AP Power Save

Feature History for AP Power Save

This table provides release and related information for the feature explained in this module.

This feature is also available in all the releases subsequent to the one in which they are introduced in, unless noted otherwise.

Table 1: Feature History for AP Power Save

Release	Feature Information
Cisco IOS XE Cupertino 17.8.1	This feature allows a network administrator to force APs to operate in low-power mode to reduce power consumption.

Information About AP Power Save

The power-save mode in APs allows a network administrator to force APs to operate in low-power mode to reduce power consumption.

The AP Power Save feature is supported in the following APs:

- Cisco Catalyst 9115 Series Access Points

- Cisco Catalyst 9117 Series Access Points
- Cisco Catalyst 9120 Series Access Points
- Cisco Catalyst 9130 Series Access Points
- Cisco Catalyst 9136 Series Access Points

Access Point Power Policy

The access point power policy allows you to define the power budget utilization available for an AP, wherein, you can define a set of policies for different interfaces on an AP. You can manage interfaces such as Ethernet interfaces, Wi-Fi radios, USB, and so on, as required.

Use Case for AP Power Policy

The following is the use case of an AP power policy:

- You can define a power policy for the available power inputs, such as, 802.3af, 802.3at (for multiple levels), DC power, and so on. With tri-radio and quad-radio APs, the power requirement has gone beyond the capability of the 802.3at Power over Ethernet (PoE) mode. Therefore, with the AP power policy, for example, we statically predefine an AP operation when provided with non-802.3bt power (such, as TX power, radio chains, USB port, SFP, and so on).

Power-Save Mode

The power-save mode enables an AP to switch to a low-power mode when no clients are associated with the AP. For example, when this mode is enabled in workspaces, the AP falls asleep during after hours, thereby saving power consumption of the AP throughout the night.

The following are the advantages of the power-save mode:

- Increases the energy saving per AP: In the power save mode you can reduce AP functions during off-peak hours and save an additional 20% in energy costs compared to the regular idle mode.
- Enables environmentally conscious purchases: Large enterprises and companies track environmental performance as one of their key indices. They have a centralized energy team to monitor their energy efficiency, which magnifies the importance of the power-save feature.

PoE Profiles

- Fixed PoE Profile: The APs negotiate the power that is required, from the switches they are connected to. The power required varies from one AP model to another AP model. If an AP is not granted the power it requested, it operates under the power budget. In such conditions, some of the interfaces operate under *degraded conditions*.

  For example, some radios may operate at 2SS instead of at 4SS, which they are capable of. The operating conditions for each of the AP interfaces differs from one power level to another. These are referred to as fixed PoE profiles. Fixed PoE profiles are applied when the AP is operating in normal mode, that is, nonpower-save mode. When the AP operates in power-save mode, the configured PoE power policies are applied.

- PoE Power Policy: With power policies or profiles, you can configure interfaces that you want to set at certain speeds. With this policy, you can configure a profile of your choice that will be pushed to the AP based on your calendar or timing. For example, on a group of APs in the second floor, push a profile where you want to turn off all APs, except 2.4-GHz radio and multigigabit Ethernet at 100 megabyte, from 7 p.m. to 7 a.m.

Table 2: AP Power Draw Specifications: Cisco Catalyst 9115, 9117, 9120, 9130 Series APs

Access Points	PoE-In-Mode/DC Mode	Consumption @ Power Device	Consumption @ Power Source Equipment	Feature Mode						
		AP	Worst-Case Cable	Radio 1	Radio 2	Radio 3	Ethernet	USB	Module	PoE Out
Cisco Catalyst 9115AXI Access Points	.3af	13.0	15.4	2X2	2X2	—	1G	N	—	—
	.3at	16.0	18.9	4X4	4X4	—	2.5G	N	—	—
	.3at	20.4	24.1	4X4	4X4	—	2.5G	Y(3.75W)	—	—
Cisco Catalyst 9115AXE Access Points	.3af	13.0	15.4	2X2	2X2	—	1G	N	—	—
	.3at	17.0	20.1	4X4	4X4	—	2.5G	N	—	—
	.3at	21.4	25.3	4X4	4X4	—	2.5G	Y(3.75W)	—	—
Cisco Catalyst 9117 Access Points	.3af	13.5	15.4	2X2	2X2	—	2.5G	N	—	—
	.3at	25.0	29.3	4X4	8X8	—	5G	N	—	—
	.3at	24.1	28.0	4X4	4X4	—	5G	Y(4.5W)	—	—
	.3bt/UPoE	30.0	32.7	4X4	8X8	—	5G	Y(4.5W)	—	—
	.3at/.3bt/UPoE	22.4	25.7/23.8/23.8	4X4	4X4	—	2.5G	Y(4.5W)	—	—
Cisco Catalyst 9120AXIE Access Points	.3af	13.8	15.4	1X1	1X1	Enabled	1G	N	—	—
	.3at	20.5	23.2	4X4	4X4	Enabled	2.5G	N	—	—
	.3at	25.5	30.0	4X4	4X4	Enabled	2.5G	Y(4.5W)	—	—

Access Points	PoE-In-Mode/DC Mode	Consumption @ Power Device	Consumption @ Power Source Equipment	Feature Mode						
		AP	Worst-Case Cable	Radio 1	Radio 2	Radio 3	Ethernet	USB	Module	PoE-Out
Cisco Catalyst 9130AXIE Access Points	.3af	13.8	15.4	1X1	1X1	Enabled	1G	N	—	—
	.3at	25.5	30.0	8X8	4X4	Enabled	5G	N	—	—
	.3at	25.5	30.0	Primary 4X4 Secondary Off	4X4	Enabled	5G	Y(4.5W)	—	—
	.3at	25.5	30.0	Primary 4X4 Secondary 4X4	Disabled	Enabled	5G	Y(4.5W)	—	—
	.3bt	30.5	33.3	8X8	4X4	Enabled	5G	Y(4.5W)	—	—

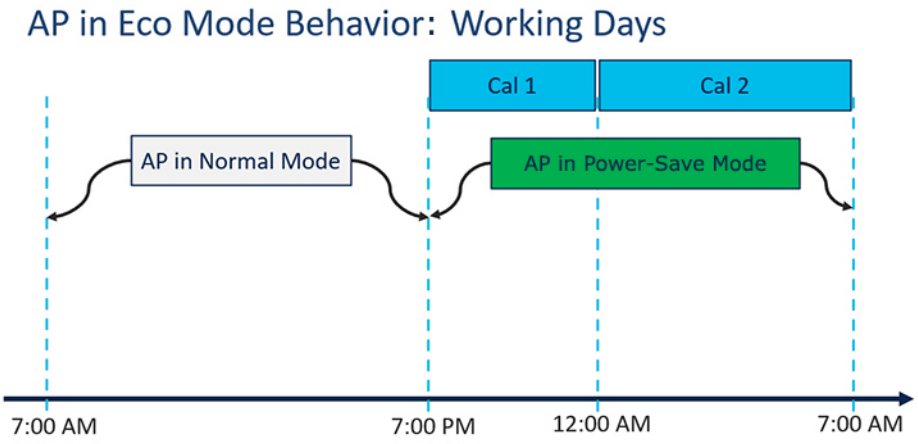
Table 3: AP Power Draw Specifications: Cisco Catalyst 9136 Series APs

Access Points	PoE-In-Mode	Consumption @Power Device	Consumption @Power Source Equipment	Feature Mode								
		at AP	Worst-Case Cable	5G Radio	2G Radio	6G Radio	AUX Radio	Mgig0	Mgig1	USB	Module	PoE-Out
Cisco Catalyst 9136 Series Access Points	.3af - Fixed	13.9	15.4	Disabled	Disabled	Disabled	Enabled	1G	Disabled	Disabled	—	—
	.3at - Fixed	24.0	27.90	Primary - 4X4 Secondary - Disabled	2X2	2X2	Enabled	2.5G	2.5G (hitless failover standby)	Disabled	—	—
	.3bt - Fixed	43.4	54.81	8X8 or Dual 4X4	4X4	4X4	Enabled	5G	5G	Y(9W)	—	—
	.3bt - PoE Policy 1	37.3	41.63	8X8 or Dual 4X4	4X4	4X4	Enabled	5G	5G	Disabled	—	—

AP Power Save Scenarios

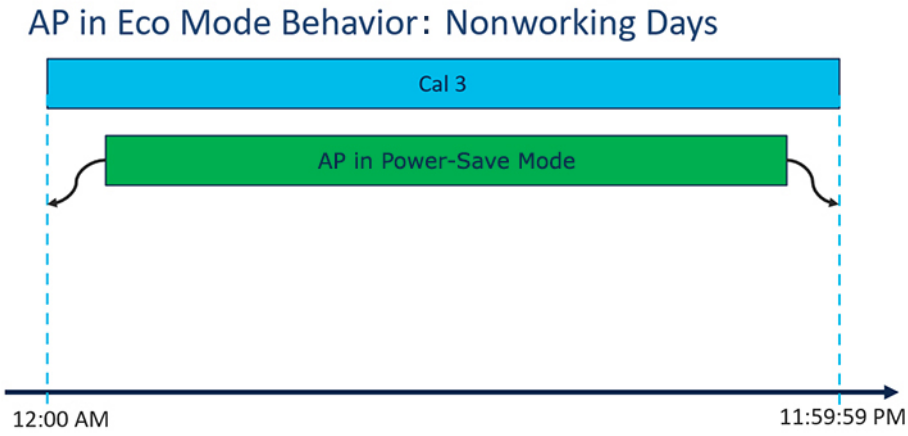
The AP Power Save feature helps APs to enter into a power-save mode or low-power mode by applying a calendar, for example, for after hours, associated with the corresponding power profile. The AP profile is enhanced to associate a PoE power policy with calendar profiles. The following are the scenarios for Eco mode APs:

- ***Figure 1: AP in Eco Mode Behavior: Working Days***



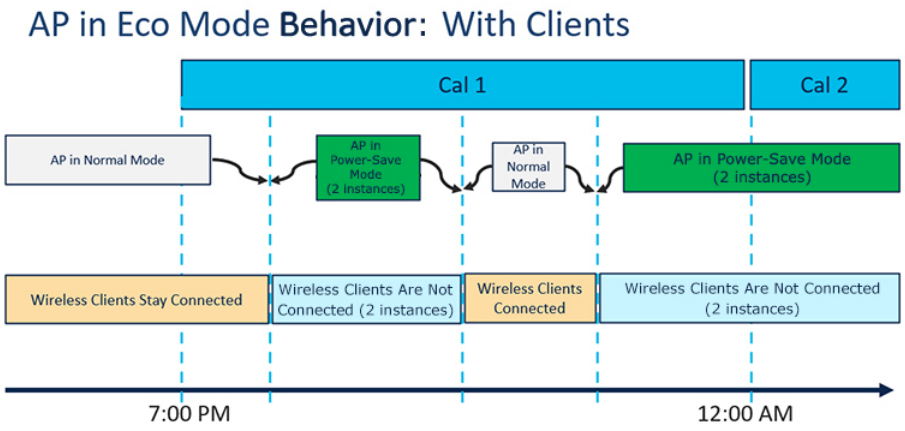
On working days, from 7:00 a.m. to 7:00 p.m, the AP functions in normal mode or fixed mode, when the maximum number of clients are connected to the AP. From 7:00 p.m. to 12:00 a.m., the **Cal1** calendar profile timer starts to put the AP in the power-save mode. Likewise, the **Cal2** calendar profile timer starts, and extends the power-save mode from 12:00 a.m. to 7:00 a.m. Again, at 7:00 a.m., the AP goes into normal mode.

- ***Figure 2: AP in Eco Mode Behavior: Nonworking Days***



On nonworking days, the AP goes into power-saving mode from 12:00 a.m. to 11:59:59 p.m. The **Cal3** calendar profile is applied here. This profile defines the timer for the power-save mode. This means that there are no clients connected to the AP, and that the AP is asleep.

- ***Figure 3: AP in Eco Mode Behavior: With Clients***



When clients are connected to the AP, the AP automatically switches to the normal mode. For example, in the calendar profile **Cal1**, the AP is in normal mode, because wireless clients are connected to the AP. At 8:00 p.m., clients get dissociated from the AP, and the AP goes into power-save mode. When clients enter the AP coverage area at 9:30 p.m., the AP automatically switches from power-save mode to normal mode of operation.

Configuring Power Policy Profile (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Power Profile**.

Step 2 Click **Add**.
The **Add Power Profile** window is displayed.

Step 3 Enter a name and description for the power profile. The name must be ASCII characters of up to 128 characters, without leading or trailing spaces.

Step 4 Click **Add** to add rules for the power profile.

Step 5 In the **Sequence number** field, enter a unique sequence number to designate the priority in which power should be disabled for the component. The sequence number of 0 indicates that the component should be disabled first.

Step 6 From the **Interface** and **Interface ID** drop-down list, choose interface and interface ID to designate to the component for which the power derating rule applies.

Step 7 From the **Parameter** and **Parameter value** drop-down list, choose the values depending on the interface you chose in step 6.

For example, if you chose **Ethernet** as an interface, you can further customize the rule for the interface by choosing the associated speed. This rule ensures that the AP disables power for the Ethernet interface that is operating at a higher speed, and thereby consuming more power.

Step 8 Click the check mark to save and then click **Apply to Device**.

Configuring a Power Policy Profile (CLI)

Before you begin

You must keep at least one radio interface up and running before you configure a power policy profile.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile power** *power-profile-name* **Example:** `Device(config)# wireless profile power power-profile-name`	Configures the power policy profile.
Step 3	*sequence-number* **ethernet** {**GigabitEthernet0** | **GigabitEthernet1 speed** {**1000mbps** | **100mbps** | **2500mbps** | **5000mbps**} | **LAN1** | **LAN2** | **LAN3 state disable**} **Example:** `Device(config-wireless-power-profile)# 10 ethernet gigabitethernet1 speed 1000mbps`	Configures the power policy for Ethernet. *sequence-number*: The power profile settings are ordered by sequence numbers. AP derating takes place as per the sequence number entered. The same combination of interface identifiers and parameter values does not appear in another sequence number. The same interface with the same parameter can appear multiple times with different parameter values. **Note** • The Ethernet interface is used to join the controller. The uplink interface is not disabled even if it is defined in the power policy. • Ethernet speed configuration is not operational in Cisco IOS XE Cupertino 17.8.1.
Step 4	*sequence-number* **radio 24ghz** {**spatial-stream** {**1** | **2** | **3** | **4**} | **state shutdown**}	Configures spatail stream for the 2.4-GHz band radio.

	Command or Action	Purpose
	Example: `Device(config-wireless-power-profile)# 20 radio 24ghz spatial stream 2`	Here: *sequence-number*: The power profile settings are ordered by sequence numbers. AP derating takes place as per the sequence number entered. The same combination of interface identifiers and parameter values does not appear in another sequence number. The same interface with the same parameter can appear multiple times with different parameter values. • 1: Specifies a 1X1 radio spatial stream. • 2 : Specifies a 2X2 radio spatial stream. • 3 : Specifies a 3X3 radio spatial stream. • 4 : Specifies a 4X4 radio spatial stream. **state shutdown**: Indicates that the radio state is down.
Step 5	*sequence-number* **radio 5ghz** {**spatial-stream** {**1** | **2** | **3** | **4** | **8**} | **state shutdown**} **Example:** `Device(config-wireless-power-profile)# 30 radio 5ghz spatial stream 4`	Configures spatail stream for the 5-GHz band radio. Here: *sequence-number*: The power profile settings are ordered by sequence numbers. AP derating takes place as per the sequence number entered. The same combination of interface identifiers and parameter values does not appear in another sequence number. The same interface with the same parameter can appear multiple times with different parameter values. • 1: Specifies a 1X1 radio spatial stream. • 2 : Specifies a 2X2 radio spatial stream. • 3 : Specifies a 3X3 radio spatial stream. • 4 : Specifies a 4X4 radio spatial stream. • 8 : Specifies a 8X8 radio spatial stream. **state shutdown**: Indicates that the radio state is down.
Step 6	*sequence-number* **radio secondary-5ghz** {**spatial-stream** {**1** | **2** | **3** | **4** | **8**} | **state shutdown**} **Example:** `Device(config-wireless-power-profile)# 40 radio 5ghz spatial stream 4`	Configures spatail stream for a secondary 5-GHz band radio. Here: *sequence-number*: The power profile settings are ordered by sequence numbers. AP derating

	Command or Action	Purpose
		takes place as per the sequence number entered. The same combination of interface identifiers and parameter values does not appear in another sequence number. The same interface with the same parameter can appear multiple times with different parameter values. • 1: Specifies a 1X1 radio spatial stream. • 2 : Specifies a 2X2 radio spatial stream. • 3 : Specifies a 3X3 radio spatial stream. • 4 : Specifies a 4X4 radio spatial stream. • 8 : Specifies a 8X8 radio spatial stream. **state shutdown**: Indicates that the radio state is down.
Step 7	*sequence-number* **radio 6ghz** {**spatial-stream** {**1** | **2** | **3** | **4** | **8**} | **state shutdown**} **Example:** `Device(config-wireless-power-profile)# 50 radio 6ghz spatial stream 2`	Configures spatail stream for the 6-GHz band radio. Here: *sequence-number*: The power profile settings are ordered by sequence numbers. AP derating takes place as per the sequence number entered. The same combination of interface identifiers and parameter values does not appear in another sequence number. The same interface with the same parameter can appear multiple times with different parameter values. • 1: Specifies a 1X1 radio spatial stream. • 2 : Specifies a 2X2 radio spatial stream. • 3 : Specifies a 3X3 radio spatial stream. • 4 : Specifies a 4X4 radio spatial stream. • 8 : Specifies a 8X8 radio spatial stream. **state shutdown**: Indicates that the radio state is down.
Step 8	*sequence-number* **usb 0 state disable** **Example:** `Device(config-wireless-power-profile)# 60 usb 0 state disable`	Configures the power policy for USB.

Configuring a Calendar Profile (GUI)

Configure calendar profiles to set up a daily, weekly, or monthly recurrence schedule.

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Calendar**.

Step 2 Click **Add**.
The **Add Calendar Profile** window is displayed.

Step 3 Enter a name for the calendar profile. The name must be ASCII characters of up to 32 characters, without leading or trailing spaces.

Step 4 From the **Recurrence** drop-down list, choose the schedule for which you want to create a profile.

Step 5 Select the **Start Time** and the **End Time** for the recurrence schedule.

Note

- For daily recurrences, you can select the start time and end time. For example, if you want the AP to derate the power on certain interfaces between 7 p.m. to 7 a.m. daily, or if you want the controller to not allow any clients to be associated during this period, you can set up this daily recurrence schedule.

  To cover this timespan, you must create two calendar profiles, one for 7 p.m. till 23:59:59, and another one from midnight to 7 a.m. of the next calendar day, and map it to the same power profile. After this, assign it to the AP Join profile.

- For weekly recurrences, select the specific days of the week along with the start and end time.

- For monthly recurrence, select the specific days of the month along with the start and end time.

Step 6 Click **Apply** to save the configuration.

Configuring a Calendar Profile (CLI)

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile calendar-profile name** *calendar_profile_ap_power* **Example:**	Configures a calendar profile. Enters the calendar profile configuration mode.

	Command or Action	Purpose
	`Device# wireless profile calendar-profile name ap_power_calendar`	Here, **name** refers to the name of the calendar profile.
Step 3	**recurrence daily** **Example:** `Device(config-calendar-profile)# recurrence daily`	Configures daily recurrence for daily profile.
Step 4	**start** *start-time* **end** *end-time* **Example:** `Device(config-calendar-profile)# start 16:00:00 end 20:00:00`	Configures the start time and end time for calendar profile.
Step 5	**end** **Example:** `Device(config-calendar-profile)# end`	Returns to privileged EXEC mode.

Mapping a Power Profile Under an AP Profile (CLI)

Before you begin

Ensure that you have defined a calendar profile in the wireless profile, before you map the calendar profile to an AP join profile.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**ap profile** *ap-profile-name* **Example:** `Device(config)# ap profile ap-profile-name`	Configures an AP profile and enters AP profile configuration mode.
Step 3	**calendar-profile** *calendar-profile-name* **Example:** `Device(config-ap-profile)# calendar-profile ap-calendar-profile`	Maps a calendar profile to the AP profile. Enters the AP profile calendar configuration mode.
Step 4	**[no] action power-saving-mode power-profile** *power-profile-name*	Maps a specific power profile to a specific calendar profile. Maps the power-saving mode

	Command or Action	Purpose
	Example: `Device(config-ap-profile-calendar)#` **`action power-saving-mode power-profile`** *`power-profile1`*	action for the calendar profile. Use the **no** form of this command to disable the command. **Note** You can have more than one mapping of calendar profile to power profile.

Configuration Example of Power Profile

The following example shows how to define a power save policy:

```
wireless profile power power-save
            10 radio 5ghz state shutdown
            20 radio secondary-5ghz state shutdown
            30 radio 6ghz state shutdown
            40 usb 0 state disable
```

The following example shows how to define a calendar profile:

```
wireless profile calender-profile name eve-to-midnight
            recurrence daily
            start 19:00:00 end 23:59:59
wireless profile calender-profile name midnight-to-morning
            recurrence daily
            start 00:00:00 end 07:00:00
wireless profile calender-profile name weekends
            recurrence weekly
            day Saturday
            day Sunday
            start 00:00:00 end 23:59:59
```

The following example shows how to define an AP join profile and map a calendar profile to a power profile:

```
ap profile wireless-prof-site1
                 calendar-profile eve-to-midnight
                  action power-saving-mode power-profile power-save
                 calendar-profile midnight-to-morning
                  action power-saving-mode power-profile power-save
                 calendar-profile weekends
                  action power-saving-mode power-profile power-save
```

Verifying Access Point Power Policy (GUI)

To verify the applied configuration on the GUI, follow these steps:

Procedure

Step 1 Choose **Monitoring** > **AP Statistics**.

Step 2 Click a Cisco Catalyst 9136 series AP from the list of APs.
The **General** window is displayed.

Step 3 Click the **Power** tab.
The **Power Operational Status** and the **AP Fixed Power Policy** details are displayed.

Step 4 Click **OK**.

To verify the AP fixed power policy details from the list of configured APs, follow these steps:

Procedure

Step 1 Choose **Configuration** > **Access Points**.

Step 2 Click a Cisco Catalyst 9136 series AP from the list of APs.
The **Edit AP** window is displayed.

Step 3 Click the **Interfaces** tab.
The **AP Fixed Power Policy** details are displayed.

Step 4 Click **Update & Apply**.

Verifying the Access Point Power Profile

To view the calendar profile and its mapping, run the following command:

```
Device# show ap profile name default-ap-profile detailed
AP Profile Name                     : default-ap-profile
Description                         : default ap profile
Power profile name                  : power_prof_day
AP packet capture profile           : Not Configured
AP trace profile                    : Not Configured
Mesh profile name                   : default-mesh-profile
Power profile name                  : Not Configured
Calendar Profile
    Profile Name                   : cal47
    Power saving mode profile name : pow_da
    ---------------------------------------------------
    Profile Name                   : cal48
    Power saving mode profile name : pow23
    ---------------------------------------------------
```

To view the operational details of the AP, run the following command:

```
Device# show ap name cisco-ap power-profile summary
AP power derate Capability      : Capable

Power saving mode
Power saving mode profile        : pow2
Associated calendar profile      : cal1

AP power profile status         : Insufficient De-rating

Interface    Interface-ID       Parameter        Parameter value    Status
-------------------------------------------------------------------------------------------
Radio        5 GHz              State            DISABLED           Success
Radio        6 GHz              State            DISABLED           Not Applicable
Ethernet     LAN1               State            DISABLED           Not Applicable
Radio        2.4 GHz            State            DISABLED           Success
Ethernet     Gig0               Speed            5000 MBPS          Fixed Policy
```

AP power derate capability is displayed in the output as **Capable** only for those APs that support power policy. For the other APs, it is displayed as **Not Capable**.

In the **show ap name cisco-ap power-profile summary** output, in the power saving mode, the status of the interface configured in the power profile (for example, **pow2**) is applied on the AP, and the AP sends the details (that are displayed in the show command) such as, the name of the power saving profile and the associated calendar profile.

The table that is displayed shows the interfaces and the parameter status of the power saving profile. The AP sends the information as to which of the interfaces are disabled. For example, if the AP does not have a 6-GHz radio interface, the **Status** is displayed as **Not Applicable**. If the interfaces are applied without any errors, then **Success** is displayed.

Note When the AP uses the fixed power policy, due to inactive calendar or client connectivity, the interfaces are not displayed in the power profile summary if their status is UP on the AP.