BECKHOFF New Automation Technology

Manual | EN

CU8210-D001-0102

WLAN USB Stick for Europe, Russia, South Africa, Israel, Korea, Taiwan, China, Japan, Australia, New Zealand, India, Singapore



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1 Notes on the documentation

This description is intended exclusively for trained specialists in control and automation technology who are familiar with the applicable national standards.
The documentation and the following notes and explanations must be complied with when installing and commissioning the components.
The trained specialists must always use the current valid documentation.

The trained specialists must ensure that the application and use of the products described is in line with all safety requirements, including all relevant laws, regulations, guidelines, and standards.

Disclaimer

The documentation has been compiled with care. The products described are, however, constantly under development.
We reserve the right to revise and change the documentation at any time and without notice.
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1.1 Representation and structure of warnings

The following warnings are used in the documentation. Read and follow the warnings.

Warnings relating to personal injury:

⚠ DANGER
Hazard with high risk of death or serious injury.

⚠ WARNING
Hazard with medium risk of death or serious injury.

⚠ CAUTION
There is a low-risk hazard that can result in minor injury.

Warnings relating to damage to property or the environment:

NOTICE
There is a potential hazard to the environment and equipment.

Notes showing further information or tips:



This notice provides important information that will be of assistance in dealing with the product or software. There is no immediate danger to product, people or environment.

1.2 Documentation issue status

Version	Changes
1.0	First version
1.1	Configuration chapter adapted
1.2	Technical data chapter adapted
1.3	Nameplate chapter adapted
1.4	WLAN channels chapter adapted
1.5	TwinCAT/BSD chapter added
1.6	WLAN channels chapter adapted
1.7	Approval “Singapore” added
1.8	Operating system Beckhoff RT Linux® added

2 For your safety

Read the chapter on safety and follow the instructions in order to protect from personal injury and damage to equipment.

Limitation of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Unauthorized modifications and changes to the hardware or software configuration, which go beyond the documented options, are prohibited and nullify the liability of Beckhoff Automation GmbH & Co. KG.
In addition, the following actions are excluded from the liability of Beckhoff Automation GmbH & Co. KG:

- Failure to comply with this documentation.
- Improper use.
- Use of untrained personnel.
- Use of unauthorized replacement parts.

2.1 Intended use

With the CU8210-D001-0102 WLAN stick, Beckhoff Industrial PCs can be equipped with a WLAN module and subsequently connected to a network.

The WLAN stick was developed for a work environment that conforms to protection class IP20. This involves finger protection and protection against solid foreign objects up to 12.5 mm, but not protection against water. Operation of the devices in wet and dusty environments is not permitted, unless specified otherwise. The specified limits for electrical and technical data must be adhered to.

The WLAN stick is used:

- to equip Industrial PCs with a network connection without a comprehensive cable-based infrastructure, or
- to reach difficult to access machine or plants more easily.

Improper use

The WLAN stick is not suitable for operation in the following areas:

- areas in which the use of radio devices is prohibited.
- Potentially explosive atmospheres.
- Areas with an aggressive environment, e.g. aggressive gases or chemicals.
- applications that require real-time communication via radio.

2.2 Staff qualification

All operations involving Beckhoff software and hardware may only be carried out by qualified personnel with knowledge of control and automation engineering. The qualified personnel must have knowledge of the administration of the Industrial PC and the associated network.

All interventions must be carried out with knowledge of control programming, and the qualified personnel must be familiar with the current standards and guidelines for the automation environment.

2.3 Safety instructions

The following safety instructions must be followed during installation and working with networks and the software.

WLAN

- The WLAN stick can be impaired in the vicinity of metal constructions or plants that emit electromagnetic waves. Plan the distances and use the WLAN stick in such a way that the connection between the WLAN stick and the WLAN is as unobstructed as possible.
- Do not allow any dust, liquids or vapors that could damage the WLAN stick to get inside it. Use the WLAN stick together with the CU8210-M001-01x0 or CU8210-M002-0100 cabinet dome in order to protect it against environmental influences.
- Encrypt the WLAN with the WPA2 security mechanism.

Working with networks

- Restrict access to all devices to an authorized circle of persons.
- Change the default passwords to reduce the risk of unauthorized access.
- Protect the devices with a firewall.
- Apply the IT security precautions according to IEC 62443, in order to limit access to and control of devices and networks.

3 Product overview

With the CU8210-D001-0102 WLAN stick, Beckhoff Industrial PCs can be equipped with a WLAN module and operated in client mode or as an access point, depending on the operating system.

The WLAN stick offers the encrypted exchange of data at a transfer rate of up to 433.3 Mbit/s and supports 20 MHz, 40 MHz and 80 MHz transmission bandwidths. The WLAN stick supports the IEEE 802.11 ac Draft 2.0 and 802.11 a/b/g/n specifications. The WLAN stick is backward compatible and enables communication with older devices.

In addition, the WLAN stick supports the WiFi-Direct standard. A connection can thus be established between two WLAN end devices without a central access point.

3.1 Structure

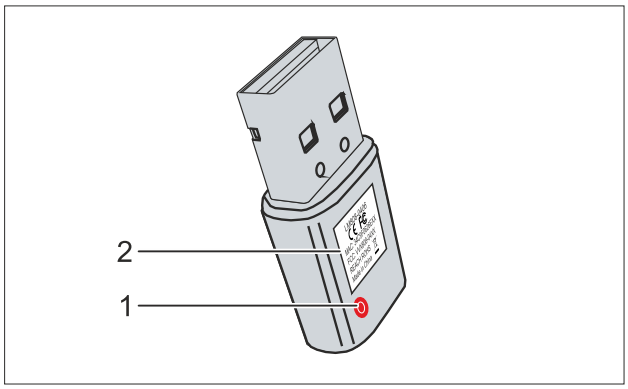


Fig. 1: Structure of a CU8210-D001-0102 WLAN stick.

Table 1: Legend for the configuration.

No.	Component	Description
1	Diagnostic LED [▶ 31]	The LED is located under the plastic. The diagnostic LED indicates the status of the WLAN stick and, for example, whether the WLAN stick is switched on or is connected to a network.
2	Name plate	The name plate can be used for the identification of the model. The MAC address can be found here.

3.2 Name plate

The WLAN sticks are available in two versions, which differ only in the type of certification. Depending on the certification, the sticks can be used in certain regions or countries.

The name plate makes it easier to find a stick with the appropriate certification for a region or country. The name plate is located on the housing of the WLAN stick:

- The marking LM808-0406 corresponds to the CU8210-D001-0102 WLAN stick, which is suitable for operation in Europe, Russia, South Africa, Israel, Korea, Taiwan, China, Japan, Australia, New Zealand, India, Singapore.
- The marking LM808-0407 corresponds to the CU8210-D001-0101 WLAN stick, which is suitable for operation in USA, Canada.

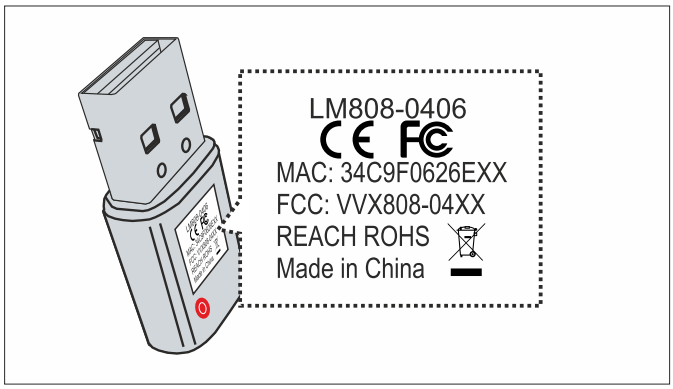


Fig. 2: CU8210-D001-0102 Name plate.

In addition, the MAC address of the WLAN stick is shown on the name plate and a list of certificates on the USB plug.

3.3 System requirements

Table 2: CU8210-D001-0102 System requirements.

Operating system	Version
Windows	Windows 7 (32 and 64-bit) Windows 10 (32 and 64-bit)
TwinCAT/BSD®	TwinCAT/BSD® v.12.1
Beckhoff RT Linux®	13

3.4 WLAN principles

WLAN (Wireless Local Area Network) is a radio technology that makes wireless networks and wireless internet access possible. WLAN, which is defined by the IEEE 802.11 standards family, can be configured in the following mode:

Infrastructure network

The main difference between wireless infrastructure networks and wireless ad hoc networks is that the PCs in a wireless infrastructure network can access the Internet via an access point.

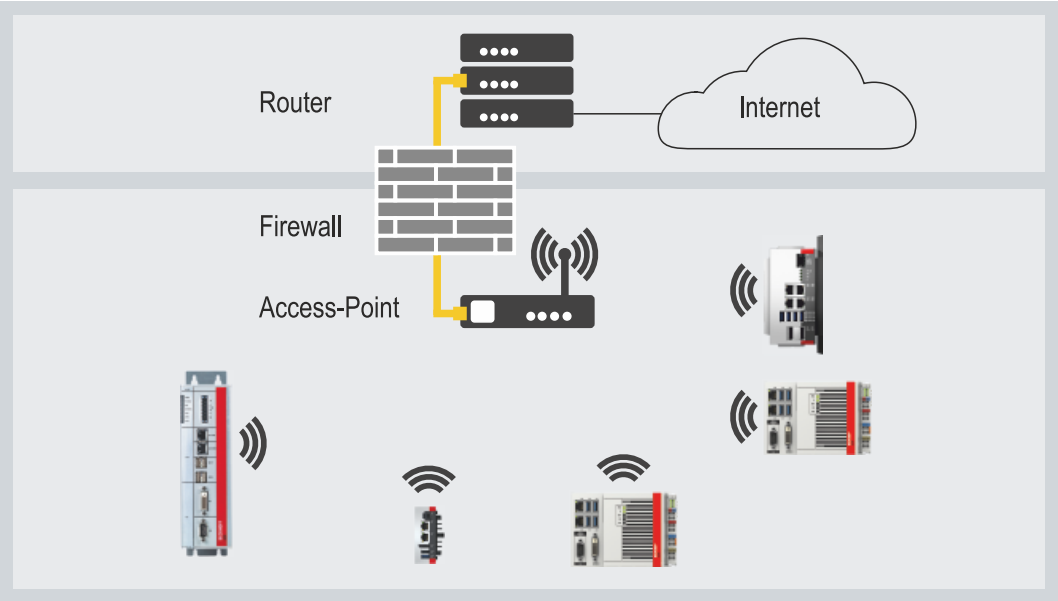


Fig. 3: Example of an infrastructure network.

Pay attention to security when setting up an infrastructure network, because a connection to the internet is a potential weak point in the network infrastructure.

Encryption

WLAN encryption is an important security setting and you must ensure that no unauthorized user can log on and use the network resources. The WLAN stick supports the WPA2 (Wi-Fi Protected Access) security mechanism,

where a key that is used to encrypt the data is defined in the access point or router. This key must be entered in the clients' settings and must match the defined key.

Encryption with WEP is obsolete and can be decrypted in a short time.

Frequency range

If several WLANs are operated within a small radius, mutual interference can occur because both WLANs work in the same frequency range or the distance between the channels is too small.

This can affect the connection quality in terms of reliability and data transfer rate.

If there are persistent disturbances, select a different channel to prevent frequency sharing.

4 Configuration

4.1 Windows 7

The WLAN stick only functions on Windows 7 systems after installing the driver. The configuration software from Realtek, with which the WLAN stick can be configured, is also installed together with the driver.

- The WLAN stick can be configured as an access point with the configuration software from Realtek.
- A WLAN connection can also be established using Windows standard applications.

4.1.1 Installing the driver

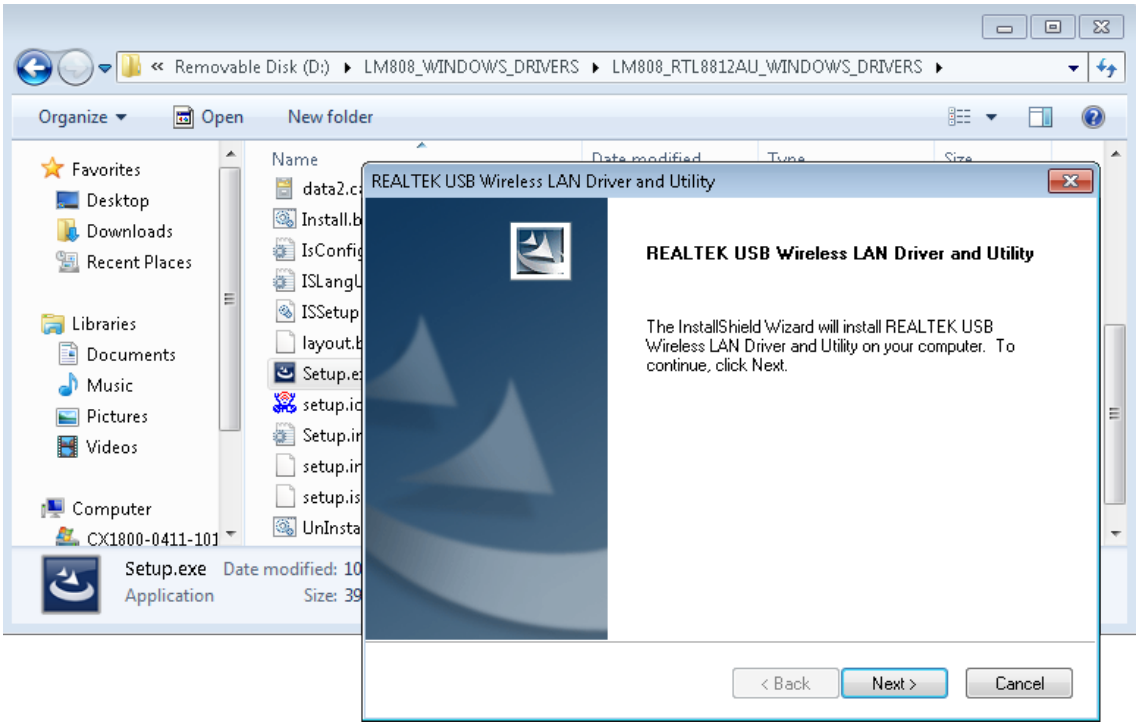
The appropriate driver must first be installed in order to use the WLAN on Windows 7. During the installation, the Realtek driver and configuration software will be installed. All other WLAN settings can be made with the software.

Requirements:

- Driver: Provided by Beckhoff Service.

Install the driver as follows:

1. Make sure that the WLAN stick is not yet connected to the Industrial PC.
2. Run the Setup.exe file to start the installation.



3. Follow the further installation instructions.

⇨ Restart the Industrial PC after the installation and only then connect the WLAN stick to the Industrial PC. The WLAN stick is now ready to operate.

4.1.2 Connecting to WLAN

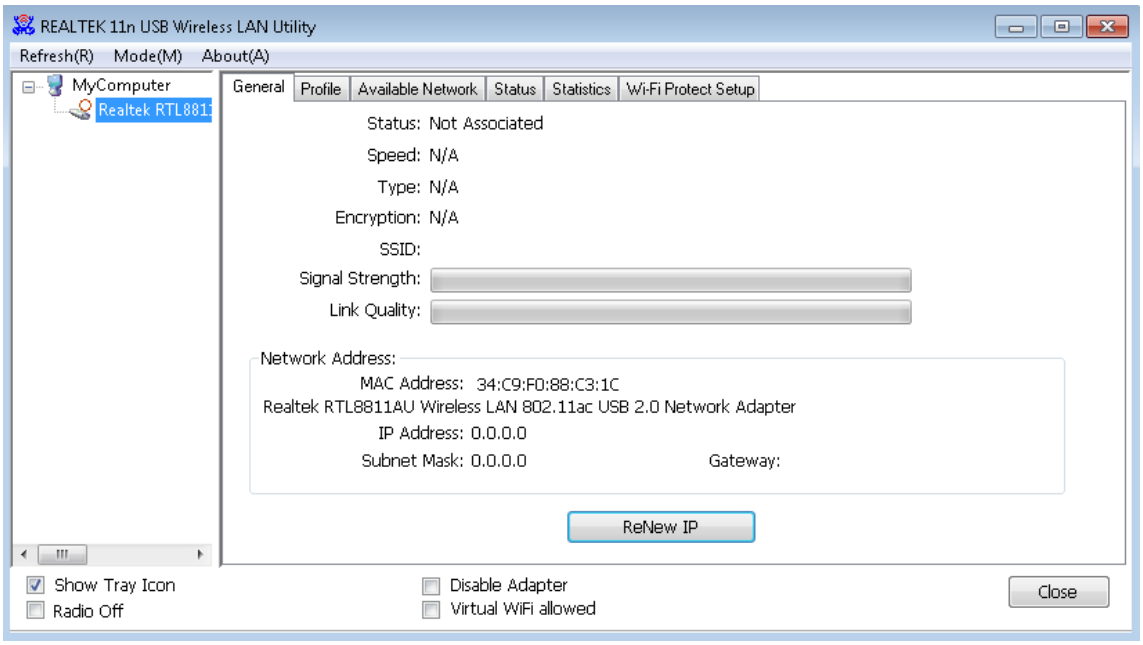
In this work step we show you how to establish a WLAN connection. In addition, you will find out how to search for WLANs and determine the SSID. In this example, the IP address is automatically assigned by a DHCP server.

Requirements

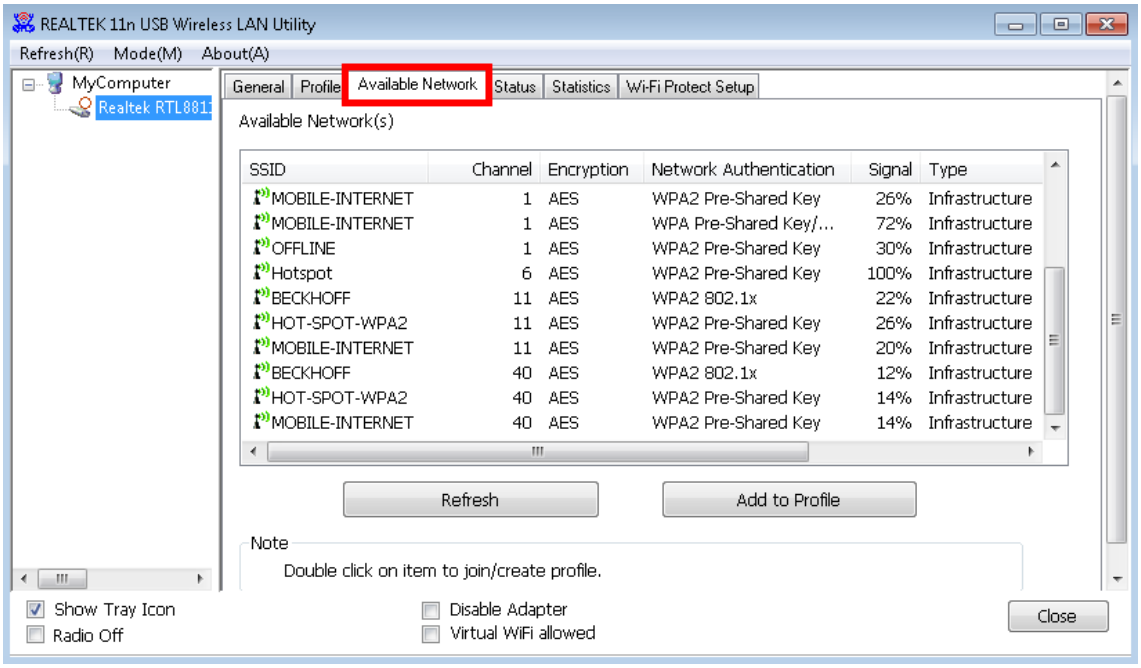
- Existing WLAN with configured access point.
- WLAN key (password).

Proceed as follows:

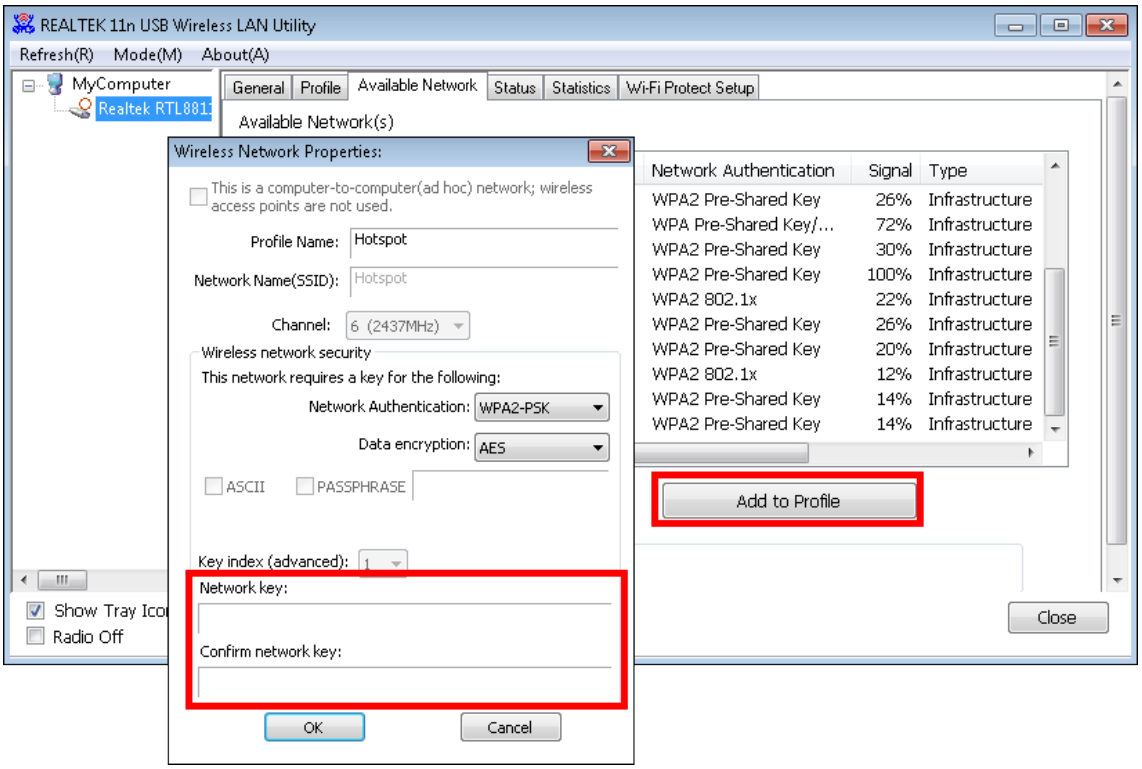
1. Start the Realtek configuration software.



2. Click at the top on the **Available Network** tab to search for available networks. Networks that are within range are listed with SSID, channel and encryption method.

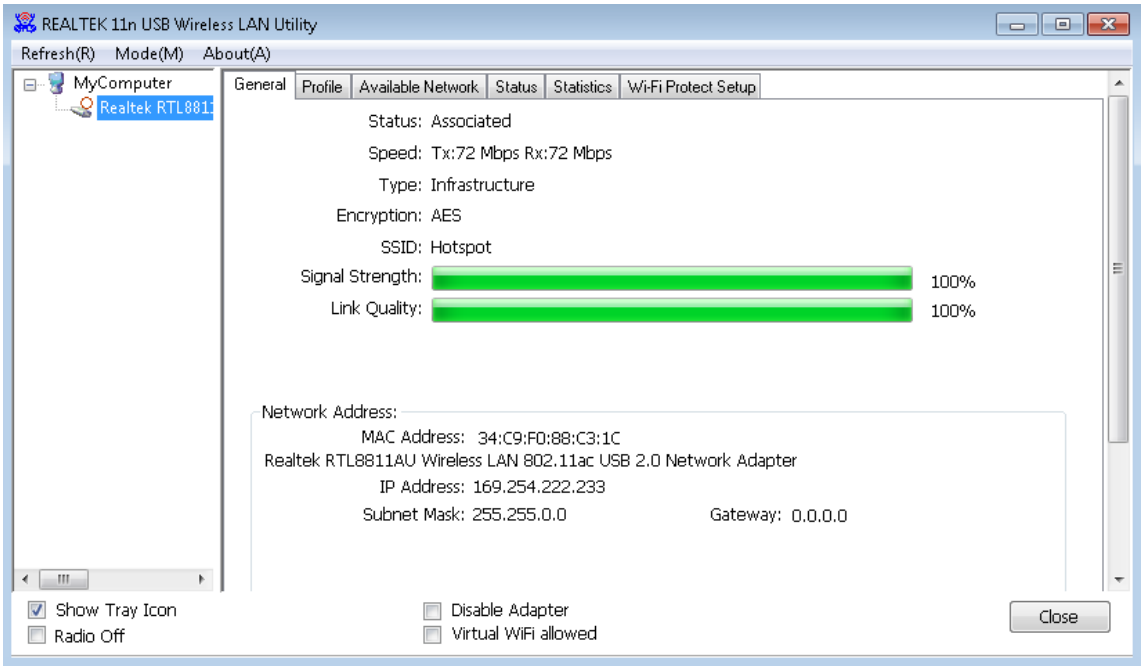


3. Select the network with which you wish to establish a WLAN connection and click **Add to Profile**. The Wireless Network Properties window appears.



4. Enter the WLAN key of your WLAN and confirm with **[OK]**.

⇨ Following a successful connection, a summary is automatically displayed on the **General** tab, where you will find more information such as the speed, signal strength or IP address of the network.



4.1.3 Establishing a connection to Windows standard applications

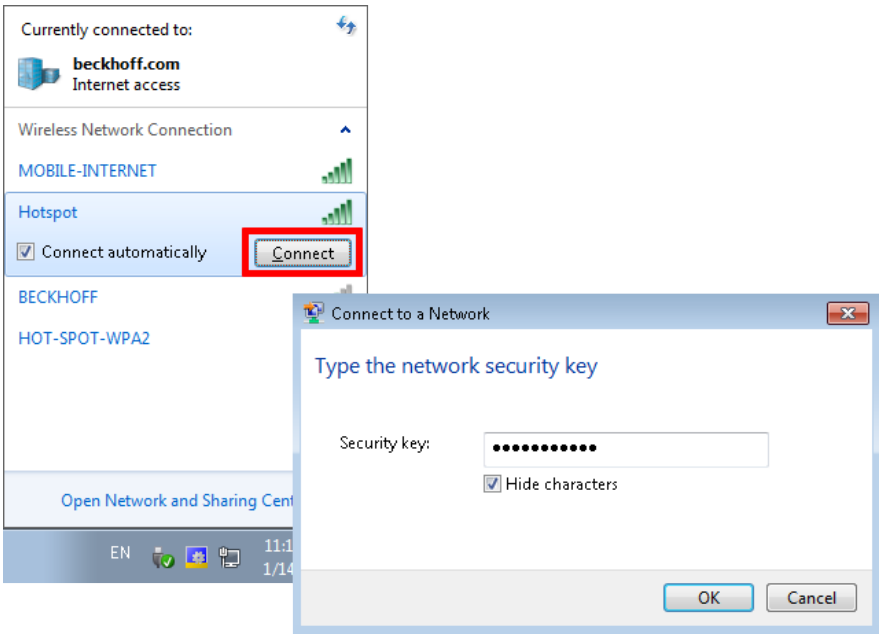
In this work step we show you how to establish a WLAN connection to Windows standard applications. In this example, the IP address is automatically assigned by a DHCP server.

Requirements:

- Existing WLAN with configured access point.
- WLAN key (password).

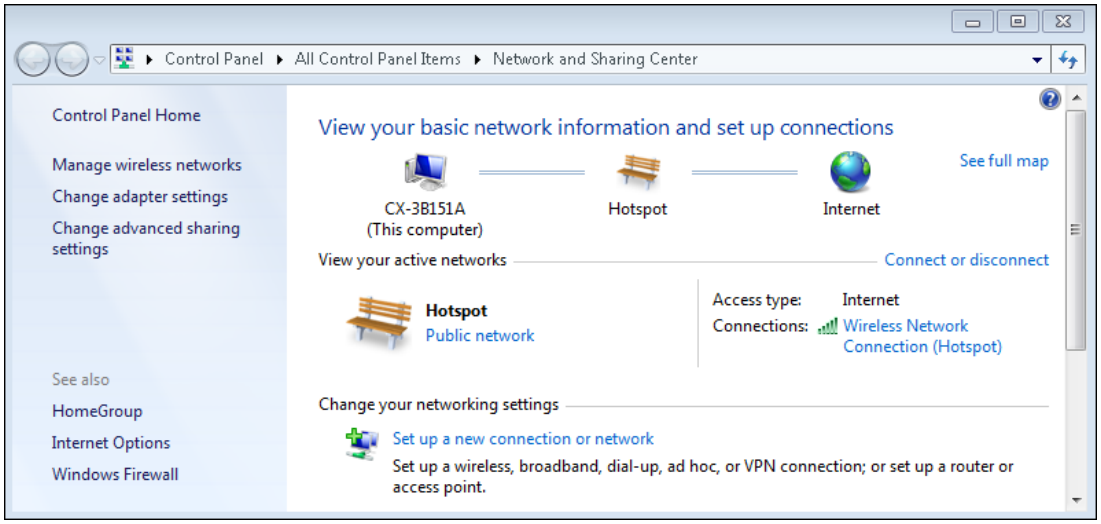
Proceed as follows:

1. Click the network icon at the bottom right in the taskbar to display all WLANs in range.
2. Choose the appropriate network and click **Connect**.



3. Enter the WLAN key for the network in order to establish the connection.

⇨ You have successfully established a WLAN connection. For more information about the network, see **Start > Control Panel > Network and Sharing Center**.



4.1.4 Configuring as access point

NOTICE

Unwanted access over the internet

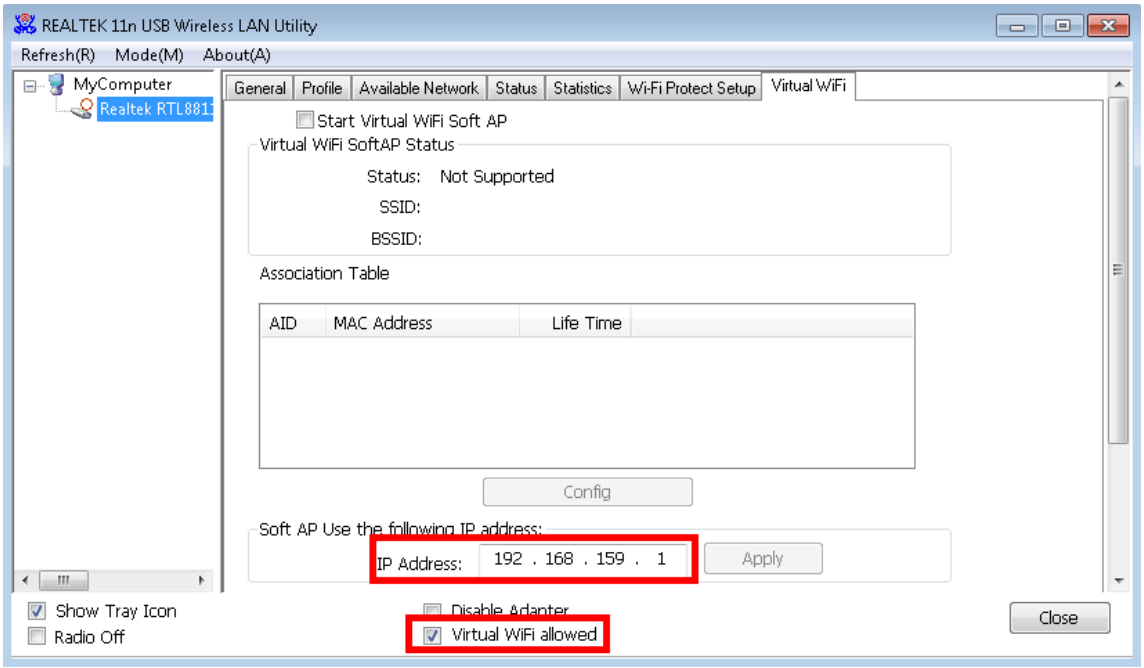
An access point with an internet connection poses a security risk. Take appropriate precautions with your IT department. Adapt your infrastructure, e.g. firewall or VPN.

In this work step we show you how to configure a WLAN stick as a virtual access point, where the access point is based on the Windows 7 hosted network function.

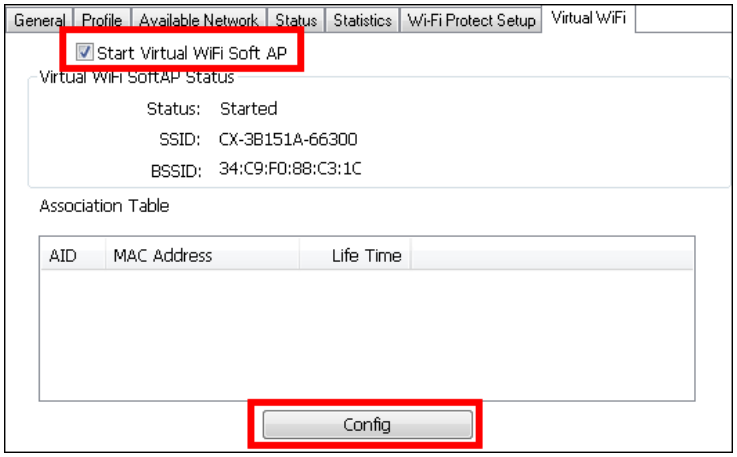
With the Internet Connection Sharing option (ISC), the access point can be configured in such a way that the internet connection of the access point is shared with the clients.

Proceed as follows:

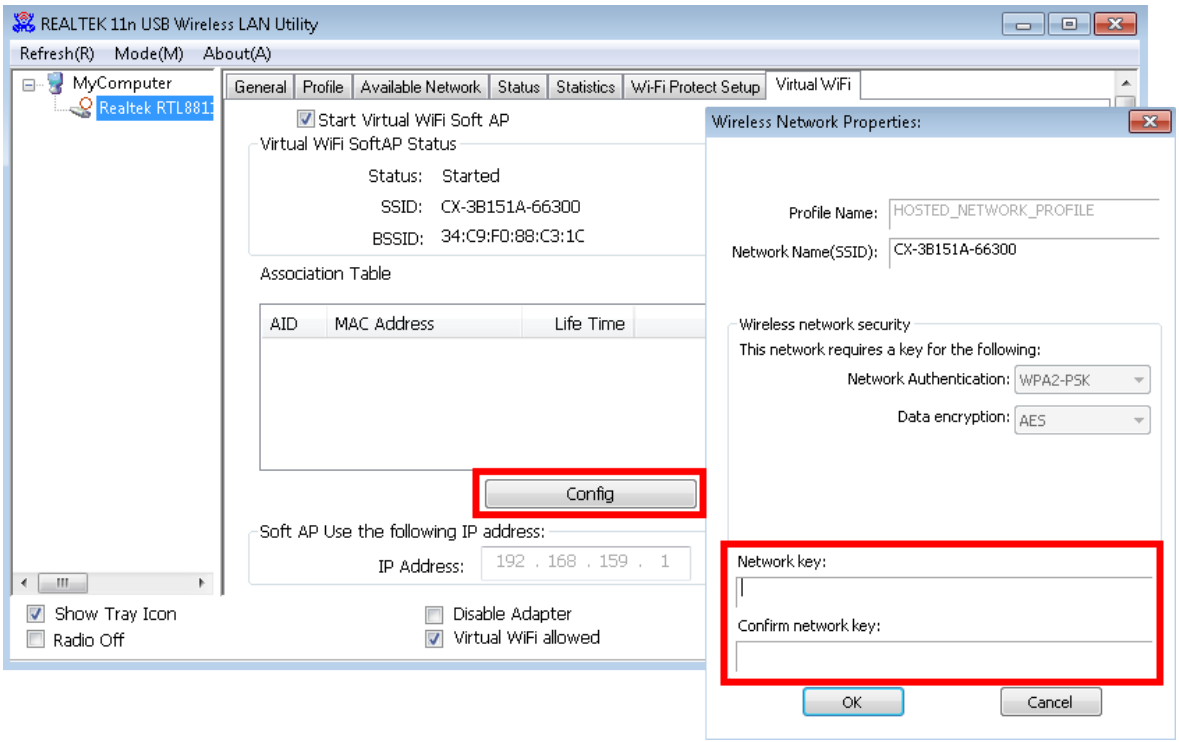
1. Start the Realtek configuration software.
2. To activate the access point, select the option **Virtual WiFi allowed** below.
3. In the **IP Address** field, set the address range for IP addresses that are subsequently assigned by the DHCP server to the clients.
   In this example the clients are given the IP addresses: 192.168.159.2... / 3... / 4... and so on.



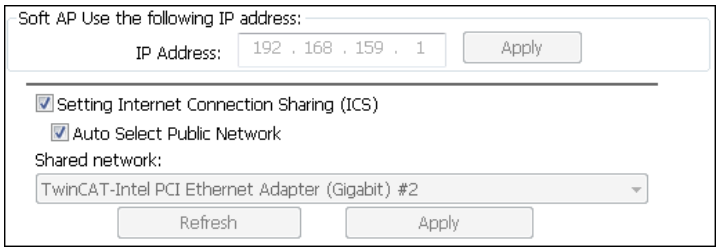
   Make sure when assigning addresses that you do not interfere with a higher-level DHCP server from the network infrastructure.
4. Subsequently, select the option **Start Virtual WiFi Soft AP** to start the access point.
5. Click the **Config** button. The Network Properties window appears.



6. Change the network name if necessary (SSID) and define a WLAN key with at least eight characters for the network.



7. Deactivate the option **Setting Internet Connection Sharing (ISC)** if the internet connection of the access point is not to be shared.



The option **Internet Connection Sharing (ISC)** is active by default.

⇨ You have successfully configured the WLAN stick as an access point. Clients that connect to the access point are listed in the **Associated Table**.

4.2 Windows 10

The configuration software from Realtek is not required with Windows 10. The configuration is done using standard Windows tools or with the help of configuration software from Beckhoff if the WLAN stick is to be used as an access point.

4.2.1 Establishing a connection

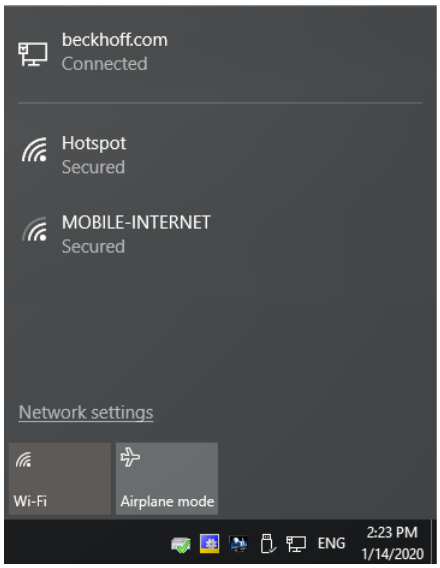
In this work step we show you how to establish a WLAN connection. In this example, the IP address is automatically assigned by a DHCP server.

Requirements:

- WLAN key (password).

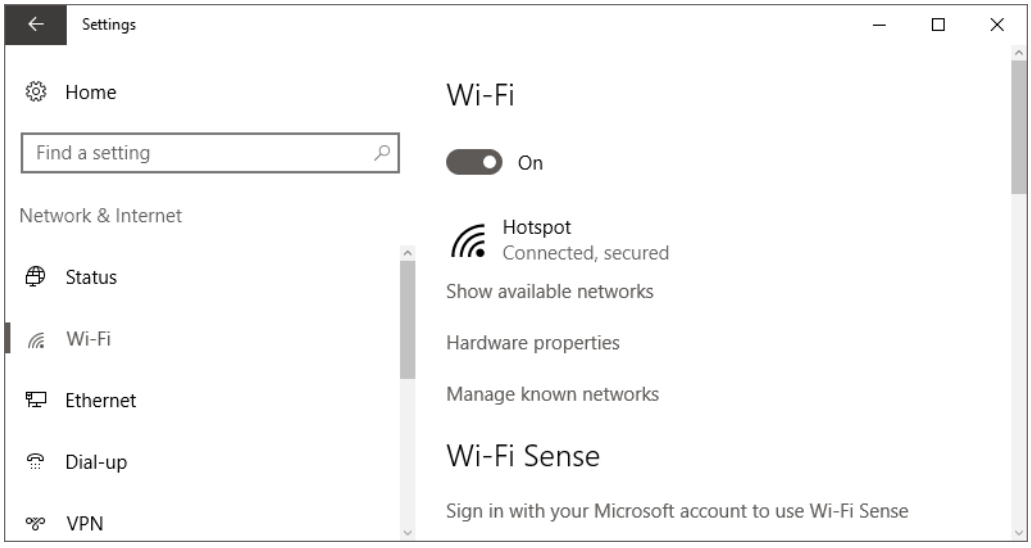
Proceed as follows:

1. Click the network icon at the bottom right in the taskbar to display all WLANs in range.
2. Choose the appropriate network and click **Connect**.



3. Enter the WLAN key for the network in order to establish the connection.

⇨ You have successfully established a WLAN connection. For more information about the network, see **Start > Settings > Network & Internet > Wi-Fi**.



4.2.2 Configuring as a hotspot

NOTICE

Unwanted access over the internet

A hotspot with an internet connection poses a security risk. Take appropriate precautions with your IT department. Adapt your infrastructure, e.g. firewall or VPN.

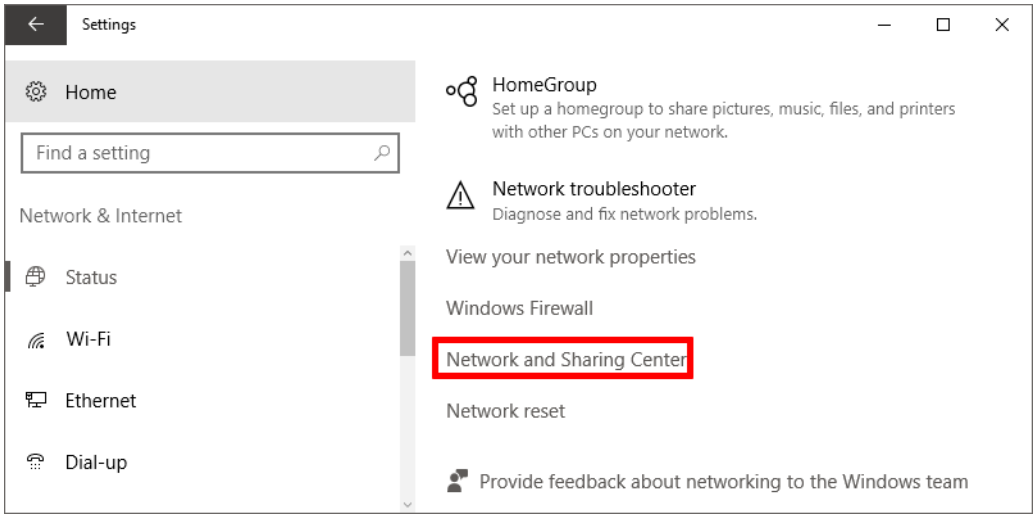
In this step we show you how to configure a WLAN stick as a hotspot on Windows 10 systems. The hotspot works only with an existing internet connection, which the hotspot then shares with the clients. You cannot activate a hotspot on Windows 10 systems without an internet connection.

Requirements:

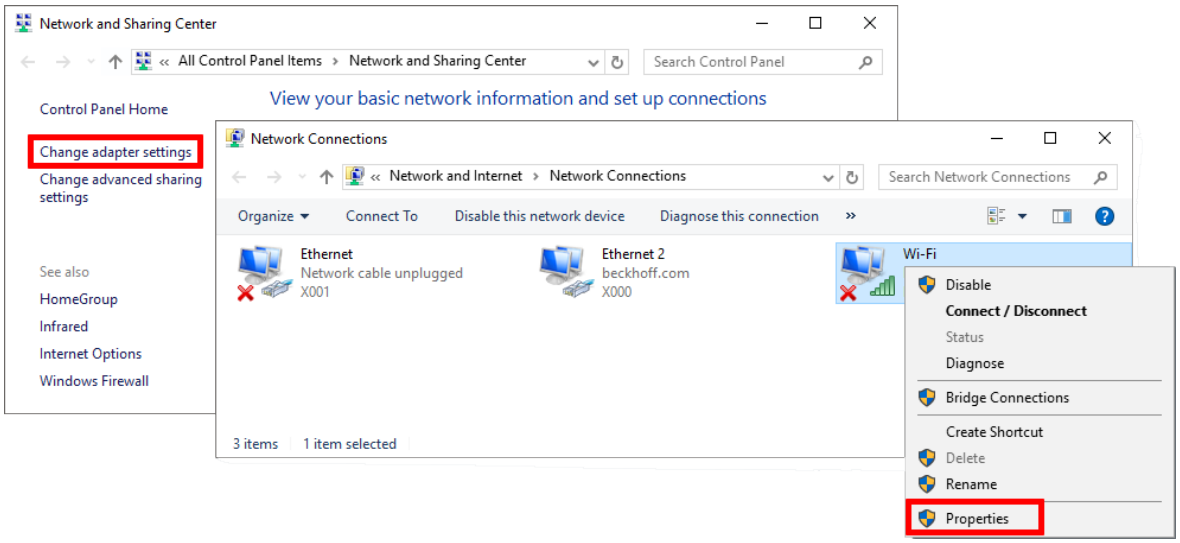
- Internet connection

Proceed as follows:

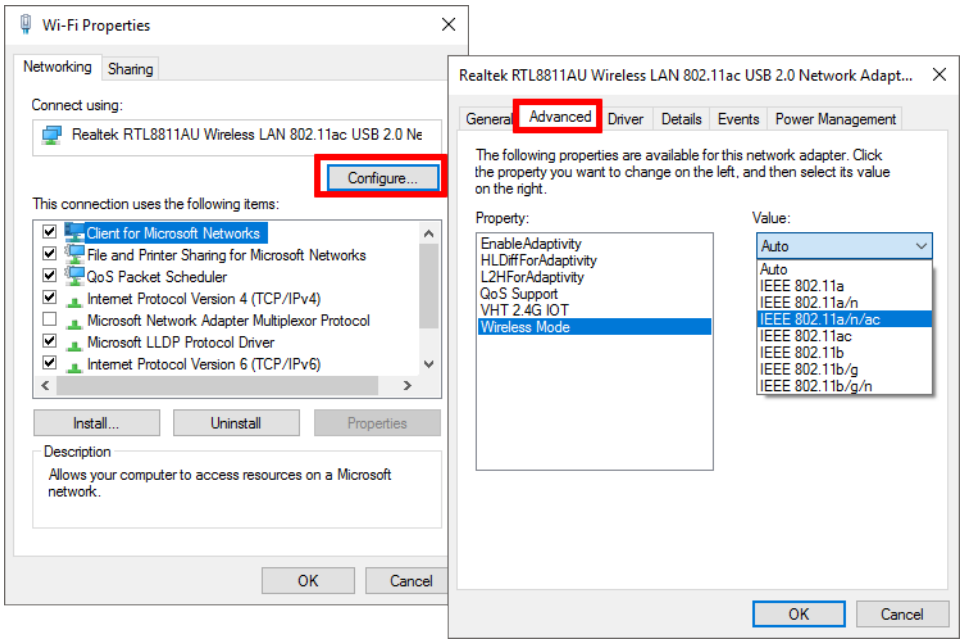
1. Click **Start > Settings > Status > Network & Internet**. The Settings window appears.
2. Click the **Network and Sharing Center** button.



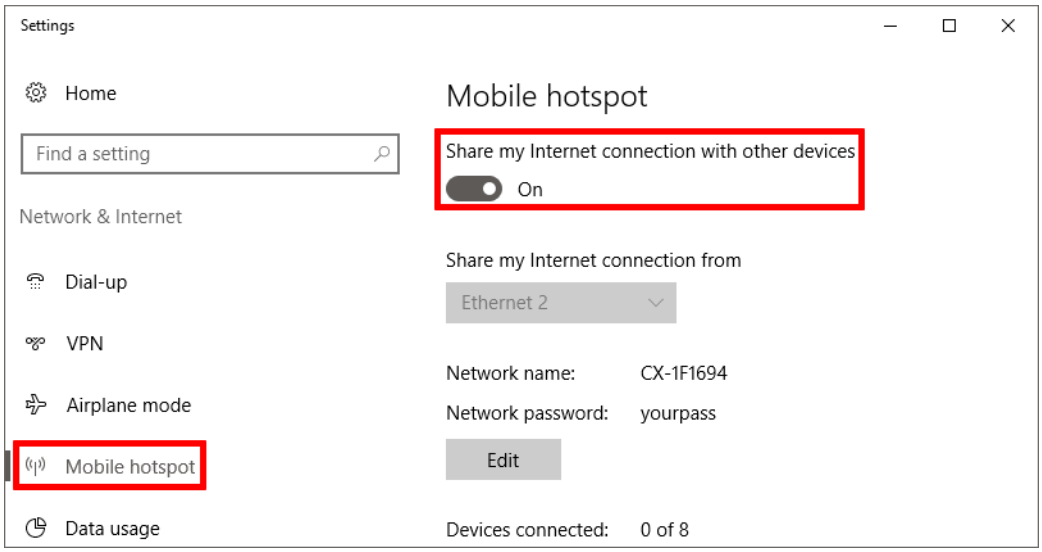
3. On the left, click **Change adapter settings**. Right-click the WLAN adapter, then click **Properties**.



4. Click the **Configure** button and select the appropriate value for the WLAN mode on the **Advanced** tab. The value depends on your network environment and the desired transfer rate.



5. Click **Mobile hotspot** under **Start > Settings**. Under **Edit,** change the SSID and WLAN key of the network.



6. Activate the hotspot with the button **Share my Internet connection with other devices**.

⇨ You have successfully activated the hotspot and can now connect clients to this hotspot. All devices are listed under **Devices connected.**

4.2.3 Configuring as access point

The Beckhoff-Virtual-WLAN-Access-Point software must be installed so that the WLAN stick can be configured and used as an access point with Windows 10. The network is managed with the help of the software. Clients such as tablets, cell phones or notebooks can connect to the WLAN provided. In this way, access to the web HMI of the Industrial PC or Condition Monitoring concepts are conceivable.

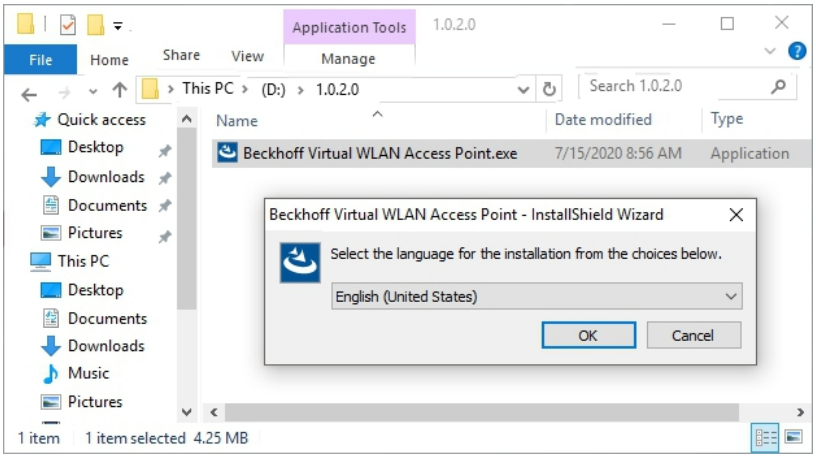
As the host of the WLAN network, the Industrial PC or the WLAN stick is given the IP address 192.168.137.1. The clients obtain their IP addresses from the integrated DHCP-Server and these addresses cannot be changed due to WiFi-Direct restrictions.

Requirements:

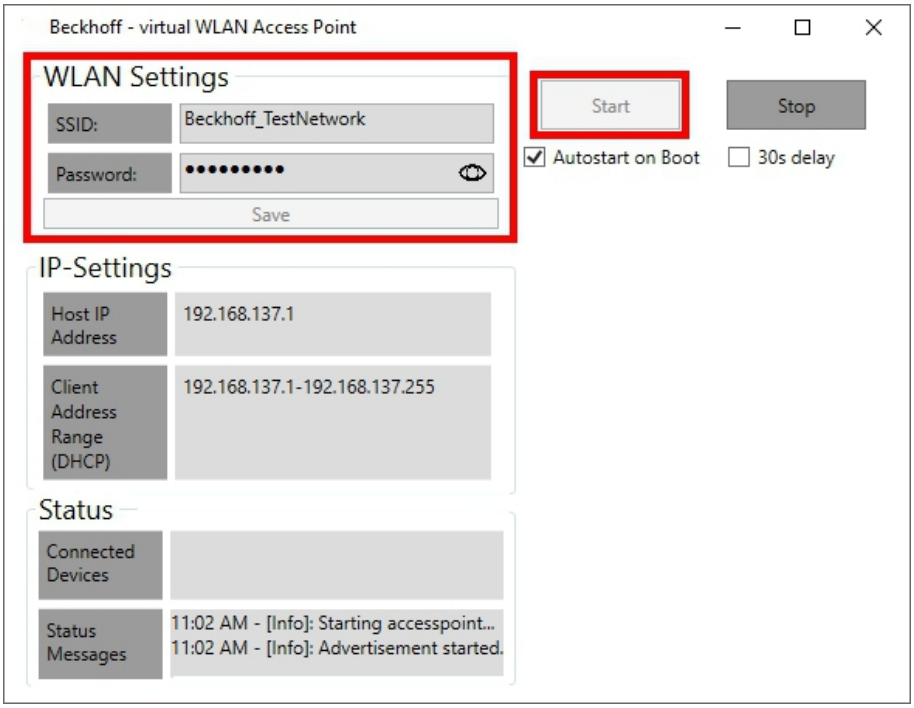
- Beckhoff-Virtual-WLAN-Access-Point: The software is provided by Beckhoff Service.

Proceed as follows:

1. To start the installation, run the file *Beckhoff Virtual WLAN Access Point.exe*.

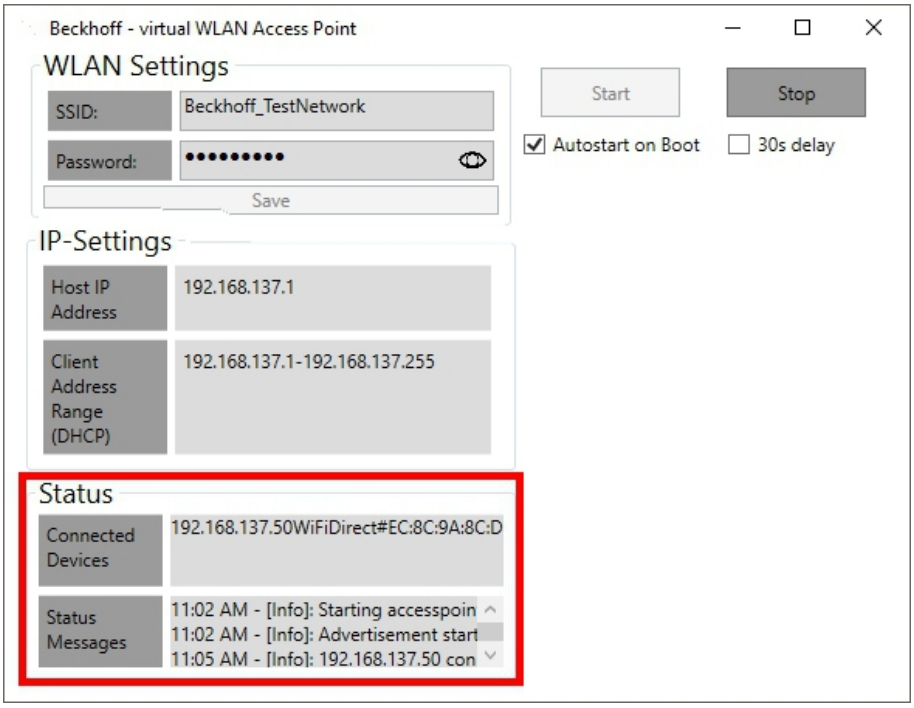


2. Follow the installation instructions.
3. Start the software under **Start > Beckhoff > Beckhoff - Virtual WLAN Access Point**.
4. Define an SSID for the WLAN network and issue a password with at least 8 characters.



5. Click **Save** and then **Start** to start the access point.

⇨ The access point is started and the start is displayed under **Status Messages**. The WLAN network becomes visible with the defined SSID. Connect your clients to the WLAN network. Connected clients and their IP addresses are displayed under **Connected Devices**.



4.3 TwinCAT/BSD

This chapter describes various aspects of WLAN configuration under TwinCAT/BSD and includes step-by-step instructions on how to connect an industrial PC to a WLAN, configure it as an access point or set up a DHCP server.

The first section shows how to establish a WLAN connection, including searching for networks and assigning an IP address via a DHCP server. The second section explains the configuration of the industrial PC as an access point with the packet `hostapd`. The third section is dedicated to the installation and configuration of a DHCP server, which may be required depending on the network infrastructure.

4.3.1 Connecting to WLAN

This step shows how to establish a WLAN connection with an access point under TwinCAT/BSD. In addition, you will learn how to search for WLAN networks and determine the SSID.

WLAN is encrypted with WPA2, and the IP address is automatically assigned by a DHCP server.

Requirements:

- Beckhoff WLAN sticks: CU8210-D001-0101 or CU8210-D001-0102
- SSID and password of an existing WLAN.

Proceed as follows:

1. Enter the `sysctl net.wlan.devices` command in the console to obtain the device name. With a Beckhoff WLAN stick, for example, `rtwn0` is given as the device name.
2. Open the `rc.conf` file with `doas ee /etc/rc.conf` and add the following lines:

```
# wireless
wlans_rtwn0="wlan0"    #wlan0 is now your network interface
create_args_wlan0="country DE"
ifconfig_wlan0="up scan WPA DHCP"
```

3. The following lines must be added if dhcpcd is used (standard from version 13.2.0.6 / 89449).

```
# wireless
wlans_rtwn0="wlan0"    #wlan0 is now your network interface
create_args_wlan0="country DE"
ifconfig_wlan0="up scan WPA"
```

4. If DHCP is not active or desired, a fixed IP address is defined with the following entry.

```
# wireless
wlans_rtwn0="wlan0"    #wlan0 is now your network interface
create_args_wlan0="country DE"
ifconfig_wlan0="WPA inet 192.168.0.100 netmask 255.255.255.0 up scan"
```

5. Restart the network service with `doas service netif restart` to apply the settings in the rc.conf file.
6. Search for new WLAN networks using `doas ifconfig wlan0 up scan`. The `doas ifconfig wlan0 list scan` command displays networks that are already known.
7. Save the access data for a WLAN network with the `doas ee /etc/wpa_supplicant.conf` command by adding the following lines to the `wpa_supplicant.conf` file.

```
network={
    ssid="myssid"    #for myssid specify the name of the network
    psk="mypsk"      #for mypsk enter password of network
}
```

8. Enter `doas service netif restart` to restart the network service.

⇨ The WLAN connection is established. Use `ifconfig` to display the network status of the WLAN interface.
For further information, see: https://www.freebsd.org/doc/handbook/network-wireless.html

4.3.2 Configuring as access point

You can configure an Industrial PC as an access point under TwinCAT/BSD. This feature requires the `hostapd` packet to be installed. Install the `hostapd` packet with: `doas pkg install hostapd`

The `hostapd` daemon takes care of client authentication and key management on the WPA2-enabled access point.

Make sure the correct regulatory domain is used for the respective country. This includes, for example, the permitted channels, permitted transmission power and DFS activation for certain 5 GHz channels.

Requirements:

- Installing the `hostapd` packet.
- Internet connection.
- Reinsert the WLAN stick if it was plugged in at startup.

Proceed as follows:

1. Open the file `rc.conf` with `doas ee /etc/rc.conf` and add the following lines:
   Example:

```
hostapd_enable="YES"    #starts the hostapd daemon automaticaly after boot
wlans_rtwn0="wlan0"    #wireless interface used for access point
create_args_wlan0="wlanmode hostap ssid yourSSIDname authmode WPA2"
ifconfig_wlan0="inet 192.168.0.1 netmask 255.255.255.0 country DE"
```

2. Use the command `doas ee /etc/hostapd.conf` to open the file `hostapd.conf` and add the following lines:
   Example:

```
interface=wlan0
debug=1
ctrl_interface=/var/run/hostapd
ctrl_interface_group=wheel
ssid=yourSSIDname
wpa=2
wpa_passphrase=freebsdmall    #password for wlan network
wpa_key_mgmt=WPA-PSK
wpa_pairwise=CCMP
channel=6    #Channel for the desired radio band (default: 0 stands for ACS, automatic Channel
Selection)
hw_mode=g    #Operation mode, in this case g=IEEE802.11g (2.4 GHz)
country_code=DE #used to set the right regulatory domain for your country
ieee80211d=1    #advertises the country_code an the set of allowed channels and transmit power
levels based on the regulatory limits (default=0)
```

3. Enter the command `doas service hostapd forcestart` to start the access point.

⇨ You have successfully configured the Industrial PC as an access point. WLAN devices can now connect to the network using the SSID and the password from the `hostapd.conf` file.
For further information see: https://www.freebsd.org/doc/handbook/network-wireless.html

4.3.3 Setting up a DHCP server

Depending on the network infrastructure, you may need a DHCP server. This step shows how to install and configure a DHCP server.

Requirements:

- Internet connection.
- Adjust the firewall and apply the rules to the WLAN interface (see: Firewall)

Proceed as follows:

1. Enter the `doas pkg install dhcpd` command in the console to install the DHCP server.
2. Open the `dhcpd.conf`. file with `doas ee /usr/local/etc/dhcpd.conf` and edit the configuration according to your requirements..
   Sample:
   ```
   subnet 192.168.0.0 netmask 255.255.255.0 {
   range 192.168.0.10 192.168.0.20;
   default-lease-time 600;
   max-lease-time 72400;
   option subnet-mask 255.255.255.0;
   }
   ```
3. Open the `rc.conf` file with `doas ee /etc/rc.conf` and add the following lines:
   ```
   dhcpd_enable="YES"
   dhcpd_flags="wlan0"
   dhcpd_ifaces="wlan0"
   ```
4. Enter the `doas service dhcpd start` command to start the DHCP service. After a restart, the DHCP service is started automatically because of the corresponding entry in `rc.conf`.
5. The `ee /var/db/dhcpd.leases` command can be used to view current and expired leases.

⇨ The DHCP server is thus active and only listens to requests on the interface `wlan0`.
For more information, see: https://www.freebsd.org/doc/en_US.ISO8859-1/books/handbook/network-dhcp.html or https://man.openbsd.org/dhcpd.8

4.4 Beckhoff RT Linux®

This chapter describes the WLAN configuration under Beckhoff RT Linux®. It addresses two operating modes:

- operation as a WLAN client (connection to an existing access point)
- and operation as a virtual access point with hostapd.

The prerequisites (iwd, suitable WLAN firmware; additionally hostapd for AP operation) and the necessary steps are discussed: installation, use of the configuration examples for systemd-networkd, establishing connections as well as DHCP and firewall configuration (nftables). The aim is to operate the Beckhoff system as a WLAN client or as an access point and to manage the connected clients.

4.4.1 WLAN configuration

This chapter describes the configuration of WLAN interfaces under Beckhoff RT Linux®. Two typical application scenarios are described:

- Operation as a WLAN client (connection to an existing access point)
- Operation as a virtual access point with `hostapd`

To operate a WLAN interface as a client, the following software components must be installed and active.

install iNet Wireless Daemon (iwd)

The iwd service (iNet Wireless Daemon) is a system service for Linux® that manages WLAN connections. It runs as the systemd unit iwd.service. It performs the following tasks, among others.

- Scan for available WLAN networks

- Authentication to access points
- Setting up and managing the WLAN connection
- Management of WPA/WPA2/WPA3 keys
- Provision of a D-Bus interface for management tools such as iwctl

The package must be installed for iwd to be used:

```
sudo apt install iwd
```

The service must be active as well:

```
sudo systemctl enable --now iwd
```

If the iwd service is not active, no WLAN devices or networks can be queried.

Install WLAN firmware

Without the appropriate firmware, the WLAN adapter can be recognized by the system, but is not operational. Depending on the WLAN chipset used, the appropriate firmware package must be installed. For Realtek-based WLAN adapters, such as the Beckhoff WLAN stick CU8210-D001-0102, the following package is usually used:

```
sudo apt install firmware-realtek
```

The firmware is loaded automatically when the device is initialized. A manual configuration is not required.

Restart after firmware installation

After installing the iwd service and the firmware, the system must be restarted:

```
sudo shutdown -r now
```

Check whether the WLAN interface is recognized by the system after the restart:

```
ip addr show
```

The output then looks as follows in the example with a Beckhoff WLAN stick:

```
4: wlx34c9f09ab29c: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc noqueue state DOWN group
default qlen 1000
     link/ether 34:c9:f0:9a:b2:9c brd ff:ff:ff:ff:ff:ff
```

The WLAN stick is displayed with the interface name wlx34c9f09ab29c: "wl" = WLAN, "x" = MAC-based, predictable name (`systemd/udev`). The following sequence of digits is the MAC address.

Notice : The interface name can vary depending on the system and hardware (e.g. wlan0, wlp2s0, wlx..., enp3s0f1). Determine which interface name is used in your installation and use that name in all commands and configuration examples.

4.4.2 Connecting to a WLAN access point

This step shows how to establish a WLAN connection with an access point under Beckhoff RT Linux®. In addition, you will learn how to search for WLAN networks and determine the SSID.

Prerequisites:

- Beckhoff WLAN sticks: CU8210-D001-0101 or CU8210-D001-0102
- SSID and password of an existing WLAN
- Installing the iwd service and firmware [▶ 26]

Proceed as follows:

1. A ready-made sample configuration for WLAN networks is stored on the system at `/usr/lib/systemd/network/80-wifi-station.network.example`, which you can use. Copy the sample configuration from the directory to the appropriate folder.

   ```
   sudo ln -s /usr/lib/systemd/network/80-wifi-station.network.example /etc/systemd/network/80-wifi-station.network
   ```

2. Reload the configuration.

```
sudo networkctl reload
```

3. Check the configuration and display the available WLAN devices.

```
sudo iwctl device list
```

4. The output looks as follows. The name of the WLAN device is also displayed here.

```
                              Devices
--------------------------------------------------------------------------------
  Name              Address             Powered      Adapter      Mode
--------------------------------------------------------------------------------
  wlx34c9f09ab29c   34:c9:f0:9a:b2:9c   on           phy0         station
```

5. Use the following command to search for available WLAN networks nearby.

```
sudo iwctl station wlx34c9f09ab29c get-networks
```

6. The availability of WLAN networks is displayed as follows:

```
                                Available networks
--------------------------------------------------------------------------------
      Network name                      Security            Signal
--------------------------------------------------------------------------------
  >   COMPANY_Guest                     psk                  ****
      cx_pc                             8021x                ****
      testssid6015                      psk                  ****
      testssid                          psk                  ****
      BCS-DE-Verl-T5152                 psk                  ****
```

7. Establish a connection to open WLAN networks with the following command. For SSID, enter the appropriate name for the WLAN network you want to connect to.

```
sudo iwctl station wlx34c9f09ab29c connect <SSID>
```

8. Establish a connection to a WPA2-protected WLAN with the following command.

```
sudo iwctl --passphrase <SSID_password> station wlx34c9f09ab29c connect <SSID>
```

9. Use `ip addr show` to check whether the WLAN connection has been established and an IP address has been assigned:

```
ip addr show
```

10. The output for the WLAN device `wlx34c9f09ab29c` in this example is as follows:

```
4: wlx34c9f09ab29c: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group
default qlen 1000
    link/ether 34:c9:f0:9a:b2:9c brd ff:ff:ff:ff:ff:ff
    inet 172.21.180.77/19 metric 1024 brd 172.21.191.255 scope global dynamic wlx34c9f09ab29c
       valid_lft 3598sec preferred_lft 3598sec
    inet6 fe80::36c9:f0ff:fe9a:b29c/64 scope link proto kernel_ll
       valid_lft forever preferred_lft forever
```

4.4.3 Configure as a virtual access point

You can configure an industrial PC under Beckhoff RT Linux® as an access point. This requires the hostapd package. hostapd (Host Access Point Daemon) is a system service that operates a WLAN card in AP mode and acts as an 802.1X/WPA authenticator for client authentication and key management.

Prerequisites:

- Beckhoff WLAN sticks: CU8210-D001-0101 or CU8210-D001-0102
- SSID and password of an existing WLAN
- Installing the iwd service and firmware [▶ 26]
- Post-install the Hostapd service

Proceed as follows:

1. Install the package `hostapd` with:

```
sudo apt install hostapd
```

2. Open the configuration file hostapd.conf with a text editor.

```
sudo nano /etc/hostapd/hostapd.conf
```

3. Customize the Hostapd configuration file as follows:

   ⇨ **Notice** : Use a passphrase between 8 and 63 characters; otherwise the `hostapd` service will not start.

```
interface=wlx34c9f09ab29c
debug=1
ssid=yourSSID
wpa=2
wpa_passphrase=yourPassword
wpa_key_mgmt=WPA-PSK
wpa_pairwise=CCMP
channel=7
hw_mode=g
country_code=DE
ieee80211d=1
ctrl_interface=/var/run/hostapd
ctrl_interface_group=0
```

4. Start `hostapd` with the following command:

```
sudo systemctl start hostapd
```

5. The following error message appears, reporting that the hostapd service is masked. With systemd, masked means that the service is deliberately blocked so that it cannot be started in order to avoid conflicts.

```
Failed to start hostapd.service: Unit hostapd.service is masked.
```

6. Execute the following command to remove the masking.

```
sudo systemctl unmask hostapd
```

7. Then restart the service.

```
sudo systemctl start hostapd
```

Configure DHCP and IP address

As soon as the service is running, systemd-networkd must be set up so that the access point assigns IP addresses via DHCP.

8. A ready-made example configuration for access points is stored on the system under /usr/lib/systemd/network/80-wifi-ap.network.example, which you can use. Copy the sample configuration from the directory to the appropriate folder.

```
sudo ln -s /usr/lib/systemd/network/80-wifi-ap.network.example /etc/systemd/network/80-wifi-ap.network
```

9. Open the configuration file with a text editor

```
sudo nano /etc/systemd/network/80-wifi-ap.network
```

10. Expand the entries in the configuration file `/80-wifi-ap.network` as follows:

```
# SPDX-License-Identifier: MIT-0
#
# This example config file is installed as part of systemd.
# It may be freely copied and edited (following the MIT No Attribution license).
#
# To use the file, one of the following methods may be used:
# 1. add a symlink from /etc/systemd/network to the current location of this file,
# 2. copy the file into /etc/systemd/network or one of the other paths checked
#    by systemd-networkd and edit it there.
# This file should not be edited in place, because it'll be overwritten on upgrades.

[Match]
WLANInterfaceType=ap
Name=wlx34c9f09ab29c

[Network]
Address=192.168.11.1/24
DHCPServer=yes
IPMasquerade=ipv4

PoolOffset=10
PoolSize=20
EmitDNS=yes
DNS=8.8.8.8
```

Enable ports for DHCP requests

Finally, the ports for the clients' DHCP requests to the server must also be released.

11. Open the configuration file with a text editor.

```
sudo nano /etc/nftables.conf.d/00-basic.conf
```

12. Expand the configuration file and enable port 67 and port 68.

```
table inet filter {
  chain input {
    type filter hook input priority 0; policy drop;

--snipped

    # DHCPv4: Client -> Server
    udp dport 67 accept

    # DHCPv4: Server -> Client
    udp sport 67 udp dport 68 accept

--snipped--
```

13. Restart the service `nftables` with the following command.

```
sudo systemctl restart nftables
```

14. Check the open ports with the following command.

```
sudo nft list ruleset
```

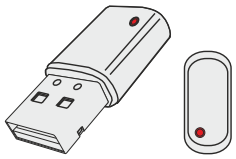
The access point is now fully configured and can be used by clients to establish a connection. To do this, use the configured SSID name and the WPA2 password defined in the `/etc/hostapd/hostapd.conf` file.

The connected clients can be displayed with the following command:

```
sudo hostapd_cli list_sta
```

This command outputs the MAC addresses of all WLAN clients currently connected to the access point.

5 Diagnostic LED

Display	Error code	Description
	Off	The WLAN stick is deactivated.
	Flashes quickly	The connection is being established.
	Flashes continuously	WLAN stick is active.

6 Technical data

Table 3: Technical data, dimensions and weights.

	CU8210-D001-0102
Dimensions (W x H x D)	15 mm x 8 mm x 29.5 mm
Weight	approx. 5 g

Table 4: Technical data, general data.

	CU8210-D001-0102
Chipset	Realtek
Number of transmitters	1 transmitter, 1 receiver
Standards	IEEE 802.11 ac/a/b/g/n/d/e/h/i
Operating system	Windows 7, Windows 10, Windows 11, TwinCAT/BSD®, Beckhoff RT Linux®
Data transfer rate	1, 2, 5.5, 11, 6, 9, 12, 18, 24, 36, 48, 54, 60, 90, 120, 150, 173.3, 180, 240, 270, 300, and maximum 433.3 Mbit/s
Encryption	WEP, WPA/WPA2 (TKIP/AES)
Modulation method	CCK, DQPSK, DBPSK, BPSK, QPSK,16QAM, 64QAM, 256QAM
Frequency band	2.4 GHz and 5 GHz (5.15-5.25 GHz - U-NII-1) ISM Bands
RF Output Power (Tolerance ±2 dBm)	17dBm - 802.11b @ 11Mbps 15dBm - 802.11g @ 54Mbps 13dBm - 802.11a @ 54Mbps 13dBm – 802.11n @ MCS7_HT20 13dBm – 802.11n @ MCS7_HT40 11dBm – 802.11ac @ NSS1 MCS9_BW20, BW40, BW80 -82dBm – 802.11b @ 11Mbps -71dBm – 802.11g@54MBps
Receiver sensitivity	-67dBm – 802.11n @ MCS7_BW20 -64dBm – 802.11n @ MCS7_BW40 -57dBm – 802.11ac @ NSS1_MCS9_BW20 -54dBm – 802.11ac @ NSS1_MCS9_BW40 -51dBm – 802.11ac @ NSS1_MCS9_BW80

Table 5: Technical data, approvals.

	CU8210-D001-0102
Approvals	Europe, Russia, South Africa, Israel, Korea, Taiwan, China, Japan, Australia, New Zealand, India, Singapore

Table 6: Technical data, environmental conditions.

	CU8210-D001-0102
Ambient temperature during operation	0 °C ... +70 °C ambient temperature 5 to 95 % (non-condensing)
Ambient temperature during storage	-40 °C ... +80 °C ambient temperature 5 to 95 % (non-condensing)
Protection class	IP 20

6.1 WLAN channels

The number of WLAN channels used varies depending on the target market. Please obtain this information from your local authorities. Depending on the country in which it is operated, the WLAN stick supports channels 1-14 in the 2.4 GHz range and channels in band 1 (36-48) and band 4 (149-165) in the 5 GHz range. The stick does not support DFS and therefore cannot be used in these 5 GHz ranges.

6.2 Dimensions

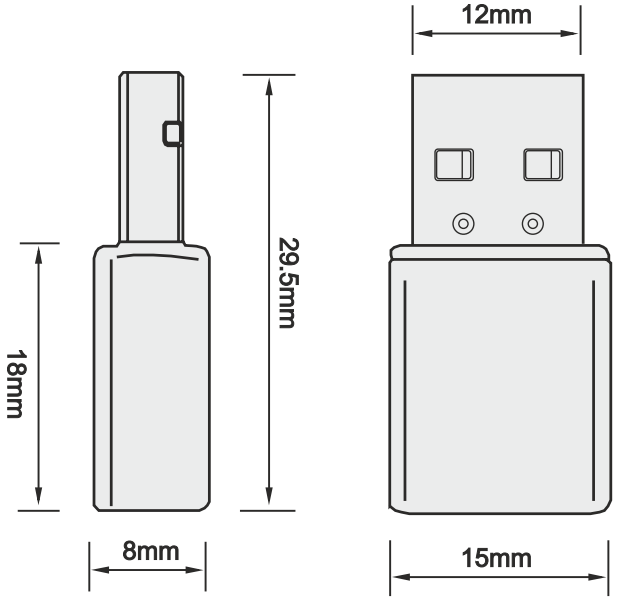


Fig. 4: CU8210-D001-0102 Dimensions.

7 Support and Service

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More Information:
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