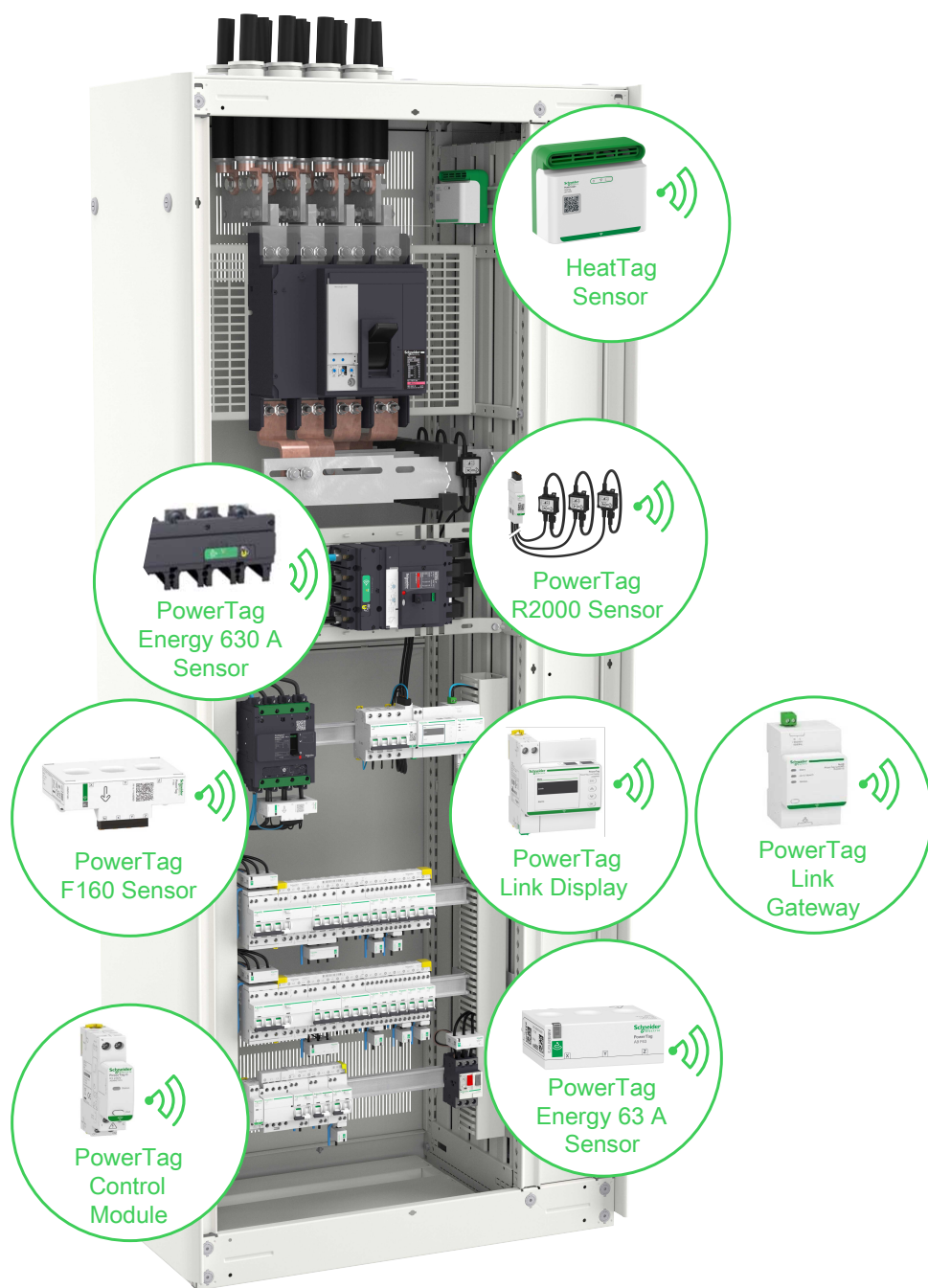# PowerLogic

PowerTag System

Design and Commissioning Guide

PowerLogic offers power quality, uptime and efficiency.

DOCA0194EN-00
11/2020

HeatTag
Sensor

PowerTag
R2000 Sensor

PowerTag
Energy 630 A
Sensor

PowerTag
F160 Sensor

PowerTag
Link Display

PowerTag
Link
Gateway

PowerTag
Energy 63 A
Sensor

PowerTag
Control
Module

Schneider Electric

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Table of Contents

Important Information

NOTICE

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 alert you to 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.

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

About the Book

Document Scope

PowerTag System is a Schneider Electric wired/wireless solution designed to connect and digitize the electrical distribution installation and to perform energy management and monitoring, from the switchboard incomer down to the load level.

This guide is intended for design of PowerTag system in basic electrical panel with only one gateway up to large installation with a high number of power data units, gateways, and wireless devices.

It guides users to:

- Design and build a reliable PowerTag system.
- Understand and apply wireless design rules in case of advanced wireless architecture.

It also provides recommendations for the PowerTag system commissioning.

Validity Note

The PowerTag system can be integrated into any building management or any electrical distributions architecture. It offers several types of gateways (Smartlink Modbus, Smartlink SIB, PowerTag Link, and PowerTag Link HD), which can be associated to wired and/or wireless devices to offer the following features:

- Metering with PowerTag energy sensors
- Monitoring and Control with wired Acti9 devices with TI24 interface and wireless PowerTag control modules
- Detection of abnormal heating of power cables in panel with HeatTag sensor (commercialized in January 2021)
- Local display of electrical measures with PowerTag Link display

Based on the Modbus TCP protocol, the PowerTag system allows switchboard data to be exchanged in real time with a supervision system or a PLC.

Online Information

The information contained in this guide is likely to be updated at any time. Schneider Electric strongly recommends that you have the most recent and up-to-date version available on www.se.com/ww/en/download.

The technical characteristics of the devices described in this guide also appear online. To access the information online, go to the Schneider Electric home page at www.se.com.

Related Documents

Title of Documentation	Reference Number
PowerTag Link Gateway – User Guide	DOCA0157EN
Smartlink SI B Gateway – User Guide	DOCA0123EN
Smartlink Modbus Communication System – User Guide	DOCA0004EN
PowerLogic HeatTag – User Guide	DOCA0171EN
PowerTag Link Gateway – Instruction Sheet	PHA81113
Smartlink SI B Gateway – Instruction Sheet	NVE12086

Title of Documentation	Reference Number
Smartlink Modbus Gateway – Instruction Sheet	S1B33423
PowerTag C IO 230 V Control and Monitoring Wireless Communication Module – Instruction Sheet	MFR25181
PowerTag C 2DI 230 V Monitoring Wireless Communication Module – Instruction Sheet	MFR25190
PowerTag Link Display – Instruction Sheet	GDE66713
PowerLogic HeatTag – Instruction Sheet	MFR5173801
PowerTag M63 Energy Sensor – Instruction Sheet	EAV31628
PowerTag P63 Energy Sensor – Instruction Sheet	QGH78639
PowerTag F63 Energy Sensor – Instruction Sheet	QGH78642
PowerTag F160 Energy Sensor – Instruction Sheet	MFR85580
PowerTag R2000 Energy Sensor – Instruction Sheet	GDE25175
PowerTag M250 Energy Sensor – Instruction Sheet	QGH46815
PowerTag M630 Energy Sensor – Instruction Sheet	QGH46820
PowerTag M250/M630 on ComPact NSX Plug-in Base – Instruction Sheet	MFR37601

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PowerTag System Presentation

## Introduction

PowerLogic Master Range

PowerLogic smooths the power supply, protects the network, the installation and the operator by improving the power factor and hence the quality of the power. It also allows for remote control of equipment and the monitoring of its performance and condition in real time.

Overview

The PowerTag system can be adapted to design a basic electrical distribution panel with only one gateway or large installation with a high number of power data units, gateways, and wireless devices.

The PowerTag system consists of:

- Gateways
- Wired Acti 9 devices
- Wireless PowerTag devices
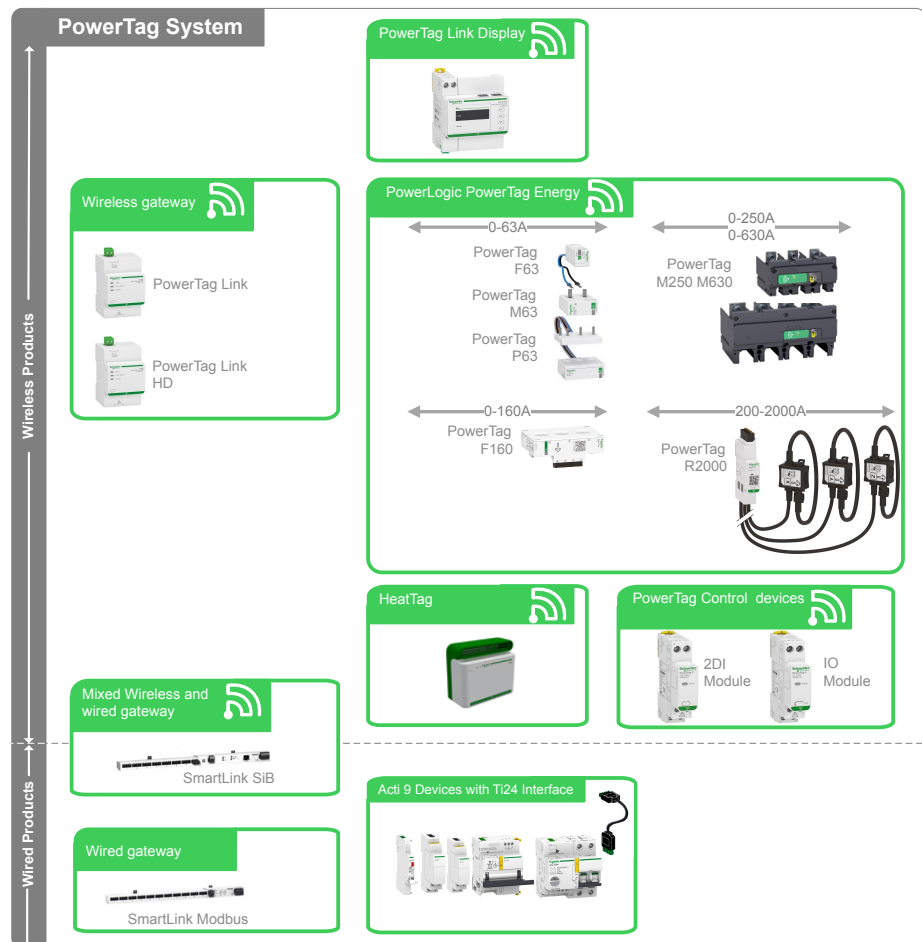
For more information on the system components, refer to Related Documents, page 6.

PowerTag System Enclosure

The PowerTag system is designed for mounting inside low voltage (LV) enclosures. It can be mounted from simple plastic panel (for example, Kaedra panel) up to multi-column (non-partitioned) metallic switchboard (for example, Okken switchboard, BlokSeT switchboard, and PrismaSeT panel).

The PowerTag system can be also mounted inside the enclosures provided by third party manufacturers.

Metallic partition inside the enclosure impacts the wireless communication.

Follow the wireless design rules (refer to Generic Design Rules, page 12) to have an efficient wireless communication in the panels or switchboards.

Okken Switchboard   PrismaSet Panel   Kaedra Panel
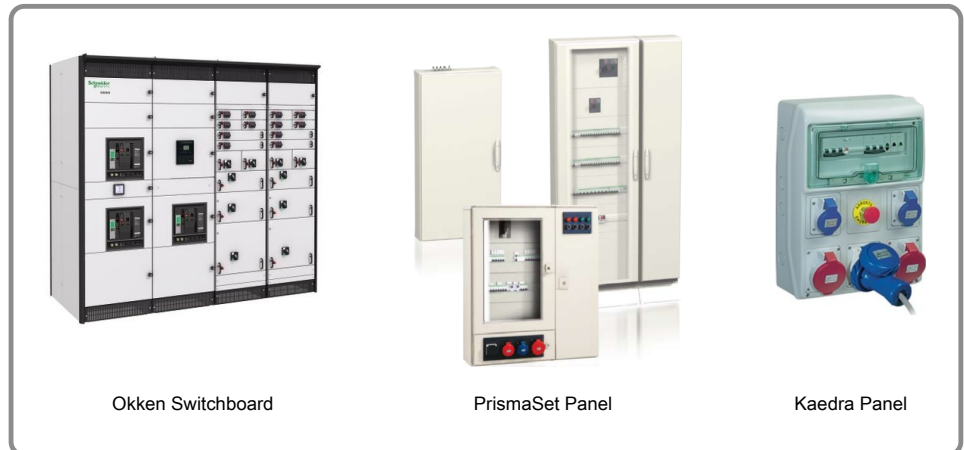
PowerTag System Architecture Ranking

The PowerTag system architecture is ranked as:

- **Sparse wireless architecture**: When only one gateway communicates in a radius of 20 meters.

- **Concentrated wireless architecture**: When two gateways communicate in a radius of 20 meters.

In Concentrated wireless architecture, the communication load of the wireless PowerTag system must be balanced on several channels. It is required to create a Wireless Channel Assignment Plan (refer to Wireless Channel Assignment Plan Definition, page 18) to study this type of architecture.

NOTE: The radius of 20 meters is the distance to confirm that the two PowerTag systems are totally independent.

The maximum distance for communication between the gateway and the wireless devices is 3 meters (refer to Rule GEN4, page 13).

The following figure shows various examples of PowerTag system architectures:

Installation with 2 Sparse wireless architectures

Installation with 1 Concentrated wireless architecture

Installation with 1 Concentrated wireless architecture

Installation with 1 Concentrated wireless architecture
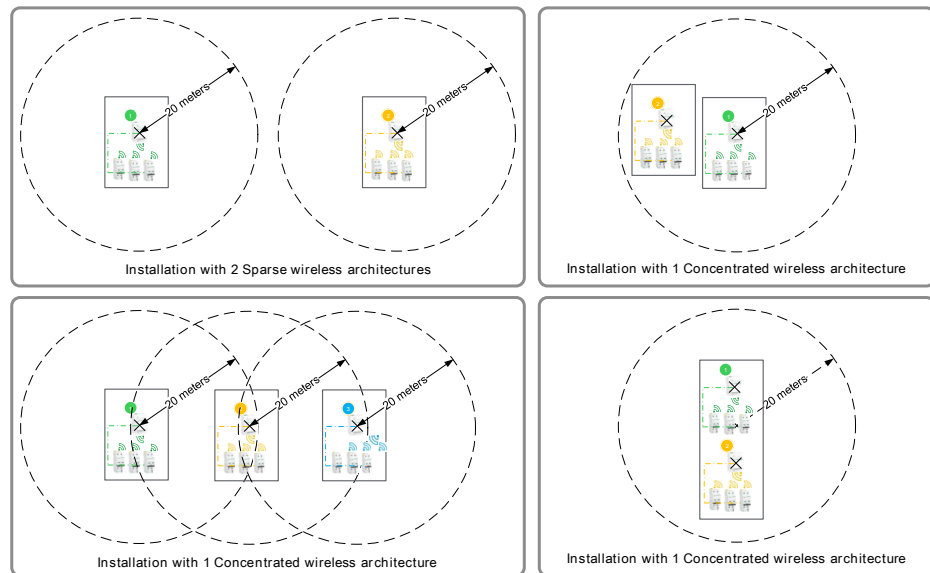
PowerTag System Engineering Workflow

The PowerTag System engineering workflow consists of the following design phases:

- PowerTag system enclosure design
    - For generic design rules, refer to Generic Design Rules, page 12.
    - For enclosure implementation rules, refer to Enclosure Implementation Rules, page 16.
- Radio frequency plan design
    - For wireless channel assignment plan, refer to Wireless Channel Assignment Plan Definition, page 18.
- PowerTag system commissioning
    - For commissioning rules, refer to Commissioning Rules, page 25.

Graphic Rules

The following legends are used to qualify the architecture and implementation:

| Icon	Description
	Architecture or implementation forbidden
	Architecture or implementation possible
	Architecture or implementation recommended
	Remarks

PowerTag System Enclosure Design

Generic Design Rules

Rule GEN1: Mount the devices of the system in the same enclosure.

The gateway and the associated wireless devices shall be mounted in the same enclosure (plastic or metallic) to have:

- A wireless perimeter protected against the wireless external disturbances (especially for the metallic enclosure)
- A perimeter always with the same wireless propagation behavior (irrespective of the enclosure material)
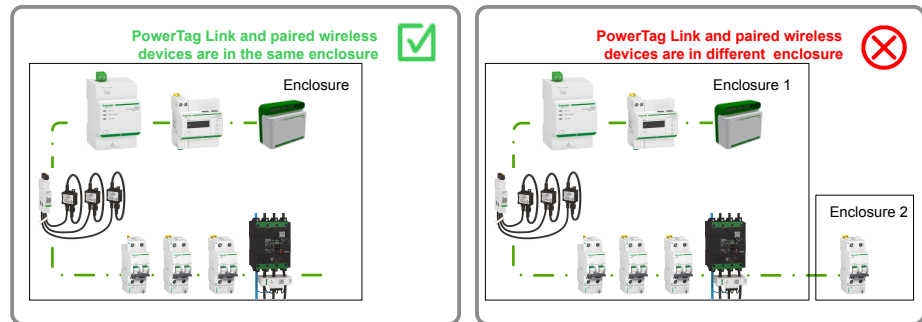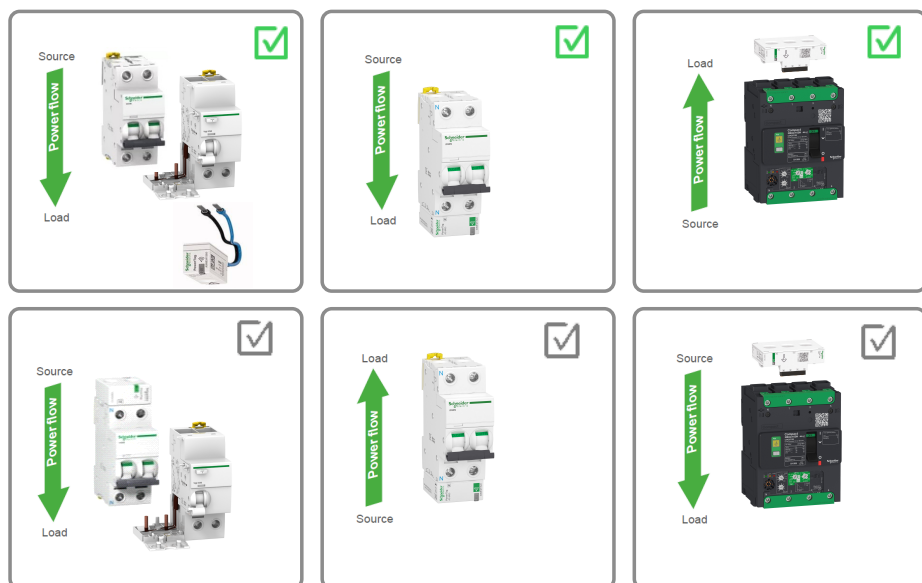

Rule GEN2: Mount the PowerTag energy sensor downstream the circuit breaker.

If the circuit breaker is top fed, mount the PowerTag energy sensor at the bottom of the circuit breaker. But:

- If the circuit breaker is bottom fed, it is recommended to mount the PowerTag energy sensor on the top of the circuit breaker
- If the circuit breaker is coupled with Residual Current Device Add-on, use PowerTag Flex energy sensor.

The advantage of PowerTag energy sensor downstream circuit breaker is that the voltage loss alarm is generated for each PowerTag energy sensor.

Rule GEN3: Mount the PowerTag energy sensor upstream a contactor, a variable speed drive, or a motor starter.

It is not possible to mount the PowerTag energy sensor downstream a contactor, a variable speed drive, or a motor starter.
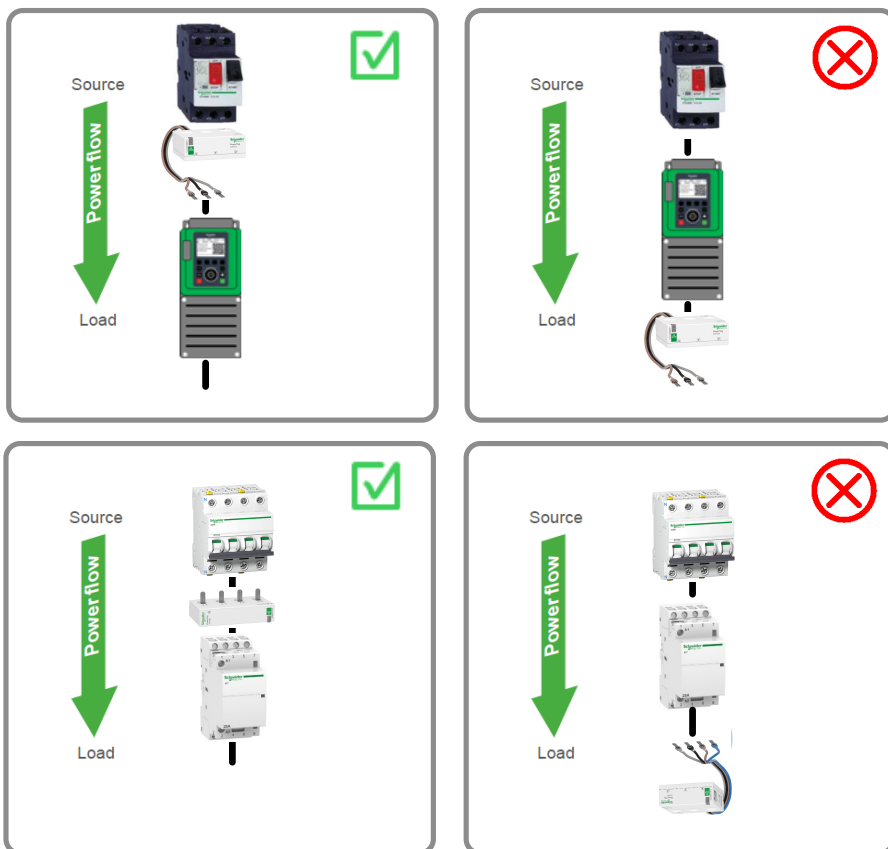
Rule GEN4: 3 meters maximum between the gateway and the wireless devices.

To avoid wireless communication disturbances, the gateway and the wireless devices must be mounted with a maximum distance of 3 meters between them.
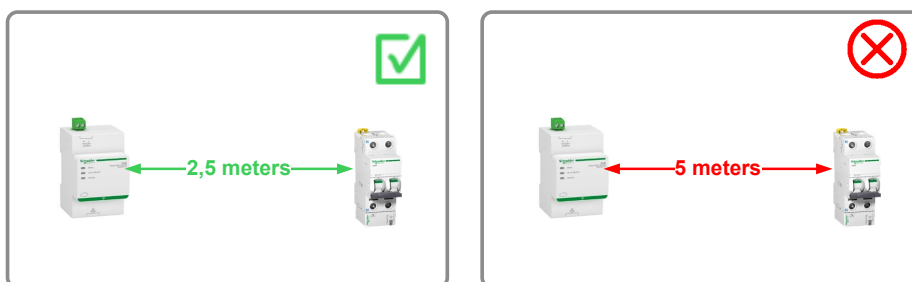
Rule GEN5: No metallic partition between the gateway and the wireless devices.

To avoid wireless communication disturbances, the gateway and the wireless devices must be mounted without metallic partition between them.

Rule GEN6: Follow the maximum capacity of the system.

For more information on the maximum number of wireless devices per gateway, refer to the below user guides, as applicable:

- DOCA0157EN PowerTag Link Gateway – User Guide
- DOCA0123EN Smartlink SI B Gateway – User Guide

Rule GEN7: Balance the number of wireless devices between the gateways.

When several gateways are installed in the same panel, balance the PowerTag control modules and other wireless devices between them.

The balancing of these devices is necessary to avoid having a fully loaded gateway and to optimize the wireless communication.

The following figures show examples of balanced and unbalanced wireless devices:

In example 1, the PowerTag energy sensors and PowerTag control modules are balanced between the two gateways.
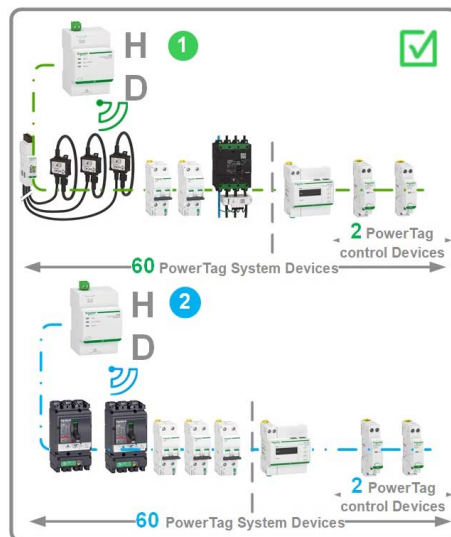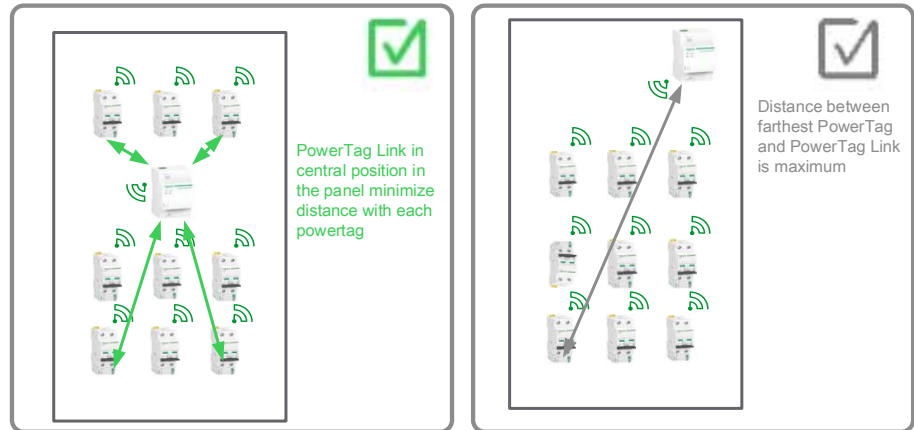
In example 2 and 3, the PowerTag energy sensors or PowerTag control modules are not balanced between the two gateways.
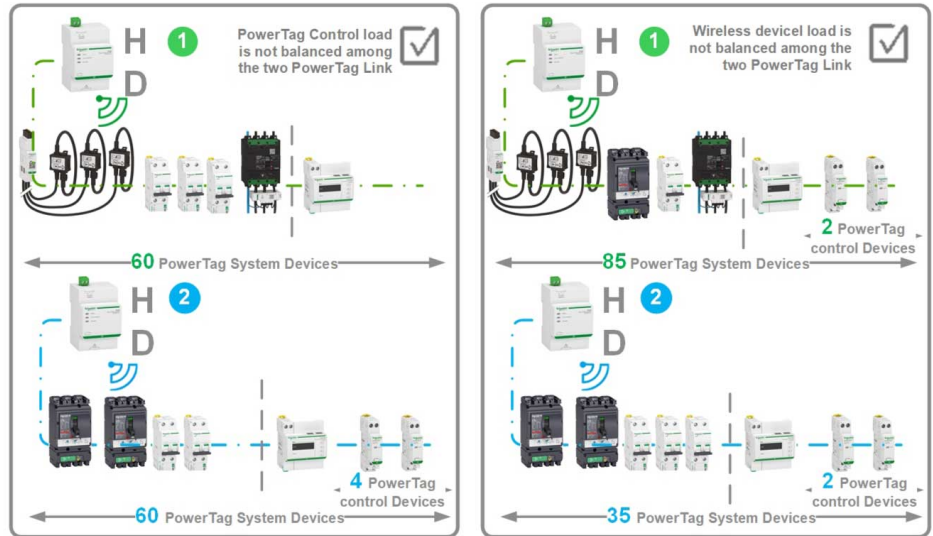
Enclosure Implementation Rules

Rule SW1: Mount the gateway in the center of the switchboard.

Reduce the distance between the gateway and the wireless devices to avoid wireless communication disturbances.

Rule SW2: Supply the wireless devices and gateway as upstream as possible in the switchboard.

To secure the power supply of a gateway, PowerTag Link display, PowerTag control modules, and HeatTag sensor, it is recommended:

- to use a secured incomer (UPS) when available in the switchboard
- to connect it as upstream as possible in the switchboard near to the main circuit breaker

This method helps to limit the risk of power outage on these devices.
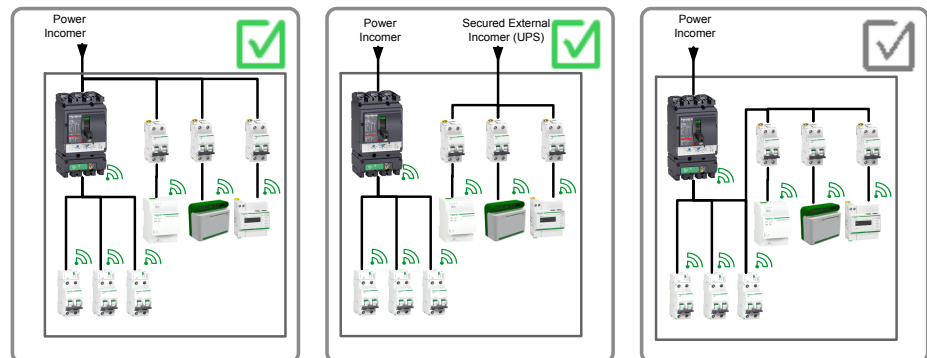
Rule SW3: Use one gateway per cubicle in partitioned switchboard.

Use one gateway per cubicle in partitioned switchboard to avoid wireless communication disturbances.
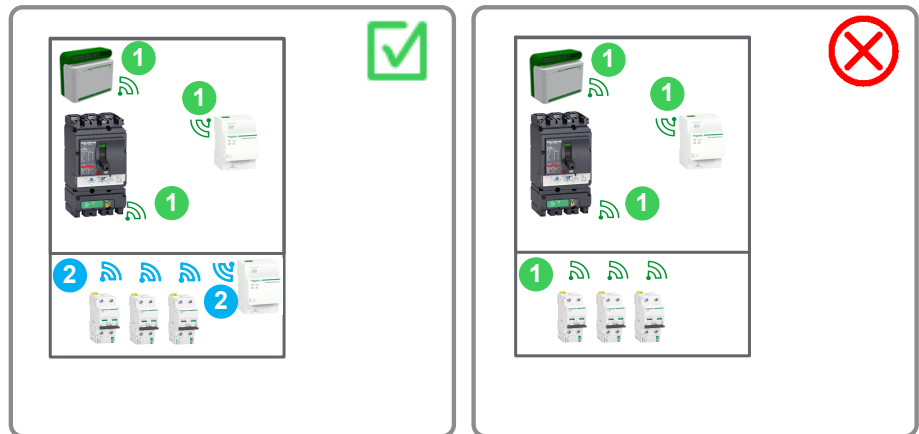
Rule SW4: Use one gateway for a maximum of three non-partitioned cubicles.

Use one gateway for a maximum of three non-partitioned cubicles with a maximum cubicle width of 0.7 meters, to avoid wireless communication disturbances.

Wireless Channel Assignment Plan Design

Wireless Channel Assignment Plan Definition

Each gateway is set to one wireless channel.

A wireless channel has a limited bandwidth and it depends upon:
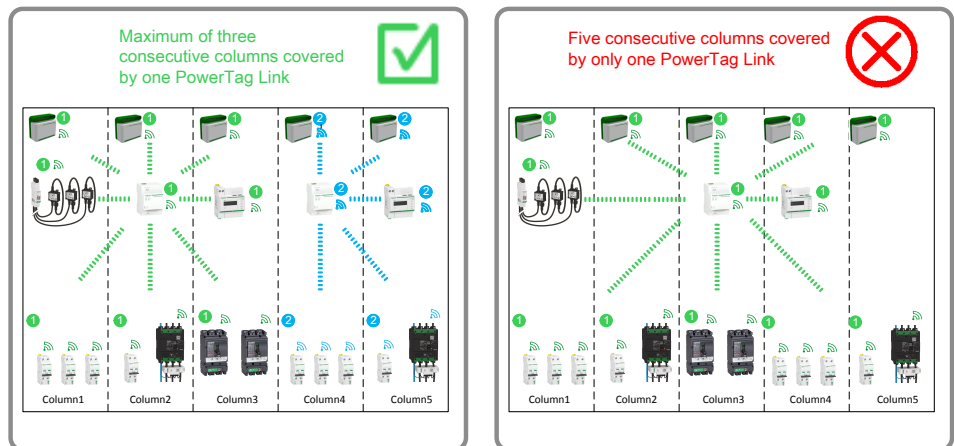
- the number of associated gateways and their paired wireless devices
- the wireless communication periods set in each gateway

  NOTE: If the bandwidth in a channel exceeds the limit, it can lead to wireless communication disturbances and communication issues in the PowerTag system.

The two objectives of the wireless channel assignment plan are:

- to assign a channel (11 to 26) to each gateway, to balance communication loads and to avoid future communication.
- to define the two wireless communication periods:
  - one for the energy sensors and control modules
  - one for the HeatTag sensors

Wireless Channel Assignment Prerequisite

Before assigning the wireless channels, make sure that the following conditions are met:

- The total number of PowerTag systems for the architecture is defined.
- The panels are pre-designed in accordance with the enclosure implementation rules (refer to Enclosure Implementation Rules, page 16). Therefore, the number of gateways and the number of wireless devices per PowerTag system for each type of panel is defined.
- The physical position of each panel in the architecture is defined.

Wireless Channel Assignment Procedure

Step	Action
1	Add all the panel in the layout of the zone (strictly follow the scale of the layout) and tag each panel with a label.
2	Indicate a legend to identify the type of panel and to associate easily with the PowerTag system.
3	Define the overlapped wireless channel using the wireless spectral analysis (refer to Rule WCAP2, page 22).
4	Define one or two reserved wireless channels for future evolution (refer to Rule WCAP3, page 23).
5	Define wireless channel for each gateway and associated wireless devices (refer to Rule WCAP4, page 23).
6	Define the wireless communication periods for the PowerTag energy sensor, control modules, and HeatTag sensor (refer to Rule WCAP5, page 24).

Wireless Parameters in PowerTag System

The parameters dedicated to wireless communication are defined in a gateway. These parameters are set through the webpage during the gateway commissioning:

- Wireless channel selection mode (automatic or manual)
- Wireless channel (only if wireless channel selection mode is set on manual)
- Wireless communication periods for energy monitoring, control sensors, and HeatTag sensor (future features)

For more details on wireless parameters, refer to the below user guides, as applicable:

- *DOCA0157EN PowerTag Link Gateway – User Guide*
- *DOCA0123EN Smartlink SI B Gateway – User Guide*

Wireless Channel Selection Mode

The wireless channels are selected by either of the two modes:

- Automatic
- Manual

Automatic Mode

The gateway selects the wireless channel automatically by analyzing the wireless load of each channel during the pairing phase. This mode is recommended only for sparse wireless architecture, which includes only one gateway in a radius of 20 meters. Refer to PowerTag System Architecture Ranking, page 10.

NOTE: The pairing phase is performed frequently in the panel builder workshop. In case of automatic mode selection, the wireless channel is defined according to the wireless environment of the workshop. The wireless environment can be different in end user site. Hence, the initial channel that is automatically selected is not always the optimal channel in terms of wireless performances.

Manual Mode

The value of wireless channel is filled by user during the commissioning phase. This value is obtained in the wireless channel assignment plan, which considers all the wireless environment around the PowerTag system.

Wireless Channel

During commissioning, the user defines the wireless channel used by PowerTag system for wireless bidirectional communication between the gateway and the paired wireless devices.

The value can be set from channel 11 to 26 in gateway webpage. Each channel is 2 MHz wide with an unused spacing of 5 MHz.

The following figure shows the radio frequency bandwidth per PowerTag system channel:
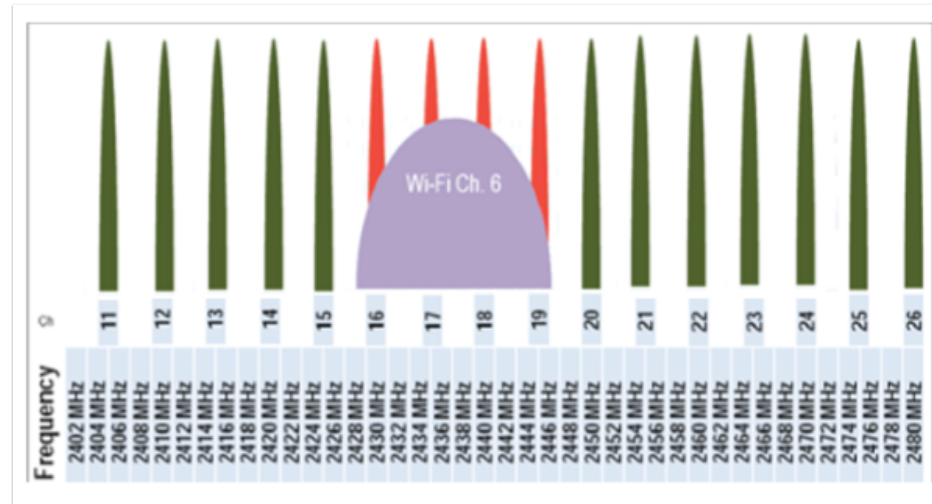
The frequency range associated to the selected channel in a gateway can be also used by another wireless system such as Wi-Fi network and third-party wireless equipment around it.

> **NOTE:** In case of two contiguous wireless systems (PowerTag system or third-party radio frequency system such as Wi-Fi network), the system can run on the same bandwidth without any problem. However, it is recommended to segregate two different non-contiguous channels in the design phase (refer to Rule WCAP2, page 22).

The following figure shows the radio frequency bandwidth per Wi-Fi channel:
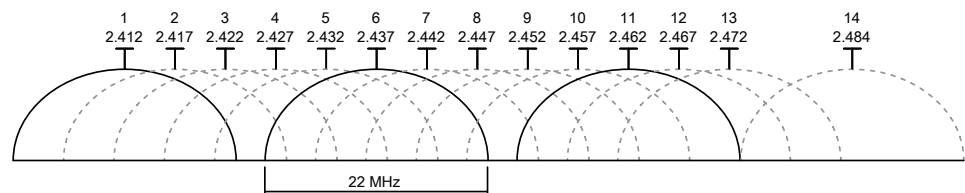
For example, Wi-Fi channel 6 (2427–2447 MHz bandwidth) and PowerTag system wireless channels 16, 17, 18, and 19 (2429–2431 MHz, 2434–2436 MHz, 2439–2441 MHz, 2444–2446 MHz bandwidth respectively) are based on the same frequency range. Hence, it is recommended to avoid these channels.

A free channel analyzer software such as Chanalyser 4 software can be used on PC or smartphone to analyze the radio frequency occupation before defining the PowerTag system channels.

Wireless Communication Periods

The user defines the wireless communication periods for cyclic data exchanged between the gateway and the various types of wireless devices.

These periods have an impact on the periodic wireless traffic generated. Their values must be increased to decrease the wireless traffic, in case of concentrated architecture.

These periods have no impact on the response time for instantaneous wireless traffic generated on events. For example, a new input value detected on a wired input of a PowerTag control module will be immediately sent to the gateway to refresh the data irrespective of the value of the communication period. For more details, refer to the following table:

Wireless devices	Periodic wireless traffic		Instantaneous wireless traffic on event
	Period	Example of exchanged data	Example of exchanged data
PowerTag energy sensors	Adjustable range between 5–60 s	Electrical measures (voltage, current, power, and energy)	Voltage loss alarm
PowerTag control modules		On line device status	• Input status • Output order
HeatTag sensors (future feature)	Adjustable range between 120–600 s	Ambient measures (temperature)	Alarms

For more information on communication periods, refer to the below user guides, as applicable:

- DOCA0157EN PowerTag Link Gateway – User Guide
- DOCA0123EN Smartlink SI B Gateway – User Guide

Wireless Channel Assignment Plan Rules

Rule WCAP1: Assign non-contiguous channels in a panel.

Follow the rules to assign non-contiguous channels in a panel:

- Do not use the same channel for several gateways inside an enclosure.
- Do not use contiguous channel for adjacent gateway inside an enclosure.
- Prefer to use non-contiguous channels inside an enclosure.

Rule WCAP2: Privilege channel not overlapped by another radio frequency signal.

Follow the rules to avoid overlapping of privilege channel by another radio frequency signal:

- Do not use the privileged channels if they are known before the design plan of wireless channel assignment plan design.
- Check the behavior of the PowerTag system during commissioning in the end user site.

Rule WCAP3: Reserve channels for future evolution.

Follow the rules to reserve the channels for future evolution::

- Two channels, if the density will be up to 1500 wireless devices in a radius of 20 meters.
- One additional dedicated channel, if any third-party radio frequency network is to be added for other wireless system.

Rule WCAP4: Define the available channels.

Follow the rules to define the available channels:

- Use all the available channels to balance the gateways and their paired wireless devices.

  Available channels = 16 - overlapped channels - reserved channels

- Use the channels uniformly.
- Priority 1: Maximize the distance between the gateway using the same channel.
- Priority 2: Maximize the distance between the gateway using channel X and adjacent channels – Channel X-1 and X+1.

Left diagram:

Wireless traffic not balanced on all the channels !
(too much traffic on channel 14)

PS= PowerTag System

PS1 Ch22	PS2 Ch12	PS3 Ch23	PS4 Ch15	PS5 Ch13	PS6 Ch23
PS11 Ch24	PS12 Ch14	PS13 Ch20	PS14 Ch11	PS15 Ch21	PS16 Ch11
PS21 Ch20	PS22 Ch11	PS23 Ch22	PS24 Ch24	PS25 Ch14	PS26 Ch23
PS31 Ch24	PS32 Ch14	PS33 Ch20	PS34 Ch12	PS35 Ch21	PS36 Ch12
PS41 Ch21	PS42 Ch15	PS43 Ch24	PS44 Ch14	PS45 Ch23	PS46 Ch14
PS51 Ch14	PS52 Ch22	PS53 Ch12	PS54 Ch20	PS55 Ch11	PS56 Ch21

CHANNEL 11
CHANNEL 12
CHANNEL 13
CHANNEL 14
CHANNEL 15
CHANNEL 16 — Forbidden due to wifi
CHANNEL 17 — Forbidden due to wifi
CHANNEL 18 — Forbidden due to wifi
CHANNEL 19 — Forbidden due to wifi
CHANNEL 20
CHANNEL 21
CHANNEL 22
CHANNEL 23
CHANNEL 24
CHANNEL 25 — Reserved for future evolution
CHANNEL 26 — Reserved for future evolution

Right diagram:

Contiguous switchboards with the same channel:
-PS3, PS11 and PS12 on channel 24
-PS43 and PS44 on channel 14

PS= PowerTag System

PS1 Ch22	PS2 Ch12	PS3 Ch24	PS4 Ch15	PS5 Ch13	PS6 Ch23
PS11 Ch24	PS12 Ch24	PS13 Ch20	PS14 Ch11	PS15 Ch21	PS16 Ch11
PS21 Ch20	PS22 Ch11	PS23 Ch22	PS24 Ch24	PS25 Ch15	PS26 Ch23
PS31 Ch24	PS32 Ch13	PS33 Ch20	PS34 Ch12	PS35 Ch21	PS36 Ch12
PS41 Ch21	PS42 Ch15	PS43 Ch14	PS44 Ch14	PS45 Ch23	PS46 Ch14
PS51 Ch13	PS52 Ch22	PS53 Ch12	PS54 Ch20	PS55 Ch11	PS56 Ch21

CHANNEL 11
CHANNEL 12
CHANNEL 13
CHANNEL 14
CHANNEL 15
CHANNEL 16 — Forbidden due to wifi
CHANNEL 17 — Forbidden due to wifi
CHANNEL 18 — Forbidden due to wifi
CHANNEL 19 — Forbidden due to wifi
CHANNEL 20
CHANNEL 21
CHANNEL 22
CHANNEL 23
CHANNEL 24
CHANNEL 25 — Reserved for future evolution
CHANNEL 26 — Reserved for future evolution

Rule WCAP5: Define two wireless communication periods according to the wireless devices density.

Follow the rules to define the values of two wireless communication periods:

- Set the same wireless communication periods for all gateways of the zone.
- Up to 400 wireless devices in a radius of 20 meters, set the wireless communication periods to 30 seconds minimum.
- Up to 600 wireless devices in a radius of 20 meters, set the wireless communication periods to 60 seconds minimum.
- More than 600 wireless devices in a radius of 20 meters, contact your Schneider Electric representative.

Number of wireless devices in a radius of 20 m	Minimum wireless communication period recommended ($T_{wireless\ comm}$)
Up to 100	5 s
Up to 200	10 s
Up to 400	30 s
Up to 600	60 s

$T_{wireless\ comm}$ is the wireless communication period defined for the type of device in the gateway configuration.

PowerTag System Commissioning

Commissioning Rules

The commissioning rules are applicable to the gateway webpages.

Rule COM1: Use the Manual Channel Selection mode in concentrated wireless architecture.

In concentrated wireless architecture, the PowerTag systems interfere between themselves. Therefore, the channel must be set according to the wireless channel assignment plan in Manual Channel Selection mode.
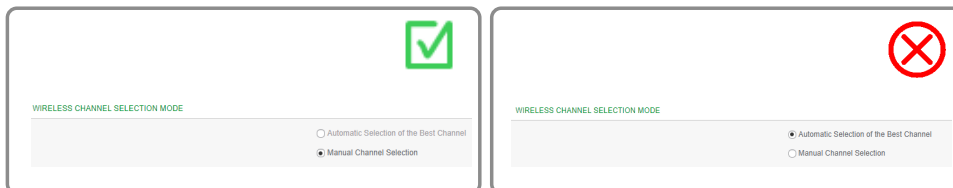
Rule COM2: Configure the wireless channel before the wireless devices discovery.

- Set the channel value before pairing the wireless devices to save time.
- In case of wireless channel modification after pairing, the PowerTag system will need several minutes or hours to recover wireless communication.

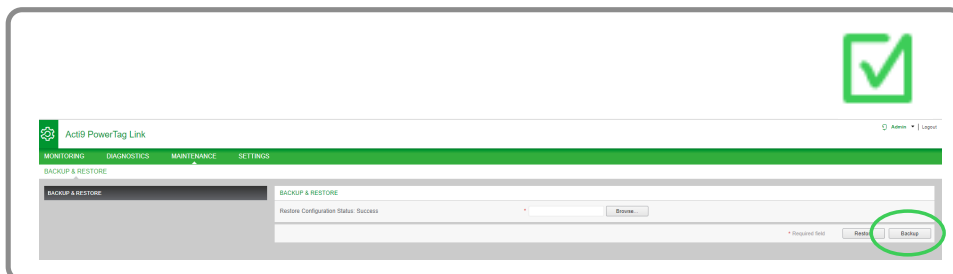### Rule COM3: Save the PowerTag Link gateway configuration.

Generate a backup file of the PowerTag Link gateway configuration at the end of the commissioning.

NOTE: It is not possible to generate a backup file with a Smartlink SIB gateway.

It is possible to replace a defective PowerTag Link gateway by a new one without load power outage if a backup file was previously generated and saved.

Without this backup file, it is mandatory to restart all the wireless devices (and interrupt the associated supply load) to replace the PowerTag Link gateway.

It is recommended to generate and save these backup files, especially when the PowerTag Link gateway is to be installed with high level of continuity of service and critical supply load.

DOCA0194EN-00