# Installation and commissioning manual

## Waveguide Access Point
## WGA631

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# Conformity

This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Council Directive 2004/108/EC) and concerning electrical equipment for use within specified voltage limits (Low-voltage directive 2006/95/EC). This conformity is the result of a test conducted by ABB in accordance with Article 10 of the directive in agreement with the product standards EN 50263 and EN 60255-26 for the EMC directive, and with the product standards EN 60255-6 and EN 60255-27 for the low voltage directive. The IED is designed in accordance with the international standards of the IEC 60255 series.

# Safety information

Non-observance can result in death, personal injury or substantial property damage.

Only a competent electrician is allowed to carry out the electrical installation.

National and local electrical safety regulations must always be followed.

The device contains components which are sensitive to electrostatic discharge. Unnecessary touching of electronic components must therefore be avoided.

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# Section 1 Introduction

## 1.1 This manual

Installation and Commissioning Manual contains instructions on how to install and commission WGA631. The manual provides procedures for mechanical and electrical installation as well as configuration. The chapters are organized in the chronological order in which WGA631 should be installed and commissioned.

## 1.2 Intended audience

This manual addresses the personnel responsible for installing and configuring WGA631 and the related software.

## 1.3 Product documentation

### 1.3.1 Document revision history

| Document revision/date | Product version | History |
|---|---|---|
| A/06.08.2008 | 1.0 | First release |
| B/23.06.2009 | 1.1 | Second release |

Download the latest documents from the ABB web site http://www.abb.com/substationautomation.

### 1.3.2 Related documentation

| Name of the document | Document ID |
|---|---|
| WGA631 WINBOX tool | 1MRS756597 |
| Waveguide tube drawings | 1VB8001475<br>1VB8001476<br>1VB8001478 |

# 1.4 Document symbols and conventions

## 1.4.1 Safety indication symbols

This publication includes the following icons that point out safety-related conditions or other important information:

The electrical warning icon indicates the presence of a hazard which could result in electrical shock.

The warning icon indicates the presence of a hazard which could result in personal injury.

The caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard which could result in corruption of software or damage to equipment or property.

The information icon alerts the reader to relevant facts and conditions.

The tip icon indicates advice on, for example, how to design your project or how to use a certain function.

Although warning hazards are related to personal injury, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all warning and caution notices.

## 1.4.2 Document conventions

The following conventions are used for the presentation of material:

- Abbreviations in this manual are spelled out in the section "Glossary". In addition, the section contains descriptions on several terms.
- Dialog box elements are shown in bold, for example:
  Click **OK** to confirm.

# Section 2 WGA631 overview

## 2.1 Overview

WGA631 is a waveguide access point which is used to connect IEDs over the TCP/IP network by using the same Ethernet link.

- LAN/WLAN connectivity with IEC 61850-8-1 protocol for IEDs with an RJ-45 LAN interface
- Auxiliary power supply
- Disturbance recorder file upload via IEC 61850
- Configuration via the serial interface, TCP/IP-based Telnet connection or the Windows-based WINBOX configuration tool.

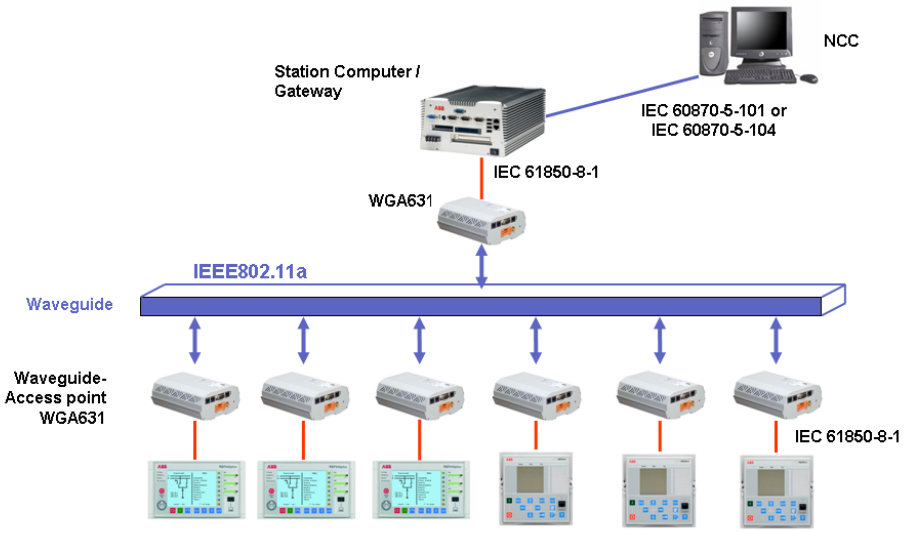
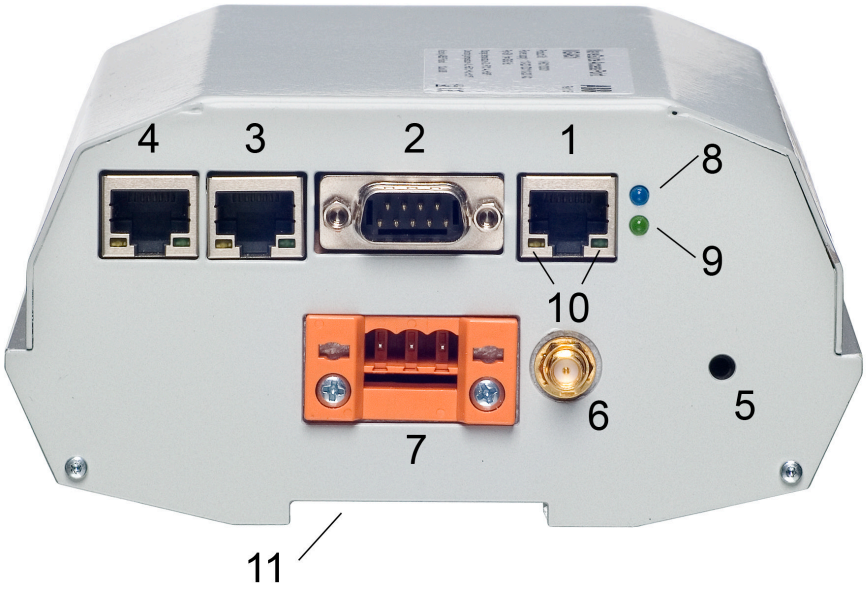



*Figure 1: Example of a typical system setup*

## 2.2 Product version history

| Product version | Release date | Product history |
|---|---|---|
| 1.0 | 06.08.2008 | Product released |

## 2.3 Physical interfaces




1 RJ-45 Ethernet connector 1
2 Service port
3 RJ-45 Ethernet connector 2
4 RJ-45 Ethernet connector 3
5 Earthing screw
6 Coaxial waveguide interface
7 Auxiliary power supply connector
8 Power-up LED
9 Start-up LED
10 LAN and diagnostic LEDs
11 DIN rail mounting

## 2.4 Authorization

The user name and password settings are predefined for the WGA631 unit.

*Table 1: Login information*

| Description | Value |
|---|---|
| ABB Login | admin |
| Password | <empty> |

## 2.5 System requirements for the WINBOX tool

- Windows 2000, Windows XP or Windows Server 2003 operating system
- 10 MB free hard disk space
- RJ-45 interface for configuration with WINBOX
- RS-232 interface for configuration via script file download.

# Section 3 Mounting requirements

Coax connectors and fixing threads are necessary components for a waveguide system inside a switchgear.

Follow the mounting requirements to set up the system properly.

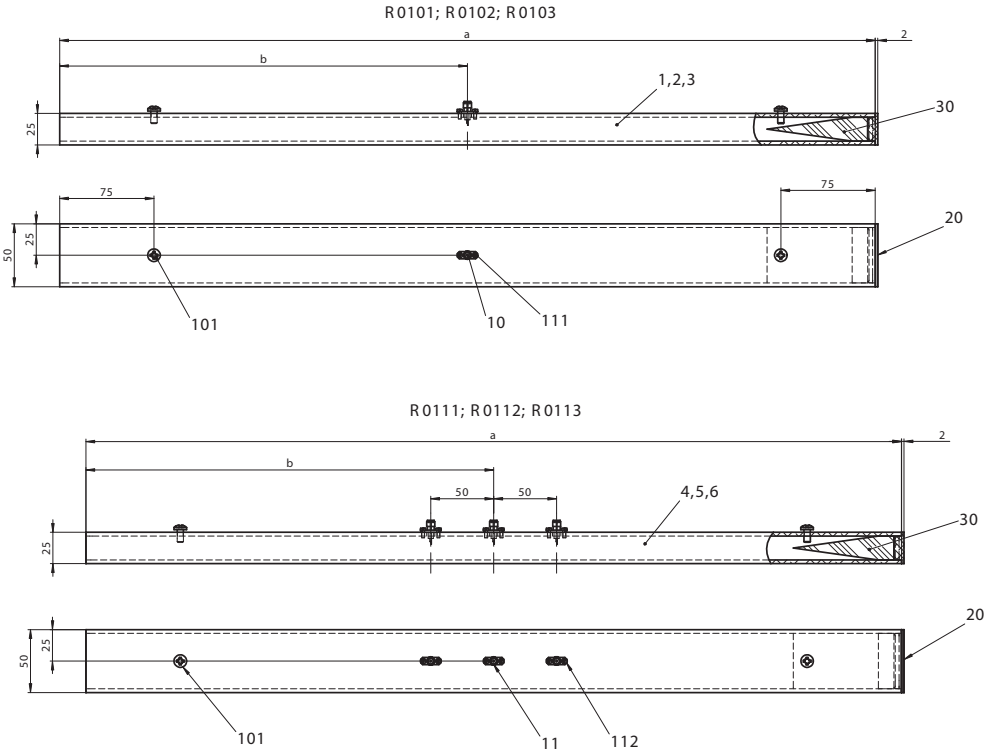



*Figure 2: Waveguide tube coax connectors and fixing threads, 1VB8001475*

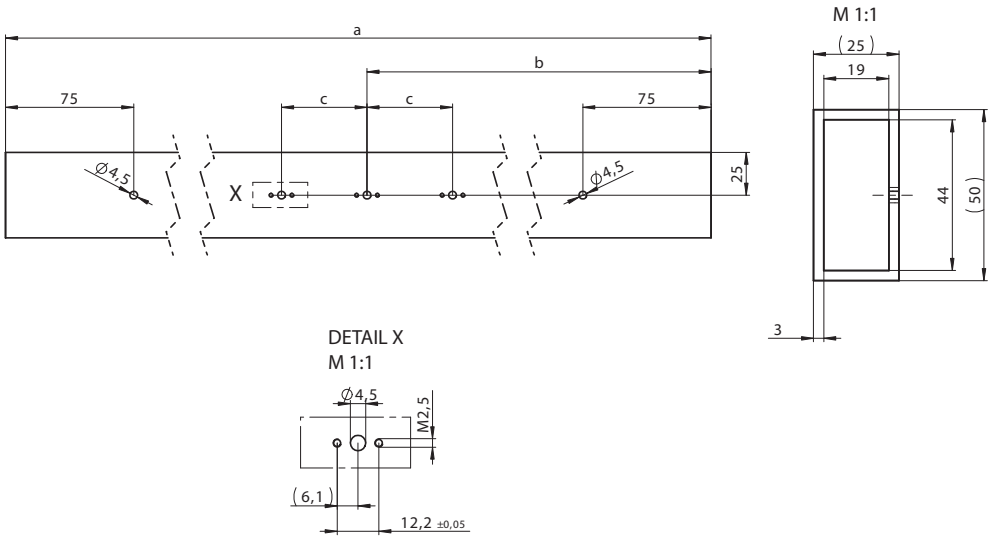



*Figure 3: Details for coax connector, 1VB8001478*

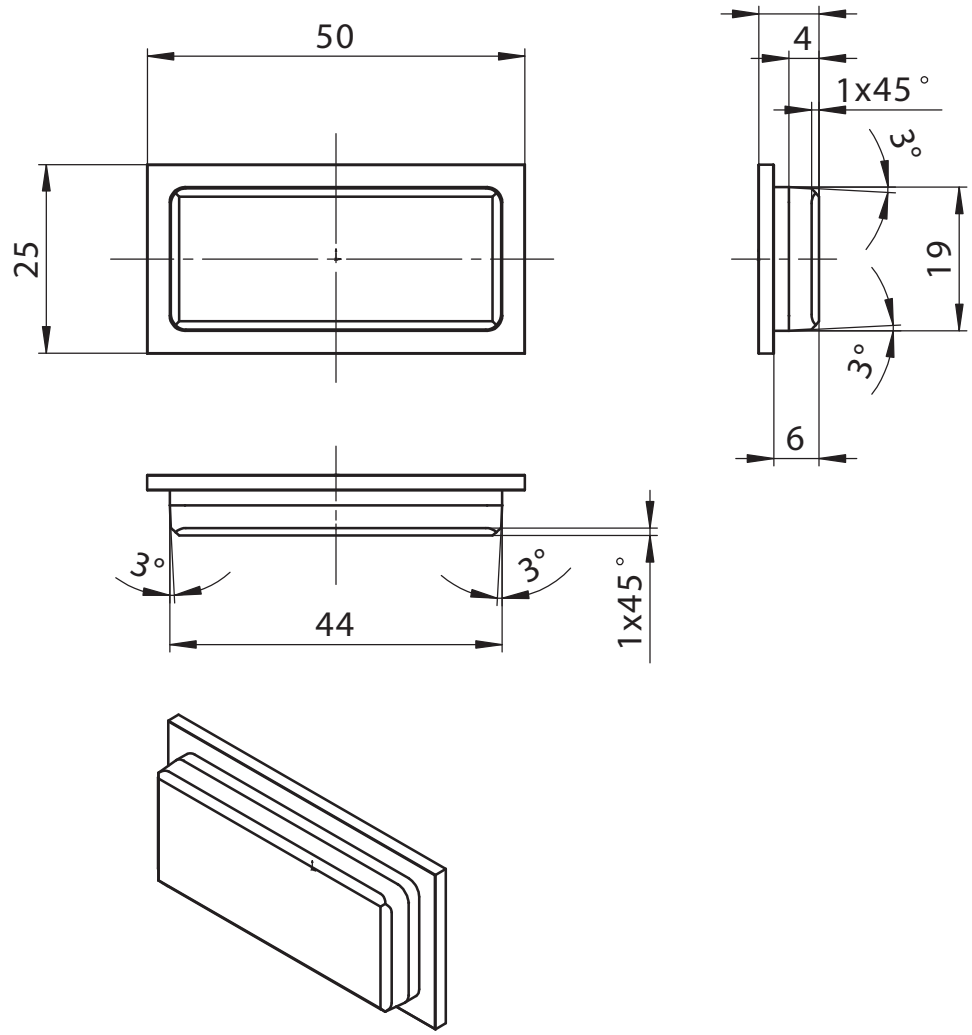



*Figure 4: End cover for the waveguide tube, 1VB8001476*

## 3.1 Horizontal displacement

The wireless communication system works properly with the horizontal displacement of Z < 5 mm between the waveguide tubes. Larger gaps are not allowed because the transmitting power should be limited to 0 dBm.

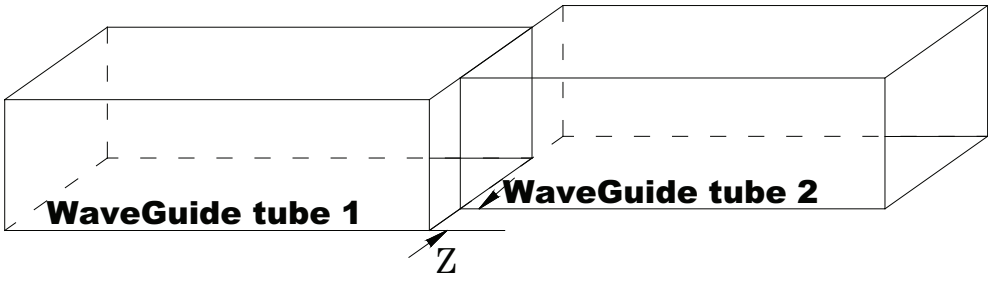



*Figure 5: Horizontal displacement*

## 3.2 Vertical displacement

The wireless communication system works properly with the vertical displacement of Y < 5 mm between the waveguide tubes. Larger offsets are not allowed because the transmitting power should be limited to 0 dBm.

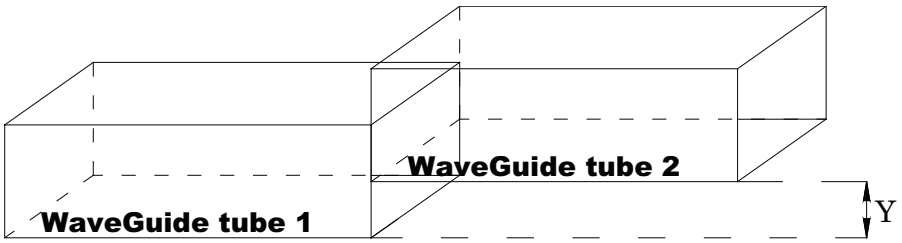



*Figure 6: Vertical displacement*

## 3.3 Angle-related displacement

The wireless communication system works properly with the angle displacement of < 10° between the two waveguide sections. Larger angles are not allowed because the transmitting power should be limited to 0 dBm.

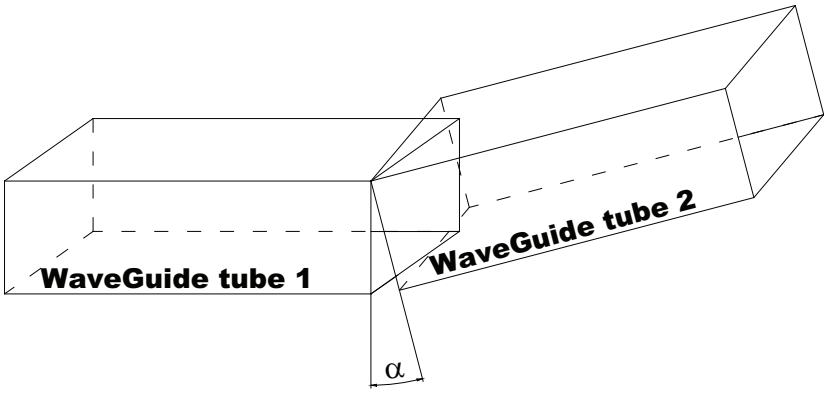



*Figure 7: Angle-related displacement*

## 3.4 Horizontal distance between two waveguide tubes

The wireless communication system works properly with the deviation of X < 5 mm for the distance between the waveguide tubes. Larger gaps are not allowed because the transmitting power should be limited to 0 dBm.

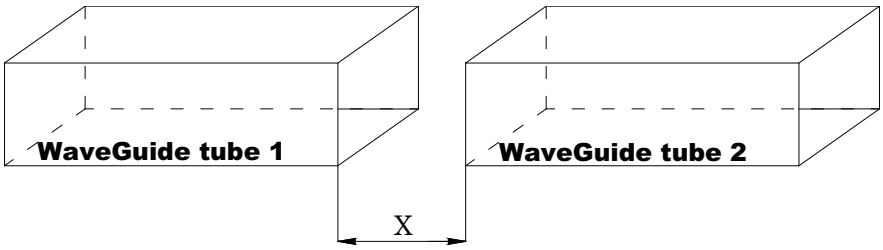



*Figure 8: Horizontal distance between two waveguide tubes*

# Section 4 Mounting

## 4.1 Mounting WGA631

1. Install the WGA631 unit on the DIN rail system.
   The clamp on the backside of WGA631 allows also the disassembly of the unit by pushing it to the DIN rail under an angle of 90°.
2. Place WGA631 near the IED.

Pay attention to the length of the CAT 7 and the antenna cable during the installation.

# Section 5 Connecting

## 5.1 Connecting the RJ-45 LAN cable

1. Connect the RJ-45 LAN cable, that is CAT 7, between the IED and WGA631.
2. Connect the LAN cable to the LAN connector, for example, to Port 1 of WGA631.
   The other end of the cable is connected to the IED's Ethernet communication port.

## 5.2 Connecting auxiliary power and earthing

1. Connect the auxiliary power.
   The voltage range for the external power connection $U_{aux}$ is 110-220 V DC / AC.

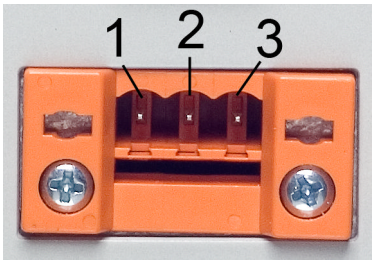



*Figure 9: Screw terminal of $U_{aux}$ connection*

*Table 2: Screw terminal connectors*

| Screw terminal | AC | DC |
|---|---|---|
| 1 | L | + |
| 2 | | |
| 3 | N | - |

2. Connect the earth of the WGA631 unit to the protective earth of the low voltage compartment.

The earthing screw on the right side of the screw terminal is available for the protective earth conductor.

3. Connect solid, low-impedance operational earthing to the earthing surface inside the low voltage compartment.
   The cross-section of the earth wire must be at least 2.5 mm².

# Section 6 Configuring

See the IED manual for the IED's communication properties before connecting to the Ethernet adapter. You also need basic understanding of the Ethernet and TCP/IP technology to configure the network.

## 6.1 Configuring via WINBOX

WGA631 fulfils the typical features for standard routers. In this case only the preferred configuration of WDS is used for the waveguide network technology to get the full functionality for substation automation communication.

WGA631 can be configured either as a Master (AP-bridge) or a Client in slave mode (wds-slave).

A point-to-point WLAN link is used to connect two networks in AP-bridge or wds-slave mode. For example, as an Ethernet bridge, WGA631 connects two Ethernet networks. The WDS-bridge mode in the waveguide application is used for transparent and fast transmission of all Ethernet packets and also for all GOOSE messages which are transmitted as VLAN-tagged packets. All clients can be configured as standard modules; only the physical and wireless IP addresses have to be adjusted. Each IED can be connected to a client router to communicate in the system. All routers work in the same physical network and communicate in the same wireless network.

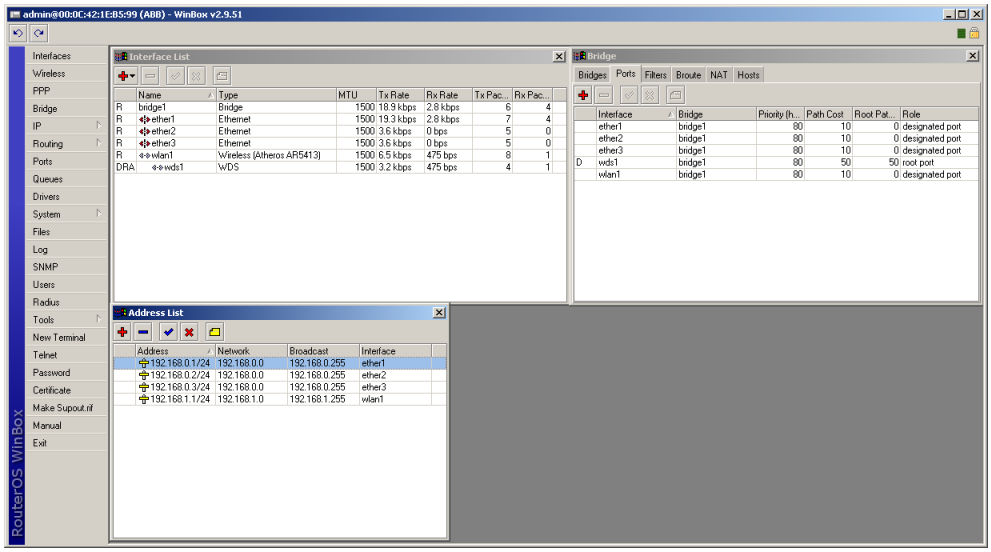



*Figure 10: Example configuration with one master and client*

## 6.1.1 Installing and starting WINBOX

The WINBOX tool is stored on the WGA631 web interface. The tool is also available on the ABB web site.

1. Copy the winbox.exe file to the local hard disk.
2. Double-click the winbox.exe file to start the WINBOX tool.
3. Connect WGA631 to the service PC via an Ethernet cable.

## 6.1.2 Connecting to WGA631

1. Start the WINBOX tool.

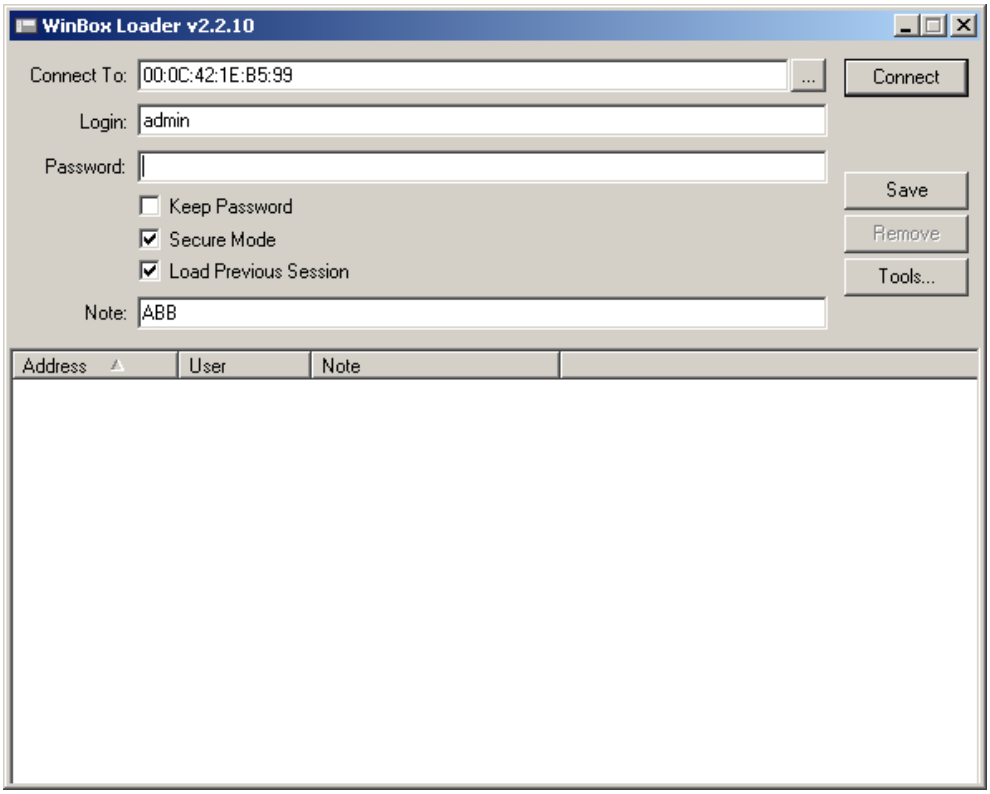



*Figure 11: Connecting to WGA631*

The WINBOX mask enables connection to the WGA631 unit via the Ethernet.

2. Click ... to search for WGA631 units with an Ethernet interface.

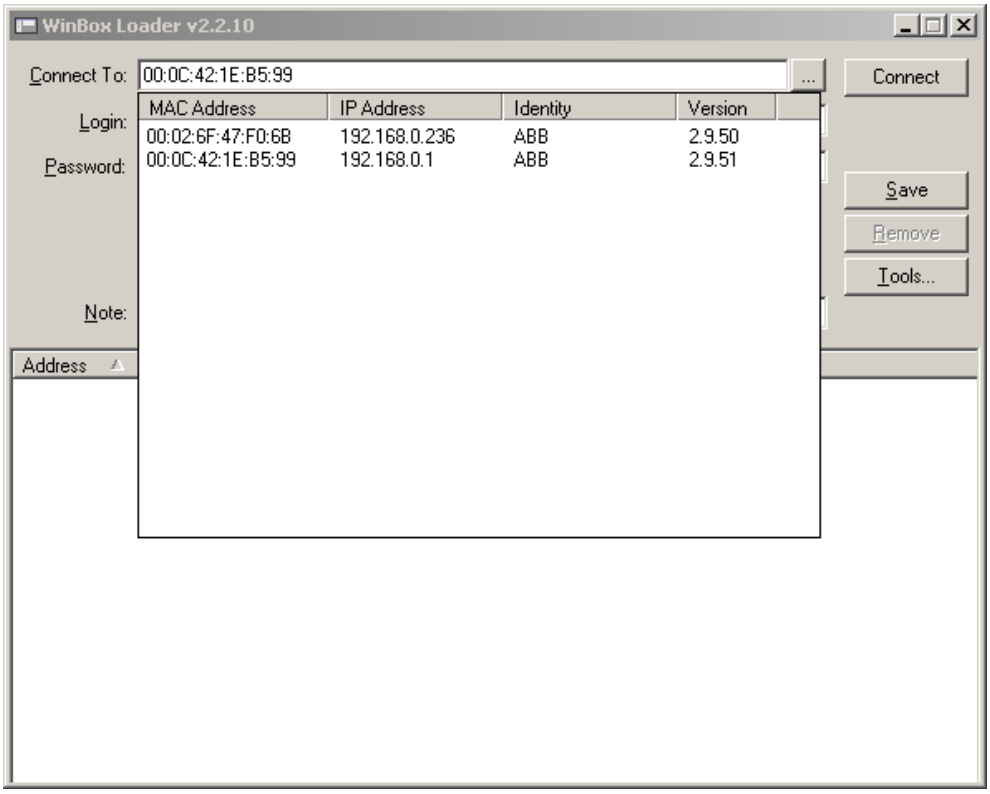



*Figure 12: Available Ethernet units*

The list shows all the available Ethernet units in the connected segment.

3. Select the WGA631 unit to be configured.
4. Click **Connect** to open the configuration window.

## 6.1.3 Configuring address and interface lists

1. Click **Interfaces** to check that the required interfaces ether1-3 and wlan1-3 are available.
2. Click **IP** and **Addresses** to check that the IP addresses are available.

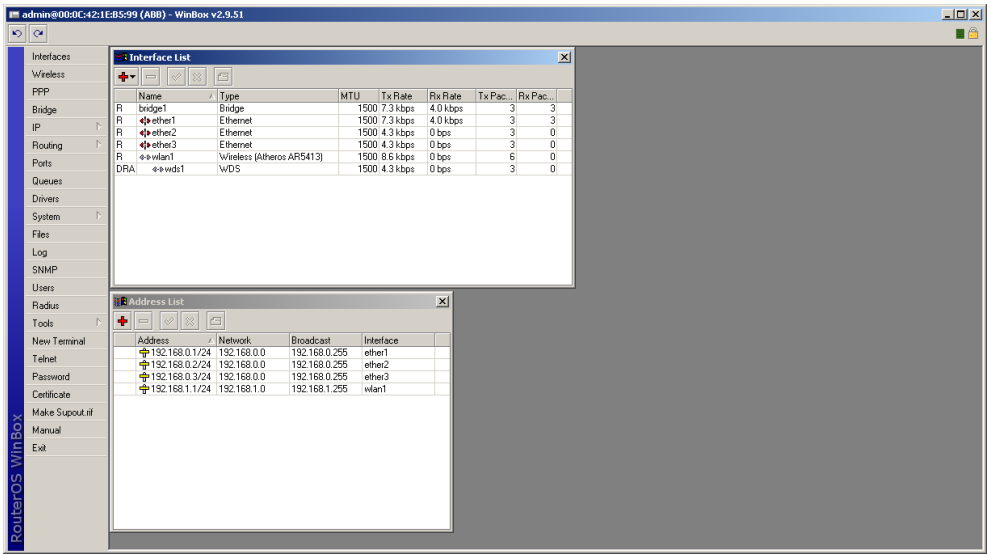



*Figure 13: Verifying interfaces and IP addresses*

- If the IP addresses are not visible, click .

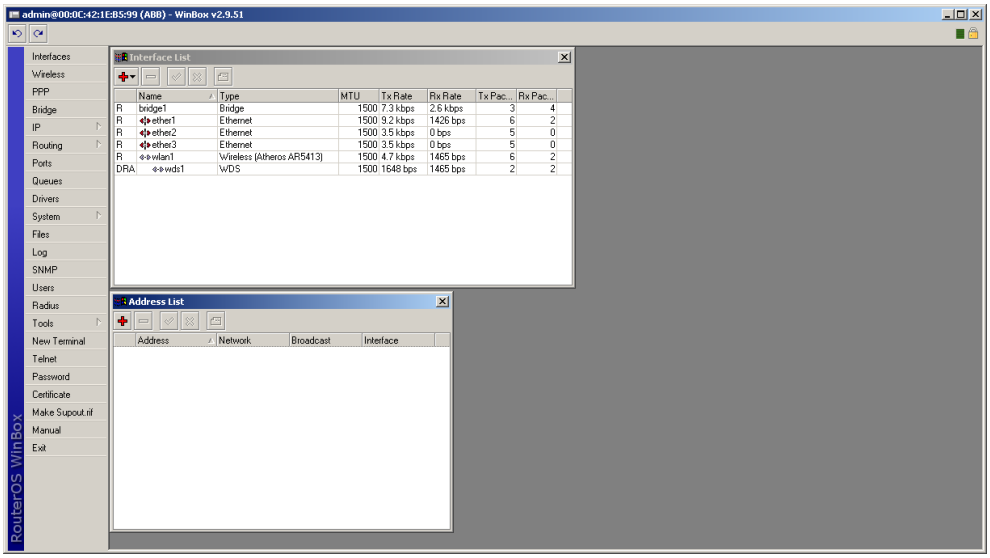



*Figure 14: Displaying missing IP addresses*

3. Insert the network settings for the available Ethernet interfaces ether1-3.

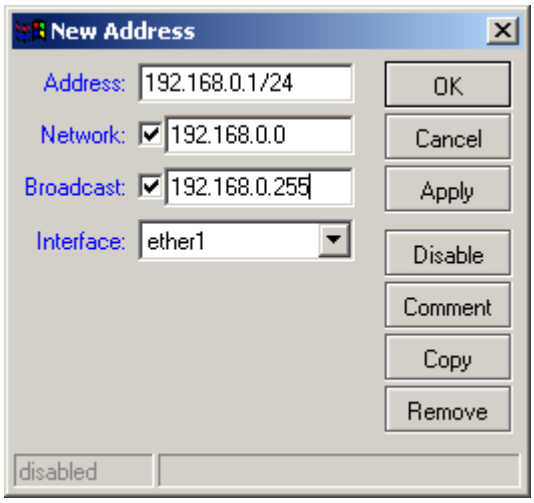



*Figure 15: Configuring Ethernet interface*

Make sure that the IP address has the suffix /24 which represents the subnet mask information. The first 24 bits of the IP address indicate the subnetwork 255.255.255.0.

4. Click **OK** to close the window.
5. Click .
6. Configure the WLAN interface.

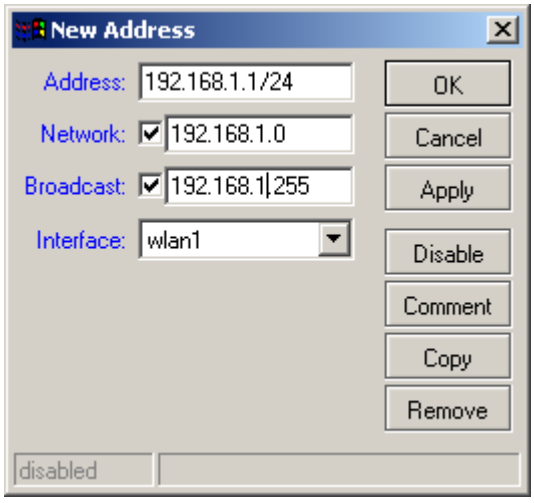



*Figure 16: Configuring WLAN interface*

For example, the IP address range can be 192.168.x.y.

x = 0 Ethernet interface subnet for ether1

x = 1 WLAN interface subnet

y [1] = 1 ether1

y [1] = 1 wlan1

If several IP addresses are configured, all available addresses are listed in the address list.

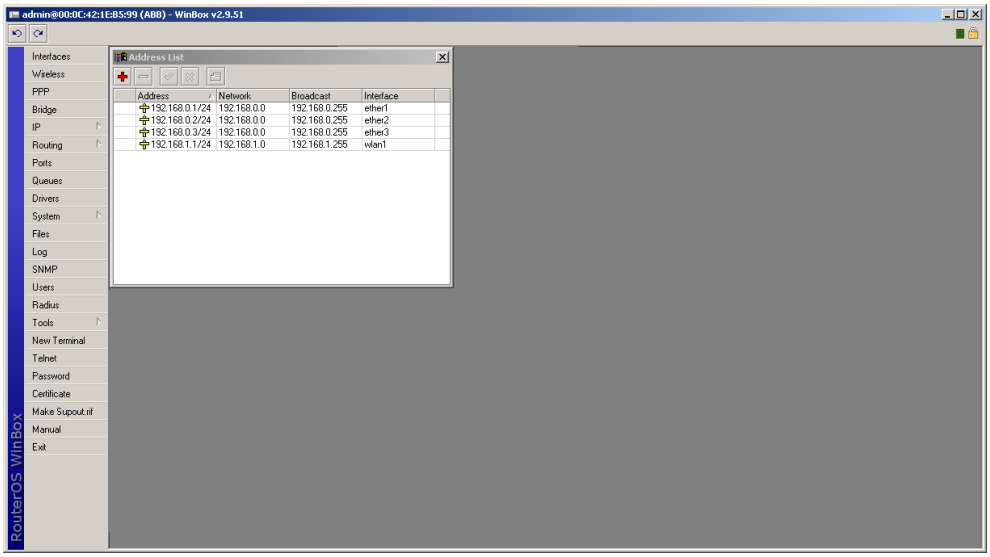



*Figure 17: List of several configured IP addresses*

## 6.1.4 Adding and configuring bridge

### 6.1.4.1 Adding bridge

1. Click **Bridge**.
2. Click to add a new bridge.
3. In the **Name** box, type a name for the new interface.

[1] This is the last number of the IP address.

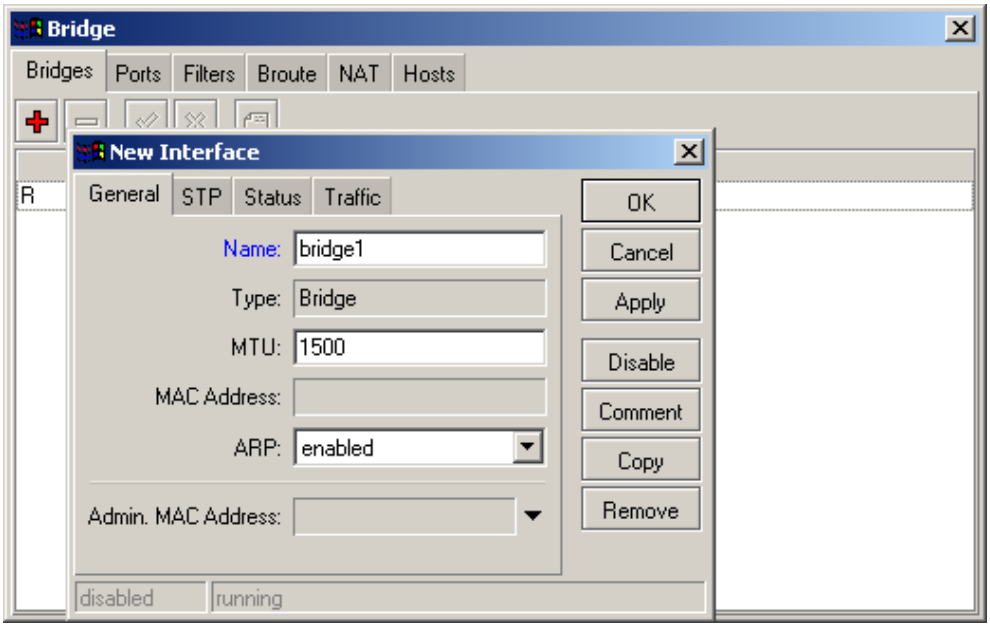



*Figure 18: Adding a new bridge*

4. Click **OK** or **Apply** to confirm.

### 6.1.4.2 Configuring bridge

1. Double-click an existing bridge, for example, **bridge1**.
2. Select the **STP** tab.
3. Under **Protocol Mode**, click **stp**.

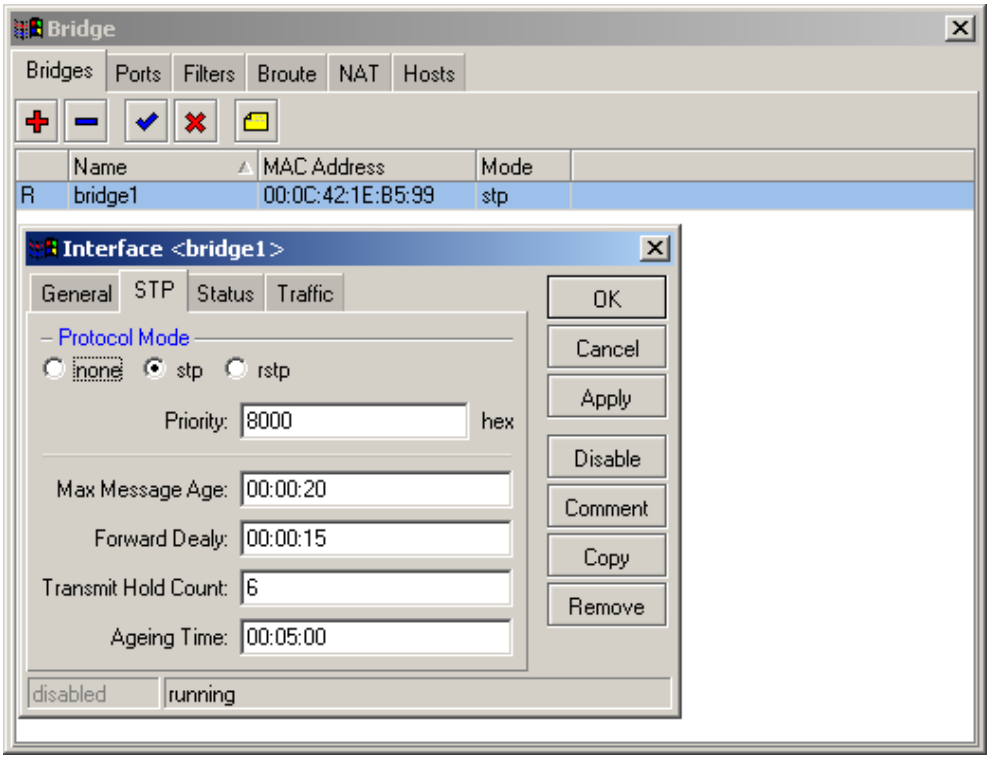



*Figure 19: Selecting stp protocol mode*

4. In the **Priority** box, type a value, for example 8000, for test purposes.
5. Click **OK** to confirm.

### 6.1.4.3 Configuring ports

1. Click **Ports** to configure the port and to add bridge ports to the interface.
2. Select the bridge port.
3. Select the **Ports** tab.
4. Click to add a new port.
5. In the **Interface** list, click the correct interface, for example ether1.
6. In the **Bridge** list, click **bridge1**.
   Leave the values in the **Priority** and **Path Cost** boxes as shown in the figure.

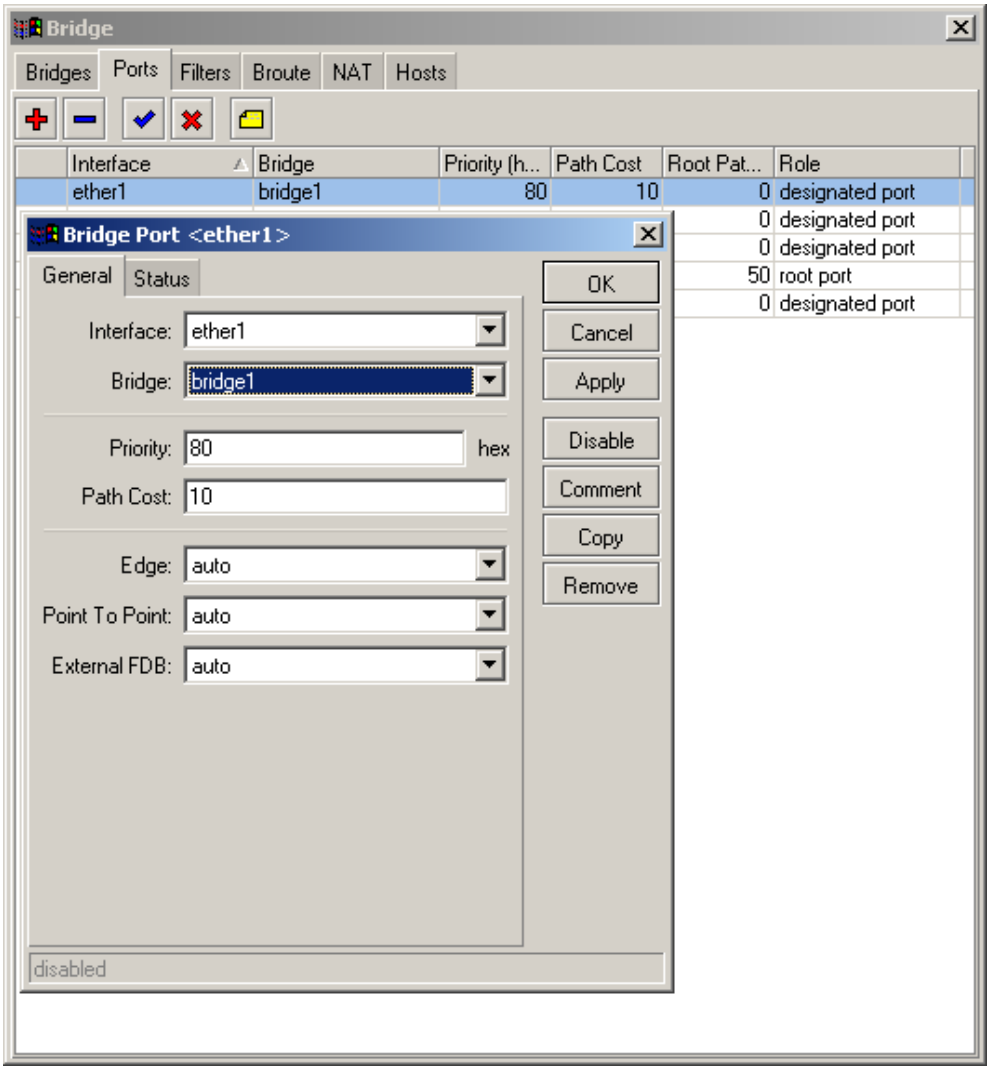



*Figure 20: Interface port settings for the bridge*

7. Click **OK** or **Apply** to confirm.

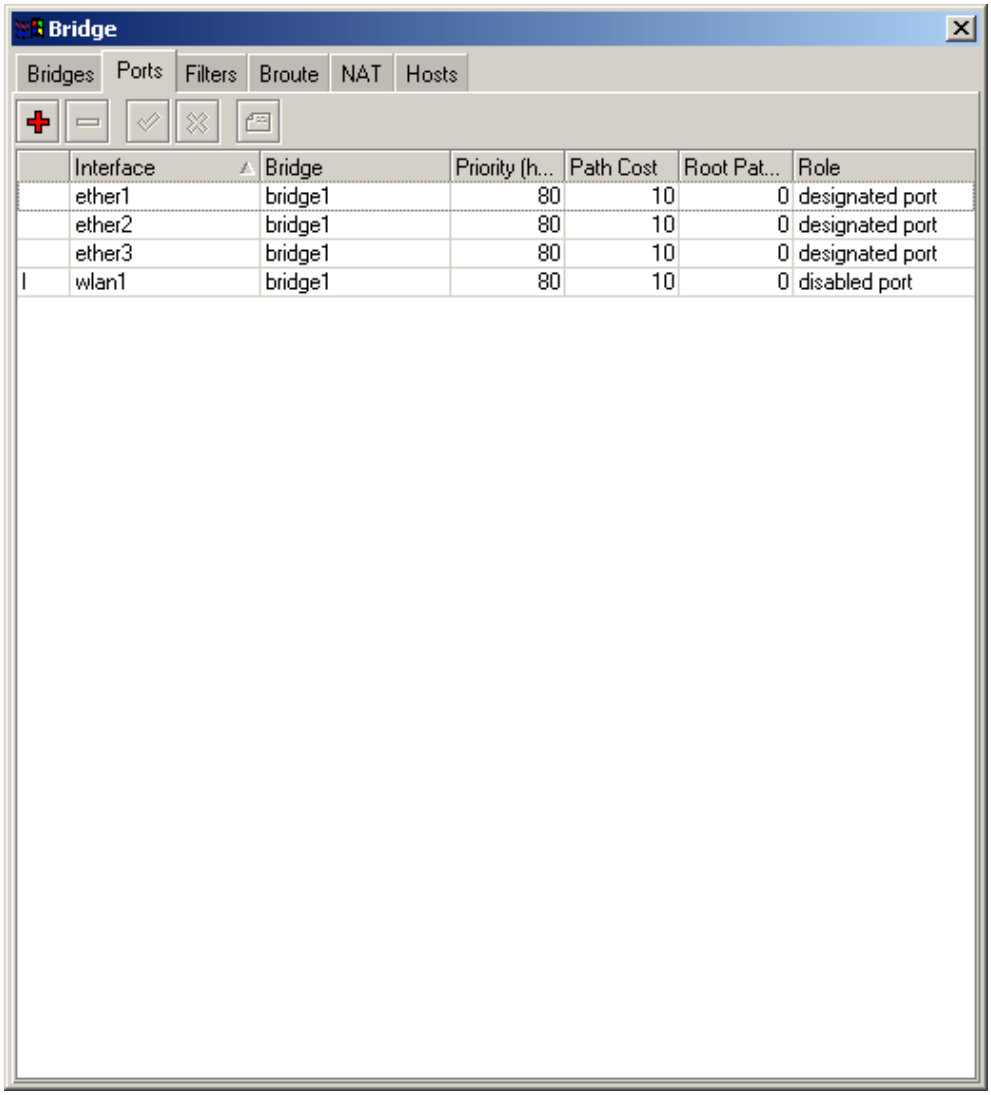



*Figure 21: Example of bridge configuration*

Repeat steps 3-7 to configure more Ethernet or WLAN ports.

## 6.1.5 Configuring wireless interface

1. Click **Wireless**.
2. Click the **Wireless** tab.
3. In the **Mode** list, click **ap bridge** to set the master's mode.
   Apply the WLAN settings according to the figure.

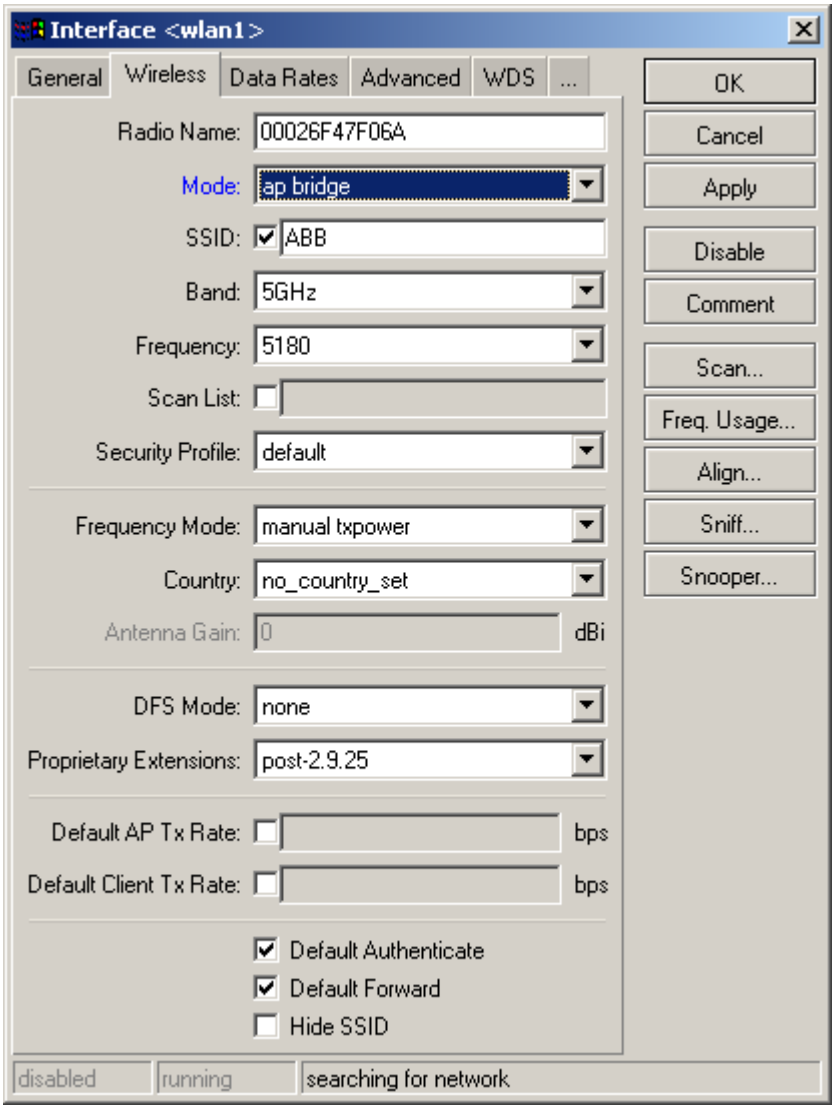



*Figure 22: WLAN settings for the WGA631 master*

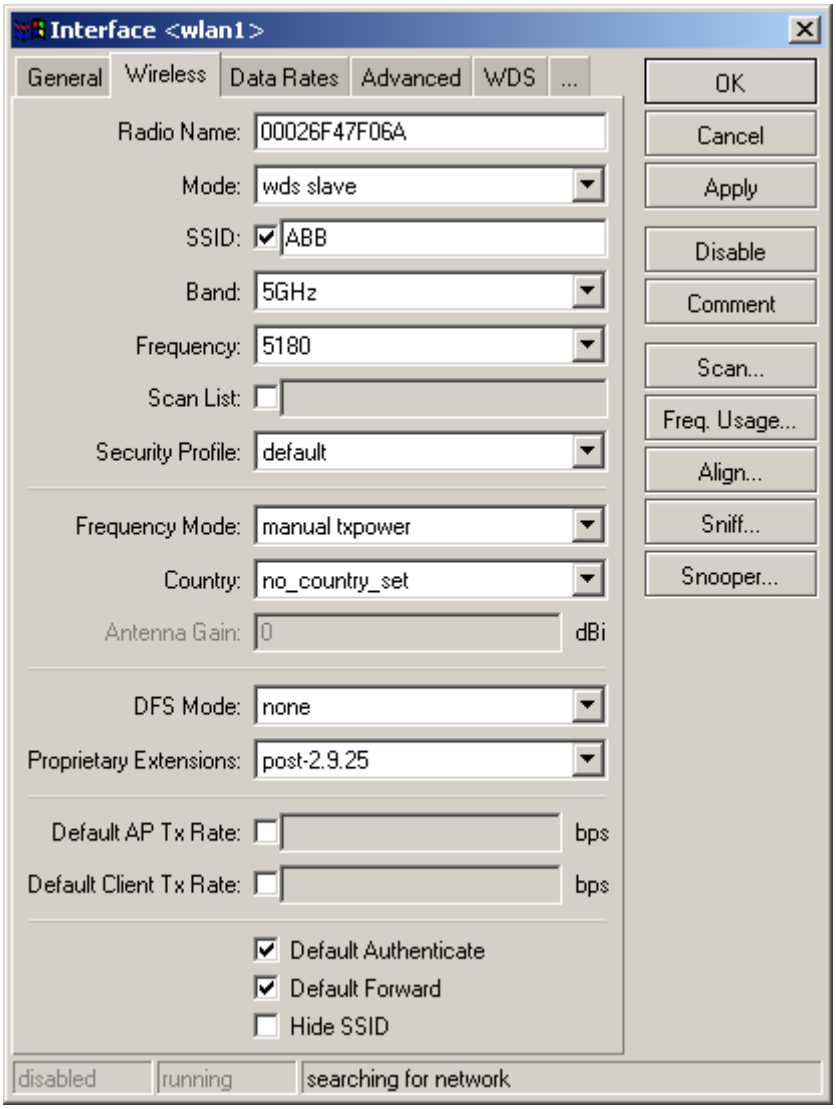



*Figure 23: WLAN settings for the WGA631 client*

4. Click the **Data rates** tab page to set the data rates of the wireless interface.

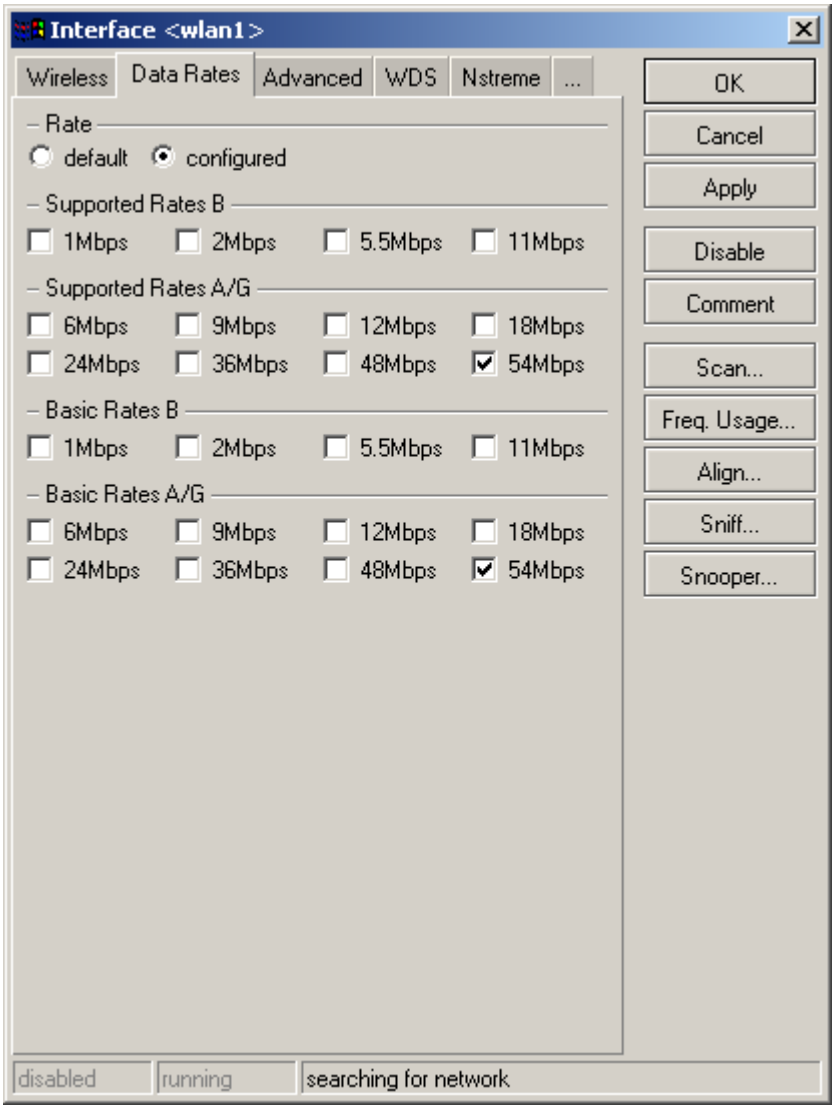



*Figure 24: Setting data rates*

5. Click the **WDS** tab to set the parameters.

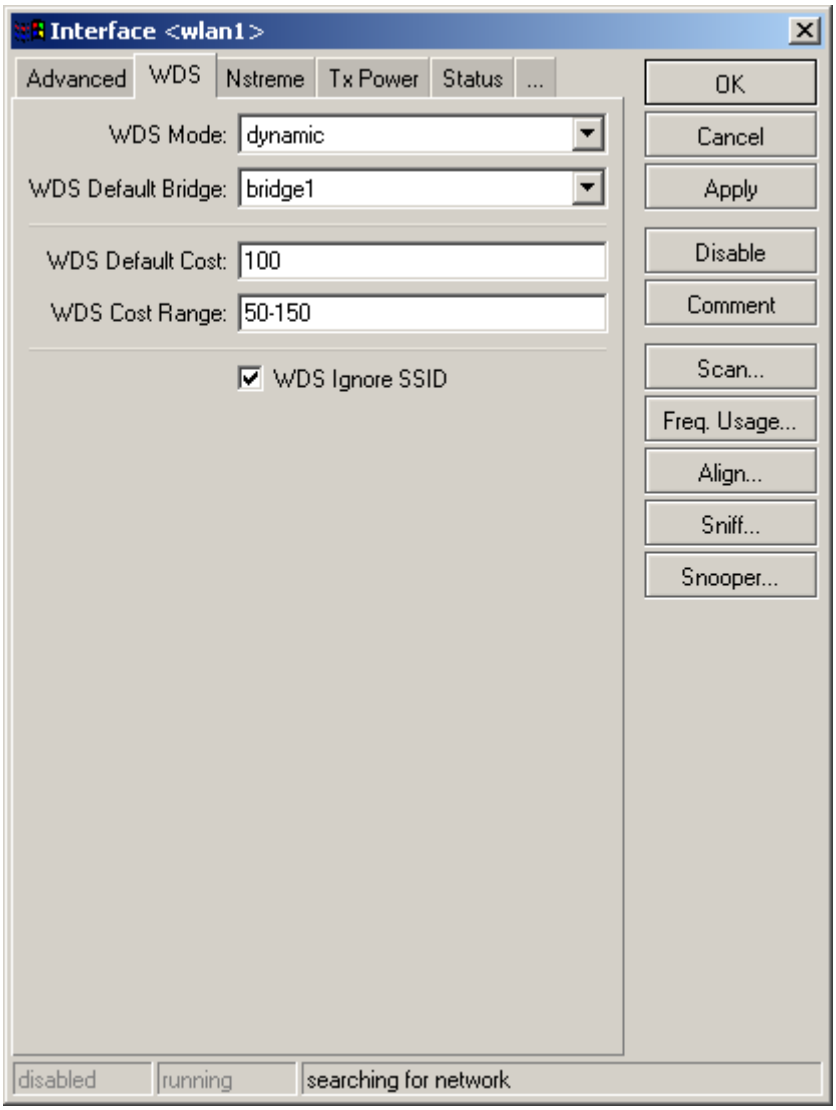



*Figure 25: Setting WDS*

6. Click the **Tx Power** tab to set the parameters.

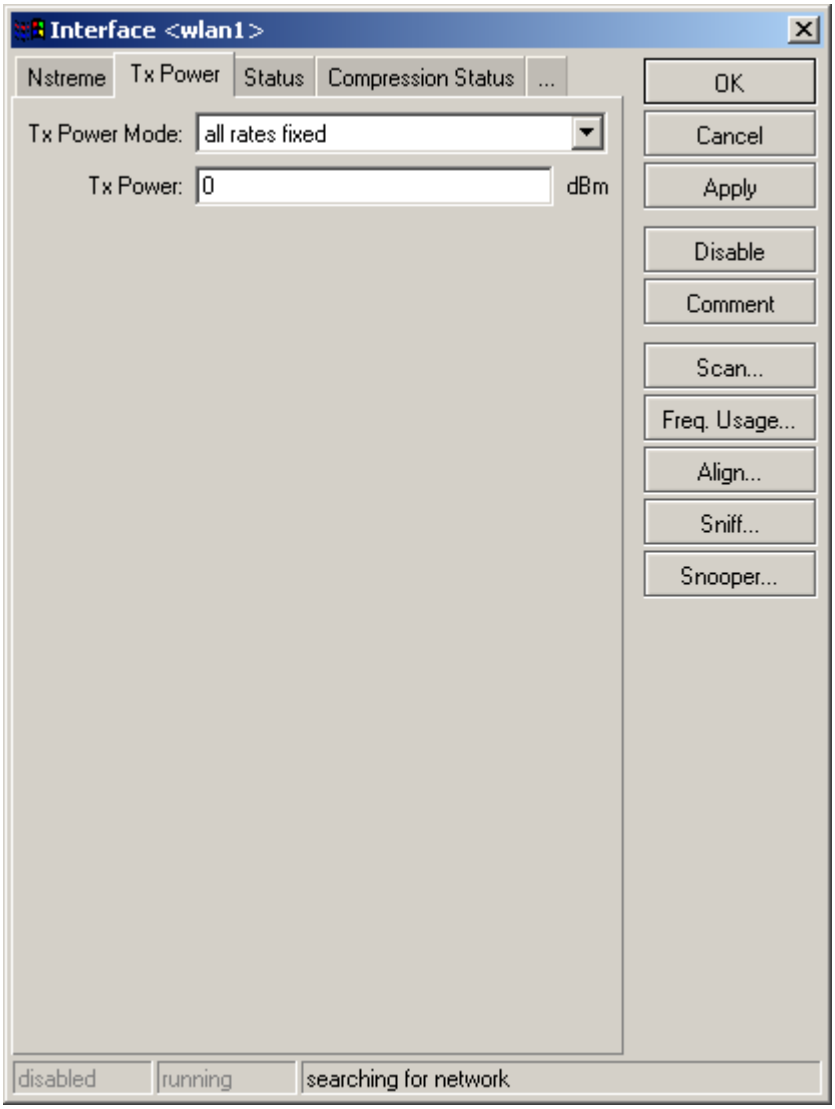



*Figure 26: Setting Tx power*

## 6.2 Configuring via serial interface

### 6.2.1 Configuring serial interface

1. Connect WGA631 to the serial line RS-232 interface of the service PC via a null-modem cable and start the serial line tool.

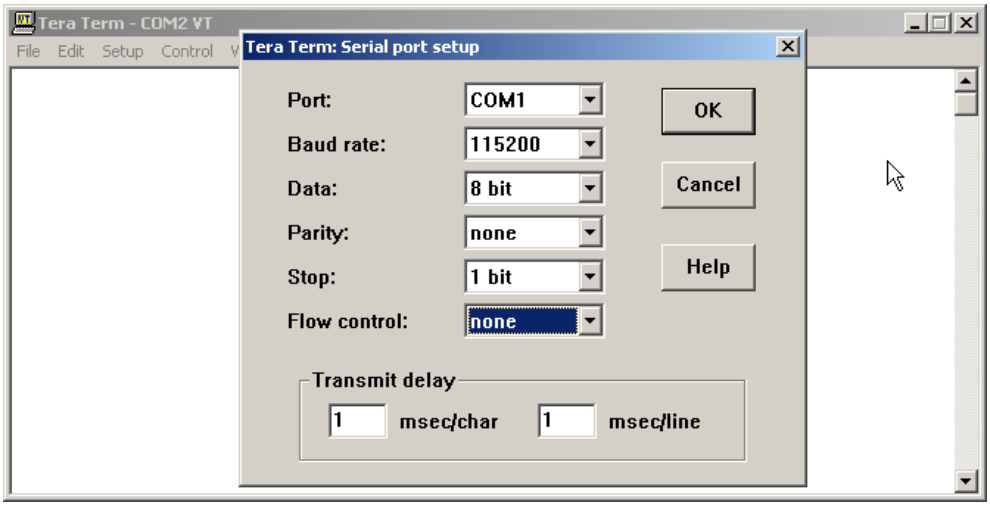



*Figure 27: RS-232 settings*

2. Open the terminal settings, for example with TeraTerm, and enter the correct parameters.

*Table 3: Example of the terminal program RS-232 settings*

| Description | Value |
|---|---|
| Port | 1 |
| Baud rate | 115200 |
| Data | 8 bit |
| Parity | none |
| Stop | 1 bit |
| Flow control | none |

## 6.2.2 Logging in

1. Switch on the WGA631 unit to display the serial line prompt.

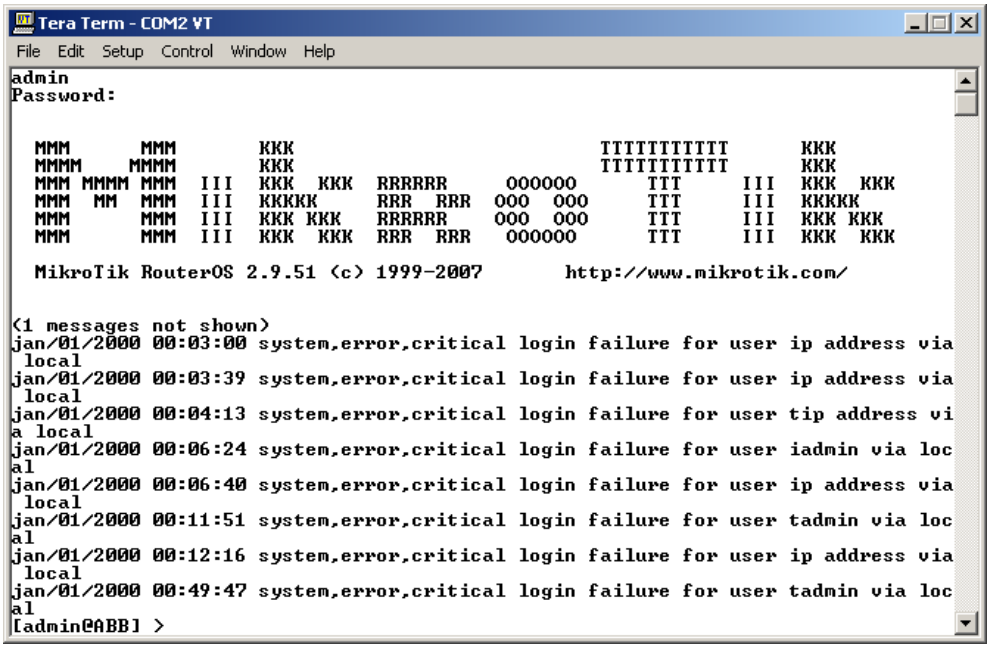



*Figure 28: Entering user name and password*

2. At the command prompt, type **admin** as the ABB Login and press **Enter**.
3. Leave the password empty and press **Enter**.
4. Download the Script-file configuration in WDS-Mode with predefined IP addresses.
   4.1. **File**.
   4.2. **Send**.
   4.3. Select the script file, for example WGA631_script_file_XY.txt, from a folder or hard disk.

The terminal program allows you to control the downloading procedure. The final description gives an overview of the current configuration.

## 6.2.3 Default IP addresses

*Table 4: Default IP address configuration*

| LAN/WLAN | IP address |
|---|---|
| LAN-IP1 | 192.168.0.1 |
| LAN-IP2 | 192.168.0.2 |
| LAN-IP3 | 192.168.0.3 |
| WLAN-IP | 192.168.1.1 |

IP addresses can be changed.

# Section 7 Technical data

## 7.1 Dimensions

*Table 5: WGA631 dimensions and weight*

| Dimension | Value |
|---|---|
| Width | 141.5 mm |
| Height | 71 mm |
| Depth | 200 mm |
| Weight | 1.25 kg |

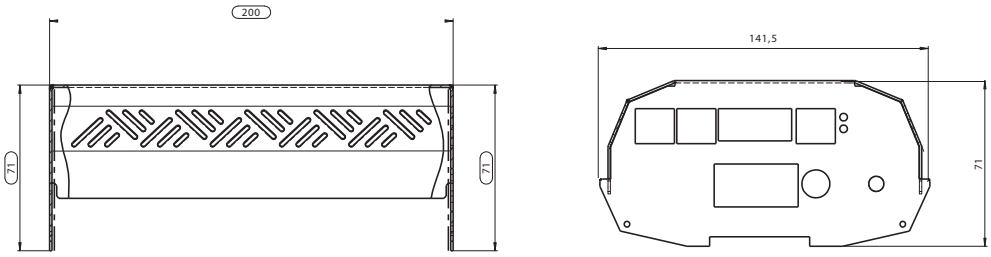



*Figure 29: WGA631 dimensions*

## 7.2 Interfaces

*Table 6: WGA631 interfaces*

| Description | Value |
|---|---|
| Power supply | 110…220 V DC (-30% / +10%)<br>110…230 V AC<br>Pq < 5 W |
| Storing temperature | -20…+70 °C / -4…+158 °F |
| Operating temperature | -10…+55 °C / +14…+131 °F |
| Waveguide connector type | R-SMA Cable connector 1) |
| Ethernet connector type | RJ-45 galvanic LAN connector |
| Protocol type | IEC 61850 |

1) For example, Telegärtner R-SMA, J01150R0001

# 7.3 Environmental conditions and tests

*Table 7: Environmental conditions*

| Description | Value |
|---|---|
| Service temperature range | -10...+55 °C / 14…131 °F (continuous) |
| Transport and storage temperature range | -20...+70 °C / -10…158 °F according to IEC 60068-2-48 |

*Table 8: Environmental tests*

| Description | Value |
|---|---|
| Dry heat test | According to IEC 60068-2-2<br>Test values:<br>• 96 h at +65 °C<br>• Start-up at +55 °C |
| Dry cold test | According to IEC 60068-2-1<br>Test values:<br>• 96 h at -40 °C<br>• Start-up at -40 °C |

# 7.4 Electromagnetic compatibility tests

*Table 9: Power Supply module*

| Description | Value |
|---|---|
| 1 MHz burst disturbance test, class IV<br>• Common mode<br>• Differential mode | According to IEC 61000-4-4<br>4 kV<br>2 kV |
| Fast transient disturbance tests, class IV | According to IEC 61000-4-4<br>4 kV |
| Surge immunity test | According to IEC 61000-4-5<br>4 kV, line-to-earth<br>2 kV, line-to-line |
| Electromagnetic emission tests<br>• Conducted, RF-emission (Mains term.)<br>• Radiated RF-emission | According to EN 55011<br>EN 55011 (0.15…30 MHz)<br>IEC 61000-4-3 (80 MHz…1 GHz, 10 V/m) |

*Table 10: Enclosure*

| Description | Value |
|---|---|
| Electrostatic discharge test, class IV | According to IEC 61000-4-2 |
| • For contact discharge | +/- 8 kV |
| • For air discharge (without LED) | +/- 8 kV |
| Radio frequency interference tests | |
| • Conducted, common mode | According to IEC 61000-4-6<br>10 V (rms), f = 150 kHz...80 MHz |
| • Radiated, amplitude-modulated | According to IEC 61000-4-3<br>10 V/m (rms), f = 80...3000 MHz |

*Table 11: Ethernet and WGA port*

| Description | Value |
|---|---|
| Fast transient disturbance tests, class III | According to IEC 61000-4-4<br>2 kV |
| Radio frequency interference tests | According to IEC 61000-4-6 and IEC 60255-22-6 |
| • Conducted, common mode | 10 V (rms), f = 150 kHz...80 MHz |
| CE approval | Complies with the EMC directive 89/336/EEC and the LV directive 73/23/EEC |

*Table 12: Standard tests*

| Mechanical tests | |
|---|---|
| Vibration tests (sinusoidal) | According to DNV |

*Table 13: Power consumption*

| Description | Value |
|---|---|
| Running | ~ 5 W |

# Section 8 Ordering data

The order code for the waveguide access point is WGA631.

The WINBOX configuration tool can be downloaded from the ABB intranet.

# Section 9 Applicable standards and regulations

IEC 61850-6

IEC 61850-7-2

IEC 61850-7-3

IEC 61850-7-4

IEC 61850-8-1

IEEE 802.11a

# Section 10 Glossary

| | |
|---|---|
| **CAT 7** | Cable standard for Ethernet and other interconnect technologies that can be made to be backwards compatible for example with traditional CAT 5 Ethernet cable. |
| **DIN rail** | A standardized 35 mm wide metal rail with hat-shaped cross section. |
| **EMC** | Electromagnetic compatibility |
| **Ethernet** | A large, diverse family of frame-based computer networking technologies that operate at many speeds for LANs interconnecting computing devices. Ethernet is a trademark of Xerox Corporation, Inc. and defined in the IEEE 802.3 standard in which computers access the network through a CSMA/CD protocol. |
| **GOOSE** | Generic Object Oriented Substation Event |
| **IEC** | International Electrotechnical Commission |
| **IEC 61850** | International standard for substation communication and modelling. |
| **IED** | Intelligent Electronic Device |
| **IP** | Internet Protocol |
| **IP address** | Internet protocol address is a set of four numbers between 0 and 255, separated by periods. Each server connected to the Internet is assigned a unique IP address that specifies a location for the TCP/IP protocol. |
| **LAN** | Local area network |
| **LED** | Light-emitting diode |
| **LON** | Local operating network |
| **LV** | Low voltage |
| **PC** | Personal Computer; Polycarbonate |
| **RJ-45** | Galvanic connector type. |
| **RS-232** | Serial interface standard. |
| **TCP/IP** | Transmission Control Protocol / Internet Protocol |
| **Telnet** | An Internet protocol that lets the user log onto a remote computer using a username and password. |
| **VLAN** | Virtual LAN |
| **WDS** | Wireless distribution system |

**WGA631** Waveguide access point

**WINBOX** Windows-based software for configuring and monitoring WGA631.

**WLAN** Wireless LAN

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