sub-each test to perform.
7. Tap the name of each test to configure the measurement parameters.
8. Ping – Tests the round trip time between the tester and the Target. Useful for detecting delays on the network to specific servers or websites.
    - Count: The number of packets to send during the test.
    - Pause (ms): The delay between each packet in milliseconds. 1000 ms = 1 second. Cannot be adjusted when more than one target is selected.
    - Length: The number of bytes (size) of the packet.
    - Target (s): Tap **+** to add a new target or tap to select a Target from the saved list. Tap **-** to remove a target.
    - Tap ✓ to save the settings.
9. TraceRoute – Identifies the number of routers between the tester and the target. Useful for detecting congested routers on the network that are causing transmission delays.
    - Enter a Target URL or IP address, or tap to choose a target from the list. Only one Target is allowed for TraceRoute.
    - Max Hops: The maximum number of router hops allowed before the test aborts.
    - Timeout (s): The maximum time the test will wait for a router to respond with to the request before skipping and reporting “Unknown”.
    - Type: Specify whether the test should use ICMP (Internet Control Message Protocol) or UDP packets. ICMP is a special type of diagnostic packet, use this first and then try UDP if there are problems performing the test with ICMP.
    - Name Lookup: attempts to resolve the IP address to a user identifiable name. Name resolution depends on the router configuration.Go to the Home screen.





7. Copper/Fiber Network Diagnostics

10. Netscan – Discovers devices connected to the network by IP and MAC address.



- Local / Custom: Local = scan the same local network that the tester is connected to. In this example the tester has been assigned an IP address of 10.0.0.207. Selecting Local will scan for devices in this subnet.
  Custom allows the user to set an IP address in a different subnet.
- IP Address: Displays the IP address assigned to the tester when in Local mode. Allows the user to input an IP address when in Custom mode.
- Scan range: Sets the subnet mask - which part of the IP address identifies networks and which part identifies devices.

  Class C/24: Subnet mask 255.255.255.0. The first 24 bits of the 32 bit address are the network address, the last 8 bits are device addresses (2^{8}). Scans for 256 devices.

  Class C/20: Subnet mask 255.255.240.0. The first 20 bits are the network address, the last 12 bits are device addresses (2^{12}). Scans for 4,096 devices.

  Class B/16: Subnet 255.255.0.0. The first 16 bits are the network address, the last 16 bits are device addresses (2^{16}). Scans for 65,536 devices.
- Custom Scan Range: Manually enter the starting and ending IP address range to scan for devices.
- IPv6 Scan Enabled: Perform NetScan on IPv6 networks if the tester is assigned an IPv6 address.

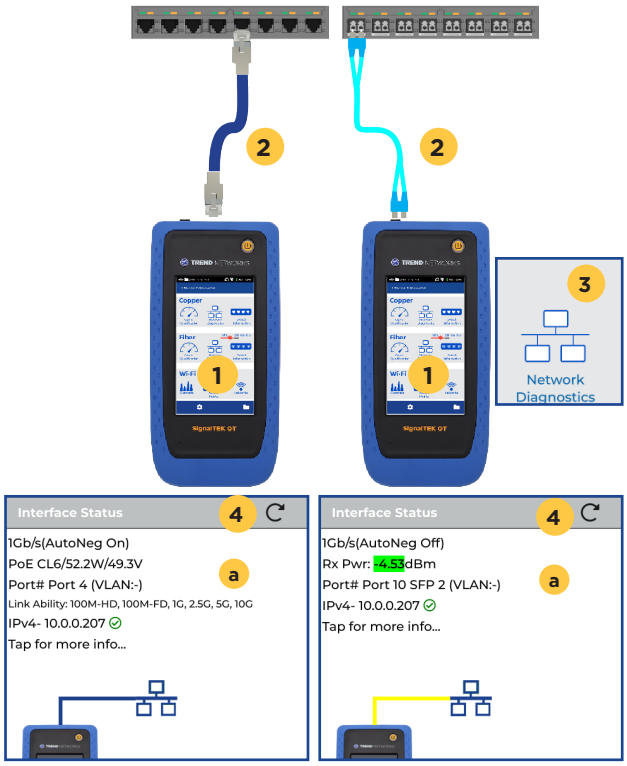
Note

- Selecting small network ranges/large device ranges (C/20, B/16) significantly increases the time to perform the network scan.

7. Copper/Fiber Network Diagnostics

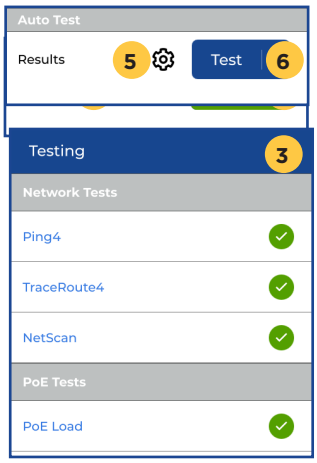
7.5 Running copper/fiber network diagnostic tests

1. Return to the Home screen.
2. Connect to the network with the copper or SFP test port.
3. Tap Network Diagnostics.
4. Wait for the tester to establish a network link.
   - Copper test mode Interface Status.
   - Fiber test mode Interface Status
5. Tap ⚙ to verify the test settings.
6. Tap Test to run the diagnostic test.
   - During the test “Ready” will change to “Testing” and the “Test” button will change to “Abort”.
   - Tap “Testing” to view the test in progress. Tap “Abort” to stop the test.
   - *Note: The test cannot begin until PoE classification is complete. A warning message is displayed if a Test is pressed before PoE classification is complete.*

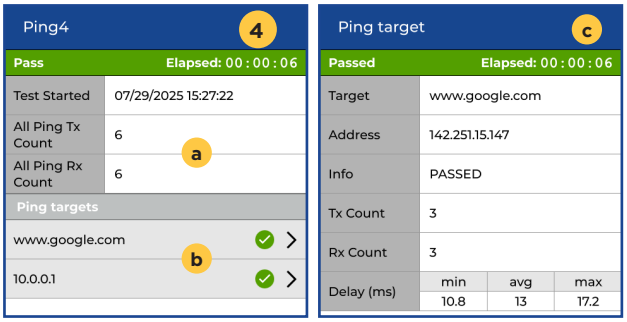


7.6 Network diagnostic test results

1. The test button is green Test ✓ if the test passed or red Test x if the test failed.
2. Tap **Results** to view the list of test results.
3. Tap a network test to view the details.
   - *Note: PoE Load is available only on copper network tests.*

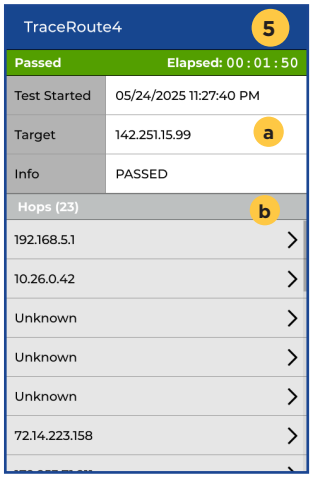


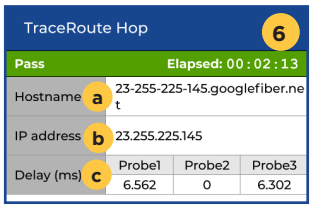
4. Ping test results.
   - **a.** Total transmit and receive packets.
   - **b.** Summary result for each target.
   - **c.** Detailed Ping result for a specific target.



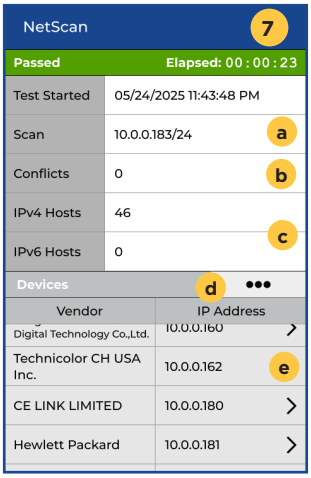
7. Copper/Fiber Network Diagnostics

5. TraceRoute test results.
   - **a.** Test start time, IP address resolved from URL, test result.
   - **b.** Address of each hop from the tester to the Target. Tap a hop to view the details.
6. Hop details
   - **a.** Router name if resolved.
   - **b.** Router IP address.
   - **c.** Round trip delay time to router. Each hop is tested three times.

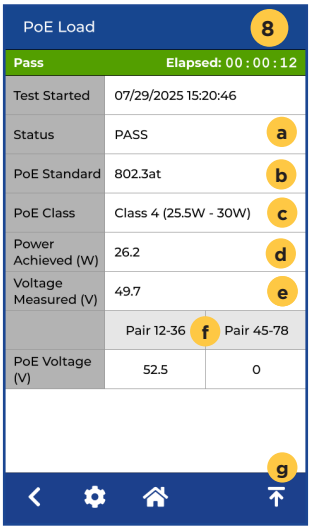


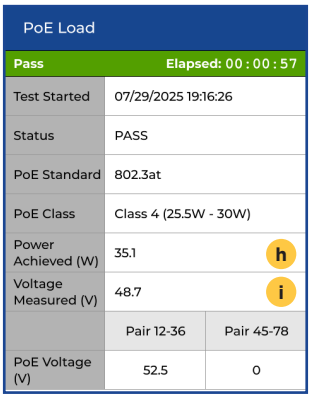


7. Netscan test results
   - **a.** Tester IP address and subnet setting for scan range.
   - **b.** Number of devices with the same IP address.
   - **c.** Total number of IPv4/IPv6 devices detected on the scan.
   - **d.** Tap ••• to sort by IP or MAC address.
   - **e.** List of devices detected on the network. The name of the vendor is displayed when available.



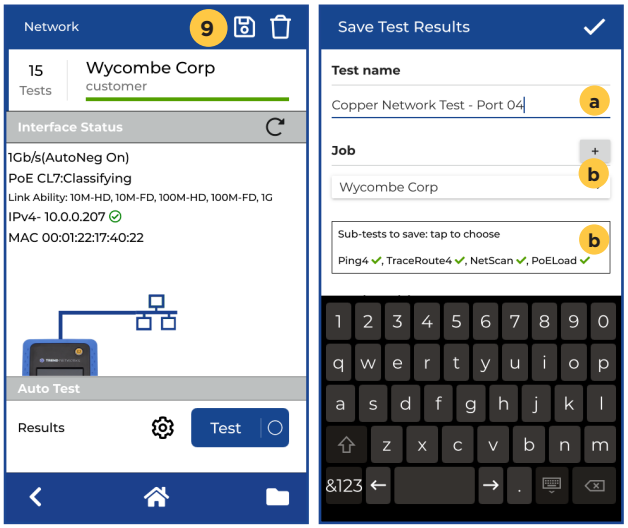
8. PoE load test results
   - **a.** Pass/Fail result.
   - **b.** PoE Type detected. None for non-standard PoE injectors or af, at, bt for IEEE 802.3 compliant PSEs.
   - **c.** Class detected and power required for test to pass.
   - **d.** Power available during load test.
   - **e.** Voltage available during load test. The voltage will drop depending on cable length, wire gauge and temperature of the cable.
   - **f.** Powered pair(s) and the voltage present when <u>not</u> under load.
   - **g.** Extended power PoE test. Tapping this will force the tester to incrementally draw more power than the standard test to determine if the switch/PSE is able to supply more power than requested.
     - *Note: The extended power test may cause the switch/PSE to reset or shut down if it detects the increase power draw as a fault.*
     - *The amount of additional power available depends on the switch/PSE, length of the cable, wire gauge and cable temperature.*
   - **h.** Extended power PoE test result (watts). 35.1 W vs. initial result of 26.2 W, an increase of 8.9 watts.
   - **i.** Extended power PoE test result (volts). 48.7 V vs. initial result of 49.7 V, a drop of 0.9 volts due to the additional power draw.





7. Copper/Fiber Network Diagnostics

9. Tap to save the test result or tap to delete the test result.
   a. Enter the test name.
   b. Select a job from the list or tap **+** to create a new job.
   c. All sub-tests are saved by default. Tap inside the sub-test box to changed the saved sub-tests if desired.
   d. Tap ✓ to confirm and save the test.



7.7 Fiber cable qualification introduction

Fiber optic cables are qualified by measuring insertion loss (attenuation) and length of the fiber cabling. The results are compared to a limit defined by the IEEE for each Ethernet speed or to a manual limit set by the user. The IEEE Ethernet limits define the attenuation and length for each grade of optical fiber from OM1-OM5 for multimode and OS1 or OS2 for single-mode.

SignalTEK QT Pro measures attenuation and length with optical SFP modules in a loopback mode. The first step is to perform a calibration with a patch cord and loopback plug to set the reference power level and zero the length measurement.

Attenuation is the difference in power measured during the test from the reference level measured during calibration. Length is calculated by the time a light pulse takes to travel from the transmit port to the receive port of the SFP module. The round trip time is divided by 2 to claculate the length of the installed cabling.

Three wavelengths of SPF modules are supported. 850 nm for testing multimode fiber, 1310 nm and 1550 nm for testing single-mode fiber.

Note: 1310 nm modules may also be used to test multimode fiber although the attenuation reported may be higher than expected.

Measurement precautions

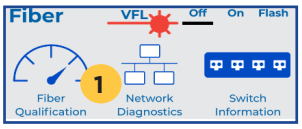
- Measurement accuracy is dependant on the stability of the SFP light source.
- TREND brand SFP modules are stable to ±0.05 dB after a 15 minute warm-up.
- Other brands of SFP modules can be used and the accuracy of the attenuation measurements is affected by the source stability. Check the manufacturer's specifications before using for fiber qualification testing.
- Clean all connectors and the SFP ports prior to calibration and testing. A fiber optic microscope can be attached to the SignalTEK QT Pro for inspection to ensure all connections are clean.
- Most failures are caused by dirty connectors. Clean and inspect connectors in the event of a failure.

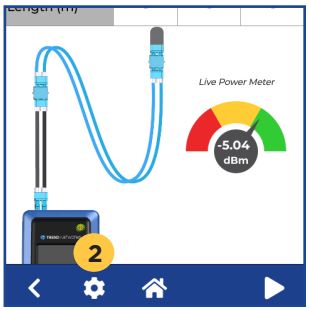
7. Copper/Fiber Network Diagnostics

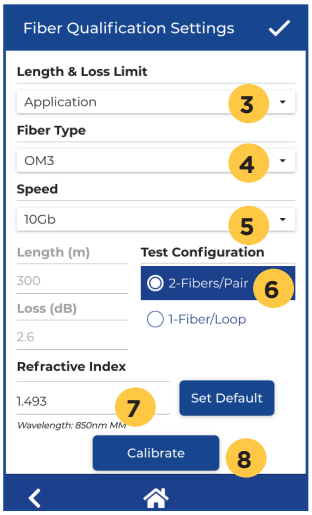
7.8 Fiber cable qualification setup

Insert the SFP module into the tester and allow the temperature of the module to stabilize for 15 minutes prior to calibration and testing.

1. Tap Fiber Qualification on the Home screen.
2. Tap the setting icon to open Fiber Qualification Settings.
3. Choose Application or Manual from the Length & Loss Limit menu. Application will qualify the fiber using IEEE Ethernet limits, Manual allows the user to specify a loss and length limit.
4. Set the Fiber Type to match the fiber being tested.
5. Set the Speed to the desired qualification speed. The range of speeds available depends on the Fiber Type selection, ranging from 100 Mb to 100 Gb.
   - The Length and Loss values update to reflect the limits based on the Fiber Type and Speed settings.
6. Select 2-Fibers/Pair if testing a pair of fibers with a loopback plug at the far end (typical testing mode). Select 1-Fiber/Loop if connecting one fiber between the Tx and Rx ports of the SFP (both ends of a single fiber connecting to the SFP).
7. Set the Refractive Index to match the specifications of the fiber being tested. This setting adjusts the length measurement similar to the NVP setting for copper cables.
8. Tap Calibrate to begin the referencing process.







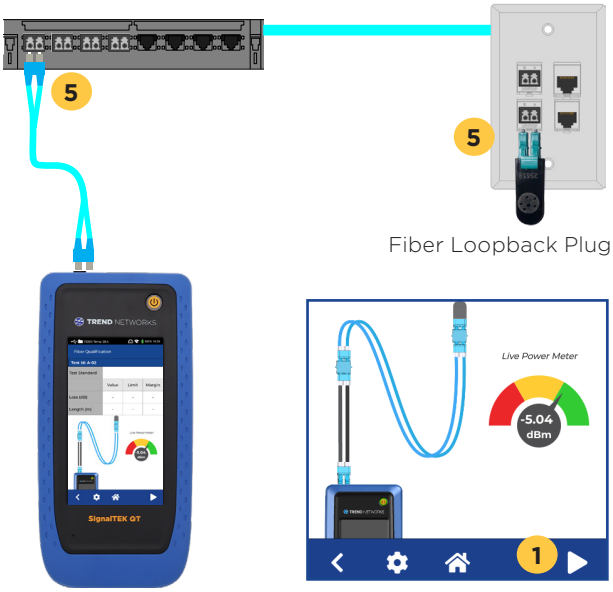
7. Copper/Fiber Network Diagnostics

7.9 Fiber cable calibration

Before performing a qualification test the loss and length of the loopback plug and test jumper must be measured so the results can be subtracted from the final test result. The live power meter displays the absolute power in dBm detected by the SFP receiver. The meter should read from 0 to -10dBm if the SFP ports, jumper connectors and loopback plug connectors are clean. 0 to -3 dBm indicates very clean connections.

1. Connect the fiber jumper and loopback plug to the tester. Test LC cables with the LC-LC jumper and LC loopback or test SC cables with the LC-SC jumper and SC loopback.
2. Tap CALIBRATE if the pointer and dBm value is in the green range.

   Clean the test cord, loopback plug and SFP connectors if the power level is in the yellow or red range.
3. A pass message is shown if the loss is within limits.
4. Tap FINISH to complete calibration.
5. Disconnect the loopback plug from the jumper. Connect the jumper to one end of the cable under test and connect the loopback plug to the other end of the cable.

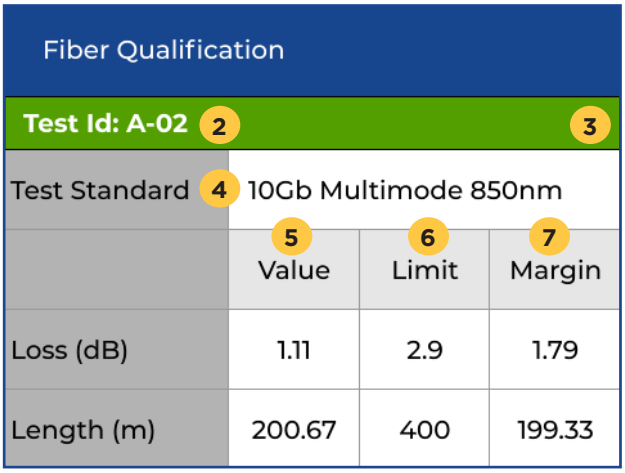


7. Copper/Fiber Network Diagnostics

7.10 Fiber qualification test and results

- Set the qualification settings described in “Fiber Qualification Setup”.
- Allow the tester and SFP to warm up for 15 minutes then perform the calibration described in “Fiber cable calibration”. Connect the tester and loopback plug to the cable under test.
- The live power meter will display -- dBm when the loopback is not connected to the same fiber pair as the tester. When properly connected the live power meter will update to display the power level detected by the receiver.

1. Tap the start button to run a test, the results screen updates when the test is complete.
2. The last number/letter in the ID automatically increments from the previously saved test.
3. A green bar represents pass, a red bar indicates fail.
4. Selected test standard.
5. Value
   - Loss (dB) = measured attenuation
   - Length (m) or (ft) = measured length of the cable.
6. Limit - the maximum loss and length allowed by the selected test limit.
7. Margin - The “headroom” between the Value and Limit. Positive numbers pass, negative numbers fail.



8. Wi-Fi Network Diagnostics

8.1 Introduction

SignalTEK QT Pro can perform several diagnostic tests on wireless networks to validate connectivity and check for potential problems.

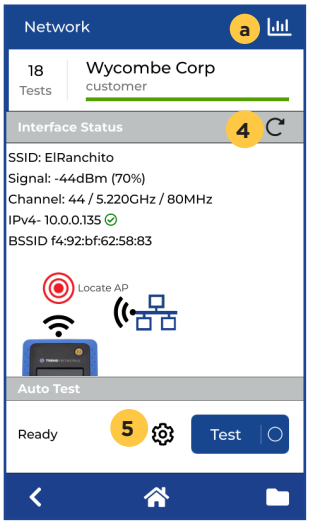
The available diagnostic tests are Ping, TraceRoute and Netscan. Network diagnostic tests are run against a Target. Targets can be a device on the LAN or Internet. The default target set in the tester is www.google.com.

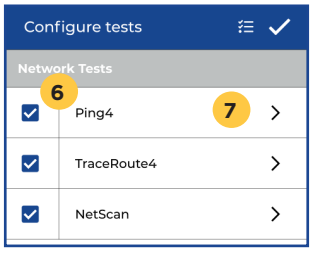
Targets can be modified in **Settings > Default Test Settings > IPv4/IPv6 Targets**. Targets can also be specified on a test-by-test basis. The Ping test supports up to **three** Targets allowing the user to check connectivity to different devices/servers from the wireless network the tester is connected to.

8.2 Wi-Fi network diagnostics setup

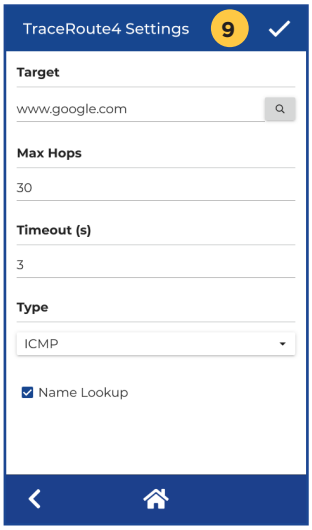
- Confirm the Wi-Fi antenna is set to Internal or External as desired in **Settings > Network > Wi-Fi**. Ensure the antenna is connected if the setting is set to External Antenna, otherwise the wireless reception will be low.
- The signal strength indicator at the top of the screen displays when Internal antenna is selected and when External antenna is selected.

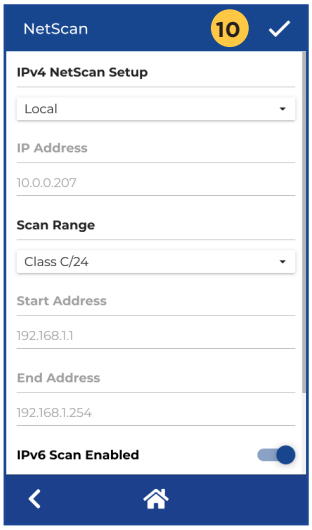
1. Return to the Home screen.
2. Tap Networks Diagnostics in the Wi-Fi section.
3. The tester will connect to the last known network.
   a. Tap to select a different wireless network.
4. The Interface Status of the network is displayed.
   - SSID: Name of the network the tester is connected to.
   - Signal: Current signal strength in -dBm (decibel milliwatts) and percent. -30 dBm is nearly perfect, -50 dBm is excellent, -60 dBm is good, -70 dBm is low, and -80 to -90 dBm is very low.
   - Channel: Channel the wireless access point (AP) is currently using.
   - IPv4/IPv6: IP address assigned to the tester by the network. A ✓ indicates the tester is connected to the Internet (pings google.com in the background).
   - MAC: Media Access Controller number of the tester's Wi-Fi radio.
5. Tap to configure the network diagnostic tests.
6. Tick the boxes next to sub-each test to perform.
7. Tap the name of each test to configure the measurement parameters.
8. Ping – Tests the round trip time between the tester and the Target. Useful for detecting delays on the network to specific servers or websites.
   - Count: The number of packets to send during the test.
   - Pause (ms): The delay between each packet in milliseconds. 1000 ms = 1 second. Cannot be adjusted when more than one target is selected.
   - Length: The number of bytes (size) of the packet.
   - Target (s): Tap **+** to add a new target or tap to select a Target from the saved list. Tap **-** to remove a target.
   - Tap ✓ to save the settings.





8. Wi-Fi Network Diagnostics





9. TraceRoute – Identifies the number of routers between the tester and the target. Useful for detecting congested routers on the network that are causing transmission delays.

- Enter a Target URL or IP address, or tap to choose a target from the list. Only one Target is allowed for TraceRoute.
- Max Hops: The maximum number of router hops allowed before the test aborts.
- Timeout (s): The maximum time the test will wait for a router to respond with to the request before skipping and reporting "Unknown".
- Type: Specify whether the test should use ICMP (Internet Control Message Protocol) or UDP packets. ICMP is a special type of diagnostic packet, use this first and then try UDP if there are problems performing the test with ICMP.
- Name Lookup: attempts to resolve the IP address to a user identifiable name. Name resolution depends on the router configuration.

10. Netscan – Discovers devices connected to the network by IP and MAC address.

- Local / Custom: Local = scan the same local network that the tester is connected to. In this example the tester has been assigned an IP address of 10.0.0.207. Selecting Local will scan for devices in this subnet.
  Custom allows the user to set an IP address in a different subnet.
- IP Address: Displays the IP address assigned to the tester when in Local mode. Allows the user to input an IP address when in Custom mode.
- Scan range: Sets the subnet mask - which part of the IP address identifies networks and which part identifies devices.

  Class C/24: Subnet mask 255.255.255.0. The first 24 bits of the 32 bit address are the network address, the last 8 bits are device addresses (2^{8}). Scans for 256 devices.

  Class C/20: Subnet mask 255.255.240.0. The first 20 bits are the network address, the last 12 bits are device addresses (2^{12}). Scans for 4,096 devices.

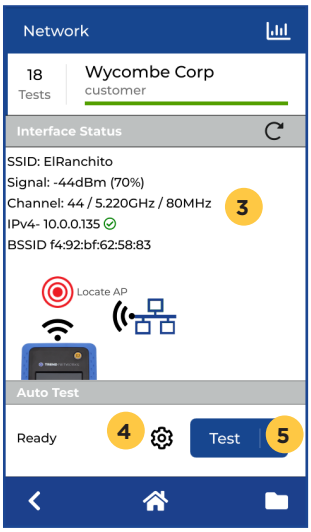
  Class B/16: Subnet 255.255.0.0. The first 16 bits are the network address, the last 16 bits are device addresses (2^{16}). Scans for 65,536 devices.
- Custom Scan Range: Manually enter the starting and ending IP address range to scan for devices.
- IPv6 Scan Enabled: Perform NetScan on IPv6 networks if the tester is assigned an IPv6 address.

8. Wi-Fi Network Diagnostics

8.3 Running Wi-Fi network diagnostic tests

- Check the antenna configuration in **Settings > Network > Wi-Fi** is set to match the antenna connected to the tester.

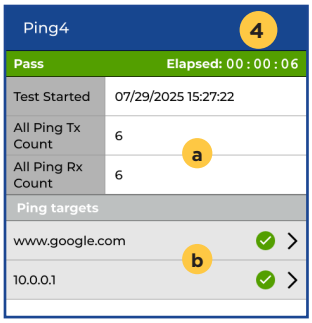
1. Return to the Home screen.
2. Tap Network Diagnostics.
3. Wait for the tester to establish a network link.
   - Copper test mode Interface Status.
   - Fiber test mode Interface Status
4. Tap ⚙ to verify the test settings.
5. Tap Test to run the diagnostic test.
   - During the test "Ready" will change to "Testing" and the "Test" button will change to "Abort".
   - Tap "Testing" to view the test in progress. Tap "Abort" to stop the test.
   - *Note: The test cannot begin until PoE classification is complete. A warning message is displayed if a Test is pressed before PoE classification is complete.*

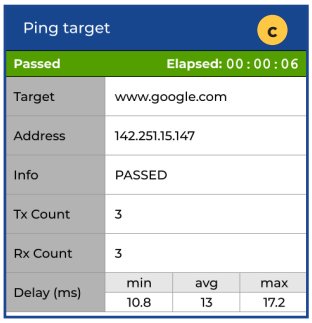


8.4 Wi-Fi network diagnostic test results

1. The test button is green Test ✓ if the test passed or red Test x if the test failed.
2. Tap **Results** to view the list of test results.
3. Tap a network test to view the details.

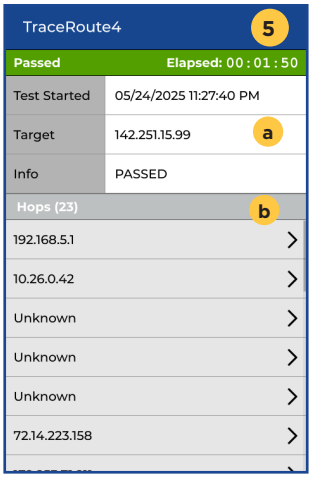
4. Ping test results.
   a. Total transmit and receive packets.
   b. Summary result for each target.
   c. Detailed Ping result for a specific target.

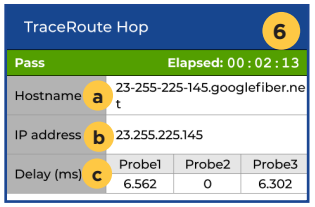


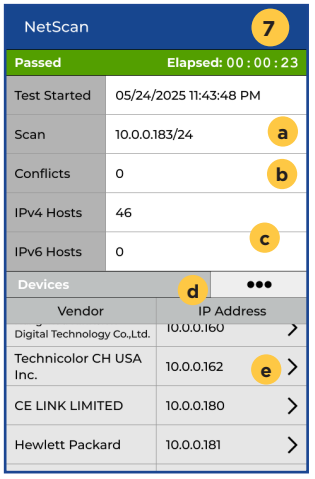


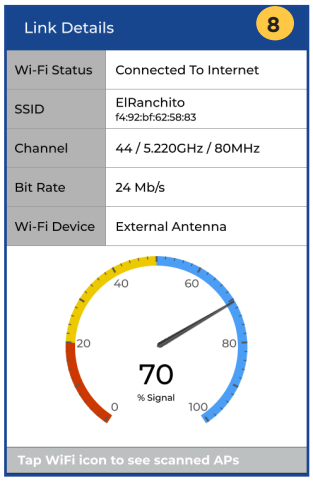
8. Wi-Fi Network Diagnostics

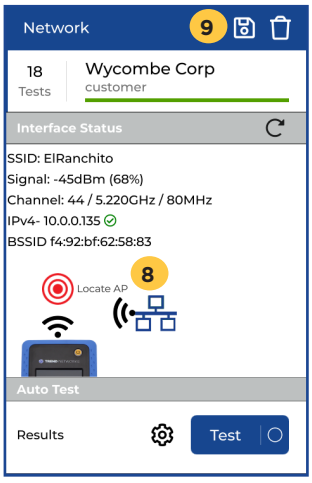
5. TraceRoute test results.
   - **a.** Test start time, IP address resolved from URL, test result.
   - **b.** Address of each hop from the tester to the Target. Tap a hop to view the details.
6. Hop details
   - **a.** Router name if resolved.
   - **b.** Router IP address.
   - **c.** Round trip delay time to router. Each hop is tested three times.
7. Netscan test results
   - **a.** Tester IP address and subnet setting for scan range.
   - **b.** Number of devices with the same IP address.
   - **c.** Total number of IPv4/IPv6 devices detected on the scan.
   - **d.** Tap ••• to sort by IP or MAC address.
   - **e.** List of devices detected on the network. The name of the vendor is displayed when available.
8. Tap the icon to view the signal strength meter.
   - Use this to locate an access point by walking around to find the peak signal. Using the external antenna is useful with the SignalTEK Pro model.
9. Tap 💾 to save the test result or tap 🗑 to delete the test result.
   - **a.** Enter the test name.
   - **b.** Select a job from the list or tap **+** to create a new job.
   - **c.** All sub-tests are saved by default. Tap inside the sub-test box to changed the saved sub-tests if desired.
   - **d.** Tap ✓ to confirm and save the result.

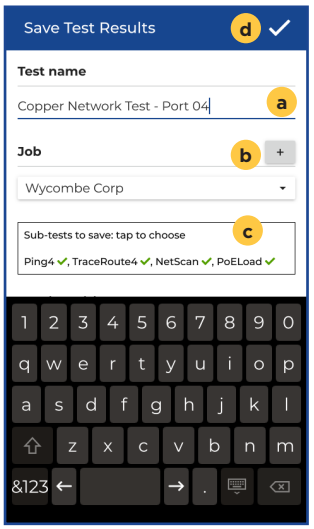












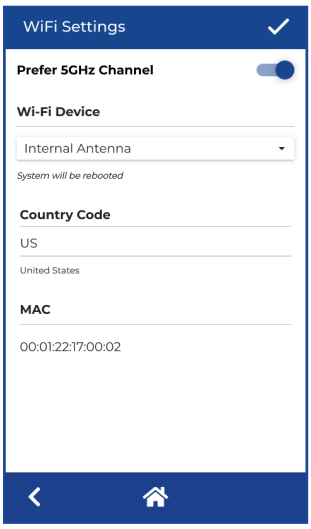
9. Wi-Fi Channel Map (Pro Model)

9.1 Introduction

The Wi-Fi Channels function provides a graphical view of the wireless access points detected by the tester using the internal 2.4/5 GHz Wi-Fi radio (Wi-Fi 5) or by using an external USB Wi-Fi adapter. (Wi-Fi 6 or higher).

In Channel Map mode the tester does not need to be connected to a Wi-Fi network. Channel Map is a passive mode where the tester is "listening" to beacon packets that are broadcast by wireless access points. The beacon packets contain information about the access point including the network name (SSID), AP hardware address (BSSID), signal strength, channel number, etc. The channel map updates every few seconds as it receives beacon packets from nearby APs.

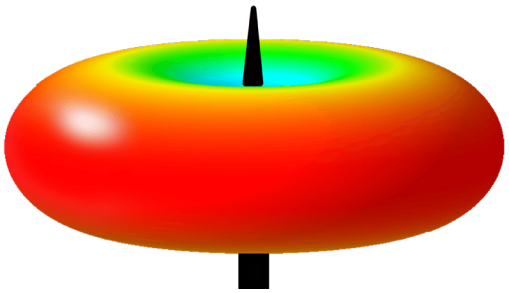
When using the internal Wi-Fi radio, either the internal or external antenna can be selected in **Settings > Network > Wi-Fi**. The internal external provides better reception than the internal antenna and will detect APs that are farther away than the internal antenna.



Note:

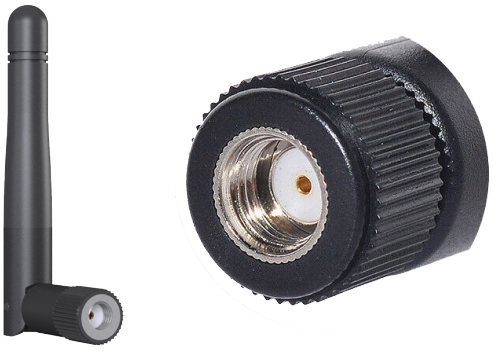
- Always verify the antenna setting prior to using the Channel Map function.
- SignalTEK QT meets radio transmitter regulations only when using the internal antenna or the supplied external antenna. The supplied external antenna is compatible with 2.4 GHz and 5 GHz Wi-Fi bands.
- Only USB Wi-Fi adapters using a MediaTek® chipset are supported.

The included external antenna is a dipole type that provides uniform sensitivity in a "donut" shape around the antenna body. The sensitivity gradually weakens as distance from the antenna increases.



The lowest sensitivity zones are at the ends of the antenna. For optimal sensitivity, ensure the antenna is oriented vertically when using the tester. Pointing the antenna in a direction or at a device will reduce the reception in the direction it is pointed.

The connector on the supplied antenna is RP-SMA, male (Reverse Polarity-Sub Miniature version A, male) and the length is 10.8 cm/4.25 inches.



External dipole antenna with RP-SMA Male Connector

Using an antenna other than that supplied with the SignalTEK QT Pro may result in the Wi-Fi radio no longer meeting regulatory requirements.

Using a directional antenna may aid in the location of hidden Access Points however it may result in the Wi-Fi radio no longer meeting regulatory requirements.

Note:

- TREND Networks is not responsible if non-compliant or directional/patch antennas are used with SignalTEK QT Pro.

9. Wi-Fi Channel Map (Pro Model)

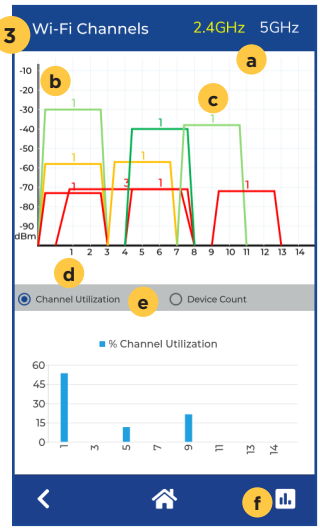
9.2 Channel Map Display

- Verify the antenna selection in **Settings > Network > Wi-Fi**.

1. Return to the Home screen.
2. Tap Channels in the Wi-Fi section.

Wi-Fi channels

3. Wait for the Wi-Fi service to start and begin detecting nearby access points.



   a. The active Wi-Fi band is shown in yellow at the top of the screen. Tap 2.4GHz or 5GHz to select the desired band. Each detected access point it represented by a bracket.

- Brackets are centered over the channel the AP is broadcasting on. Signal strength is represented by the height of the bracket. AP bandwidth is represented by the width of the bracket.

   b. Channel Map bracket color reflects signal strength according to the table below.

Signal Strength	Quality	Notes
-10 to -39 dBm	Excellent	Very close to the access point.
-40 to -49 dBm	Very Good	Very high transmission speeds.
-50 to -59 dBm	Good	Reliable packet delivery with minimal packet loss.
-60 to -69 dBm	Not Good	Basic connectivity and high packet loss.
-70 to -90 dBm	Unusable	May connect with minimal functionality.

   c. Number of networks (SSIDs) on a channel at similar strength.
      - When multiple networks are detected on a channel with the same signal strength a number above the bracket represents the number of networks detected.
      - Use of the external antenna will likely increase the SSID count as it allows the tester to detect weak signals from access points that are farther away.
   d. Channel number – Each bracket is centered over the Primary channel number the network is broadcasting on.
   e. Change lower display to Channel Utilization or Device Count.
      - Channel Utilization displays the percentage of time devices are actively transmitting on the channel. Utilization ≥70% identifies a channel that is very busy and users may experience slow connection speeds.
      - Device count displays the number clients (phones, tablets, computers, TVs, etc) detected by the tester on each channel. Use of the external antenna will likely increase the device count as it allows the tester to detect weak signals from devices that are farther away.
   f. Tap to view a list of detected networks/SSIDs. The tester can connect to a network from this page to perform diagnostic tests.

9. Wi-Fi Channel Map (Pro Model)

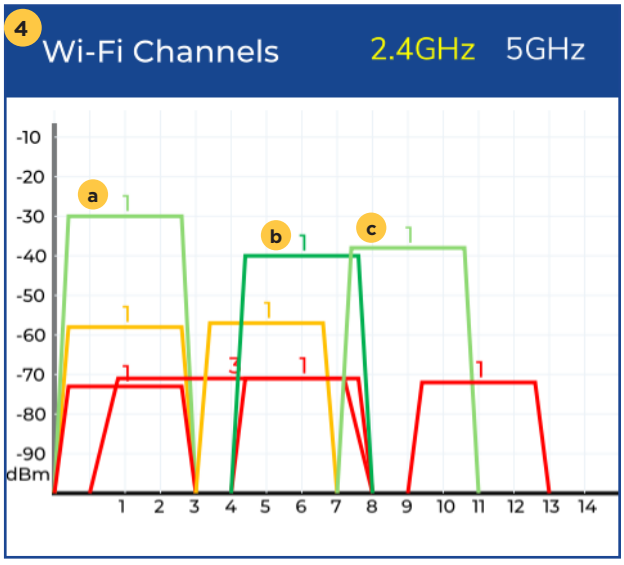
4. 2.4 GHz Channel Map

- In the 2.4 GHz band channels can be 20 or 40 MHz wide. 40 MHz channels provide more bandwidth/throughput but are more likely to overlap causing interference between adjacent channels. 20 MHz channels provide less bandwidth/throughput and are less likely to interfere with adjacent channels.
- Channels in this band are evenly spaced from channel 1 to 14 (2.401 GHz to 2.495 GHz) depending on geographic region.
- At the current location of the tester, networks **“a”, “b”** and **“c”** are not interfering because of channel separation even through the signals are strong.
- The other networks on the same channels are weak enough not to cause interference with a, b and c. A difference of 20 dB (99% weaker) provides good isolation.

a. The tester is in a location where strong signal APs are only slightly overlapping. Channels 6 and 9 are both strong and there is suitable separation becuase the channels are 20 MHz wide. If both were 40 MHz wide there would be significant interference between channels 6 and 9.

b. There is overlap between channels 3, 4 and 6. The signal level is from -60 to -80 dBm so at the tester’s location these networks are very weak compared to the networks on channel 6 (-40 dBm) and channel 9 (-30 dBm).

- Good Wi-Fi performance if your network is on channels 6 and 9, and someone else’s networks are on channels 3, 4, 10 or 11.
- Bad Wi-Fi performance if your network is on channels 3, 4, 10 or 11, and someone else’s networks are on channels 6 and 9.
- If your own network has overlapping channels of similar signal strength consider checking the transmit power settings of your access points and lowering the transmit power or setting it to Auto to provide better signal separation between channels.



9. Wi-Fi Channel Map (Pro Model)

5. 5. GHz Channel Map
   - In the 5 GHz band channels are 20 MHz wide and can be combined to create greater throughput.
   - Channels in this band are in four ranges.
     - Low range = Channels 36-48 (5.170 to 5.250 GHz)
     - Mid range = Channels 52-64 (5.250 to 5.330 GHz)
     - High range = Channels 100-144 (5.490 to 5.730 GHz)
     - Upper range = Channels 149-165 (5.735 to 5.835 GHz)

Note:

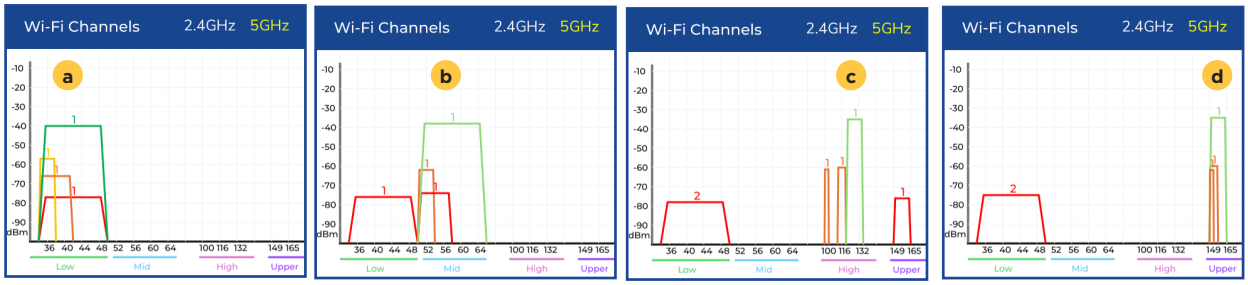
- In the High and Upper ranges the channel numbers and channel widths are compressed. The screens below demonstrate 20, 40 and 80 MHz channels in all four ranges.

a. Low range 20 (yellow) / 40 (orange) / 80 (green, red) MHz channels

b. Mid range 20 (orange) / 40 (red) / 80 (green) MHz channels

c. High range 20 (1st orange) / 40 (2nd orange) / 80 (green) MHz channels

d. Upper range 20 (1st orange) / 40 (2nd orange) / 80 (green) MHz channels



6. Combined Wi-Fi Channels in the 5 GHz band

   Standard Wi-Fi channels have a width of 20 MHz. When an access point is configured to use 40, 80 or 160 MHz channels the process is accomplished by combining multiple 20 MHz channels together. The AP will be set to a Primary 20 MHz channel and use Secondary 20 MHz channels below or above the Primary channel to create a 40, 80 or 160 MHz combined channel for increased throughput.

9. Wi-Fi Channel Map (Pro Model)

The table below illustrates an example of combining 20 MHz channels to create wider channels to increase bandwidth. Channel **44** is the Primary 20 MHz channel used in this example.

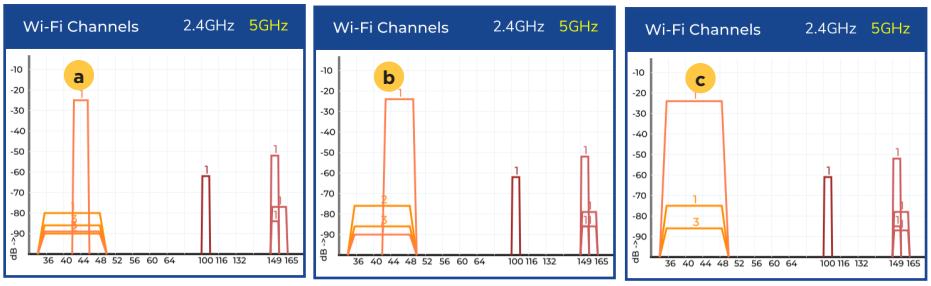
Center Frequency (MHz)	20 MHz Primary Channel	40 MHz Secondary Channel	80 MHz Secondary Channel	160 MHz Secondary Channel
5180	36	38	**42**	**50**
5200	40			
5220	**44**	**46**		
5240	48			
5260	52	54	58	
5280	56			
5300	60	62		
5320	64			

Using Primary channel 44 to demonstrate the Channel Map view with different channel widths.

a. AP set to channel 44/20 MHz. Channel bracket over channel 44.

b. AP set to channel 44/40 MHz. Channel bracket is wider and centered over channel 46 (see table).

c. AP set to channel 44/80 MHz. Channel bracket is wider and centered over channel 42 (see table).

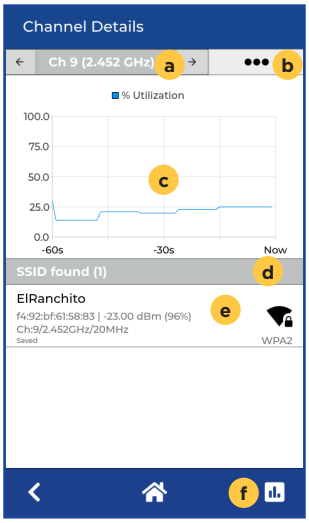


Note:

- In the 5 GHz spectrum, some 20, 40 and 60 MHz channels, and all 160 MHz channels operate on a system named Dynamic Frequency Selection (DFS). These frequency bands are used by various aircraft radar, weather radar and satellite communications systems.
- Before an access point operates on a DFS channel it must first perform a check to determine if any of these systems are detected. If the AP detects radar/satellite signals it cannot operate on a DFS channel and will automatically change to a different primary channel or change channel width to 80, 40 or 20 MHz to prevent interference with those systems. This process can take from 1 to 10 minutes depending on the radio frequency environment.
- You may expect an access point to be operating on a specific Primary channel or channel width and the tester will display a different Primary channel or channel width if the AP detected interference and automatically changed channels.

9. Wi-Fi Channel Map (Pro Model)

7. Tap the channel bracket on the Channel Map to change to the Channel Details screen.



   a. Primary Channel number and frequency. Tap ←or ←to select the previous or next channel.

   b. Tap ••• to change the Utilization plot time from 1 minute (default) to 10 minutes or 1 hour.

   c. Channel % Utilization – Amount of time the channel busy. Utilization ≥70% is busy and can result in dropped packets.

      - Consider changing some access points to different channels to reduce the load on a congested channel.

   d. SSIDs (networks) discovered – list of access points on the selected channel. The SSID is displayed when the network is broadcasting the SSID. Networks with hidden SSIDs display the BSSID (MAC address) of the access point.

   e. Network information

      - Network name (SSID)
      - BSSID of access point | signal strength
      - Channel number / frequency / channel width
      - Icon indicates relative signal strength and security status of the network.
      - Tap on a network to view the access point details in a table format.

   f. Cycle view between Channel Map, Channel Details and Wi-Fi Networks list without returning to the Home screen.

10. Wi-Fi AP Rate Test

10.1 Introduction

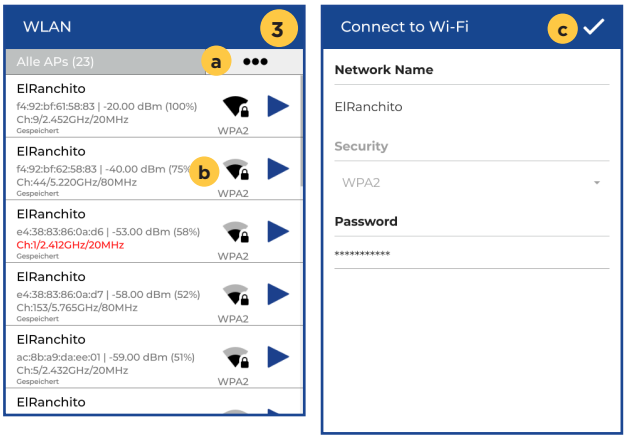
The Wi-Fi AP Test function displays a histogram of signal strength and maximum data rate from the connected access point to the tester. The view can be changed to display the previous 1 minute, previous 10 minutes or previous hour. The effective data rate depends on many factors including,

- Signal strength – affected by distance to the AP or walls and windows that reduce signal strength.
- Wi-Fi band (2.4 GHz) – Offers lower data rates and experiences less signal loss with distance or through certain obstacles. 2.4 GHz is also used by a lot of other wireless systems such as IoT devices, Bluetooth, Zigbee automation systems, microwave ovens, radio controlled hobby transmitters and even poorly shielded USB 3.0 devices. USB 3.0 provides a 5 Gb/s data rate which operates at a clock frequency of 2.4-2.5 GHz.
- Wi-Fi band (5 GHz) – Offers higher data rates but APs must be closer together to provide complete coverage. The 5 GHz band is less likely to be used by systems mentioned above, but there can be interference from various types of radar systems. Doppler weather radar, range and tracking radar and radio altimeters from commercial and military aircraft operate in the 5 GHz band. Your 5 GHz LAN may be affected if you are located near airports, weather radar stations or military sites.
- Channel bandwidth – APs can be configured to use different channel bandwidths for each channel. 2.4 GHz Wi-Fi can use 20 or 40 MHz channels, and 5 GHz Wi-Fi can use 20, 40 80 or 160 MHz channels. Wider channels offer more bandwidth which comes at the risk of higher interference from neighboring channels and external noise.

10.2 Wi-Fi AP rate setup and test

- Verify the antenna selection in **Settings > Network > Wi-Fi**.

1. Return to the Home screen.
2. Tap Access Points in the Wi-Fi section.
3. Select a network from the list. In this example the network “ElRanchito” is present on several channels with each having a different signal strength. The tester is not currently connected to a network (a connected network is shown in blue).
   a. Tap ••• to filter by 2.4 GHz, 5 GHz or All.
   b. Tapping the ElRanchito network on channel 44 to connect to it. This is a secure network and the tester will prompt for the password. The tester will enter the password if has been stored previously.
   c. Tap ✓ to connect.



10. Wi-Fi AP Rate Test

4. A histogram with the signal strength and Tx/Rx data rate is displayed.

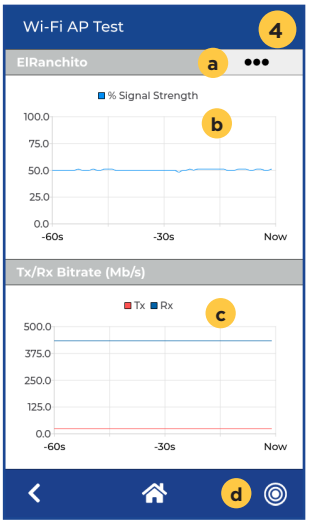
   a. Tap •••to change the time range to 1 minute, 10 minutes or 1 hour.

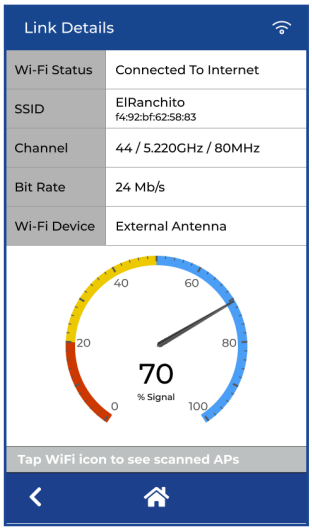
   b. Signal strength over the selected time range. The signal will increase or decrease as the tester is moved closer or further from the access point.

   c. Tx and Rx rate between tester and AP.

   - The Tx rate (orange line) is the data rate transmitted from the tester to the network. This is typically near zero as the tester is not actively transmitting to the AP.
   - The Rx rate (blue line) is the data rate that can be received by the tester as reported by the AP. The Rx rate depends on the factors mentioned in the Introduction above.

   d. Tap the target icon to open the live signal strength meter to assist in locating the access point.





5. The Rx rate is improved by changing the channel bandwidth on the access point. In the following screens the tester does not move (signal strength is stable) and the AP channel with is changed from 80 MHz, to 40 MHz, then 20 MHz. *160 MHz is not available in this area due to radar interference.*

   a. Signal strength remains steady over 10 minutes.

   b. AP set to 80 MHz – Rx rate is still 425-450 Mb/s.

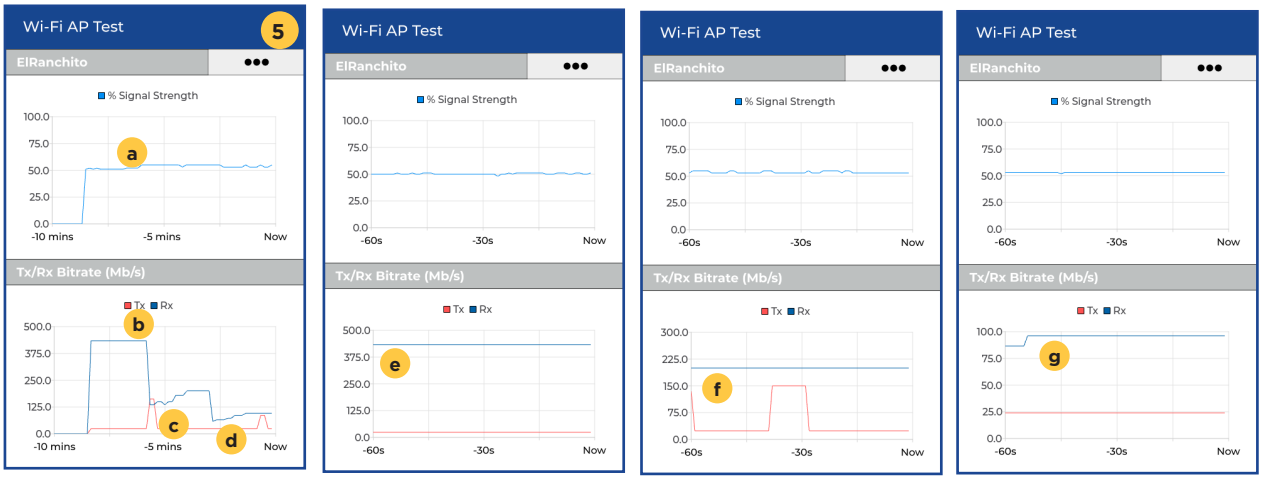
   c. AP set to 40 MHz – Rx rate drops to 125 Mb/s and slowly climbs to about 220 Mb/s as the AP negotiates with other devices connected to it.

   d. AP set to 20 MHz – Rx rate drops to 75 Mb/s and slowly climbs to about 95 Mb/s as the AP negotiates with other devices connected to it.

   e. 1 minute view at 80 MHz channel setting.

   f. 1 minute view at 40 MHz channel setting.

   g. 1 minute view at 20 MHz channel setting.



11. Appendices

Warranty Terms and Conditions

If the during the warranty term from the date of shipment, it will be repaired free of charge.

However, the following situations are not covered by the warranty:

- Failure or damage caused by natural disasters.
- Failure or damage caused by abnormal voltage supply or by connection network circuits with voltage that exceeds 60 VDC/VAC.
- Malfunction or damage caused by incorrect operation.
- Failure or damage caused by not following the operation steps in the manual.
- Consumable parts such as connectors, batteries, and other accessories.
- Warranty does not cover: accidental damage or malicious damage.

Request an RMA for service or repair

Visit www.trend-networks.com and click on Contact to locate the e-mail address and phone number of your nearest TREND Networks office and request an RMA.

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