

# Fortinet FAP-U422EV

## *Best Practices Guide*



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# Table of Contents

- Support . . . . . 2
- About FAP-U422EV . . . . . 1
- Default Radio Settings . . . . . 1
- Ethernet Ports . . . . . 2
- Power . . . . . 2
- Deployment Considerations . . . . . 3
  - 802.11ac Deployment . . . . . 3
  - WLAN Controller . . . . . 3
  - Clients per AP . . . . . 3
  - Security Profiles . . . . . 4
  - Signal Strength . . . . . 4
  - SNR. . . . . 5
  - Switch and PoE Guidelines. . . . . 5
    - FAP-U422EV . . . . . 5
    - Controller . . . . . 5
    - PoE . . . . . 5
- Mounting FAP-U422EV . . . . . 7
  - Antenna Radiation Patterns . . . . . 8

Pole Mounting FAP-U422EV . . . . .	10
Wall Mounting FAP-U422EV . . . . .	11
Planning AP Location . . . . .	13
Sitesurvey . . . . .	13
Using CLI . . . . .	14
Enabling Sitesurvey . . . . .	14
Disabling Sitesurvey . . . . .	14
Setting Country Code and Channel . . . . .	14
Setting Inactivity Time . . . . .	15
Setting IP Address . . . . .	15
Configuring SSID . . . . .	15
By default, SSID for both radios are broadcast. . . . .	16
Enable or Disable Radio . . . . .	16
Configure Sitesurvey Refresh Rate . . . . .	16
Setting the Tx Power . . . . .	16
Save Sitesurvey Configuration . . . . .	17
Using GUI . . . . .	17
Viewing Sitesurvey Results . . . . .	18
Using GUI . . . . .	19
About AP Location . . . . .	19
AP Placement Plan . . . . .	19
One-for-One AP Replacement . . . . .	19
AP Density . . . . .	20
AP Transmit Power . . . . .	20
2.4 GHz vs. 5 GHz Signal Strength . . . . .	20

<b>Migrating to Wave2 FAP</b> . . . . .	<b>21</b>
General Recommendation . . . . .	21
Migrating from 11abgn MCA Networks to 11ac MCA Networks . . . . .	21
Migrating from 11abgn SCA/VCell Networks to 11ac SCA/VCell Networks	21
Validating Coverage Post-Migration . . . . .	22
Network Tuning . . . . .	22
Migrating in FortiWLM . . . . .	23
<b>Regulatory Information</b> . . . . .	<b>25</b>
Regulatory Specifications . . . . .	26
Declaration of Conformity, Federal Communication Commission	26
Manufacturer Information . . . . .	26
Declaration of Conformity . . . . .	27
Declaration of Conformity, Industry Canada . . . . .	27
Manufacturer Information . . . . .	28
Declaration of Conformity . . . . .	28
Declaration of Conformity, R&TTE Directive 1999/5/EC . . . . .	30
Declaration of Conformity . . . . .	30
VCCI Statement . . . . .	32
General Information of RF Exposure . . . . .	32
International Guidelines . . . . .	32

FCC Guidelines . . . . .	33
Industry Canada Guidelines . . . . .	34
<b>Cautions and Warnings . . . . .</b>	<b>35</b>
Cautions . . . . .	35
Warnings . . . . .	35
<b>Additional Notes . . . . .</b>	<b>39</b>
Maximum EIRP . . . . .	39
Manufacturing Information . . . . .	39
Distributed Antenna Systems (DAS) . . . . .	39
Air Handling Space Requirements . . . . .	39
Frequencies Blocked for Regulatory Compliance . . . . .	40
Underwriters Laboratories . . . . .	40
Restriction of Hazardous Substances . . . . .	40
European Community . . . . .	40
China . . . . .	40



# 1 About FAP-U422EV

The FAP-U422EV is a dual-radio, dual-band 802.11ac Wave-2 access point that supports one radio configured for 2.4 GHz operation and one radio configured for 5 GHz 11ac operation. The AP supports MCA (Multi-Channel architecture) deployment options, such as single-channel architecture (SCA), with or without Virtual Cell, SCA with channel layering, and MCA with ARRP (Auto Radio Resource Provisioning). The APs are designed to meet the requirements for even the most challenging deployment scenarios.

**Note:** ARRP is disabled by default.

AP Model	Wireless	Wired	Antenna
FAP-U422EV	Dual Radio: 802.11ac/abgn Wave-2 4x4:4	2 interfaces: 10/100/1000	External

The FAP-U422EV radios include the following capabilities:

- Supports Universal Access
- Management from on-premise to cloud management
- 802.11ac Wave 2 technology with data rates of up to 2.2 Gbps
- 4x4 MU-MIMO (up to 4 streams) technology improves client throughput and range
- 802.11ac transmit beamforming (TxBF)
- Modulation up to 1024 QAM
- Integrated with Fortinet Security Fabric
- Virtual Cell enabled deployments segment traffic at RF layer

## Default Radio Settings

- Interface 1 defaults to 2.4 GHz 11bgn (channel 6, 20 MHz width)
- Interface 2 defaults to 5 GHz 11ac (channel 36, 80 MHz width)

## Ethernet Ports

- Supports two Gig-E ports, labeled LAN1 and LAN2
- Auto-negotiation supported
- LAN1 and LAN2 is the uplink port with PoE support.
- LACP supported.

## Power

- 802.3at without PSE out (25 Watts)
- 802.3at+ with PSE out (40 Watts)

## 2 Deployment Considerations

### 802.11ac Deployment

The FAP-U422EV is backward compatible with 802.11a/n and 802.11b/g/n clients, so you can upgrade your network today, and the existing client base will work with the new FAP U422EV. Fortinet provides solutions for both single-channel architecture (SCA) and multi-channel architecture, depending on the requirements for a particular customer's business and/or use case. Enterprises can add the FAP-U to their existing network to support additional capacity as part of their existing deployment. However, there are recommended best practices for operating a network that includes both 11n and 11ac APs. See the <Link>"Migrating to Wave2 FAP" chapter for more details.

### WLAN Controller

Customers are required to upgrade the controller software, FortiWLC (SD) to version 8.3.4 or later to support the FAP-U422EV.

FAPs support two data plane modes, bridged and tunneled. In bridged mode, also known as the remote AP mode, the data traffic from the client is bridged locally at the access layer or edge switch. Control and AP management traffic is still sent between the AP and the controller in bridged mode. In tunneled mode, all data, AP management, and control traffic is passed through the controller.

### Clients per AP

The BYOD phenomenon has changed the enterprise network landscape and has forced IT managers to plan ahead for all types of user-owned mobile devices. BYOD typically means client densities are increasing, as it is not unusual for users to carry two or three WLAN-capable devices at a time. With BYOD, the client count per AP/radio has continued to rise, as one would expect. What follows are some general client density guidelines for the FAP-U422EV.

- The maximum capability of the FAP-U422EV is 128 clients per radio, or 256 clients per AP.

- The recommendation for a typical deployment is 30 clients per radio, or 60 clients per AP.
- The recommendation for high-density developments is up to 80 clients per radio, or 160 clients per AP.
- These recommendations for FAP-U422EV are for both MCA and virtual Cell.

The actual number of clients recommended per radio depends on number and types of applications in use, SLAs, client types, etc. This subject is discussed in detail in the guide titled "BPG - High Density Design and Deployment," which is available for download through Customer Support.

# Security Profiles

To ensure that you are benefiting from the VHT data rates available in 11ac, your security policies need to be configured to use WPA2 with AES-CCMP. The AES-CCMP requirement is part of the 11ac specification.

# Signal Strength

The recommendation for 11n networks is typically that AP signal strength be -65 dBm or greater everywhere that Wi-Fi service is required for voice or video. This recommendation is influenced by the knowledge that 11n uses highest modulation rate of 64-QAM.

With 11ac, a higher signal strength is required to achieve the highest modulation rate of 1024-QAM. This is because 256 and 1024-QAM employs a much denser constellation than 64-QAM, which makes data corruption more likely at lower signal strength when using 256 and 1024-QAM. How much higher signal strength is required depends mainly on channel width. Wider channels will require higher signal strengths to achieve 1024-QAM rates.

For networks using 80 MHz channels, the widest channel width used in Wave 2 APs, a signal strength of approximately -51 dBm or greater is required to support 1024-QAM. For 40 MHz channels, a signal strength of approximately -54 dBm or greater is required to support 1024-QAM.

Modulation Scheme	40Mhz	80MHz
11n 64-QAM	-61	NA
11ac 256-QAM	-54dBm	-51dBm

# SNR

Another important metric to consider when building a wireless network is the signal to noise ratio (SNR). With 11n networks, an SNR of 28dB or greater is often recommended, particularly if voice and/or video applications are present. Although this recommendation still applies for 11n clients running on 11ac networks, for 11ac clients to achieve their highest possible data rates, the SNR should be greater than 32dB.

## Switch and PoE Guidelines

In this section, we will provide recommendations for switching and PoE capabilities.

### FAP-U422EV

The recommendation is that each AP be connected via a single 1G Ethernet port, and that edge switches have a 10G uplink back to the distribution or core network switches. Following these recommendations will eliminate potential wired infrastructure bottlenecks.

### Controller

As mentioned previously, if the data plane is configured for tunneled mode, a 10G uplink from the controller to the connecting switch is recommended, as all data plane traffic will need to pass through the controller's Ethernet port/s. A 10G uplink can be used for bridged mode deployments as well, but since all data plane traffic avoids passing through the controller's Ethernet port/s, a 1G controller uplink port will most often be more than adequate for bridged mode deployments.

### PoE

FAP-U422EV requires approximately 38W (802.3at+) static power supply with PSE out and 25W (802.3at) without PSE out. Customers that currently have 802.3af power will need to upgrade to 802.3at power. If the FAP-U detects an 802.3af power source, the radios will be disabled. The LAN1 and LAN2 ports are for uplink.



### 3 Mounting FAP-U422EV

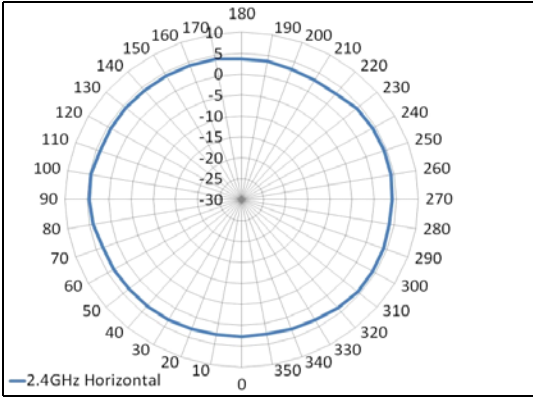
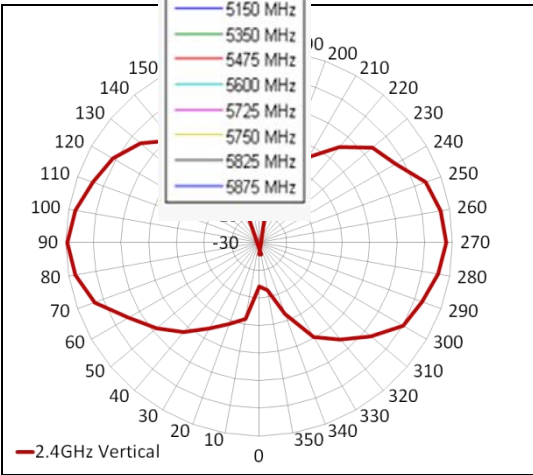
The FAP-U422EV has eight internal antennas. This AP can be mounted on the ceiling or a wall. The FAP-U422EV uses high gain omni directional antennas with 360 degrees Horizontal and greater than 60 degrees vertical beam width of coverage.

These are the supported external antennas for FAP-U422EV. For more information, refer to the *Fortinet Antennas Data Sheet*.

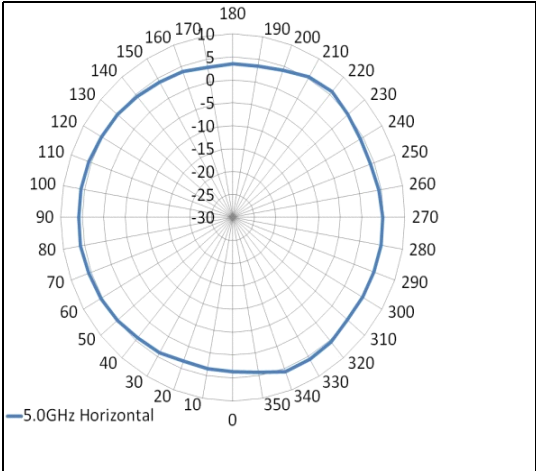
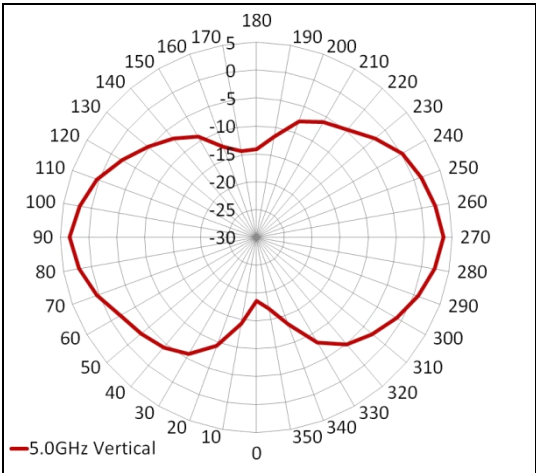
Product	SKU	Description
FortiAntenna 664N	FAN-664N	60° 8 dBi dual-band 4x4 MIMO sector panel antenna. Includes 75 cm cables with 4 N-type connectors. Purchase FAN-M22 wall/pole mount kit separately.
FortiAntenna 504N	FAN-504N	19 dBi gain panel antenna for 5 GHz Point-to-point 4x4 MIMO bridging with N-type connectors. Please purchase FAN-M22 wall/pole mount kit and LMR400 cables separately.

# Antenna Radiation Patterns

This section describes the radiation patterns of the antennas.

Antenna	Radiation Pattern
2.4GHz Horizontal	 <p>A polar plot showing the radiation pattern of a 2.4GHz horizontal antenna. The plot is circular with concentric grid lines representing signal strength in dB, ranging from -30 to 0. The outermost line is at 0 dB. The plot shows a nearly uniform radiation pattern across all angles, with a slight dip at 180 degrees. The legend indicates '2.4GHz Horizontal'.</p>
2.4GHz Vertical	 <p>A polar plot showing the radiation pattern of a 2.4GHz vertical antenna. The plot is circular with concentric grid lines representing signal strength in dB, ranging from -30 to 10. The outermost line is at 10 dB. The plot shows a radiation pattern with a main lobe at 0 degrees and a null at 180 degrees. The legend indicates '2.4GHz Vertical' and lists several frequencies: 5150 MHz, 5350 MHz, 5475 MHz, 5600 MHz, 5725 MHz, 5750 MHz, 5825 MHz, and 5875 MHz.</p>

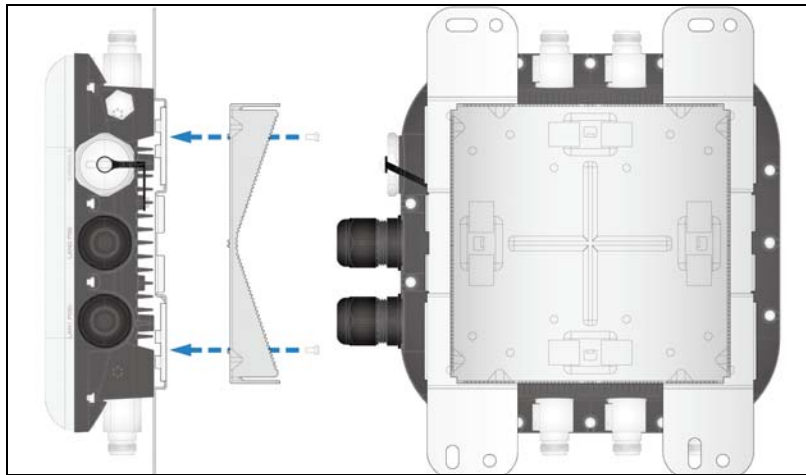


Antenna	Radiation Pattern
5GHz horizontal	 <p>A polar plot showing the radiation pattern for 5.0GHz Horizontal. The plot is circular with concentric grid lines representing signal strength in dB, ranging from 0 at the center to -30 at the outer edge. The radial axis is labeled with values 0, -5, -10, -15, -20, -25, and -30. The angular axis is labeled from 0 to 360 in increments of 10. The radiation pattern is a nearly perfect circle, indicating omnidirectional coverage. A legend at the bottom left shows a blue line segment labeled "5.0GHz Horizontal".</p>
5GHz Vertical	 <p>A polar plot showing the radiation pattern for 5.0GHz Vertical. The plot is circular with concentric grid lines representing signal strength in dB, ranging from 0 at the center to -30 at the outer edge. The radial axis is labeled with values 0, -5, -10, -15, -20, -25, and -30. The angular axis is labeled from 0 to 360 in increments of 10. The radiation pattern is a figure-eight shape, indicating directional coverage with two main lobes. A legend at the bottom left shows a red line segment labeled "5.0GHz Vertical".</p>

# Pole Mounting FAP-U422EV

Follow this procedure to attach the unit to a pole vertically or horizontally using the supplied pole mount bracket and straps..

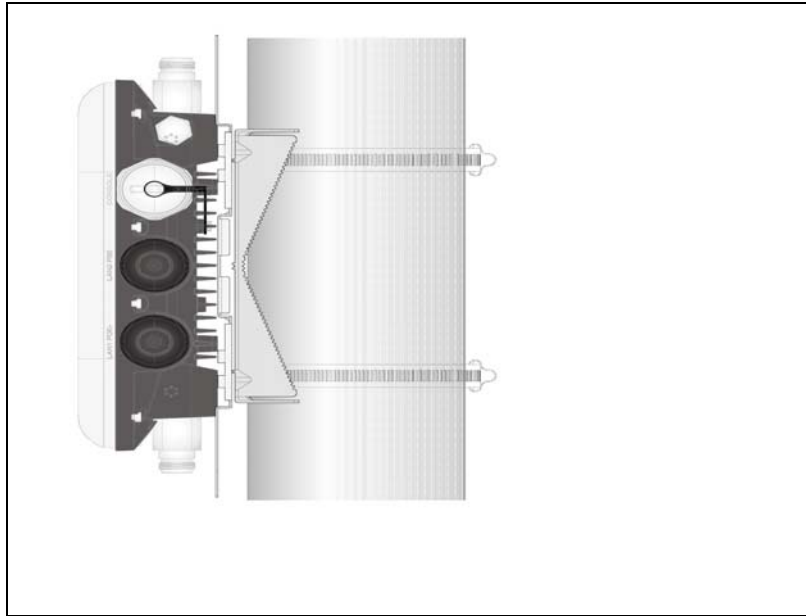
1. Attach the wall-mount base securely to the back of the unit using the provided mounting screws.
2. Attach the pole-mount bracket securely to the wall-mount base using the provided mounting screws.



3. Loop the pole straps through the slots on the bracket and then around the pole.

The pole mounting straps can be attached for either vertical or horizontal mounting.

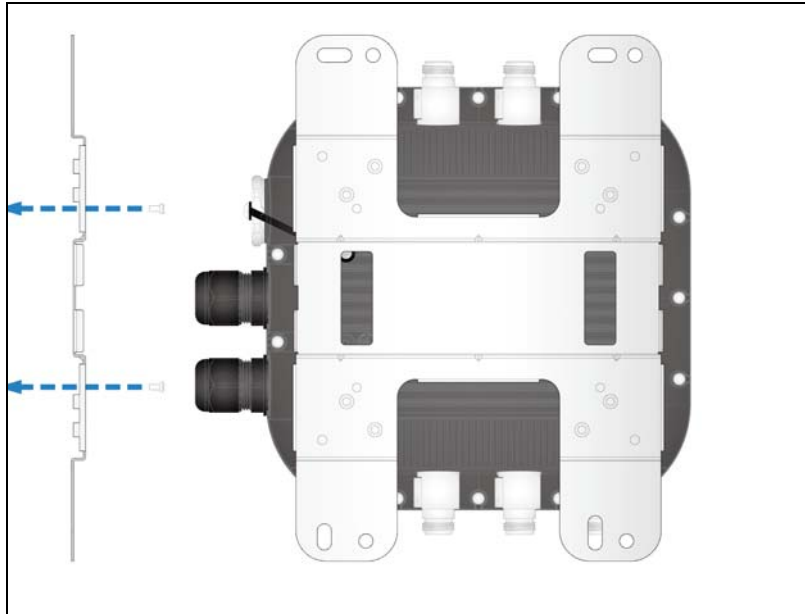
4. Tighten the straps with the provided screws to attach the unit securely to the pole.



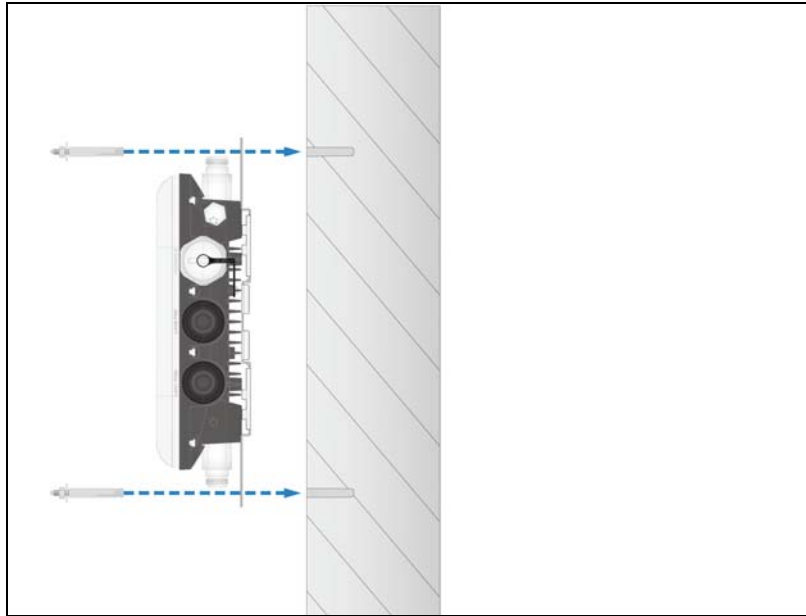
## Wall Mounting FAP-U422EV

Follow this procedure to attach the unit to a wall using the supplied wall mount bracket.

1. Using the wall-mount base as a template, mark the location of the mounting bolt holes on a flat wall surface.
2. Drill the mounting holes in the marked locations and hammer the bolts into the openings.
3. Attach the wall-mount base securely to the back of the unit using the provided mounting screws.



4. Attach the device onto the wall by using the mounting bolts to secure the mounting base to the wall.



## Planning AP Location

It is a good practice to conduct a sitesurvey to assess coverage area and look for problem areas such as poor RF coverage or high retries. Fortinet enables customers to easily complete a sitesurvey right from within the FAP-U422EV.

### Sitesurvey

Fortinet sitesurvey is a simple tool that aids in network planning to find the right placement (mounting location) of APs such that clients connected to these APs receive high throughput, excellent coverage. To find the right placement of your AP, connect your Wi-Fi client to the AP that is in the sitesurvey mode and move around the deployment perimeter to identify areas that provide good connectivity (based on the results from the sitesurvey tool) to the Wi-Fi client. You can adjust the placement of the AP depending on the sitesurvey results.

FAP-U422EV has a built in mechanism to perform a sitesurvey of a 11ac network that provide you with true validation of AP placement and RF coverage. Some of the benefits of using the sitesurvey features include:

- Fast and easy way to validate 11ac design

- No controller required while taking measurements at different floors and locations in the building
- Surveys using laptop or tablet or mobile phone
- Easy-to-use web UI for setting up and measuring survey data
- Real time RSSI, S/N ratio, 802.11 Tx and Rx rates
- Simple 3-step process - connect, configure, and monitor

## Using CLI

To get started with sitesurvey follow the simple procedure:

### Enabling Sitesurvey

```
sitesurvey enable
```

This command enables the sitesurvey mode. The AP will reboot into sitesurvey mode and display the sitesurvey prompt.

```
ss > _
```

### Disabling Sitesurvey

```
sitesurvey disable
```

This command disables the sitesurvey mode. AP will reboot into normal mode of operation.

### Setting Country Code and Channel

```
sitesurvey countrycode set <country code>
```

By default the country code is set to US. When you set a country code, the first valid channel and the max supported Tx power for radio 0 and radio 1 for that country code is automatically set. To override the default channel for a country code, enter the

```
sitesurvey channel set <radio_index> <channel> command.
```

Where,

- `radio_index` refers to the AP radios.
- Enter 1 for radio 1 (2.4 Ghz).
- Enter 2 for radio 2 (5Ghz).

To get the list of supported country codes, use the `ss countrycode help` command.

## Setting Inactivity Time

```
sitesurvey inactivitytime <itime>
```

This command sets the time (in seconds) the AP will remain in the sitesurvey mode before a client associates with it. The time is specified in seconds and by default the AP will remain in the sitesurvey mode for 3600s. After the period of inactivity, the AP will reboot into normal AP mode.

## Setting IP Address

```
sitesurvey ipconfig <ip_address> <netmask>
```

This command configures the sitesurvey AP with an IP address. You can use this IP address to access the sitesurvey GUI page via a browser. By default, the IP address and netmask are set to 192.168.0.1 and 255.255.255.0.

## Configuring SSID

```
sitesurvey ssid <radio_index> [<ssid>]
```

Where,

- `radio_index` can be 0, 1, or 3
- Enter 0 for radio 1 (2.4 Ghz)
- Enter 1 for radio 2 (5 Ghz)
- Enter 3 to specify SSID for both the radios

This command configures SSID for the specified radio. By default, SSID for radio 1 (2.4Ghz) is set to Meru\_Site\_Survey\_2.4 and SSID for radio 2 (5 Ghz) is set to Meru\_Site\_Survey\_5.

Examples

```
ss > sitesurvey ssid 3
MERU_SITE_SURVEY SSID is assigned for both radiol and radio2 as
MERU_SITE_SURVEY
ss > sitesurvey ssid 1 <?]? if SSID is not specified SSID is
assigned to radiol
as MERU_SITE_SURVEY_2.4 by default
ss > sitesurvey ssid 2 <?]? if SSID is not specified SSID is
assigned to radio2
as MERU_SITE_SURVEY_5 by default
```

When using the GUI, the browser window will reset after 3600 seconds of inactivity, irrespective of the time set for inactivity. The browser refresh time cannot be changed.

```
ss > sitesurvey ssid 3 <?]?] if SSID is not specified MERU_SITE_SURVEY_2.4 is assigned as SSID for radio1
```

MERU\_SITE\_SURVEY\_5 is assigned as SSID for radio2.

After configuring SSID on AP radios, you can use the following command to selectively (per radio) enable or disable broadcasting SSID.

```
sitesurvey publishssid <radio_index> [on|off]
```

By default, SSID for both radios are broadcast.

## Enable or Disable Radio

```
sitesurvey {radio | r} <radio_index> [on|off]
```

Where,

- radio\_index can be 0, 1, or 3
- Enter 0 for radio 1 (2.4 Ghz)
- Enter 1 for radio 2 (5 Ghz)
- Enter 3 for both the radios

This command enables or disables AP radio. Wi-fi clients connecting to the sitesurvey AP must use the same radio that is enabled in the AP. By default, both the radios are enabled.

## Configure Sitesurvey Refresh Rate

```
sitesurvey statsrefrate [<rate>]
```

This command configures the time interval (specified in milliseconds) at which the AP will collect and send (display) sitesurvey results. By default, the refresh rate is set to 1000ms. The sitesurvey results can be viewed from the sitesurvey GUI page or the CLI.

## Setting the Tx Power

```
sitesurvey txpwr set <radio_index> [<tx_power>]
```

Where,

- radio\_index can be 0, 1, or 3
- Enter 0 for radio 1 (2.4 Ghz)
- Enter 1 for radio 2 (5 Ghz)



- Enter 3 for both the radios

Use this command to selectively set the transmit power for AP radios. By default, Tx power is set to maximum possible Tx power based on the country code, channel and the hardware capabilities. The `sitesurvey txpwr set 3` command (without the power value) will set the max Tx power supported for the selected country to both the radios.

## Save Sitesurvey Configuration

```
sitesurvey save
```

After you have configured all sitesurvey options, enter this command to save your sitesurvey configuration. This command creates an ESSID with all configured parameters. Your Wi-Fi can now associate to this AP using the ESSID.

## Using GUI

To access the sitesurvey GUI page, enter the IP address of the AP. If not previously set, enter the default IP address (192.168.0.1) of the AP. By default, the GUI page shows the sitesurvey results page. Click the Configure button to access the sitesurvey configuration options.

Parameters	Description
SSID Radio 0 SSID Radio 1	Enter a value that you will be broadcast for connecting your Wi-Fi client. The default values are Meru_Site_Survey_2.4 for Radio 0 and Meru_Site_Survey_5 for Radio 1.
Country	Select a country from this list. This selection automatically sets the first valid channel for each radio. However, you can choose to override them by selecting a different channel number.
Radio 2.4 Ghz Radio 5 Ghz	Select ON or OFF to enable or disable a radio.
Tx Power Radio 0 Tx Power Radio 1	Enter transmit power for each of the radios. Maximum value for Radio 0 (2.4 Ghz) and maximum value for Radio 1 (5 Ghz) is dependent on the selected country and the channel.
2.4 Ghz Channels 5 Ghz Channels	Select a valid channel. By default this is automatically set to the first valid channel for the selected country.
Publish SSID Radio 0 Publish SSID Radio 1	Select ON or OFF to broadcast SSID.
Stats Refresh Rate	Enter the time interval (in milliseconds) to collect and send (display) sitesurvey results.
Inactivity time-out period	Enter the time interval (in seconds) for the AP to wait for client to connect. After the inactivity time period, the AP will reboot to normal AP mode.

After configuring the above parameters click the Apply button to save the configuration.

## Viewing Sitesurvey Results

Sitesurvey results can be viewed from CLI and using the GUI.

## Using GUI

By default, the Sitesurvey page is displayed when you connect to the AP via browser. The Sitesurvey page among other pre-configured values displays key information about the connectivity experience of your Wi-Fi client.

**Note:** The GUI page shows Sitesurvey results of only ONE client (the last connected client) connected to the AP. To view Sitesurvey results from all connected clients, use options from CLI

## About AP Location

The AP should be placed at a clear empty location on the Ceiling or side walls. Avoid mounting the AP near heavy metal objects such as refrigerator and microwave, which will block the radio waves, impact the antenna radiation patterns and interfere with the radio receiver.

## AP Placement Plan

Developing an AP placement plan does not always require the use of a planning/survey tool such as Ekahau sitesurvey. There will be installations where placing 11ac APs every 50-100 feet (depending on the signal strength, client density, and throughput capacity requirements) will be sufficient. These simple installations are characterized by a uniform structure where it is relatively trivial to predict coverage patterns of 11ac APs.

When coverage planning is required due to highly irregular building designs, contractual agreement, or some other reason, the recommendation is to use the planning tools available in Ekahau Site Survey.

A post-AP-installation sitesurvey is generally recommended. The recommendation is to use a sitesurvey tool like Ekahau sitesurvey.

## One-for-One AP Replacement

One question that is often asked related to migrating from non-11ac networks to 11ac networks is whether the network would work if a one-for-one swap is performed (i.e., replacing the 11n APs with 11ac APs). Assuming that the 11n network was designed to provide -65 dBm coverage or greater everywhere, the simple answer is yes. In addition, as mentioned previously, if the network is composed of mostly 11n clients, the network will likely perform even better with 11ac APs. Of course, the network will perform considerably better if the majority of clients are of the 11ac variety; however, if the network is to be optimized to deliver optimal performance for 11ac clients, higher AP densities will be required (as compared to a typical 11n network).

## AP Density

A good rule of thumb when determining the optimal 11n AP density, from the perspective of a station, is that a station, no matter where it is located, should be able to hear from 2 to 3 APs. This recommendation would still hold true for 11ac networks if the design called for approximately -65 dBm signal strength or greater everywhere; however, in order to support the highest data rates available in 11ac, higher AP densities will very likely be required. Higher AP densities will allow a client to hear more APs. Therefore, the recommendation for 11ac networks optimized for peak 11ac client performance is that clients should be able to hear from 3-5 APs.

Another consideration is that supporting 1024-QAM through a wall or some other signal attenuating obstruction is challenging, and therefore if you intend to optimize your network for 11ac performance, the recommendation is to put 11ac APs within line of sight of the intended coverage areas. Assuming line of site, 1024-QAM rates are achievable up to distances between 25 and 30 feet.

## AP Transmit Power

With higher AP densities, there will likely be a need to reduce AP transmit power to lessen the negative effects of co-channel interference (CCI) and adjacent channel interference (ACI). This is true for high-AP-density Single Channel Architecture (SCA) networks as well as Multi Channel Architecture (MCA) networks.

## 2.4 GHz vs. 5 GHz Signal Strength

Thus far, all of the discussions regarding signal strength and AP density have been focused on 11ac radios. As was already mentioned, performing one-for-one AP replacements is a valid approach if the network design requirements for signal strength are roughly the same as they were for the existing network (e.g., -65 dBm or >). If this is the case, the 2.4 GHz network coverage and signal strength will be comparable to what existed prior to performing the one-for-one AP swap to 11ac APs. If, however, higher AP densities are required to meet higher signal strength requirements (e.g., -52 dBm or >), then there is a strong likelihood that the new network will be over-provisioned in the 2.4 GHz band. If this is the case, the recommendation is to provision some of the 2.4 GHz radios as full-time spectrum sensors, and/or configure some of the 2.4 GHz radios to 5 GHz radios and enable channel layer load balancing across the 11ac channel layers for high client density areas. It should be mentioned that certain restrictions apply with channel layer load balancing.

## 4 Migrating to Wave2 FAP

The following section contains instructions for migrating from wave1 11ac APs. The information is applicable to AP122, AP822, AP832

### General Recommendation

The general recommendation when migrating from 11n and wave1 AP to wave2 (FAP-U422EV) is to proceed with one floor or section of a building at a time. This recommendation holds true for SCA (Single Channel Architecture) networks or MCA (Multi-Channel Architecture) networks, although the reasons behind these recommendations differ.

NOTE: It is also recommended that you increase the Tx power of FAPs to 20dBm after completing migration.

### Migrating from 11abgn MCA Networks to 11ac MCA Networks

For MCA networks, if 11ac APs were mixed with 11abgn APs in an area, clients that are moving through this area may prefer an 11ac 80 MHz channel to an 11an 40 MHz channel. This could potentially cause some clients to stick to 11ac APs while ignoring 11n APs that may offer better service. Therefore, the recommendation is to migrate floor-by-floor or wing-by-wing to avoid mixing 11ac and non-11ac APs in the same area of a building.

### Migrating from 11abgn SCA/VCell Networks to 11ac SCA/VCell Networks

For SCA (Single Channel Architecture) with VCell (Virtual Cell), it is recommended to avoid mixing AP model numbers for a given area, as VCell currently does not span across different AP model numbers. As with MCA (Multi Channel Architecture) networks, the general recommendation is to migrate floor-by-floor or wing-by-wing of a building.

At the border where 11ac APs are adjacent to 11abgn APs, there are a number of recommended techniques that can be used to prevent any issues related to VCell.

A border area could be the floor above or below, as well as a section or wing of a building that is adjacent to the area where a FAP has just been installed. The following configuration options would be recommended for 11ac AP and 11abgn AP border areas. Any one of the options listed below could be used to prevent VCell compatibility issues.

FAP-U422EV are configured to use different channels than the bordering non-wave2 access points.

Different ESS Profile Names are used for the FAP-U422EV and the bordering non-AP832s. (The same SSID can be used for both sets of APs.)

A different controller is used for each model of AP (11ac and non-11ac) and the controller index numbers are unique.

Again, just one of the three options listed above would be sufficient to satisfy the requirement when deploying SCA with VCell in areas where FAP-U422EV and non- FAP-U422EV are used.

## Validating Coverage Post-Migration

Once the new FAP-U422EV have been installed, channels have been selected, AP transmit power levels have been set, and so on, the recommendation is to do a thorough coverage survey throughout the entire deployment. The main goals here are to validate that the network is in fact providing the designed signal strength and SNR, and in the case of MCA deployments, that there is a minimal amount of overlapping coverage for APs that are sharing the same channel. Ekahau's sitesurvey suite has tools that can perform this task, whether the network was built using SCA or MCA.

If it is determined that there are areas where coverage does not meet the requirements, AP transmit power can be adjusted; or if external antennas are used, they may need to be adjusted. In some cases, additional APs may need to be deployed. The validation/adjustment process should be iterative until all areas of the deployment have the coverage specified in the design requirements.

## Network Tuning

It is highly unlikely that any initial Wi-Fi deployment will be optimally tuned, even if extreme care was taken during the planning and implementation phases, as there are too many variables to account for when dealing with Wi-Fi. Although it is beyond the scope of this guide to

delve deeply into the art and science of Wi-Fi network tuning, this section will touch on a number of things that should be checked and, if applicable, adjusted.

There are a number of statistics that should be monitored post-deployment to determine how well the network is running, such as client counts per radio, channel utilization rates, radio retry rates, client data rates, application performance, SLAs met, etc.

Monitoring channel utilization rates, for example, can help identify where capacity needs may be high enough to warrant adding channel capacity. If adding more channel capacity is not the preferred option to increase throughput capacity, another option could be to upgrade clients from the existing 11n set to 11ac.

Network monitoring and tuning should be an ongoing activity, as RF environments, client mixes, application requirements, etc., tend to change over the course of the life of a Wi-Fi network.

## Migrating in FortiWLM

In order to facilitate the FAP-U422EV migration within FortiWLC (SD) and FortiWLM, a guide that describes the process to swap out APs has been created. Once the swap process has been performed on the controller, FAP-U422EV automatically get updated in FortiWLM.





# A Regulatory Information

The Fortinet Access Point (APs) must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product. For country-specific approvals, see below. Fortinet Networks, Inc. is not responsible for any radio or television interference caused by unauthorized modification of APs, or the substitution or attachment of connecting cables and equipment other than that specified by Fortinet Networks, Inc. The correction of interference caused by such unauthorized modification, substitution or attachment is the responsibility of the user. Fortinet Networks, Inc. and its authorized resellers or distributors are not liable for any damage or violation of government regulations that may arise from the user failing to comply with these guidelines.

# Regulatory Specifications

**TABLE 1:** *Regulatory Specifications*

Category	Items
Safety	<ul style="list-style-type: none"><li>• UL 60950-1</li><li>• CSA C22.2</li><li>• EN 60950-1</li><li>• IEC 60950-1</li></ul>
Unintentional Radiation Compliance	<ul style="list-style-type: none"><li>• FCC Part 15.107 - 47CFR15.107</li><li>• FCC Part 15.109 - 47CFR15.109 B</li><li>• ICES-003 Class B</li><li>• EN 301 489-1</li><li>• EN 301 489-17</li><li>• EN55022 Class B</li><li>• EN55024/AS/NZS CISPR 24</li><li>• VCCI Class B</li></ul>
Intentional Radiation Compliance	<ul style="list-style-type: none"><li>• FCC Part 15.247 - 47 CFR Ch. I</li><li>• FCC Part 15.407 - 47 CFR15.407</li><li>• RSS-210</li><li>• EN 300 328</li><li>• EN 301 893</li><li>• Japan Radio (Ninsho)</li></ul>

## Declaration of Conformity, Federal Communication Commission

### Manufacturer Information

Fortinet Networks, Inc  
894 Ross drive,  
Sunnyvale, CA 94089  
USA

## Declaration of Conformity

This device complies with Part 15 rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

Device Name	FCC ID Number
FAP-U422EV	TVE-291BB033

This product is FCC marked according to the provisions of FCC Part 15.



This equipment has been tested and found to comply with the limits of a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and radiates radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference. However, there is no guarantee that interference will not occur. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.



The Part 15 radio device operates on a non-interference basis with other devices operating at this frequency when using the integrated antennas. Any changes or modification to the product not expressly approved by Fortinet could void the user's authority to operate this device.

## Declaration of Conformity, Industry Canada

This equipment is in compliance with the essential requirements of other relevant provisions of Directive.

## Manufacturer Information

Fortinet Networks, Inc  
894 Ross drive,  
Sunnyvale, CA 94089  
USA

## Declaration of Conformity

The Class B digital portion of this apparatus complies with Canadian standard ICES-003. These devices comply with RSS210 of Industry Canada.

La partie numérique de Classe B de cet appareil est conforme à la norme ICES-003 canadien. Ces appareils sont conformes à la norme RSS 210 d'Industrie Canada..

Per RSS 210 A9.5 point 7:

- The device for the band 5150-5250 MHz is only for indoor usage to reduce potential for harmful interference to co-channel mobile satellite systems (The device for the band 5150-5250 MHz is only for indoor usage to reduce potential for harmful interference to co-channel mobile satellite systems)
- The maximum antenna gain permitted (for devices in the bands 5250-5350 MHz and 5470-5725 MHz) to comply with the EIRP limit; and the maximum antenna gain permitted (for devices in the band 5725-5825 MHz) to comply with the EIRP limits specified for point-to-point and non point-to-point operation as appropriate, as stated in section A9.2(3) (The maximum antenna gain permitted (for devices in the bands 5250-5350 MHz and 5470-5725 MHz) to comply with the EIRP limit; and the maximum antenna gain permitted (for devices in the band 5725-5825 MHz) to comply with the EIRP limits specified for point-to-point and non point-to-point operation as appropriate, as stated in section A9.2(3).
- In addition, users should also be cautioned to take note that high-power radars are allocated as primary users (meaning they have priority) of the bands 5250-5350 MHz and 5650-5850 MHz and these radars could cause interference and/or damage to WLAN devices (En outre, les utilisateurs doivent également être avertis de prendre note que les radars à haute puissance sont désignés comme utilisateurs principaux (ils ont la priorité) des bandes 5250-5350 MHz et 5650-5850 MHz et ces radars pourraient cause des interférences et / ou endommager aux appareils WLAN.
- These devices are not permitted to operate in the 5600 - 5650 MHz band (Ces appareils ne sont pas autorisés à opérer dans le 5600 - bande 5650 MHz.)

For products available in the Canadian markets, only channels 1 through 11 can be operated. Selection of other channels is not authorized. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.

Pour les produits disponibles sur les marchés canadiens, seuls les canaux 1 à 11 peuvent être utilisés. La sélection d'autres canaux n'est pas autorisée. Son fonctionnement est soumis aux

deux conditions suivantes: (1) cet appareil ne doit pas provoquer d'interférences et (2) cet appareil doit accepter toute interférence, y compris celles pouvant causer un mauvais fonctionnement de ce dispositif

This device and its listed antenna(s) must not be co-located or operated in conjunction with any other antenna or transmitter

Cet appareil et son antenne énuméré (s) ne doivent pas être situés ou exploités conjointement avec une autre antenne ou transmetteur

The term "IC" before the equipment certification number only signifies that the Industry Canada technical specifications were met.

Le terme "IC" avant le numéro de certification de l'équipement signifie seulement que les spécifications techniques d'Industrie Canada ont été atteints

To reduce the potential radio interference to other users, the antenna type and gain should be chosen so that the equivalent isotropic radiated power (EIRP) is not more than that required for successful communication. This device complies with Class B Limits of Industry Canada. Operation is subject to the following two conditions:

Pour réduire le risque d'interférence avec d'autres utilisateurs, le type d'antenne et le gain doivent être choisis de telle sorte que la puissance isotrope rayonnée équivalente ne soit pas supérieure à celle requise pour une communication réussie. Cet appareil est conforme aux limites de Classe B d'Industrie Canada. Son fonctionnement est soumis aux deux conditions suivantes

- This device may not cause harmful interference, and
- Cet appareil ne doit pas provoquer d'interférences nuisibles, et
- This device must accept any interference received, including interference that may cause undesired operation.
- Cet appareil doit accepter toute interférence reçue, y compris les interférences pouvant entraîner un fonctionnement indésirable.

To prevent radio interference to the licensed service, this device is intended to be operated indoors and away from windows to provide maximum shielding. Equipment (or its transmit antenna) that is installed outdoors is subject to licensing.

Pour empêcher que cet appareil cause du brouillage au service faisant l'objet d'une licence, il doit être utilisé à l'intérieur et devrait être placé loin des fenêtres afin de fournir un écran de

blindage maximal. Si le matériel (ou son antenne d'émission) est installé à l'extérieur, il doit faire l'objet d'une licence.

Device Name (Nom de l'appareil)	Industry Canada ID Number (Industrie Canada Numéro d'identification)
FAP-U422EV	7280B-291BB033

## Declaration of Conformity, R&TTE Directive 1999/5/EC

This equipment is in compliance with the essential requirements of other relevant provisions of Directive.

### Declaration of Conformity

Hereby, Networks Inc. declares that this unit is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

To obtain the declaration of conformity (DoC) for R&TTE Directive, please access the following URL address. <http://www.Fortinetnetworks.com>

Notice for customers: the following information is only applicable to equipment sold in countries applying EU directives. System may be operated in following countries:

*EU Countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.*

This equipment can be operated in other non-European countries.

*EFTA Countries: Norway and Switzerland*

*EU Applicants: Albania, Bosnia and Herzegovina*

*EU Candidate: Iceland, Macedonia and Montenegro*

The following standards were applied:

- EMC-EN 301.489-1 Article 3.1 (b) of R&TTE Directive; EN 301.489-17 Article 3.1 (b) of R&TTE Directive
- Health & Safety-EN60950-1
- Radio-EN 300 328 Article 3.1 (b) of R&TTE Directive; EN 301.893 Article 3.1 (b) of R&TTE Directive

- The conformity assessment procedure referred to in Article 10.4 and Annex III of Directive 1999/5/EC has been followed.

Language	Content of Declaration
<b>Български- (Bulgarian)</b>	това оборудване е в съответствие със съществените изисквания и другите приложими разпоредби на Директива 1999/5/ЕО
<b>Češka- (Czech)</b>	Toto zařízení je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice 1999/5/ES
<b>Dansk- (Danish)</b>	Dette udstyr er i overensstemmelse med de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF
<b>Deutsch- (German)</b>	Das Udstyr ist in Übereinstimmung mit den wesentlichen Anforderungen und anderen relevanten Bestimmungen der Richtlinie 1999/5/EG
<b>Esti- (Estonian)</b>	See seade on vastavuses oluliste Krav ja muude asjaomaste komisjoni direktiivi 1999/5/EÜ
<b>English- (English)</b>	This equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC
<b>Español- (Spanish)</b>	Este equipo cumple con el requerimiento esencial y otras comisiones pertinentes de la Directiva 1999/5/CE
<b>Ελληνικά- (Greek)</b>	Αυτή η συσκευή είναι σύμφωνα με τις βασικές ΚραV και άλλα αρμόδια επιτροπή της οδηγίας 1999/5/ΕΚ
<b>Français- (French)</b>	Cet appareil est en conformité avec le Krav essentielles et aux autres commissions pertinentes de la directive 1999/5/CE
<b>Íslenska- (Icelandic)</b>	Þessi búnaður er í samræmi við nauðsynleg Krav og aðrar viðeigandi þóknun tilskipunar 1999/5/EB
<b>Italiano- (Italian)</b>	Questa apparecchiatura è conforme con il Krav essenziali e altri servizi della Commissione, della direttiva 1999/5/CE
<b>Latviešu- (Latvian)</b>	Šis aprīkojums ir saskaņā ar būtiskajām Krav un citiem attiecīgajiem Komisijas Direktīvas 1999/5/EK
<b>Lietuvių- (Lithuanian)</b>	Ši įranga atitinka esminius Krav ir kitomis atitinkamomis Komisijos direktyvos 1999/5/EB
<b>Nederlands- (Dutch)</b>	Deze apparatuur voldoet aan de essentiële Krav en andere relevante provisies van Richtlijn 1999/5/EG
<b>Malti- (Maltese)</b>	Dan it-tagħmir huwa konformi mal-Krav essenzjali u kummissjoni rilevanti oħra tad-Direttiva 1999/5/KE
<b>Magyar- (Hungarian)</b>	Ez a berendezés megfelel a vonatkozó alapvető Krav és egyéb releváns bizottsági irányelv 1999/5/EK
<b>Norsk- (Norwegian)</b>	Dette utstyret er i samsvar med de grunnleggende Krav og andre relevante oppdrag i direktiv 1999/5/EF
<b>Polski- (Polish)</b>	Ten sprzęt jest zgodny z zasadniczymi KRAV oraz innych właściwych komisji dyrektywy 1999/5/WE
<b>Portugues- (Portuguese)</b>	Este equipamento está em conformidade com o Krav essencial e outra comissão pertinente da Directiva 1999/5/CE
<b>Română- (Romanian)</b>	Acest echipament este în conformitate cu Krav esențiale și alte Comisie relevante ale Directivei 1999/5/CE
<b>Slovensko- (Slovenian)</b>	Ta oprema je v skladu z bistvenimi Krav in druge ustrezne provizije Direktive 1999/5/ES
<b>Slovensky- (Slovak)</b>	Toto zariadenie je v súlade so základnými Krav a ostatnými príslušnými útvarmi Komisie smernice 1999/5/ES
<b>Suomi- (Finnish)</b>	Tämä laite on yhdenmukainen olennaisten Krav ja muiden asiaan liittyvien komission direktiivin 1999/5/EY
<b>Svenska- (Swedish)</b>	Denna utrustning är i överensstämmelse med de grundläggande Krav och andra relevanta uppdrag av direktiv 1999/5/EG

This device is intended to be used in all EU and EFTA countries.



Device Name	Certification Report Number
FAP-U422EV	TBD

## VCCI Statement

この装置は、クラスB情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。

取扱説明書に従って正しい取り扱いをして下さい。

VCCI-B

### English Translation

This is a Class B product based on the standard of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. User shall install and use the equipment according to the instruction manual.

## General Information of RF Exposure

### International Guidelines

This Device Meets International Guidelines for Exposure to Radio Waves.

The FAP-U422EV device includes radio transmitters and receivers. It is designed not to exceed the limits for exposure to radio waves (radio frequency electromagnetic fields) recommended by international guidelines. The guidelines were developed by an independent scientific organization (ICNIRP) and include a substantial safety margin designed to ensure the safety of all persons, regardless of age and health.

As such the systems are designed to be operated as to avoid contact with the antennas by the end user. It is recommended to set the system in a location where the antennas can remain at



least a minimum distance as specified from the user in accordance to the regulatory guidelines which are designed to reduce the overall exposure of the user or operator.

Separation Distance		
MPE	Distance	Limit
0.82 mW/cm2	25 cm (9.84 inches)	1.00 mW/cm2

The World Health Organization has stated that present scientific information does not indicate the need for any special precautions for the use of wireless devices. They recommend that if you are interested in further reducing your exposure then you can easily do so by reorienting antennas away from the user or placing the antennas at a greater separation distance than recommended.

## FCC Guidelines

This device meets FCC guidelines for exposure to radio waves.

The and FAP-U422EV include radio transmitters and receivers. It is designed not to exceed the limits for exposure to radio waves (radio frequency electromagnetic fields) as referenced in FCC Part 1.1310. The guidelines are based on IEEE ANSI C 95.1 (92) and include a substantial safety margin designed to ensure the safety of all persons, regardless of age and health.

As such the systems are designed to be operated as to avoid contact with the antennas by the end user. It is recommended to set the system in a location where the antennas can remain at least a minimum distance as specified from the user in accordance to the regulatory guidelines which are designed to reduce the overall exposure of the user or operator.

The device has been tested and found compliant with the applicable regulations as part of the radio certification process.

The FCC recommends that if you are interested in further reducing your exposure then you can easily do so by reorienting antennas away from the user or placing the antennas at a greater separation distance then recommended or lowering the transmitter power output.

Separation Distance		
MPE	Distance	Limit
0.82 mW/cm2	25 (9.84 inches)	1.00 mW/cm2

## Industry Canada Guidelines

This device meets Industry Canada guidelines for exposure to radio waves.

The and FAP-U422EV include radio transmitters and receivers. It is designed not to exceed the limits for exposure to radio waves (radio frequency electromagnetic fields) as referenced in Health Canada Safety Code 6. The guidelines include a substantial safety margin designed into the limit to ensure the safety of all persons, regardless of age and health.

As such the systems are designed to be operated as to avoid contact with the antennas by the end user. It is recommended to set the system in a location where the antennas can remain at least a minimum distance as specified from the user in accordance to the regulatory guidelines which are designed to reduce the overall exposure of the user or operator.

Health Canada states that present scientific information does not indicate the need for any special precautions for the use of wireless devices. They recommend that if you are interested in further reducing your exposure you can easily do so by reorienting antennas away from the user, placing the antennas at a greater separation distance than recommended, or lowering the transmitter power output.

Separation Distance		
MPE	Distance	Limit
0.82 mW/cm2	25 (9.84 inches)	1.00 mW/cm2

Health Canada states that present scientific information does not indicate the need for any special precautions for the use of wireless devices. They recommend that if you are interested in further reducing your exposure you can easily do so by reorienting antennas away from the user, placing the antennas at a greater separation distance than recommended, or lowering the transmitter power output.

# B Cautions and Warnings

The cautions and warnings that appear in this manual are listed below in English, German, French, and Spanish. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## Cautions

Fortinet Wireless Access Points are radio transmission devices and as such are subject to governmental regulations. Fortinet Wireless Access Points are sold through authorized, non-retail, distribution channels and are required to be deployed by a Professional Installer / Qualified Network Administrator. The professional installer responsible for the configuration and operation of Access Points must ensure the installation complies with local regulations, frequencies, channels and output power.

The power injector module is designed for indoor use only. Never mount the power injector outside with the FAP-U422EV or where it may be exposed to the elements. The FAP-U422EV does NOT support standard 802.3af compliant power, therefore the supplied injector must be used.

Never construct a radio mast, pole, or tower near overhead power lines.

Be sure that grounding is available and that it meets local and national electrical codes. For additional lightning protection, use lightning rods, lightning arrestors, or surge suppressors.

Do not install the power injector module outdoors. The unit is for indoor installation only.

High power radars are allocated as primary users (meaning they have priority) in the 5250-5350 MHz and 5650-5850 MHz frequency ranges, and these radars could cause interference and/or damage to LE-LAN devices.

## Warnings

A warning calls your attention to a possible hazard that can cause injury or death. The following are the warnings used in this manual.

"Achtung" weist auf eine mögliche Gefährdung hin, die zu Verletzungen oder Tod führen können. Sie finden die folgenden Warnhinweise in diesem Handbuch:

Un avertissement attire votre attention sur un risque possible de blessure ou de décès. Ci-dessous, vous trouverez les avertissements utilisés dans ce manuel.

Una advertencia le llama la atención sobre cualquier posible peligro que pueda ocasionar daños personales o la muerte. A continuación se dan las advertencias utilizadas en este manual.

antenas del punto de acceso.



With plastic covers removed, this product is suitable for use in environmental air-handling space in accordance with the Section 300-22(c) of the National Electric Code and Sections 2- 128.12 - 010 (3) and 12 - 100 of the Canadian Electrical Code. Part 1. C22. 1. For other countries, consult local authorities for regulations.

Bei abgenommener Kunststoffabdeckung ist dieses Produkt zur Verwendung in einem Umgebungsluftraum gemäß Abschnitt 300-22(c) des National Electric Code und Abschnitt 2- 128.12 - 010 (3) und 12 - 100 des Canadian Electrical Code Teil 1. C22.1 geeignet. Die Vorschriften für andere Länder sind bei den örtlichen Behörden erhältlich.

Sous réserve que ses couvercles de plastique soient déposés, cet appareil est adapté à une utilisation dans les vides de construction des bâtiments selon la section 300-22(c) du code NEC (National Electric Code) et les sections 2- 128.12 - 010 (3) et 12 - 100 du Code électrique du Canada, partie 1. C22. 1. Pour tous les autres pays, consulter les organismes de réglementation locaux.

Una vez desprendidas las cubiertas de plástico, este producto es adecuado para su uso en el espacio aéreo circundante en conformidad con la sección 300-22(c) del National Electric Code (Código Eléctrico Nacional de EE.UU.) y las secciones 2- 128.12 - 010 (3) y 12 - 100 del Código Eléctrico de Canadá. Parte 1. C22. 1. En otros países, consulte a las autoridades locales competentes para informarse acerca de las normativas vigentes.



Any Ethernet cables installed in air-handling spaces should be suitable under NEC Article 800.50 and marked accordingly for use in plenums and air-handling spaces with regard to smoke propagation, such as CL2-P, CL3-P, MPP (Multi Purpose Plenum), or CMP (Communications Plenum).

Alle Ethernet Kabel, die in Lüftungsräumen installiert werden, sollten gemäß NEC Artikel 800.50 geeignet sein und entsprechend zur Verwendung in Hohlräumen (Plenum) und Lüftungsräumen im Hinblick auf Rauchausbreitung gekennzeichnet sein, z.B. CL2-P, CL3-P, MPP (Multi Purpose Plenum) oder CMP (Communications Plenum).

Les câbles Ethernet installés dans un vide d'air doivent correspondre aux critères de l'article 800.50 du code NEC et identifiés en conséquence comme adaptés à une utilisation dans les vides de construction des bâtiments en matière de propagation de la fumée (marquages CL2-P, CL3-P, MPP (Multi Purpose Plenum) ou CMP (Communications Plenum)).

Todos los cables Ethernet instalados en espacios aéreos deben cumplir con el artículo 800.50 del NEC y estar marcados adecuadamente para su uso en espacios aéreos y plenums en lo concerniente a la propagación de humo, tales como CL2-P, CL3-P, MPP (Plenum multifuncional), o CMP (Plenum de comunicaciones).



Indoor antennas must be positioned to observe minimum separation of 20 cm. (~ 8 in.) from all users and bystanders. For the protection of personnel working in the vicinity of inside (downlink) antennas, the following guidelines for minimum distances between the human body and the antenna must be observed.

The installation of the indoor antenna must be such that, under normal conditions, all personnel cannot come within 20 cm. (~ 8.0 in.) from any inside antenna. Exceeding this minimum separation will ensure that the employee or bystander does not receive RF-exposure beyond the Maximum Permissible Exposure according to local country regulatory approval.

Indoorantennen müssen so positioniert werden, dass ein Mindestabstand von 20 cm (ca. 8 Zoll) zu allen Benutzern und anderen Personen gewahrt wird. Zum Schutz von Personal, das in der Nähe von Innenantennen (Downlink) arbeitet, sind die folgenden Richtlinien für Mindestabstand zwischen dem menschlichen Körper und der Antenne zu beachten.

Die Innenantenne muss so installiert werden, dass sich unter normalen Bedingungen kein Personal bis auf weniger als 20 cm (ca. 8 Zoll) an eine Innenantenne annähern kann. Durch Überschreitung dieses Mindestabstands wird sichergestellt, dass Mitarbeiter oder andere Personen keiner RF-Exposition über die maximal zulässige Exposition (MPE; Maximum Permissible Exposure) gemäß FCC CFR 47, Abschnitt 1.1310 (Grenzwerte für die allgemeine Bevölkerung/unkontrollierte Exposition) ausgesetzt werden.

Les antennes intérieures doivent être positionnées de façon à respecter une distance minimum de 20 cm par rapport aux utilisateurs et aux tiers. Pour la protection du personnel travaillant à proximité des antennes intérieures (liaison descendante), respecter les directives suivantes pour assurer des distances minimales entre les êtres humains et les antennes.

Toute antenne intérieure doit être installée de telle sorte que, dans des conditions normales, le personnel ne puisse s'en approcher à moins de 20 cm. Cette distance minimale est destinée à garantir qu'un employé ou un tiers ne sera pas exposé à un rayonnement radioélectrique supérieur à la valeur maximale autorisée, telle qu'elle est définie dans les limites d'exposition non contrôlées pour la population par la réglementation de la FCC CFR 47, section 1.1310.

Las antenas interiores deben colocarse de manera que se observe una separación mínima de 20 cm. (~ 8 pulg.) respecto a todos los usuarios y circunstantes. Para la protección del personal que trabaje en las inmediaciones de las antenas interiores (receptoras), deben observarse las siguientes directrices relativas a la distancia mínima entre el cuerpo humano y la antena.

La instalación de la antena interior debe efectuarse de tal modo que, en condiciones normales, ningún miembro del personal pueda acercarse a menos de 20 cm. (~ 8,0 pulg.) de cualquier antena interior. El cumplimiento de este mínimo de separación asegura que el empleado o circunstante no recibirá exposición a radiofrecuencia por encima de la Exposición Máxima Permissible conforme a la normativa FCC CFR 47, sección 1.1310, es decir, los límites asignados a la Exposición Incontrolada/Población Civil.

# C Additional Notes

## Maximum EIRP

The EIRP is the sum of transmit power and antenna gain. By default, FAP-U422EV EIRP is set lower than the regulatory limit.

## Manufacturing Information

The FAP-U422EV models are built in China. Contact Fortinet Networks for manufacturing related information.

## Distributed Antenna Systems (DAS)

Fortinet Networks does not certify or endorse any specific Distributed Antenna System (DAS) vendors. Fortinet Networks will provide support to Fortinet Wi-Fi customers that use distributed antennas within the terms and conditions of the FortinetAssure Terms of Service and in accordance with the customer's support agreement. Fortinet Customer Support will support Fortinet software and hardware, and will work jointly with DAS vendors to identify and troubleshoot issues, but any support related to RF issues, including RF coverage, shall be the responsibility of the DAS vendor.

Fortinet Networks recommends that customers use only a DAS that has been tested to work with Fortinet hardware and software. Fortinet does not provide any site surveys, design or implementation of Wi-Fi over DAS. Fortinet recommends that customers obtain such services from a trained and qualified systems integrator or from their DAS vendor.

## Air Handling Space Requirements

FAP-U422EV are not plenum rated.

The products should be installed in accordance with all applicable, local regulations and practices.

# Frequencies Blocked for Regulatory Compliance

These products are for indoor use only, in U-NII-1 and/or U-NII-3 band when Dynamic Frequency Selection, DFS, from 5.25-5.35 GHz and 5.47-5.725 GHz, is disabled. With DFS approval, these products can operate in U-NII-2 or U-NII-2e. To ensure compliance with local regulations, be sure to set your Access Point to the country in which you are using the Access Point.

## Underwriters Laboratories

Use only listed e information technology equipment (ITE) I.T.E. equipment.

The unit is intended for installation in Environment A as defined in IEEE 802.3.All interconnected equipments must be contained within the same building, including the interconnected equipment's associated LAN connection.


# Restriction of Hazardous Substances

## European Community

This device complies the Restriction of Hazardous Substances Directive (RoHS) for its restriction of the use of certain hazardous substances in electrical and electronic equipment for European Union.

## China

This device complies Administrative Measure on the Control of Pollution Caused by Electronic Information Products or China RoHS. FAP-U422EV may contain hazardous substances are marked with the EIP logo including an Environment Friendly Use Period (EFUP) value in 10 years.

AP832	Toxic and Hazardous Substances or Elements						
Component with toxic and hazardous substances	Pb (Lead)	Hg (Mercury)	Cd (Cadmium)	Cr(VI) (Hexavalent Chrome)	PBB (Polybrominated biphenyl)	PBDE (Polybrominated diphenyl ether)	
Circuit Modules	X	0	0	0	0	0	
Metal Parts	0	0	0	0	0	0	
Plastic and Polymeric Parts	0	0	0	0	0	0	
<div>O: Indicates that the content of the toxic and hazardous substance in all the homogenous materials of the part is below the concentration limit requirement for RoHS compliance. X: Indicates that the content of the toxic and hazardous substance in at least one homogeneous material of the part exceeds the concentration limit requirement for RoHS compliance</div>							