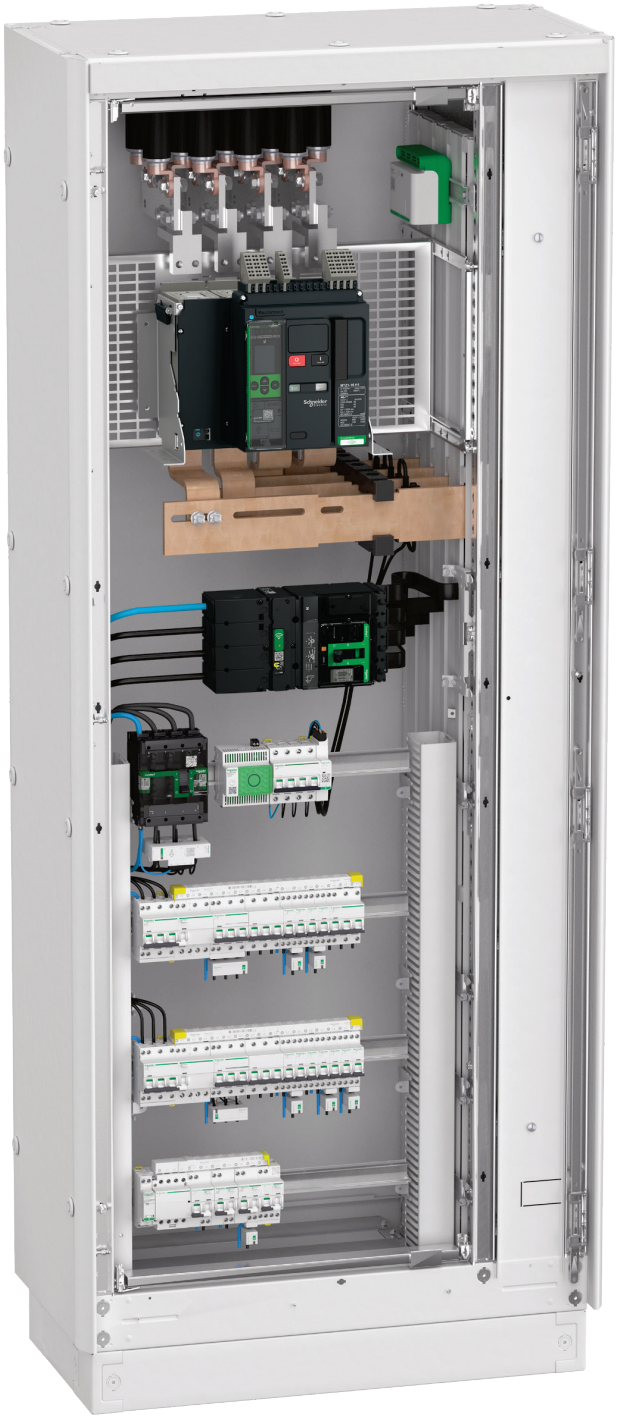
Wireless Communication with EcoStruxure Panel Server

Design Guide

DOCA0289EN
12/2024



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1. Safety Information

1.1. Important Information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it.
The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed

This is the safety alert symbol. It is used to you alert of potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

1.2. Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid hazards involved.

2. About the Document

2.1. Purpose and Scope

This guide is independent of panel type althought it only covers Form 1 and 2. (For guidelines specific for PrismaSeT refer to **Wireless Communication with EcoStruxure™ Panel Server in PrismaSeT - Design Guide**, found in section **2.5 References**).

The EcoStruxure™ Panel Server gateway is designed to connect and digitize the electrical distribution installation and to perform energy management and monitoring from the enclosure incomer down to the load level.

In addition to traditional wired connectivity, the EcoStruxure Panel Server gateway offers wireless communication:

- IEEE 802.15.4 communication to connect Schneider Electric wireless devices, for example, PowerTag Energy sensors, ambient sensors, downstream the Panel Server.
- Wi-Fi communication to connect the Panel Server to Ethernet network architecture on customer site.

This guide is intended to provide information and guidelines to help system designers, installers, and users to obtain reliable wireless communication (IEEE 802.15.4 and Wi-Fi) for the Panel Server by:

- Defining the referential installations for an efficient wireless setup inside and outside a metal enclosure.
- Proposing a method for designing an IEEE 802.15.4 wireless channel assignment plan for a balanced wireless communication on the channels in case of concentrated wireless architecture.

Note: Some Schneider Electric documents relative to specific enclosures can deliver less restrictive rules, based on additional tests made especially for the enclosures or targeted setup. In this case, these documents can replace this guide.

2.2. Scope of the Document

2.2.1. Architecture Principles

Ethernet and wireless communication are used in the architecture presented in this document.

2.2.2. Communication Protocols

Modbus TCP/IP, Wi-Fi and IEEE 802.15.4, including ZigBee Pro and ZigBee Green Power, communication protocols are used in the proposed architecture.

2.3. Validity

This document is valid for wireless architectures utilizing:

- EcoStruxure Panel Server Entry
- EcoStruxure Panel Server Universal
- EcoStruxure Panel Server Advanced

This document describes performances available with the following firmware versions of the devices and software:

Device name	Part number	Firmware version
EcoStruxure Panel Server Entry	**PAS400**	> SV1.10.0
EcoStruxure Panel Server Universal	**PAS600**, **PAS600L**	> SV1.10.0
EcoStruxure Panel Server Advanced	**PAS800**, **PAS800L**, **PAS800P**	> SV1.10.0

Table 1: Firmware version

Note: The latest EcoStruxure Panel Server firmware versions are available on **https://www.se.com**.

2.4. Convention

A switchboard can also be referred to as a panel or enclosure.

2.5. References

The following table lists the documents which can be used to become familiar with the content of this guide.

Document Name	Reference
EcoStruxure™ Panel Server - User Guide	**DOCA0172EN**
EcoStruxure™ Panel Server - External Antenna - Instruction Sheet	**NNZ58425**
EcoStruxure™ Panel Server Entry - Firmware Release Notes	**DOCA0249EN**
EcoStruxure™ Panel Server Universal - Firmware Release Notes	**DOCA0178EN**
EcoStruxure™ Panel Server Advanced - Firmware Release Notes	**DOCA0248EN**
EcoStruxure™ Panel Server - Cybersecurity Guide	**DOCA0211EN**
EcoStruxure™ Panel Server - Modbus File	**DOCA0241EN**
ComPacT NSX & NSXm Catalog	**LVPED221001EN**
MasterPacT™ MTZ with MicroLogic Active - Catalog	**LVPED225010EN**
Panel Builders Catalog	**PNBCONTR0223EN**
PowerLogic™ Energy and Power Meters for Panel Builders - Catalog	**PLSED310126EN**
Harmony XB5R and XB4R Wireless and Batteryless Pushbuttons Catalog	**DIA5ED2121214EN**
EcoXpert Catalog	**998-22477001_EcoXpert-catalog**
Emergency Lighting Catalog	**LEES GTV 014**
PowerLogic™ HeatTag Installation – Implementation and Commissioning Guide	**DOCA0327EN**
Wireless Communication with EcoStruxure™ Panel Server in PrismaSeT - Design Guide	**DOCA0375EN**

Table 2: Reference documents

Note: all documents and software can be found on the Schneider Electric website: **https://www.se.com**.

2.6. Glossary

Term	Description
EPC	EcoStruxure Power Commission
IEEE 802.15.4	Standard for Low-Rate Wireless Networks
PAS	EcoStruxure Panel Server
PER	Packet Error Rate
POE	Power over Ethernet
RF	Radio Frequency
RSSI	Received Signal Strength Indicator

Table 3: Glossary

2.7. Prerequisites

The following prerequisites are recommended to correctly implement the architectures covered in this guide. This applies to:

- The networks and communication protocols used in the architectures:
  - IEEE 802.15.4 communication
  - Modbus TCP/IP or Wi-Fi network
- The devices used in the architectures:
  - EcoStruxure Panel Server (Entry, Universal and Advanced)
  - Panel Server Antenna (needed in some architectures)
  - Power Supply
  - PowerLogic PowerTag Energy Devices (PowerTag Rope, PowerTag M630/250, PowerTag F160, PowerTag M63, PowerTag P63, PowerTag F63)
  - PowerLogic HeatTag wireless sensor
  - Acti9 Active
  - Wireless Indication Auxiliary (for ComPacT NSX and ComPacT NSXm)
  - MasterPacT MicroLogic Active Control Unit
  - PowerTag Ambient
  - Easergy TH110
  - Easergy CL110
  - Exiway Light Activa-link, Exiway Trend Activa-link, and Exiway Light SATI LINK Emergency Lighting
- Software used for commissioning the solution:
  - EcoStruxure Power Commission (EPC)

2.8. Device Descriptions

2.8.1. EcoStruxure Panel Server

PAS600L

The EcoStruxure Panel Server is a wireless concentrator and gateway (Ref: PAS400/PAS600/PAS600L/PAS800/PAS800L/PAS800P).

The Panel Server provides connection to edge control software such as EcoStruxure Power Monitoring Expert or EcoStruxure Building Operation, and to cloud applications such as EcoStruxure Asset Advisor and EcoStruxure Energy Hub.

- All-in-one gateway to retrieve data from both wireless sensors and Modbus devices and optimize energy management solutions.
- Ease of commissioning with the EcoStruxure Power Commission tool, or Panel Server embedded web pages, enabling device to plug & play and auto discovery features.
- Ease of operation with user friendly embedded web pages, and data contextualization for more relevant analytics.
- Enhanced Cybersecurity, designed through a development Life Cycle in accordance with IEC 62443-4-1.

Equipped with multiple communication protocols (including Ethernet, IEEE 802.15.4 wireless sensors and Wi-Fi), the Panel Server adapts to fast-evolving communication technologies.

For detailed information on this range of devices, refer to the **PowerLogic Energy & Power Meters Catalog for Panel Builders** in section **2.5 References**.

2.8.2. EcoStruxure Panel Server – Antenna

PASA-ANT1

The Panel Server Antenna (Ref: PASA-ANT1) can be used to extend the wireless network.

- It can be utilized with both the Panel Server Universal and Advanced to extend the Wi-Fi network.
- It can be utilized with the Panel Server Advanced to extend the IEEE 802.15.4 network.

The antenna comes with a 3m cable.

For detailed information concerning this range of devices, refer to the **EcoStruxure Panel Server - External Antenna - Instruction Sheet** in section **2.5 References**.

2.8.3. PowerLogic PowerTag Energy

PowerTag Energy sensors allow for connecting and digitizing electrical systems and handle energy management with monitoring. These sensors connect wirelessly to a gateway and enable alarming in case of overload or voltage loss. The PowerTag Energy sensors used in these architectures include:

A9MEM1591

- PowerTag Rope
  With its flexible and openable current sensors, it can be installed easily on busbars and cables without having to disconnect the conductors and is suitable for 3P or 3P+N networks up to 2000A.

LV434020

- PowerTag M630 and M250
  This PowerTag Energy is designed for Molded Case Circuit Breakers and Switches (ComPacT and TeSyS) for 3P and 3P+N electrical networks up to 630A. It is mounted directly on the bottom side of the circuit breaker, and it does not require any specific wiring.

A9MEM1580

- PowerTag F160
  With its flex design, this PowerTag Energy can be used on many products, or groups of loads, up to 160A on 3P or 3P+N networks. Its removable spring connector for voltage picking makes it easy to install, and it features shapes for brackets to enable it to be mounted and secured in place where needed in a panel.

A9MEM1543

- PowerTag M63
  This PowerTag Energy is used for Acti9 and Multi9 Monoconnect offers: “Single-terminal” circuit breakers, RCDs and switches with a pitch of 18 mm between phase and neutral, rated less than or equal to 63 A.

- PowerTag P63
  This PowerTag Energy is used for Acti9 and Multi9 PhaseNeutral offers: “Single-terminal” circuit breakers, RCDs and switches with pitch of 9 mm between phase and neutral, rated less than or equal to 63 A.

A9MEM1570

- PowerTag F63
  PowerTag Flex is used for other devices and specific installations, rated less than or equal to 63 A. It is designed to fit the following devices: Vigi iDT40, Vigi iC40, Vigi iC60, iC60 double terminal, iID double terminal, and motor starters, such as GV2.

For detailed information on this range of devices, refer to the **PowerLogic Energy & Power Meters Catalog for Panel Builders** in section **2.5 References**.

2.8.4. Acti9 Active

A9TDFC640

Acti9 Active is a family of all-in-one protection devices with wireless connectivity. When connected to a gateway, it enables remote monitoring, diagnostics, pre-alarming, and alarming.

In addition to wireless connectivity, Acti9 Active integrates Residual Current protection, Arc Fault Detection Device and Overvoltage. It includes short-circuit and overload protection due to the associated Miniature Circuit Breaker.

For detailed information on this device, refer to the **Panel Builders Catalog** in section **2.5 References**.

2.8.5. Wireless Indication Auxiliary

LV429454

LV429453

Wireless indication auxiliary contacts are available for:

- ComPacT NSX (LV429454)
- ComPacT NSXm (LV429453)

The wireless device, which is installed in the breaker, communicates using IEEE 802.15.4 and can give the breaker status including:

- OF – Closed/Open
- SD – Not tripped/Tripped
- SDE – Not tripped/Tripped due to electrical fault (only for ComPacT NSX)

For detailed information on this device, refer to the **ComPacT NSX & NSXm Catalog** in section **2.5 References**.

2.8.6. MasterPacT MicroLogic Active Control Unit

LV906402W

The MasterPacT MTZ's control unit, MicroLogic Active, monitors various breaker functions to provide vital, real-time information. Certain MasterPacT MTZ MicroLogic Active Control Units can be equipped with proprietary connectivity based on the IEEE 802.15.4 standard which enables connection with a panel server.

For detailed information on this device, refer to the **MasterPacT MTZ with MicroLogic Active Catalog** in section **2.5 References**.

2.8.7. PowerTag Ambient

A9XST114

This product is a simple to install temperature sensor with IEEE 802.15.4 wireless communication. It is used for measuring the temperature of food storage and processing equipment and rooms to maintain the cold chain. It can be used in extreme temperature ranges: -30°C to +55°C. This reference (A9XST114) is an all-in-one product without accessories sold in sets of 4 pieces.

For detailed information on this device, refer to the **Harmony XB5R and XB4R Wireless and Batteryless Pushbuttons Catalog** in section **2.5 References**.

2.8.8. PowerLogic Easergy TH110 and CL110

ZBRTT1

EMS59443

The PowerLogic Easergy TH110 and CL110 are wireless sensors which allow continuous monitoring. They use IEEE 802.15.4 wireless communication and require no additional power supply. TH110 offers continuous monitoring of the thermal status of all critical connections. CL110 offers continuous monitoring of the environmental conditions of an enclosure.

For detailed information on this device, refer to the **EcoXpert Catalog** in section **2.5 References**.

2.8.9. Exiway Activa-link and SATI LINK

OVA44210

OVA59130

The Exiway Light Activa-link and SATI LINK ranges are versatile and easy to install range of emergency blocks. These lights can communicate wirelessly to one another and to the Panel Server to be monitored remotely. They use IEEE 802.15.4 and create a mesh network, so that each unit works as a repeater. They offer real-time notifications in case of faults and digital reports downloadable at any time.

For detailed information on this device, refer to the **Emergency Lighting Catalog** in section **2.5 References**.

3. Installation Guidelines for IEEE 802.15.4

3.1. Panel Server Principles

3.1.1. Panel Server Topology

The EcoStruxure Panel Server communicates natively in Modbus TCP/IP and can be directly connected to any Ethernet network.

Two kinds of Ethernet topologies are possible, depending on the requirements of the communication architecture:

- A star communication network offers an architecture with high dependability.
- A daisy-chain architecture offers a competitive architecture, but this is less robust in the event that a device in the chain fails.

In addition to the wired connectivity (Modbus Serial Line and Modbus TCP/IP communication), the EcoStruxure Panel Server gateway offers wireless communication:

- IEEE 802.15.4 communication to connect Schneider Electric wireless devices downstream of the Panel Server.
- Wi-Fi communication to connect the Panel Server to the network architecture on the customer site.

The Panel Server also has an optional antenna which can be used as a Wi-Fi Antenna, for Panel Server Universal and Advanced. However, the Panel Server Antenna can only be used as an IEEE 802.15.4 antenna with the Panel Server Advanced.

3.1.2. Radio Frequency Channel for Wireless Devices

The wireless channel is obtained automatically by the Panel Server when doing the pairing by choosing the best one (default setting). It is recommended to keep this setting. However, if the panel environment is changed, it is recommended to verify that no new wireless networks can disturb the system. Additionally, if other wireless devices are used in the same zone, the channel can be selected manually. See section **5 Wireless Channel Assignment** for more information on what to do in a situation with more than one gateway.

3.1.3. Power Supply

Panel Server power supply:

- 110-277V AC/DC 50-60Hz for **PAS400**, **PAS600** and **PAS800**
- 24V DC for **PAS600L** and **PAS800L**
- PoE (Power over Ethernet) for **PAS800P**

3.2. Wireless Quality Indicators

The Received Signal Strength (RSSI) and Packet Error Rate (PER) are the main metrics in wireless communication systems, especially in technologies like Wi-Fi, Bluetooth, ZigBee, IEEE 802.15.4, and other radio frequency-based systems. They can help to assess and optimize the performance of communication links. RSSI provides information about signal strength and PER gives insights into the actual reliability of the transmitted data.

3.2.1. Received Signal Strength Indicator (RSSI)

The quality of the Radio Frequency (RF) communication between the Panel Server and each paired wireless device can be evaluated by using the RSSI.

RSSI measures the power level received by an antenna from a transmitter. It quantifies the strength of the received radio frequency (RF) signal, typically expressed in decibel milliwatts (dBm). RSSI is an indicator the receiver calculates to express how well it can “hear” a signal from a transmitter. If the signal is too weak, the receiver won’t be able to “hear” the message.

A higher RSSI value indicates a stronger and more reliable signal. However, a high RSSI is not sufficient to determine if the signal is strong enough. It is therefore important to also analyze the PER.

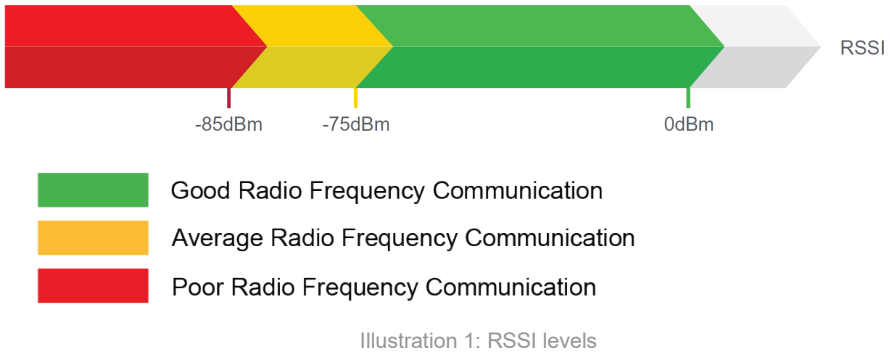


Illustration 1: RSSI levels

To help ensure a robust RF communication, the RSSI must be higher than -75 dBm.

3.2.2. Packet Error Rate (PER)

PER measures the percentage of transmitted data packets received incorrectly at the destination. It is a crucial parameter for assessing the reliability and performance of a communication link.

In digital communication systems, data is sent in packets – discrete units of information. PER is calculated by comparing the number of packets sent with the number of packets lost. A low PER indicates a more reliable communication link, while a high PER suggests that a significant proportion of transmitted data is being corrupted or lost. Monitoring PER is essential in evaluating the overall quality of a communication channel.

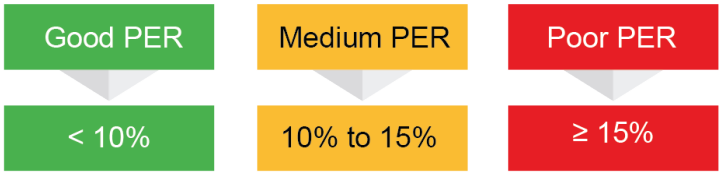


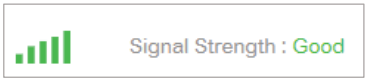
Illustration 2: Criteria for PER

To help ensure a robust RF communication, the PER must be lower than 10%.

3.2.3. How to Monitor Quality Indicators

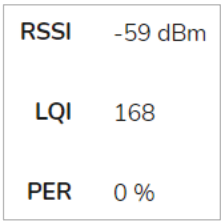
There are two ways to check the RSSI and PER:

- Using EPC, which gives the information about strong, medium, or weak RSSI signal.
  - From the EcoStruxure Panel Server icon, select **Wireless devices**; the signal strength is represented by the graphic and text, as in the following example:



- Using the PAS web pages to get the current values.
  - From the EcoStruxure Panel Server web pages, select **Maintenance > Device Communication > Wireless Devices > Wireless Network Indicator > Panel Server Indicator**

    The measured value is given in text, as in the following example:



It is necessary to recheck the RSSI and PER if any devices are added, removed, or change location.

3.3. Panel Forms of Separation

Panel separations are meant to facilitate access to a part of the panel while other parts remain energized and in service. The need for a specific form depends on the nature of tasks to be performed in the panel, the competency level and the protective gear worn by the personnel performing these tasks.

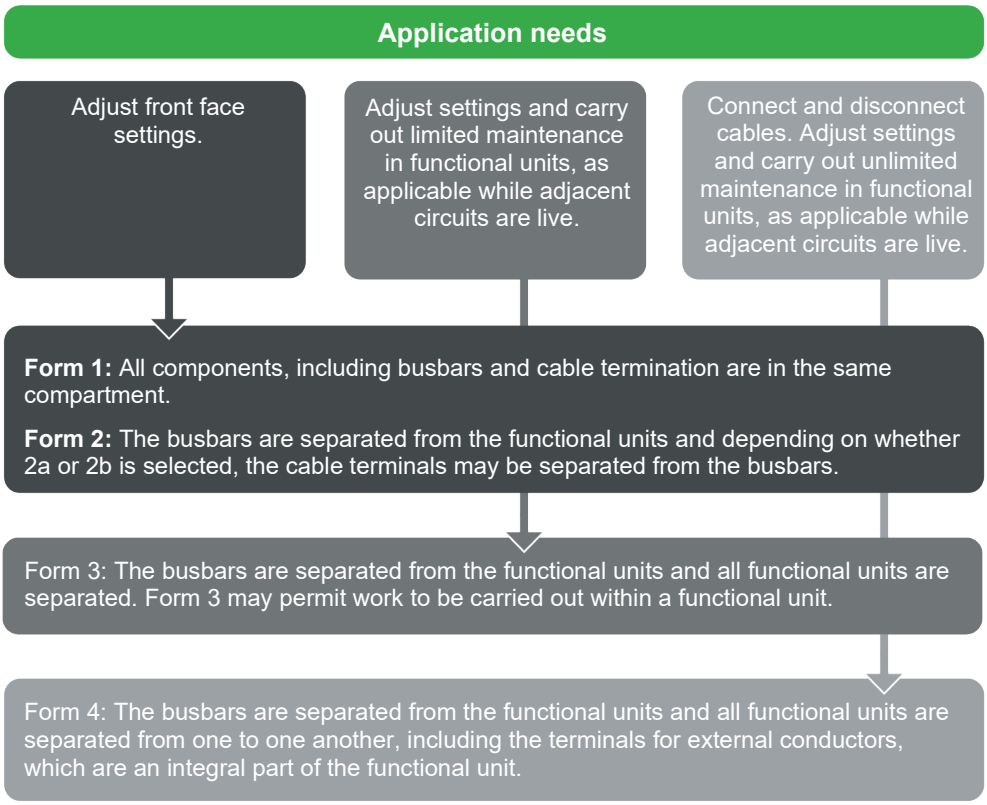


Illustration 3: Explanation of panel forms related to application needs

3.4. Installation Guidelines Inside One Enclosure

The Panel Server can be installed with wireless devices inside one metal or plastic enclosure, with up to five columns in forms 1, 2a, or 2b, with the specifications for installation outlined in this section.

3.4.1. Devices

These recommendations cover one Panel Server (Entry, Universal, or Advanced) and several different wireless devices. The tested devices include:

- PowerTag Energy Rope
- PowerTag Energy M630/250
- PowerTag Energy F160
- PowerTag Energy M63, P63, F63
- PowerLogic Energy HeatTag
- Acti9 Active
- Wireless Indication Auxiliary (for ComPacT NSX and ComPacT NSXm)
- MasterPacT MicroLogic Active Control Unit

It might be necessary to use more than one Panel Server if the number of wireless devices is higher than the maximum allowed for the Panel Server model (refer to Maximum Configuration in the **EcoStruxure Panel Server - User Guide**, found in section **2.5 References**).

If there is more than one Panel Server, refer to section **5 Wireless Channel Assignment** to help ensure a balanced wireless communication on the channels.

3.4.2. Panel Server Settings

The Panel Server settings, available on the Panel Server web pages or EcoStruxure Power Commission software, shall be set accordingly:

- Antenna setting: **Internal**
- Output power level: **Low level** (setting not editable when antenna is set to **Internal**)

3.4.3. Panel Server Positioning

Installing the Panel Server at the bottom of the column can help minimize the possibility of overheating. From a radio frequency standpoint, installing the Panel Server as close as possible to the central point of the enclosure can help to improve the signal. As a compromise, the Panel Server can be placed in the center if there are no high-heat-generating devices below it.

There can be one Panel Server to cover a five column panel, if it is placed in the center column. This will allow one Panel Server to cover its maximum number of columns (the column it is located in and up to two on each side). The number of columns refers to columns containing products, and there may also be one or more columns for cable connection, as shown in the illustration below. The illustration shows an example of an enclosure with five columns containing products, and two cable columns.

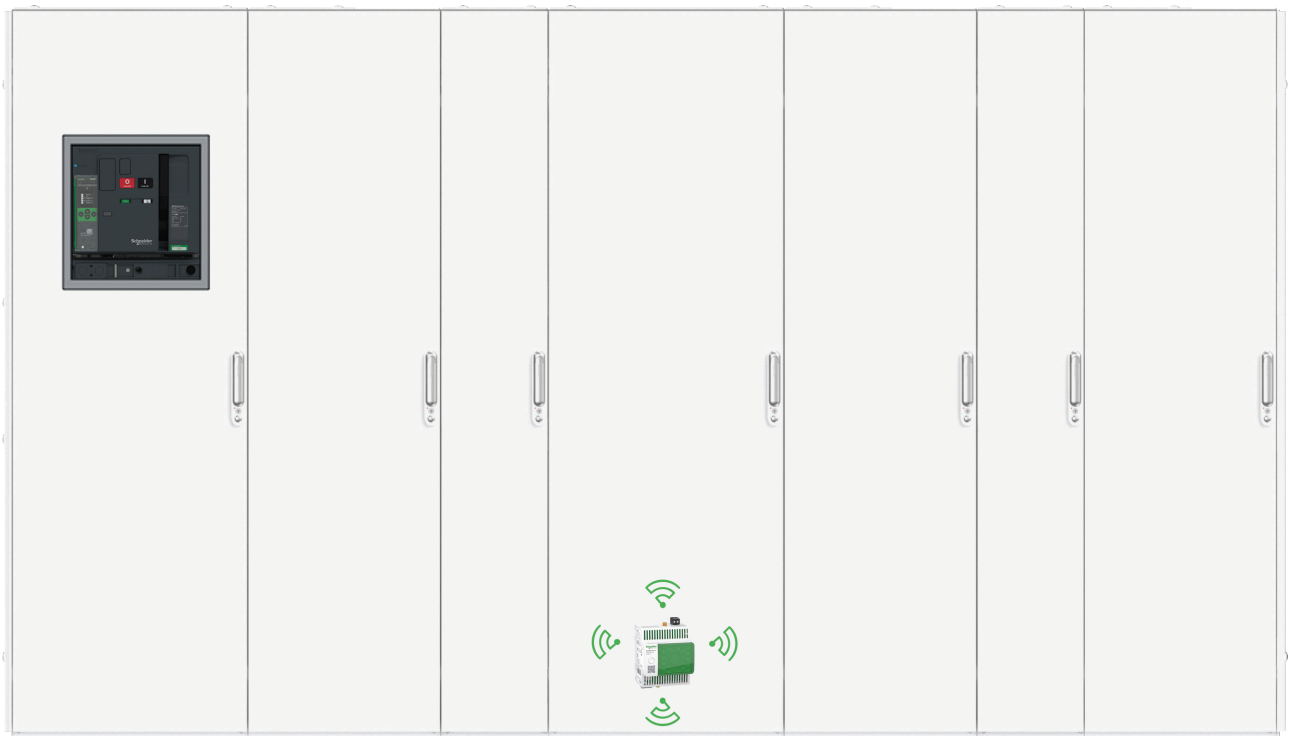


Illustration 4: Panel Server installation at the bottom of the column, covering five columns

3.5. Installation Guidelines for External Panel Server Antenna inside One Enclosure

When a Panel Server Advanced is used, the antenna can be installed to extend the IEEE 802.15.4 range.

The Panel Server Advanced with antenna installed can extend the number of columns covered per Panel Server, up to seven, in forms 1, 2a, or 2b, with the specifications for installation outlined in this section.

The antenna can be used to extend the signal within the panel. Note that the output power of the antenna must be set to **Low level** when installed inside an enclosure. It is important to note that the antenna cable length is only 3 m, so this must be considered.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION OR ALERTED FEATURE OF PROTECTIVE DEVICES
Do not set IEEE 802.15.4 **External Antenna** parameter to **High Level** if the antenna is inside the panel.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

3.5.1. Devices

These recommendations cover one Panel Server Advanced with antenna and several different wireless devices. The tested devices include:

- PowerTag Energy Rope
- PowerTag Energy M630/250
- PowerTag Energy F160
- PowerTag Energy M63, P63, F63
- PowerLogic HeatTag
- Acti9 Active
- Wireless Indication Auxiliary (for ComPacT NSX and ComPacT NSXm)
- MasterPacT MicroLogic Active Control Unit

It might be necessary to use more than one Panel Server if the number of wireless devices is higher than the maximum allowed for the Panel Server model (refer to Maximum Configuration in the **EcoStruxure Panel Server - User Guide**, found in section **2.5 References**).

If there is more than one Panel Server, refer to section **5 Wireless Channel Assignment** to help ensure a balanced wireless communication on the channels.

3.5.2. Panel Server Settings

The Panel Server settings, available on the Panel Server web pages or EcoStruxure Power Commission software, shall be set accordingly:

- Antenna setting: **Both**
- Output power level: **Low level** (setting not editable when antenna is set to **Both**)

3.5.3. Panel Server and Antenna Positioning

Installing the Panel Server at the bottom of the column can help minimize the possibility of overheating. From a radio frequency standpoint, installing the Panel Server as close as possible to the central point of the enclosure can help to improve the signal. As a compromise, the Panel Server can be placed in the center if there are no high-heat-generating devices below it.

The antenna cable length is 3 m, and for each bend in the cable, the radius of curvature must be more than 100 mm. The cable must not be wound in a loop. The antenna can be installed at the top or the bottom of the column. Due to the length of the cable, the antenna may not reach the top of the column if the Panel Server is installed at the bottom. The minimum distance required between the antenna stem and surrounding metal barriers is 10 cm.

There can be one Panel Server Advanced and one antenna to cover up to seven columns. The Panel Server and antenna can each cover the column they are in, and up to two on each side. The number of columns refers to columns containing products, and there may also be one or more columns for cable connection, as shown in the illustration below. Due to the cable length limitation, the antenna can be approximately two columns away from the Panel Server.

Illustration 5: Panel Server and antenna installation at the bottom of the column, covering seven columns

3.6. Installation Guidelines for External Panel Server Antenna with Two Metal Enclosures

When a Panel Server Advanced is used, the antenna can be installed to extend the IEEE 802.15.4 range.

In countries conforming to IEC standards, the Panel Server Advanced can be installed with wireless devices inside one metal enclosure, and other wireless devices and the external antenna installed in another metal enclosure, with the specifications for installation outlined in this section. Both metal enclosures can be in forms 1, 2a, or 2b.

Note that the output power of the antenna must be set to **Low level** when installed inside an enclosure. It is important to note that the antenna cable length is only 3 m, so this limits the distance between the two enclosures.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION OR ALERTED FEATURE OF PROTECTIVE DEVICES
Do not set IEEE 802.15.4 **External Antenna** parameter to **High Level** if the antenna is inside the panel.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

3.6.1. Devices

These recommendations cover one Panel Server Advanced with antenna and several different wireless devices. The tested devices include:

- PowerTag Energy Rope
- PowerTag Energy M630/250
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- PowerLogic Energy HeatTag
- Acti9 Active
- Wireless Indication Auxiliary (for ComPacT NSX and ComPacT NSXm)
- MasterPacT MicroLogic Active Control Unit

It might be necessary to use more than one Panel Server if the number of wireless devices is higher than the maximum allowed for the Panel Server model (refer to Maximum Configuration in the **EcoStruxure Panel Server - User Guide**, found in section **2.5 References**).

If there is more than one Panel Server, refer to section **5 Wireless Channel Assignment** to help ensure a balanced wireless communication on the channels.

3.6.2. Panel Server Settings

The Panel Server settings, available on the Panel Server web pages or EcoStruxure Power Commission software, shall be set accordingly:

- Antenna setting: **Both**
- Output power level: **Low level** (setting not editable when antenna is set to **Both**)

3.6.3. Panel Server and Antenna Positioning

Installing the Panel Server at the bottom of the column can help minimize the possibility of overheating. However, due to the antenna cable length, to reach another enclosure, it would likely need to be installed at least in the center of the column. The Panel Server can be placed in the center if there are no high-heat-generating devices below it.

The antenna cable length is 3 m, and for each bend in the cable, the radius of curvature must be more than 100 mm. The cable must not be wound in a loop. The antenna can be installed at the top or the bottom of the column. The minimum distance required between the antenna stem and surrounding metal barriers is 10 cm. It is recommended to install the antenna directed downwards with its magnetic support placed on the upper part of the enclosure, as shown in illustration 6 below.

There can be one Panel Server Advanced and one antenna to cover up to two enclosures, with the distance between the two restricted by the antenna cable length. The Panel Server and antenna can each cover the column they are in, and up to two on each side. The number of columns refers to columns containing products, and there may also be one or more columns for cable connection.

Illustration 6: Panel Server and antenna installation in two metal enclosures

3.7. Installation Guidelines with Panel Server and Wireless Devices Inside One Enclosure and Other Wireless Devices in an Open Field

When a Panel Server Advanced is used, the antenna can be installed to extend the IEEE 802.15.4 range.

The Panel Server Advanced can be installed with wireless devices inside one enclosure, in forms 1, 2a, or 2b, and other wireless devices with the external antenna installed in open field with the specifications for installation outlined in this section. Devices installed a plastic enclosure can be considered in open field for wireless communication (insignificant mitigation of radio frequency signal by plastic material).

3.7.1. Devices

These recommendations cover one Panel Server Advanced with antenna and several different wireless devices. The tested devices include:

- PowerTag Energy Rope
- PowerTag Energy M630/250
- PowerTag Energy F160
- PowerTag Energy M63, P63, F63
- PowerLogic Energy HeatTag
- Acti9 Active
- Wireless Indication Auxiliary (for ComPacT NSX and ComPacT NSXm)
- MasterPacT MicroLogic Active Control Unit
- PowerTag Ambient
- Easergy TH110
- Easergy CL110
- Exiway Light Activa-link, Exiway Trend Activa-link, and Exiway Light SATI LINK Emergency Lighting

It might be necessary to use more than one Panel Server if the number of wireless devices is higher than the maximum allowed for the Panel Server model (refer to Maximum Configuration in the **EcoStruxure Panel Server - User Guide**, found in section **2.5 References**).

If there is more than one Panel Server, refer to section **5 Wireless Channel Assignment** to help ensure a balanced wireless communication on the channels.

3.7.2. Panel Server Settings

The Panel Server settings, available on the Panel Server web pages or EcoStruxure Power Commission software, shall be set accordingly:

- Antenna setting: **Both**
- Output power level: **Low level** (setting not editable when antenna is set to **Both**)

3.7.3. Panel Server and Antenna and Device Positioning

Installing the Panel Server at the bottom of the column can help minimize the possibility of overheating. However, due to the antenna cable length, to reach the top of the enclosure, it would likely need to be installed at least in the middle of the column. The Panel Server can be placed in the middle if there are no high-heat-generating devices below it.

The antenna cable length is 3 m, and for each bend in the cable, the radius of curvature must be more than 100 mm. The cable must not be wound in a loop. It is advised to put the antenna on the top of the panel, or in a way to limit obstacles between it and the wireless devices.

There can be one Panel Server Advanced and one antenna to cover up to five columns plus the devices in an open field, up to 10 m away from the antenna outside the enclosure. The Panel Server can cover the column that it is in, and up to two on each side. The number of columns refers to columns containing products, and there may also be one or more columns for cable connection.

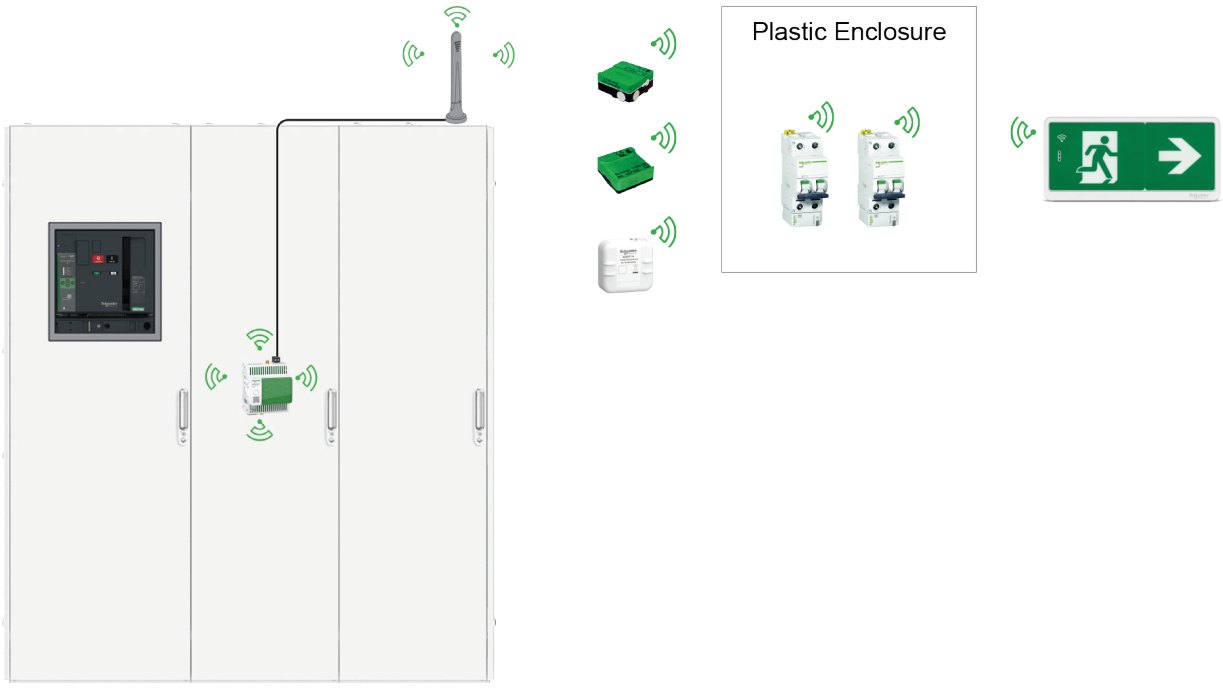


Illustration 7: Panel Server and devices in an enclosure and devices in an open field

3.8. Installation Guidelines with Wireless Devices in an Open Field

When a Panel Server Advanced is used, the antenna can be installed to extend the IEEE 802.15.4 range.

The Panel Server Advanced can be installed in a metal or plastic enclosure and wireless devices installed outside of the enclosure in open field, with the specifications for installation outlined in this section. Devices installed a plastic enclosure can be considered in open field for wireless communication (insignificant mitigation of radio frequency signal by plastic material).

3.8.1. Devices

These recommendations cover one Panel Server Advanced with antenna and several different wireless devices. The tested devices include:

- PowerTag Energy Rope
- PowerTag Energy M630/250
- PowerTag Energy F160
- PowerTag Energy M63, P63, F63
- PowerLogic Energy HeatTag
- Acti9 Active
- Wireless Indication Auxiliary (for ComPacT NSX and ComPacT NSXm)
- MasterPacT MicroLogic Active Control Unit
- PowerTag Ambient
- Easergy TH110
- Easergy CL110
- Exiway Light Activa-link, Exiway Trend Activa-link, and Exiway Light SATI LINK Emergency Lighting

It might be necessary to use more than one Panel Server if the number of wireless devices is higher than the maximum allowed for the Panel Server model (refer to Maximum Configuration in the **EcoStruxure Panel Server - User Guide**, found in section **2.5 References**).

If there is more than one Panel Server, refer to section **5 Wireless Channel Assignment** to help ensure a balanced wireless communication on the channels.

3.8.2. Panel Server Settings

The Panel Server settings, available on the Panel Server web pages or EcoStruxure Power Commission software, shall be set accordingly:

- Antenna setting: **External**
- Output power level: **Low level** or **High level**

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION OR ALERTED FEATURE OF PROTECTIVE DEVICES

Do not set IEEE 802.15.4 **External Antenna** parameter to **High Level** if the antenna is inside the panel.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Note: Selecting high level only increases the strength of the wireless packets sent by the Panel Server, but not the strength of the packets sent by the wireless devices. Therefore, since the communication is two-way, the maximum distance of 10m (32.8 ft) does not increase when high level is selected.

3.8.3. Panel Server and Antenna Positioning

Installing the Panel Server at the bottom of the column can help minimize the possibility of overheating. The Panel Server can be placed higher in the column if there are no high-heat-generating devices below it.

The antenna cable length is 3 m, and for each bend in the cable, the radius of curvature must be more than 100 mm. The cable must not be wound in a loop. It is advised to put the antenna on the top of the panel, or in a way to limit obstacles between it and the wireless devices.

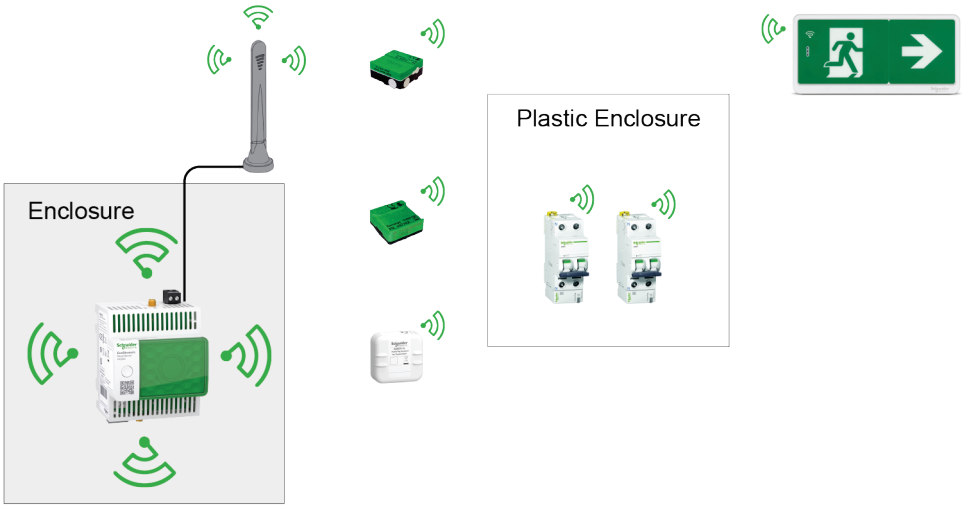


Illustration 8: Panel Server Advanced in an enclosure and wireless devices in an open field

4. Installation Guidelines for Wi-Fi Communication

The Panel Server supports Wi-Fi infrastructure, that is, the Panel Server can connect to a Wi-Fi router (access point). The Wi-Fi Antenna can be used on all Panel Server versions (except Panel Server Entry and Wired by Design models).

By default, Wi-Fi is not active in the Panel Server, so this section is meant to help with setting up the parameters for the installation with the internal or external antenna.

4.1. Installation Using Panel Server Internal Antenna

Panel Server can be installed in an enclosure with wireless devices and connected to Wi-Fi 2.4 GHz (or 5 GHz for Panel Server Advanced), compliant with the standard 802.11 a/b/g/n, through its internal antenna. It is advised to use internal Wi-Fi antenna only for commissioning. Due to its low power, the communication may be interrupted.

The following diagram shows an example of a Panel Server connected to Wi-Fi through the Panel Server internal Wi-Fi antenna.

Illustration 9: Panel Server connected to Wi-Fi using internal antenna

4.2. Installation Using Panel Server External Antenna

The Panel Server can be installed with wireless devices and connected to Wi-Fi 2.4 GHz (or 5 GHz for Panel Server Advanced), compliant with the standard 802.11 a/b/g/n, through its external antenna.

The external Wi-Fi antenna is an option for:

- Panel Server Universal (except Wired by Design models)
- Panel Server Advanced

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION OR ALERTED FEATURE OF PROTECTIVE DEVICES

Do not set Wi-Fi **Antenna** parameter to **External** Wi-Fi antenna if the external antenna is not connected to the Panel Server Universal or Advanced gateway. Do not install Wi-Fi antenna within the enclosure.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

You should use the external Wi-Fi antenna when the Panel Server is installed in an enclosure with metal partitions and door. If the Panel Server is installed in a metal enclosure, the Wi-Fi external antenna can be installed to extend the Wi-Fi network outside the metal enclosure. The output power settings for the external antenna are predefined and not editable.

The following diagram shows an example of a Panel Server Advanced connected to Wi-Fi through its external Wi-Fi antenna.

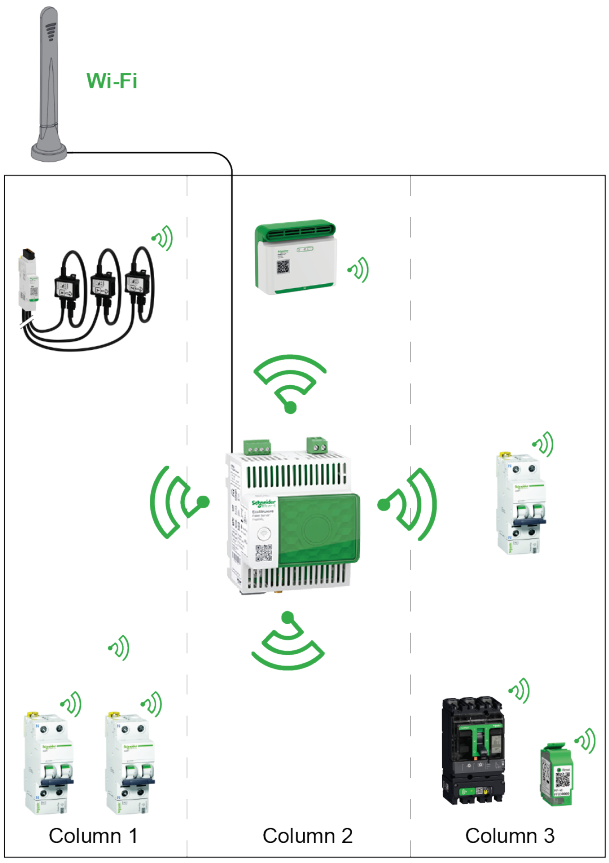


Illustration 10: Panel Server connected to Wi-Fi through connected external antenna

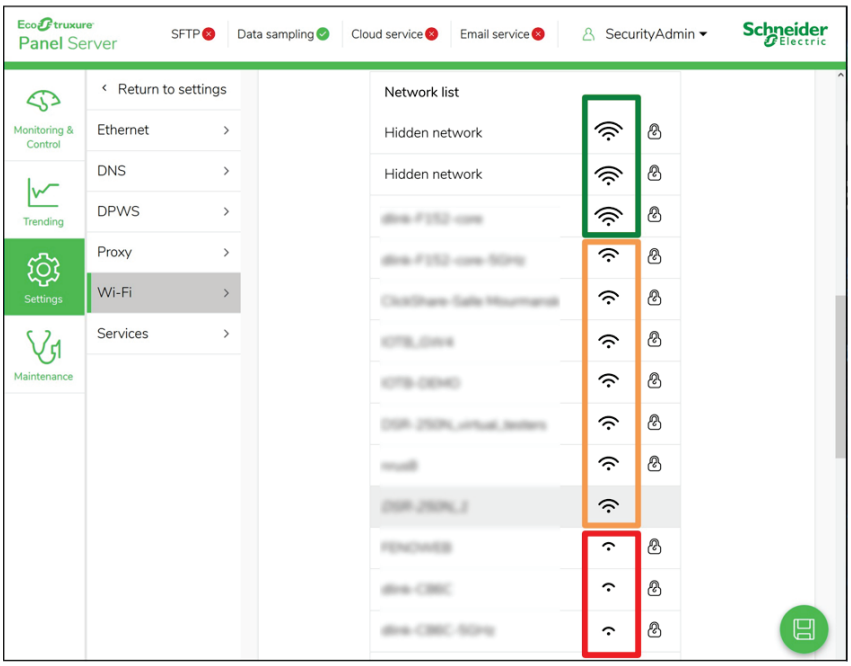
Additional recommendations and requirements:

- The antenna must be outside of the panel.
- The minimum distance required between the antenna stem and surrounding metal barriers is 10 cm (3.93 in).
- For architectures with two external antennas, the minimum distance required between both antennas is 10 cm (3.93 in).

4.3. Wi-Fi Signal and Wireless Channel Selection

4.3.1. Wi-Fi Signal Strength

Select a Wi-Fi signal with at least two power bars (strong or medium signal) in the Panel Server web page.



Strong Wi-Fi signal
Medium Wi-Fi signal
Weak Wi-Fi signal

Illustration 11: Wi-Fi signal strength shown on Panel Server web pages

4.3.2. IEEE 802.15.4 Wireless Channel Selection

Select an IEEE 802.15.4 wireless channel that does not overlap with the selected Wi-Fi 2.4 GHz channel:

- Use a Wi-Fi scanner app on a smartphone (e.g. an open source Wi-Fi analyzer) to identify the channel used by the Wi-Fi network selected on the Panel Server.
- Select or change the IEEE 802.15.4 wireless channel to avoid overlapping.

5. Wireless Channel Assignment

This section shows how to design an IEEE 802.15.4 wireless channel assignment plan to establish balanced wireless communication on the channels.

Each Panel Server is assigned one wireless channel. A wireless channel has limited bandwidth that is impacted by:

- The number of associated Panel Server gateways and paired IEEE 802.15.4 devices.
- The wireless communication periods set in each gateway for each type of device.

Note: Exceeding bandwidth in a channel can lead to wireless communication disturbances and wireless communication issues.

5.1. Wireless Channel Assignment Design Plan

5.1.1. EcoStruxure System Wireless Architecture Ranking

There are two types of wireless architectures to consider:

- **Sparse wireless architecture:** one Panel Server and its external IEEE 802.15.4 antenna (if installed) communicates with Schneider Electric wireless devices that are within a radius of 20 m (65 ft).

Note: Default Panel Server wireless settings (communication periods and automatic channel selection) can be used.

- **Concentrated wireless architecture:** two wireless gateways communicate with Schneider Electric wireless devices that are within a radius of 20 m (65 ft).

Note: The circumference of a circle with a 20 m (65 ft) radius is not the maximum distance for communication between the Panel Server gateway and paired wireless devices. It is the distance which helps ensure that two wireless Panel Server systems are independent.

The following figure shows examples of wireless architectures with Panel Server gateways:

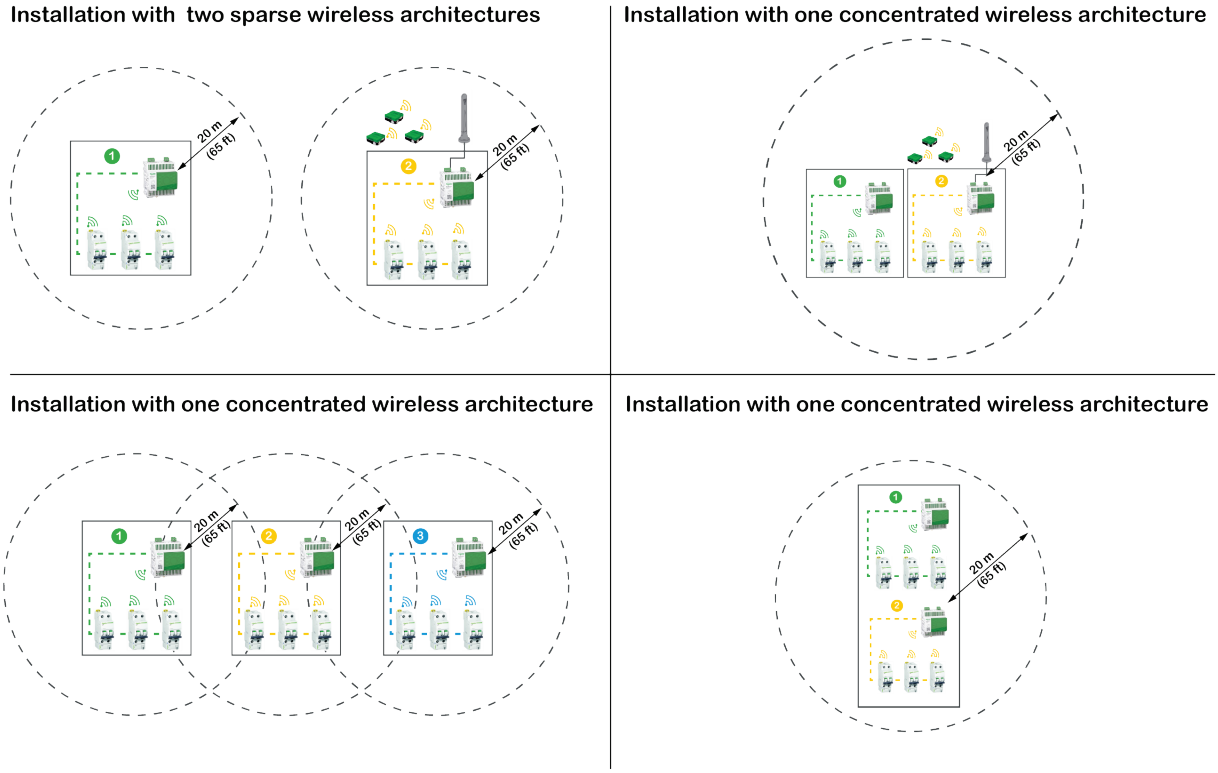


Illustration 12: Different installation examples of a sparse and concentrated architectures

5.1.2. Concentrated Architecture

For a concentrated wireless architecture, IEEE 802.15.4 wireless communication should be distributed across several channels to avoid wireless channel saturation. The system integrator needs to create a wireless channel assignment plan.

The wireless channel assignment plan must be defined in order to:

- Assign a channel (from 11 to 26) to each Panel Server by balancing communication loads.
- Define wireless communication periods for communication between each Panel Server and the paired wireless devices.

The following figures show examples of wireless channel assignment plans:

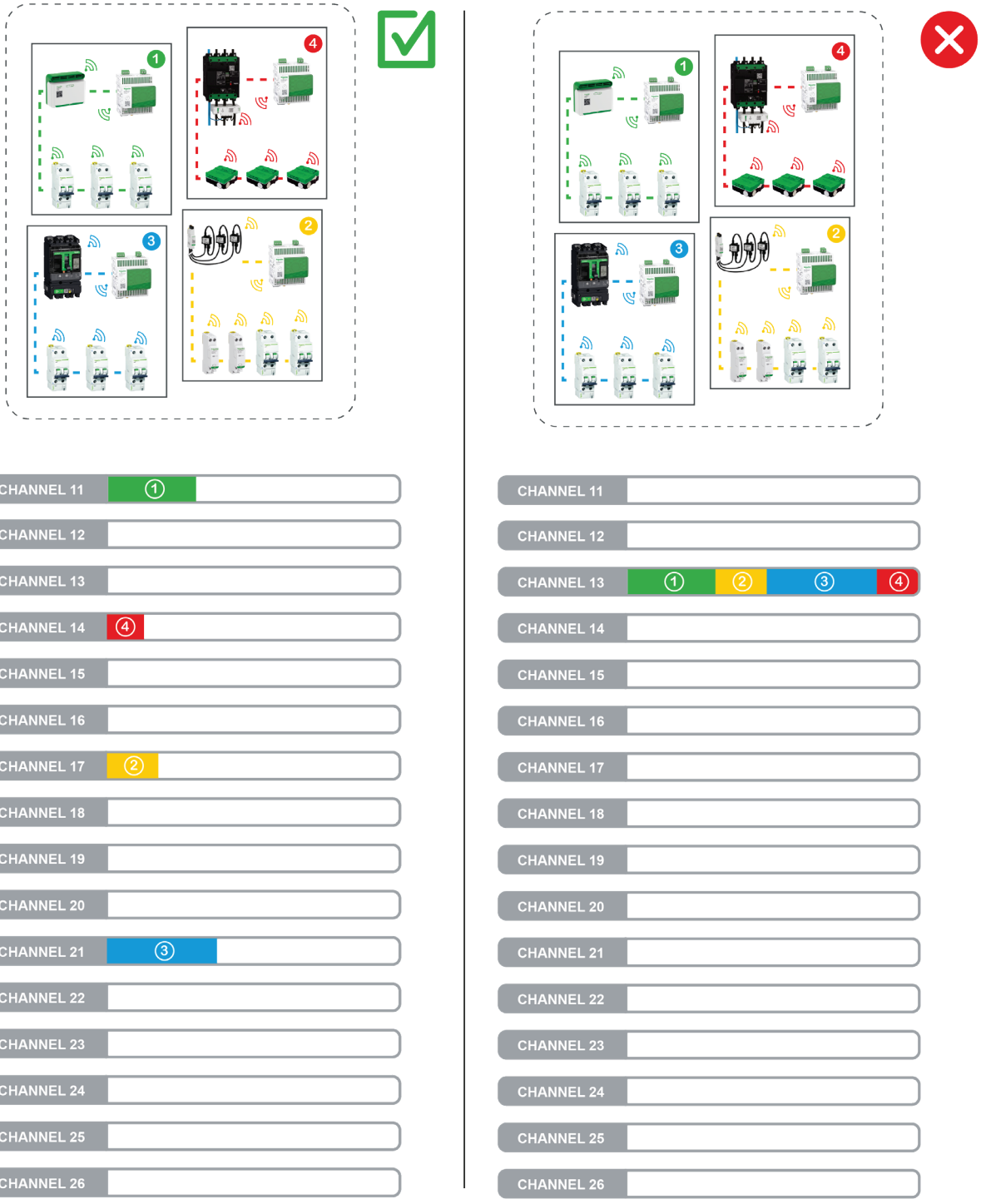


Illustration 13: Recommended and not recommended plans for wireless channel assignment

5.2. Wireless Channel Assignment Procedure

5.2.1. Prerequisites

The prerequisites for creating a wireless channel assignment plan are:

- The total number of Panel Server gateways for the architecture is defined.
- The panels/enclosures are pre-designed in accordance with design rules. Subsequently, the number of Panel Server gateways and the number and/or type of panel/enclosure is defined.
- The physical position of each panel/enclosure is defined.

5.2.2. Step 1: Define Position of Panel/Enclosure to Building Layout

For multi-story buildings, attenuation of a reinforced concrete floor can be considered to be high. Therefore, one wireless channel assignment plan should be created for each floor without dependency between the channel assignment plans of the building.

Add the panels/enclosures to the building layout (respecting scale) and label each panel/enclosure.

Reference each panel/enclosure so that the type of panel/enclosure can be identified immediately and easily associated with the type and number of paired wireless devices.

5.2.3. Step 2: Define Overlapped IEEE 802.15.4 Channels

Each IEEE 802.15.4 channel has a range of 2 MHz with 5 MHz spacing.

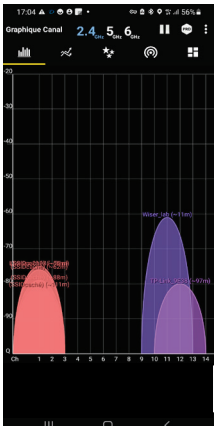


Illustration 14: Wi-Fi analyzer application example

The frequency range associated with an IEEE 802.15.4 channel selected in a Panel Server can also be used by other wireless systems (e.g. Wi-Fi 2.4 GHz network or third-party wireless equipment) around the Panel Server system. Even if two contiguous wireless systems (e.g. a PowerTag system or a third- party radio frequency system such as a Wi-Fi network) are able to run on the same frequency bandwidth without issues, Schneider Electric recommends segregating two different non-overlapped channels where possible.

To discover Wi-Fi channels around the installation, it is possible to use a channel scanner appl, for example, an open-source Wi-Fi analyzer available on mobile devices.

Scan radio frequency occupation to determine which Wi-Fi channels are used and exclude overlapped IEEE 802.15.4 channels on the wireless channel assignment plan, as per the following table:

Wi-Fi 2.4 GHz channel	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Frequency band (MHz)	2401-2423	2406-2428	2411-2433	2416-2438	2421-2443	2426-2448	2431-2453	2436-2458	2441-2463	2446-2468	2451-2473	2456-2478	2461-2483	2473-2495
Overlapped IEEE 802.15.4 channel	11-14	12-15	13-16	14-17	15-18	16-19	17-21	18-22	19-23	20-23	21-24	22-25	23-26	25-26

Table 4: Wi-Fi and IEEE 802.15.4 overlapping channels

The following figure shows the radio frequency bandwidth per IEEE 802.15.4 channel.

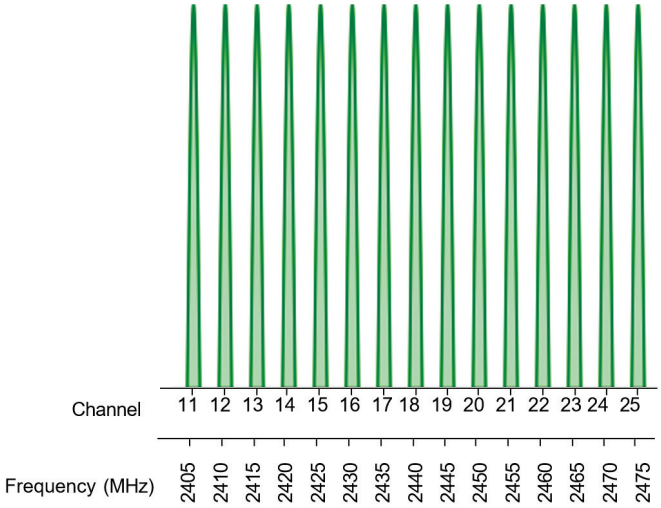


Illustration 15: Radio frequency bandwidth per IEEE 802.15.4 channel

The following figure shows the radio frequency bandwidth per Wi-Fi 2.4 GHz channel.

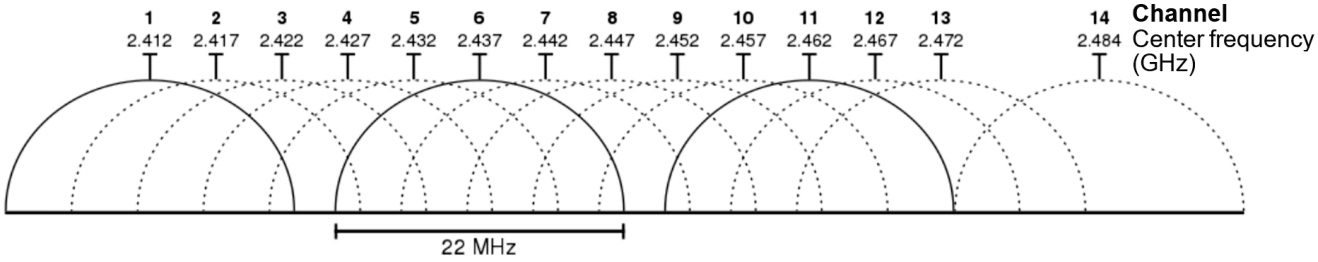


Illustration 16: Radio frequency bandwidth per Wi-Fi 2.4 GHz channel

5.2.4. Step 3: Reserve IEEE 802.15.4 Channels for Future Evolution

During the creation phase of a wireless channel assignment plan, it can be planned to add a third-party radio frequency system after the implementation of the plan. In this case, reserve a dedicated channel.

For future evolution, it is recommended to reserve channels on the wireless channel assignment plan depending on the density of Schneider Electric wireless devices that should be within a radius of 20 m (65 ft) from the Panel Server:

- Reserve one more channel if density should be lower than 1,200 Schneider Electric wireless devices.
- Reserve two more channels if density should be 1,200 or more Schneider Electric wireless devices.

5.2.5. Step 4: Define Panel Server IEEE 802.15.4 Channel

It is necessary to define the IEEE 802.15.4 channel for each Panel Server.

Use all the available channels to balance Panel Server and paired wireless devices by using the following formula:

Number of available channels = 16 - Number of overlapped channels - Number of reserved channels

Maintain uniform usage of channels by respecting both priorities:

1. Maximize distance between the Panel Server gateways using the same channel.

2. Maximize distance between a Panel Server using channel X and a Panel Server using adjacent channels (channel X-1 and channel X+1).

The following guidelines should be considered when several Panel Server gateways are installed in one metal enclosure:

- Do not define the same channel for more than one Panel Server.
- Favor the definition of non-adjacent channels for each Panel Server.

To apply the wireless channel assignment plan, each Panel Server must be set to **Channel Mode > Manual** (not to **Auto**, default setting). In manual channel mode, the system integrator can select the channel number (from 11 to 26) in accordance with the definition of the plan.

The following figures show examples of wireless channel assignment plans and the channel **Ch** associated to each Panel Server **PS**.

Illustration 17: Examples of wireless channel assignment plans and the channel associated to each Panel Server

Illustration 18: Examples of not recommended wireless channel assignment plans and the channel associated to each Panel Server

5.2.6. Step 5: Define Wireless Communication Periods

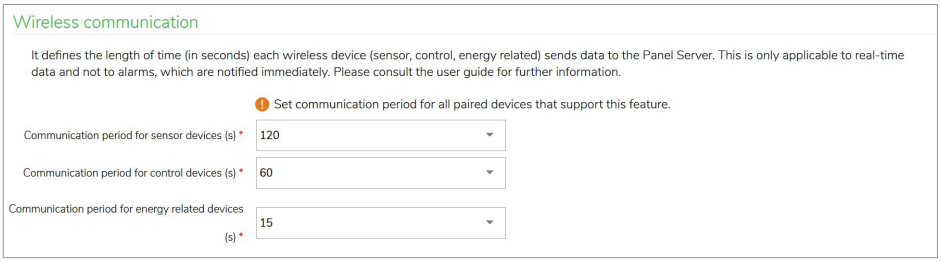
Define wireless communication period values for each type of device according to wireless device density:

- Enter identical communication period values for the Panel Server gateways in the area.
- Do not set communication periods to less than 15 seconds for concentrated wireless architectures.
- Set the Panel Server communication periods according to the number of wireless devices installed within a 20 m (65 ft) radius from the Panel Server:

Number of wireless devices	Communication periods setting
< 100	≥ 15 seconds
100–600	≥ 30 seconds
600–1,200	≥ 60 seconds
≥1,200	Contact a Schneider Electric representative.

Table 5: Panel Server communication periods according to number of wireless devices installed within a 20 m radius of the Panel Server

The screenshot shows the Panel Server web page to set communication periods.



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