



# Ruckus Wireless™ SPoT™ Release 4.4.1 and vSPoT™ Release 3.4.1

## User Guide

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[www.ruckuswireless.com](http://www.ruckuswireless.com)

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# About This Guide

This User Guide provides information on how to set up and manage the Ruckus Wireless™ SmartPositioning Technology (SPoT™) system for use in gathering location data from Ruckus Wireless WiFi controllers and Access Points.

This guide is written for service operators and system administrators who are responsible for managing, configuring, and troubleshooting Wi-Fi networks. It assumes a basic working knowledge of local area networks, wireless networking, and wireless devices.

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**NOTE** Refer to the release notes shipped with your product to be aware of certain challenges when upgrading to this release.

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Most user guides and release notes are available in Adobe Acrobat Reader Portable Document Format (PDF) or HTML on the Ruckus Wireless Support Web site at <https://support.ruckuswireless.com/contact-us>.

## Document Conventions

[Table 1: Text conventions](#) on page 6 and [Table 2: Notice conventions](#) on page 7 list the text and notice conventions that are used throughout this guide.

Table 1: Text conventions

Convention	Description	Example
message phrase	Represents messages displayed in response to a command or a status	[Device Name] >
user input	Represents information that you enter	[Device Name] > set ipaddr 10.0.0.12
<b>user interface controls</b>	Keyboard keys, software buttons, and field names	Click <b>Create New</b>
<b>Start &gt; All Programs</b>	Represents a series of commands, or menus and submenus	Select <b>Start &gt; All Programs</b>
<b>ctrl+V</b>	Represents keyboard keys pressed in combination	Press <b>ctrl+V</b> to paste the text from the clipboard.
<b>screen or page names</b>		Click <b>Advanced Settings</b> . The <b>Advanced Settings</b> page appears.
<b>command name</b>	Represents CLI commands	

Convention	Description	Example
parameter name	Represents a parameter in a CLI command or UI feature	
<i>variable name</i>	Represents variable data	{ZoneDirectorID}
filepath	Represents file names or URI strings	http://ruckuswireless.com

Table 2: Notice conventions

Notice type	Description
<b>NOTE</b>	Information that describes important features or instructions
<b>CAUTION!</b>	Information that alerts you to potential loss of data or potential damage to an application, system, or device
<b>WARNING!</b>	Information that alerts you to potential personal injury

## Related Documentation

For a complete list of documents that accompany this release, refer to the Release Notes.

In addition to this User Guide, the SmartPositioning documentation set includes the following:

- **Release Notes:** Provide information about the current software release, including new features, enhancements, and known issues.
- **Calibrator App Quick Start Guide:** Provides information on installation and configuration of the Calibrator App, for both iOS and Android clients.
- **vSPoT Installation Guide:** Provides information on installation of a virtual SPoT instance on a VMware virtual machine. Differences between vSPoT and cloud-based SPoT are detailed in the vSPoT Installation Guide or in this SPoT User Guide.

## Documentation Feedback

Ruckus Wireless is interested in improving its documentation and welcomes your comments and suggestions. You can email your comments to Ruckus Wireless at: docs@ruckuswireless.com

When contacting us, please include the following information:

- Document title
- Document part number (on the cover page)
- Page number (if appropriate)

For example:

- SPoT Release 4.2 and vSPoT Release 3.2 User Guide
- Part number: 800-71431-001 Revision A
- Page 88



# Introducing the Ruckus Wireless SmartPositioning Technology (SPoT) Solution

SPoT enables retailers, stadiums, and transportation hubs to enhance the way they interact with customers based on precise location.

Many organizations face these simple and important, but sometimes difficult to answer questions:

- How can I help my customers navigate through the large mall and deliver timely coupons to get their business?
- How much of my business last week was due to repeat customers?
- How long did passengers have to wait on average for their train?

The Ruckus Wireless SPoT solution provides the necessary intelligence to answer these questions. Specifically, location-sensitive and public-facing organizations can benefit from these services:

- Indoor way-finding in complex environments, for both customers and employees
- Delivering highly-relevant, geo-targeted advertising and promotions
- Footfall analytics
- Understanding in-facility customer behavior
- Improving the guest experience

With accurate indoor positioning that is cost-effective, and simple to deploy and use, enterprises can now create the right indoor contexts for marketing campaigns, develop comprehensive footfall analysis and provide varied forms of digital concierge services to customers and employees. These location based services and the intelligence they inherently provide can benefit a number of markets, including:

- Retail
- Hospitality
- Healthcare
- Education
- Warehousing and logistics
- Smart cities/Government
- Convention and event logistics

Ruckus SPoT makes it simple to navigate complex indoor environments, study footfall trends, and enable context driven content delivery, turning wireless LAN systems into indispensable tools for businesses and customers alike.

## How It Works

The Ruckus SmartPositioning solution collects the RSSI information of mobile clients from an existing Ruckus ZoneFlex deployment, and pushes the information to a SPoT server in the cloud. The SPoT server then computes location estimates from the RSSI information and pushes the location estimates to an API server, which allows the relevant customer-facing applications to consume the location data through a set of APIs.

The Ruckus SPoT smart positioning solution includes the following components:

- SPoT Positioning Engine - pinpoints in real time a user's location in any Ruckus WiFi-enabled environment.
- SPoT Location Analytics Dashboard - delivers a rich set of client location information.
- SPoT Engagement Tools - including a set of APIs to power a new generation of mobile apps. These tools empower developers to build "Location Intelligent" features into a new generation of mobile applications.

## SPoT Server Topology

This section illustrates and describes the SPoT Server topology.

The cloud-based SPoT software is hosted at a cloud provider's data center. A high level architecture for the SPoT Server and other required components is illustrated in [Figure 1: SmartPositioning high level architecture](#) on page 10.

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**NOTE** Ruckus also offers a virtualized version of SPoT (virtual SPoT, or vSPoT) that can be installed on a virtual machine on customer's premises. For more information, see the *vSPoT Installation Guide*, available from [support.ruckuswireless.com](http://support.ruckuswireless.com).

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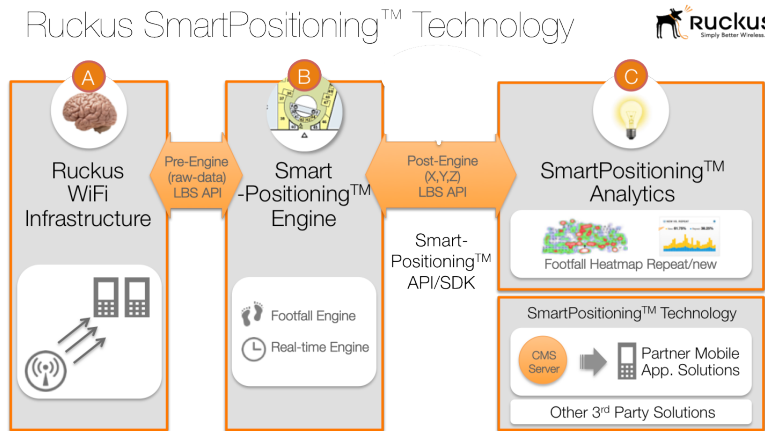
**NOTE** For the purposes of this document, the terms "SPoT" and "vSPoT" generally refer to the cloud-hosted and virtual versions of Ruckus SmartPositioning Technology (SPoT), respectively. In many cases, the term "SPoT" collectively refers to both the cloud-hosted and virtual SPoT versions, while "vSPoT" refers to the virtual application only.

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The complete SmartPositioning solution consists of the following components:

- [Wireless Infrastructure](#)
- [Venues](#)
- [SPoT Server](#)
- [API Server](#)
- [SPoT Administration Portal](#)
- [Analytics Dashboard](#)
- [Calibrator App](#)

Figure 1: SmartPositioning high level architecture



## Wireless Infrastructure

SPoT is designed to work with either a ZoneDirector or SmartZone controller, along with supported Access Points running a supported controller AP firmware.

Each controller + AP group corresponds to a specific Venue (for example, a shopping mall or a public event). The following controllers are supported:

- ZoneDirector controller + ZoneFlex APs:
  - ZD 1100
  - ZD 1200
  - ZD 3000
  - ZD 5000
- SmartZone controller + SmartZone APs:
  - SmartCell Gateway 200 (SCG 200)
  - SmartZone 100 (SZ-100)
  - virtual SmartZone (vSZ)

## Venues

Venues are the primary resource managed by a SPoT deployment.

Each venue represents a physical space that can vary in size from a small room to a large multistory building. Each venue should correspond to a specific AP Group on ZoneDirector, or an AP Zone on SmartZone controllers.

## SPoT Server

This section describes how the SPoT server works.

Each venue reports the necessary RSSI data to a SPoT Server, which receives and collates all the data from the wireless infrastructure and communicates with a ZoneDirector or SmartZone controller for any settings, configuration and management requirements.

The SPoT Server then forwards the data to a load balancer to distribute the computing load (essentially the positioning algorithm) among multiple Locator nodes. Each Locator is a virtualized computing node and it executes the core indoor positioning algorithm to calculate the location for a particular detected WiFi device. The Locators have the ability to be scaled horizontally to ensure scalability and optimal use of cloud resources.

## API Server

This section describes how the API server works.

The API server serves as a repository of the location estimates from the Locators. The External (Post Engine) API set is the interface through which applications, both 3rd party and those developed internally by Ruckus, connect with the SmartPositioning platform. Applications that require the location estimates can access the database in the API server through a set of RESTful JSON APIs over HTTPS for security and privacy.

The External (Post Engine) API allows applications to have access to the following resources:

- **Accounts:** User accounts are categorized into one of 3 roles: Admin, Calibrator, and Consumer.
- **Venues:** Venue administration is under the jurisdiction of the Admin user role.
- **Radio Maps:** Contain the necessary calibrated data, floor plans and zone information.
- **Floors:** Subset of a Radio Map for a particular floor.
- **Zone Maps:** Subset of a floor plan for a particular zone.
- **Zones:** Information regarding a zone that can be arbitrarily designed.
- **Calibration Points:** Contain the RSS reports from each AP for each calibration point.
- **Access Points:** Location information for each AP.
- **Locations:** Consumers of location data will be able to query the database in different ways.

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**NOTE** For more information on SPoT API usage, see [Using the API Explorer](#).

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## SPoT Administration Portal

The SPoT Administration Portal is the web-based interface used to manage and configure your venues, maps, access points and user accounts.

## Analytics Dashboard

The Analytics Dashboard serves as an out-of-the-box SmartPositioning application that is usable across verticals.

This is the primary Ruckus-developed tool for consumption of location data; however the provision of a post-engine API allows third party developers to develop their own applications that can use the raw location data in different ways.

## Calibrator App

The Calibrator app is a free Ruckus app for Android and iOS that is used to calibrate the system to accommodate each venue's particular RF environment.

This app must be installed and run on a mobile device while walking around the venue to calibrate the SmartPositioning location algorithm.

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**NOTE** The Calibrator App is not required for all Ruckus SPoT products (specifically, SPoT Presence does not require calibration). See [SPoT Presence](#) for more information.

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## A Typical Deployment

This section describes the key steps involved in deploying the Ruckus SPoT solution for a venue.

The figure provides a brief overview of the process. The complete setup and calibration processes are described in subsequent sections.

Figure 2: SPoT setup process

## Wi-Fi Locationing Made Simple and Quick

1

### Prepare

Determine optimal AP coverage and placement for location services

2

### Map

Obtain, scale and load venue map(s) into SPoT LBS engine

3

### Enable

Enable location service system through the controller

4

### Calibrate

Use free Ruckus calibration app to create RF fingerprint of venue



# Setting up a Venue for a SPoT Service 2

This section describes the steps required for setup and configuration of a venue for SPoT location service.

Some steps are required to be completed by the customer, while some are performed by Ruckus Sales/Support personnel or a Ruckus value-added reseller.

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**NOTE** For vSPoT, you will need to perform additional steps prior to beginning this procedure. For instructions on vSPoT virtual server installation and configuration, see the vSPoT Installation Guide, available from [support.ruckuswireless.com](http://support.ruckuswireless.com).

---

The setup process consists of the following steps:

- [Step 1: Perform a Site Survey](#)
  - [Step 2: Obtain SPoT License and Log In to Your SPoT Account](#)
  - [Step 3: Access the SPoT Admin Dashboard](#)
  - [Step 4: Map Creation and Venue Server Instantiation](#)
  - [Step 5: Adding Access Point MAC Addresses](#)
  - [Step 6: Prepare the Controller/Access Point Deployment for SPoT Calibration](#)
  - [Step 7: Perform the Calibration Process](#)
- 

**NOTE** For SPoT Presence, you do not need to perform the site survey, map creation or calibration steps in this procedure. See [SPoT Presence](#) for more information.

---

## Step 1: Perform a Site Survey

The site survey should be completed by the customer as per any WiFi installation.

As a rule of thumb, for any location in the venue, at least 3 APs should be able to hear a mobile client with at least an RSS of -85 dBm in order to achieve the best performance. For more information on best practices for performing the site survey for SPoT location service, see the [SPoT Best Practices Guide](#), available from the Ruckus Support website.

## Step 2: Obtain SPoT License and Log In to Your SPoT Account

Once you have purchased your SPoT license, you will receive an email notification with instructions on how to access your account in the SPoT Admin portal. For further instructions, please see [Requesting an Account](#).

Once your account is set up in the relevant SPoT data center, you may access your account in the SPoT Admin Portal via the relevant URL as follows:





## Step 4: Map Creation and Venue Server Instantiation

The following procedures describe the steps required to create venue maps for SPoT deployment using the SPoT Admin Portal.

### Create Your Own Maps

Use the following procedure to create your own maps using the SPoT admin portal's built-in map creation tools:

1. On the *SPoT Admin Dashboard*, go to **Radio Maps**.
2. Click **Create Radio Map**.
3. In *Radio Map Settings*, enter a **Name** for this radio map.

---

**NOTE** Only lowercase letters, numbers, underscores and dashes are accepted. (Do not use spaces in your map name.) Also, do not leave this field empty. If you leave it empty and try to create a map first, you will have to start over.

---

4. (Optional) Enter a **Description** to help you identify this radio map.
5. Click the **Start Mapping** button.

Figure 4: Click Create Radio Map

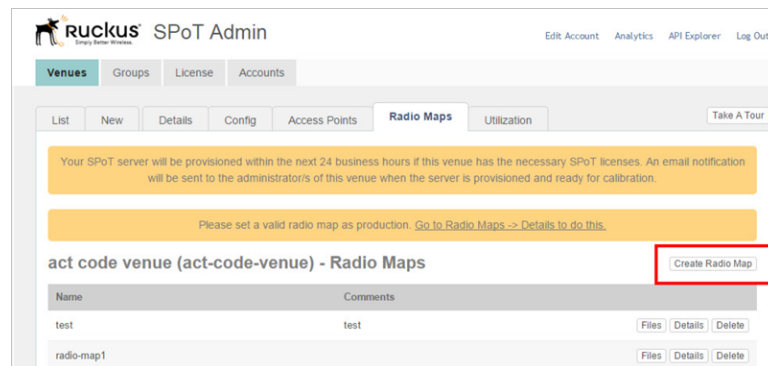


Figure 5: Enter a Name for the map and click Start Mapping to begin

## Setting up a Venue for a SPoT Service

### Step 4: Map Creation and Venue Server Instantiation

**act code venue (act-code-venue) - Create Radio Map**

**RADIO MAP SETTINGS**

**Name:**

Only lowercase letters, numbers, underscores and dashes are accepted. (If this is your first radio map, you may use 1\_0\_0; Subsequent updates could be named 1\_0\_1, or 1\_1\_0, or 2\_0\_0)

**Comments:**

Additional description that will help you identify this radio map.

**MAPPING**

- Prepare images for each floor of the venue to be used as the display map.
- Using SPoT's mapping tool, plot the required metadata over the display map.
- You can also import from a previously created radio map and make modifications over it.

**Import from:**

Note that if you move or remove any access points or calibration points, calibration data will not be copied.

**Start Mapping**

Save Back

6. If you would like to make edits on an existing radio map, select it from the **Import from** drop-down list.
7. Click **Start Mapping**.

---

**NOTE** If you are editing an existing radio map, the steps involved are the same as creating a new one. To change the background map of an existing radio map, be sure to properly align and overlay the new map over the old one. Ensure that the resolution of the map images remain the same or else the calibration cannot be retained.

---

**NOTE** If you are editing an existing radio map, note that if any AP or calibration point is removed or shifted, the calibration data will not be migrated over. This means that calibration needs to be performed again for the new radio map.

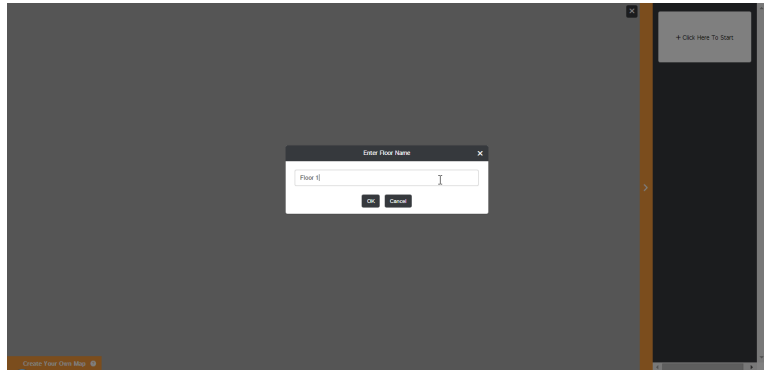
---

Figure 6: Click here to start



8. Enter a **Floor** name.

Figure 7: Enter a Floor name



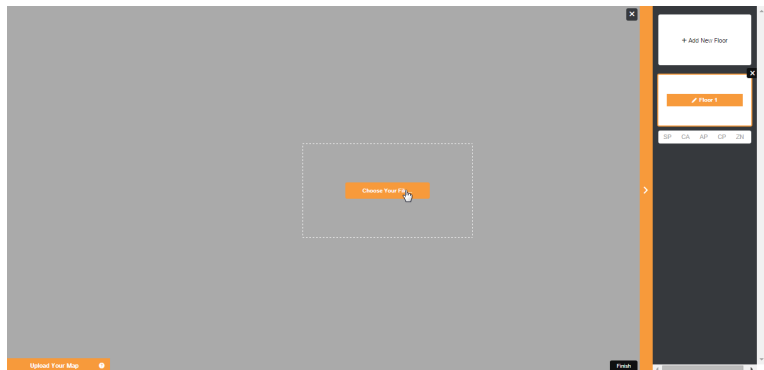
9. Click **Choose Your File...** and select your map file. It may take several seconds for the map to load. Wait for the map to load.

---

**NOTE** The maximum file size of each uploaded map is 7MB.

---

Figure 8: Choose your map file

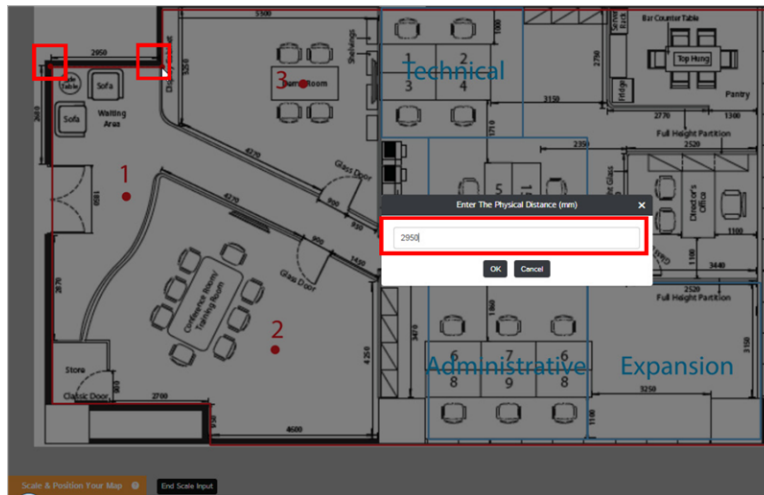


10. Once the map file is loaded, the first step is to **Scale & Position Your Map**.
11. First, grab your map image and position it within the window. Adjust the size of the map image using "click-and-drag" at the edges.
12. Click **Start Scale Input**.
13. Click two points on the map for which the distance between them is known.

Figure 9: Scale your map by selecting two points and entering the distance in mm

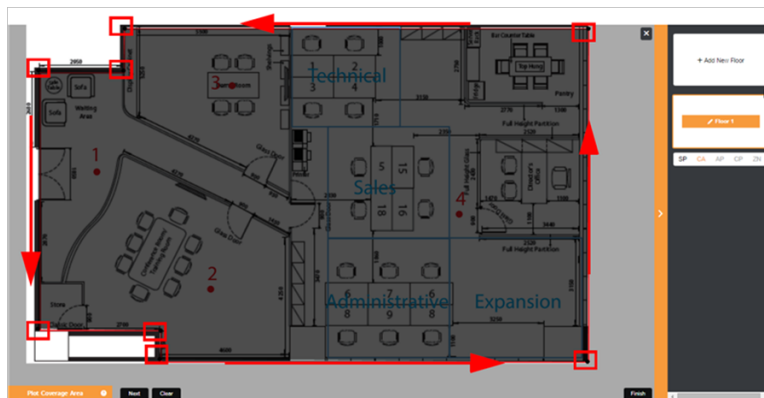
## Setting up a Venue for a SPoT Service

### Step 4: Map Creation and Venue Server Instantiation



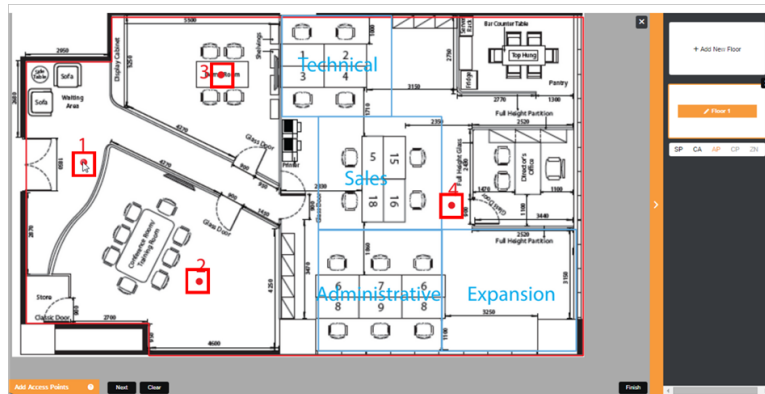
14. Click **Next**. The next step is to plot the coverage area. Do so by clicking each corner of the map around the edges. The coverage area is displayed as a grey shaded area overlaying your map.

Figure 10: Plot the coverage area



15. Click **Next**. The *Add Access Points* screen appears. Click each point on the map to indicate the locations of your APs. If your map already has APs marked (as in this example), simply click once on each of the points. When finished, click **Next**.

Figure 11: Add access points



**NOTE** At this point, a pop-up message appears to notify you that you can choose to proceed without calibration using the calibration-free locator method (Calibration-free SPoT and SPoT Presence). Click **Next** to proceed without calibration.

16. Add Calibration Points (CPs). The more CPs you add, the more data SPoT will be able to collect, and therefore the more precise your output will be. On the other hand, you will have to manually calibrate each CP twice (once for each radio), so take that into consideration. CPs that you have added are displayed as blue dots on the map. If you make a mistake, click **Clear** and start over.

Figure 12: Add Calibration Points

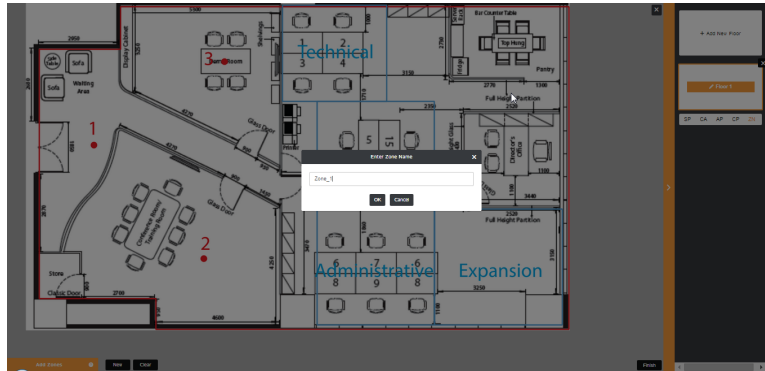


When finished, click **Next**. The next step is to **Add Zones**. (This step is optional. If you do not wish to create zones, you can skip this step.) Add Zones to demarcate areas of interest within the coverage area. Zones provide the ability to collect location data for these areas separately from the entire venue. To add a Zone, click **New**, enter a **Name** for the zone, and click **OK**.

## Setting up a Venue for a SPoT Service

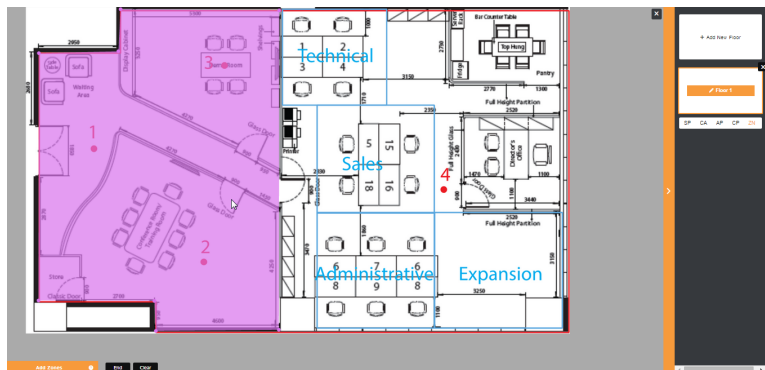
### Step 4: Map Creation and Venue Server Instantiation

Figure 13: Enter Zone name



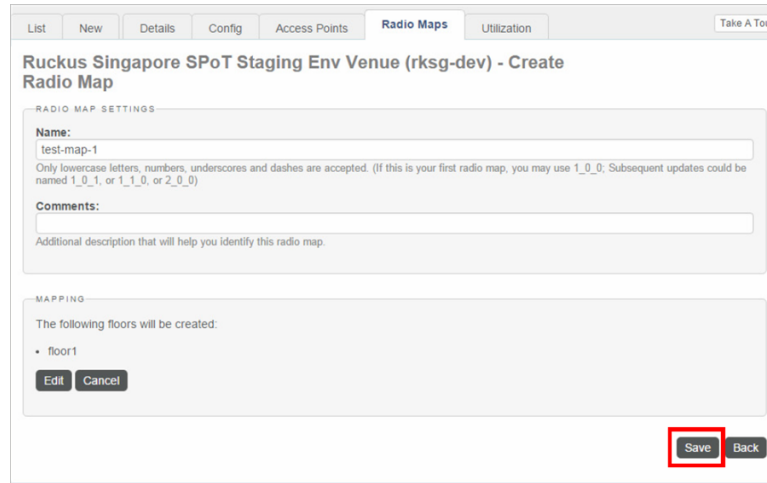
17. Define the Zone by clicking the corners of the zone to be defined. The zone is displayed as a colored overlay on the map. You may define as many zones as you wish and each zone will be represented by a different color. For regions where the zones overlap, the top-most zone will take precedence.

Figure 14: The pink section is the area defined as Zone 1



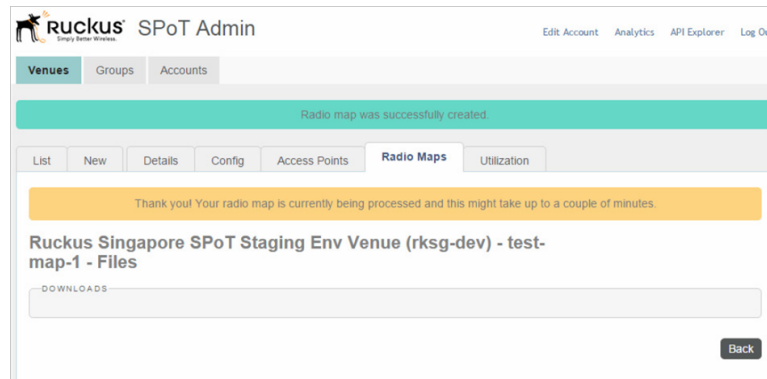
18. Click **End** to save the zone. To create multiple zones, click **New** and repeat the process. When finished creating all the zones you want to create, click **Finish**.
19. You will return to the *Create Radio Map* page. If you want to make any changes to AP or CP locations, click **Edit** in the Mapping section to edit your map.
20. Click **Save** to save your map. It may take several minutes to complete the map creation. Once completed, the screen displays a "The following floors will be created" message.

Figure 15: The following floors will be created message



21. To make changes, click **Edit**. Once you are satisfied with the floors you have created, click **Save**.
22. The system begins processing the radio map you created. Once complete, the screen displays the message, “Radio Map was successfully created.”

Figure 16: Radio map created successfully



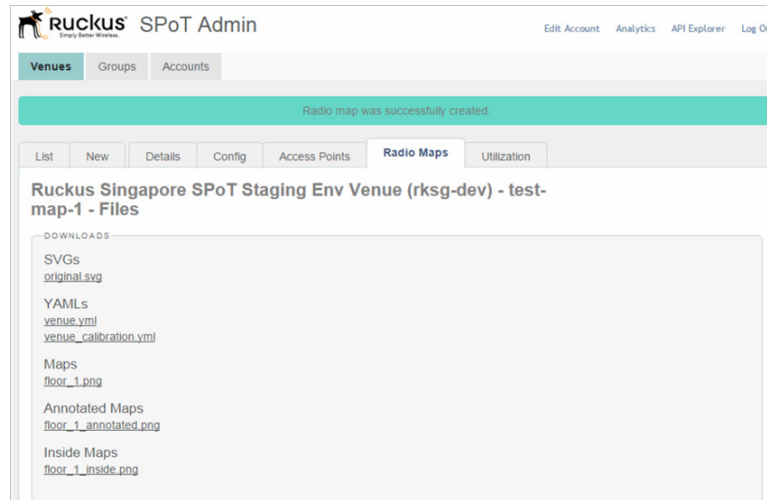
23. At this point, your map files have been completed and you can view the following files from your browser:
  - original.svg: An SVG version of your map with APs and CPs denoted.
  - venue.yml: A YAML file with details on your APs and CPs.
  - venue\_calibration.yml: A YAML file with calibration details on all CPs. These values will be empty until you have performed calibration. See [Performing the Wireless Positioning Calibration](#).
  - [Floor Name].png: A PNG version of your floor map.

## Setting up a Venue for a SPoT Service

### Step 5: Adding Access Point MAC Addresses

- [Floor Name]\_annotated.png: A PNG version of your floor map with CPs annotated.
- [Floor Name]\_zone\_sections.png: A PNG file displaying the Zones you defined.

Figure 17: Radio Map Files



Your SPoT server will be provisioned within the next 24 business hours if this venue has the necessary SPoT licenses. An email notification will be sent when the server is provisioned and ready for calibration.

## Step 5: Adding Access Point MAC Addresses

The following procedures describe the steps required to add the MAC address of the access point.

The MAC address must be filled in the access point page. The AP MAC address must coincide with the AP position on the map created in the Create Your Own Map process.

### Adding the MAC Address

1. From the **Venues** list, click the **Access Points** link to edit the venue. A list of fields with (not set) is displayed along with the AP numbering from the Map.
2. Click **Edit Access Points** to view the page. Mouse over a name to display the AP floor number and the X and Y coordinates of the floor map.
3. Fill in the MAC address of the AP you wish to update.
4. Click **Save** to confirm your changes.



---

**NOTE** If the AP is used in a venue it cannot be added to another venue since the AP cannot be used in two places. Ensure that the AP MAC address is deleted from a venue before using it with another AP.

---

## Step 6: Prepare the Controller/Access Point Deployment for SPoT Calibration

Once the Venue has been created and the WiFi infrastructure is installed and ready, access the ZoneDirector or SmartZone controller web interface and configure the Location Services so that communication between controller/APs and the SPoT Server can be established automatically.

See the following sections for the relevant controller configuration procedures:

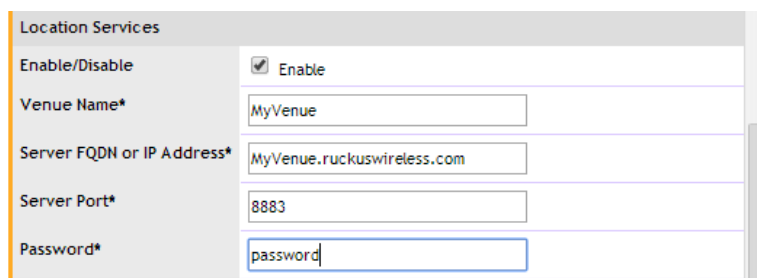
- [ZoneDirector](#)
- [SmartZone](#)

### Zone Director Configuration for Location Service Support

To configure ZoneDirector for location service support.

1. Log into ZoneDirector.
2. Go to **Configure > Access Points**.
3. In the **AP groups** section, click **Create New** or **Edit** to configure an AP group for SPoT system integration.
4. In the **Location Services** section, click **Enable**.
5. Enter the **Venue Name** that you configured on the SPoT Admin dashboard.
6. Enter the SPoT Server's **FQDN** (Fully Qualified Domain Name), and Server Port number. The FQDN, server port number and password are available from the SPoT Admin Dashboard, on the **Venues > Config** page.
7. Enter a **Password** for secure communication with the SPoT Server.
8. Click **OK** to save your changes.

Figure 18: ZoneDirector configuration



Location Services	
Enable/Disable	<input checked="" type="checkbox"/> Enable
Venue Name*	<input type="text" value="MyVenue"/>
Server FQDN or IP Address*	<input type="text" value="MyVenue.ruckuswireless.com"/>
Server Port*	<input type="text" value="8883"/>
Password*	<input type="text" value="password"/>

## Setting up a Venue for a SPoT Service

Step 6: Prepare the Controller/Access Point Deployment for SPoT Calibration

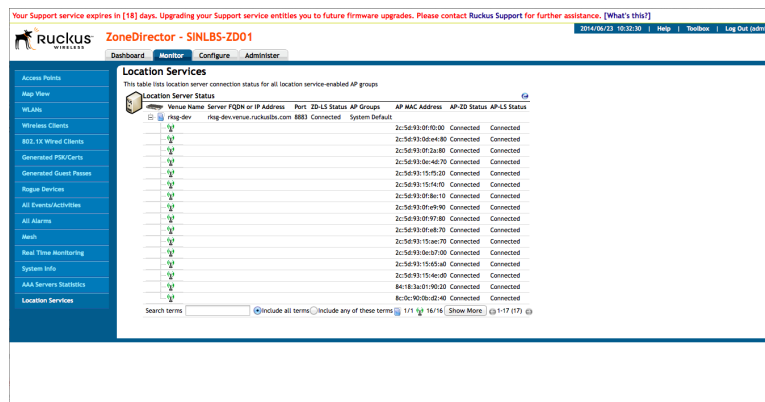
### Ensuring That ZoneDirector Can Communicate with the SPoT Server

Once the location service has been configured, you should ensure that the controller can communicate with the SPoT server.

To verify ZoneDirector and AP connectivity with the SPoT server:

1. Log into the ZoneDirector Web interface, and go to **Monitor > Location Services**.
2. Verify that the **Status** column in the *Location Server Status* table displays “Connected.”

Figure 19: Verify ZoneDirector - SPoT connectivity



Server FQDN or IP Address	Port	UD-LS Status	AP Group	AP MAC Address	AP UD Status	AP-LS Status
rlag-dev	8883	Connected	System Default	2c:5d:93:0f:05:00	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:02:a6:30	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:0f:2a:20	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:0c:4d:70	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:15:09:20	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:15:4d:40	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:0f:8e:10	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:0f:e9:90	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:09:9f:80	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:0f:e8:70	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:15:ae:70	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:0a:03:00	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:15:45:a0	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	2c:5d:93:15:4e:b0	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	84:18:3a:01:90:20	Connected	Connected
rlag-dev.venue.ruckuslb.com	8883	Connected	System Default	8c:2c:70:02:d2:e0	Connected	Connected

You can also check connectivity via ZoneDirector CLI using the ping command. If the ping is unsuccessful, the following information can be used for troubleshooting.

### Firewall rules that may be applicable

All traffic flows are initiated from IN (behind firewall) to OUT (Internet) direction. Typically, such flows do not require rules to be added to the firewall explicitly. However, it is always a good idea to have these firewall rules handy in case of any network connectivity issues. If you must input a "destination" name in a firewall rule instead of "any," use the same FQDN name that you configured on the controller's Location Services configuration page.

Table 3: Firewall ports that must be open for AP/Controller/SPoT communication

From	To	Port
Controller	SPoT cloud engine	TCP 8883
AP	SPoT cloud engine	TCP 8883
AP	Controller	TCP 1883

### Proper DNS Resolution of FQDN

Ensure that the DNS server is able to properly resolve the SPoT server's FQDN. You can check this easily by doing a ping test from either the controller or the AP.

### Making Sure the Controller Maintains the Correct Time

Ensuring that the clocks are well synchronized is of critical importance to SPoT location accuracy. To ensure that the controller keeps the correct time, Ruckus recommends using a Network Time Protocol (NTP) server and setting the controller's system time to your local time zone.

---

**NOTE** Very close NTP synchronization between controller, APs and the SPoT Location server is a very a critical step to success. Being out of sync by about 40 seconds prevents the APs from showing green on the SPoT Admin dashboard.

---

To ensure ZoneDirector maintains the correct time:

1. Go to **Configure > System**.
2. Scroll down to the **System Time** section, and verify that the **Use NTP to synchronize the ZoneDirector clock automatically** check box is enabled. ZoneDirector uses the Ruckus Wireless NTP server (`ntp.ruckuswireless.com`) by default, or you can enter the IP address of a different NTP server if you prefer.
3. Choose your time zone from the **Select time zone for your location** drop-down menu.
4. Click **Refresh** and verify that the time displayed is the proper time for your time zone.
5. Click **Apply** to save your changes (if you made any changes).

### Preparing the AP Group for Calibration

Once you have confirmed successful communication between the controller and the SPoT server, you must configure the AP group for SPoT calibration. This consists primarily of configuring an AP Group to use only a single channel for 2.4 GHz radio calibration and a single channel for 5 GHz radio calibration. After calibration is complete, you can set the channels back to your preferred channel choices.

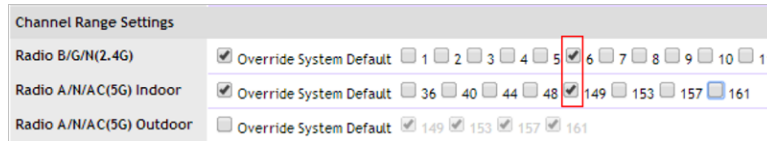
To configure the AP group for calibration:

1. On the **Configure > Access Points** page, **Edit** the relevant AP group. In **Channel Range Settings > Radio B/G/N (2.4G)**, select **Override System Default**, and *deselect all* channels but one (channel 1, 6 or 11 is recommended). In **Channel Range Settings > Radio A/N/AC (5G) Indoor**, select **Override System Default**, and *deselect all* channels but one (any 5 GHz channel can be used). Click **OK** to save your changes.

Figure 20: Set the AP group to use a single channel per radio for calibration

## Setting up a Venue for a SPoT Service

Step 6: Prepare the Controller/Access Point Deployment for SPoT Calibration



The screenshot shows the 'Channel Range Settings' interface. It has three sections: 'Radio B/G/N(2.4G)', 'Radio A/N/AC(5G) Indoor', and 'Radio A/N/AC(5G) Outdoor'. Each section has an 'Override System Default' checkbox and a row of channel selection checkboxes. In the 2.4GHz section, channels 1, 6, and 11 are selected. In the 5GHz Indoor section, channels 149, 153, and 157 are selected. In the 5GHz Outdoor section, channels 149, 153, 157, and 161 are selected. A red box highlights the '6' checkbox in the 2.4GHz section.

---

**NOTE** After calibration is completed, the AP group should be re-configured to allow only channels 1, 6 and 11 on the 2.4 GHz radio. The 5 GHz radio can be configured with any 3 channels that you prefer.

---

### Create Two Special SSIDs for Calibration

---

**NOTE** This step is not required for SPoT Presence.

---

For calibration purposes you will need to create two special WLANs (one 2.4 GHz and one 5 GHz WLAN) for calibration purposes only. After calibration is complete, you can delete these WLANs.

1. Go to **Configure > WLANs**, and click **Create New** in the *WLANs* section.
2. Enter a **Name** for the WLAN (e.g., "Calibration SSID").
3. Choose **Standard Usage**, **Open**, **WPA2** and **AES** for *Type*, *Authentication Method*, *Encryption Method* and *Encryption Algorithm*.
4. Enter a **Password**.
5. Click **OK** to save your changes.
6. Make sure the mobile device is associated with the calibration SSID before starting calibration.

---

**NOTE** After calibration, remember to delete the calibration SSIDs and change the AP group channel selection to channels 1, 6 and 11 on the 2.4 GHz radio, and any three channels on the 5 GHz radio.

---

### Verify AP Connection Status from the SPoT Admin Dashboard

The final test to ensure everything is up and running properly prior to performing calibration is to verify the AP connection status from the SPoT Admin dashboard.

1. Go to <https://us-sys.ruckuslbs.com/admin/venues/> to view a list of Venues. Click the **Manage Access Points** link next to the Venue that you will be calibrating. Verify that the Status icon for each AP is **green**.

---

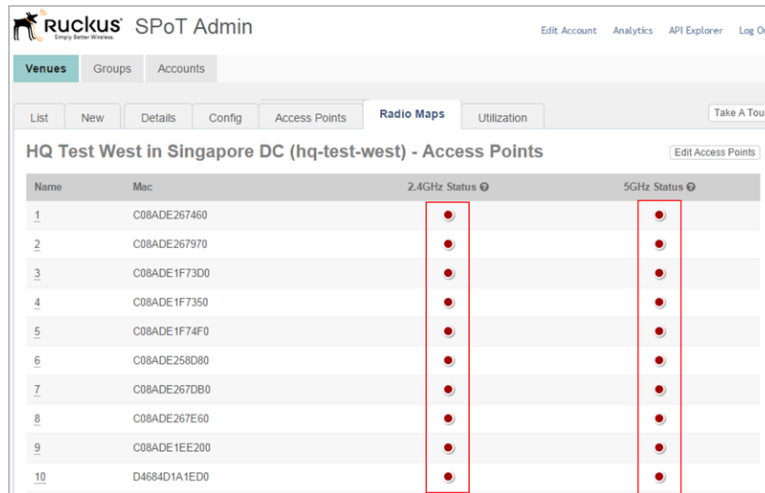
**NOTE** If the status icon is **amber**, this means that the time is out of synchronization with the AP by more than +/-5 seconds. Ensure that the controller is configured with a valid NTP server and perform a time sync between the APs and the controller.

---

Figure 21: Verify that AP status lights are green

## Setting up a Venue for a SPoT Service

Step 6: Prepare the Controller/Access Point Deployment for SPoT Calibration



Name	Mac	2.4GHz Status	5GHz Status
1	C08ADE267460	●	●
2	C08ADE267970	●	●
3	C08ADE1F73D0	●	●
4	C08ADE1F7350	●	●
5	C08ADE1F74F0	●	●
6	C08ADE258D80	●	●
7	C08ADE267DB0	●	●
8	C08ADE267E60	●	●
9	C08ADE1EE200	●	●
10	D4684D1A1ED0	●	●

## SmartZone Configuration for Location Service Support

Configure a SmartZone controller for SPoT location services using these procedures.

### Adding a SPoT Location Server

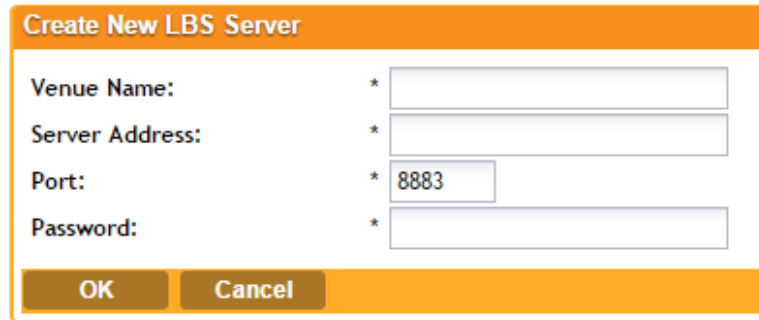
Follow these steps to add a SPoT server to the controller for SPoT communication.

1. Log on to the SPoT Administration Portal.
2. On the Venues page, click **Config** next to the venue for which you want to configure Location Services.
3. In Controller Settings, take note of the values for the following:
  - Venue Name
  - Server Address
  - Port
  - Password
4. On the SmartZone web interface, go to **Configuration > Services & Profiles > Services > Location Services**.
5. Click **Create New**. The Create New LBS Server form appears.

Figure 22: The Create New LBS Server form

## Setting up a Venue for a SPoT Service

Step 6: Prepare the Controller/Access Point Deployment for SPoT Calibration



**Create New LBS Server**

Venue Name: \*

Server Address: \*

Port: \*

Password: \*

**OK** **Cancel**

6. Enter the information you obtained in Step 3 from the SPoT Administration Portal into the four fields provided.
  - Venue Name
  - Server Address
  - Port
  - Password
7. Click **OK** to save your changes.

You have completed adding an LBS server to the controller. You can now use this LBS server along with your zone and AP group configuration (see the next section, Configuring the Controller to Use the LBS Server)

### Configuring the Controller to Use the LBS Server

There are two ways to configure the controller to use the LBS servers that you added. You can:

- Set an entire AP zone to use an LBS server
- Set an AP group to override the LBS settings of a zone

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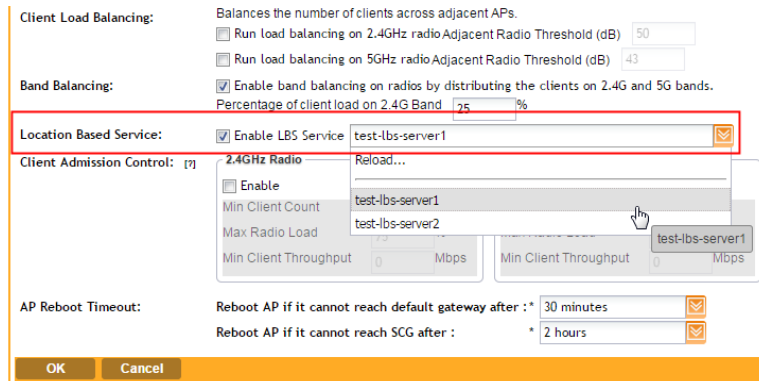
**NOTE** For information on configuring and managing the Ruckus Wireless SmartPositioning Technology (SPoT) service, refer to the SPoT User Guide, which is available for download from <https://support.ruckuswireless.com>.

---

### Setting an AP Zone to Use an LBS Server

When you create or edit an AP zone, you can enable the LBS service for the entire zone by selecting the **Enable LBS Service** check box, and then selecting an LBS server to use.

Figure 23: Enabling and selecting an LBS in the create/edit AP zone form



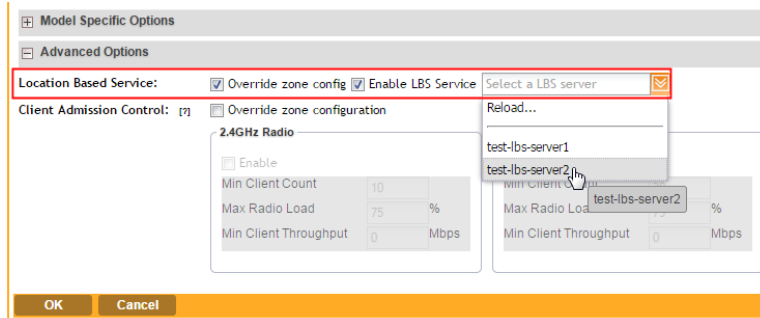
### Setting an AP Group to Override the LBS Settings of a Zone

If you want APs that belong to an AP group to use a different LBS server, you can override the LBS settings at the AP group level. Follow these steps:

1. Go to **Configuration > AP Zones**.
2. In the **AP Zone List**, click the zone name to which the AP group you want to configure belongs.
3. On the sidebar, click **AP Group**.
4. Click **Create New** to create a new AP group, or click the AP group name to edit it.
5. In the form that appears, scroll down to the Advanced Options section. Click the plus (+) sign before Advanced Options to display all options.
6. In Location Based Service, select the **Override zone config** check box.
7. Configure the LBS settings as required.
  - To disable the LBS service for this AP group, clear the Enable LBS service check box.
  - To use a different LBS server for this AP group, select the **Enable LBS service** check box, and then select the LBS server that you want to use from the drop-down list.
8. Configure the other AP group settings as required. For information on configuring AP groups, see SmartZone User Guide, “Creating an AP Group” section.
9. Click **OK**.

You have completed setting an AP group to override the LBS settings of its zone.

Figure 24: Overriding the LBS settings of a zone at the AP group level



## Step 7: Perform the Calibration Process

**NOTE** For SPoT Presence, you do not need to perform calibration. See [SPoT Presence](#) for more information.

After the controller configuration is complete and you have confirmed that the controller and its APs can communicate with the SPoT server, calibration can proceed. The calibration process consists carrying a mobile device with the calibration app running and standing at each of the designated calibration points for about 30 seconds per radio band to allow the APs to collect sufficient RSS information. The RSS data collected during the calibration process is then saved as a radio map. See [Performing the Wireless Positioning Calibration](#) for more information.



## Performing the Wireless Positioning Calibration

This section describes the calibration process which must be performed for a venue so that the APs can accurately calculate wireless client locations.

---

**NOTE** For SPoT Presence, you do not need to perform calibration. See [SPoT Presence](#) for more information.

---

### Calibrator Process Overview

This section provides you with an overview of the calibrator process.

Calibration must be performed once on each radio band (2.4 GHz and 5 GHz) for each calibration point. For each calibration point, 30 seconds is recommended between the start and end calibration calls to allow the system to collect sufficient signal reports to determine the point's observation matrix (OM). During this period the person performing the calibration should stand on the spot and slowly turn 360° to allow the signal fluctuations caused by the human body to average out. The SPoT Calibrator App is available for iOS and Android operating systems, and can be downloaded directly from the Google Play Store or the Apple iTunes App Store. See the relevant section depending on which operating system your device is running:

- [Android SPoT Calibrator App Instructions](#)
- [iOS SPoT Calibrator App Instructions](#)

### Android SPoT Calibrator App Instructions

The instructions in this section, describe the steps required to perform SPoT venue calibration using the Android version of the SPoT Calibrator App.

---

**NOTE** The SSID or Network auto switch feature has been removed since the latest Android versions have a security constraints on third party application auto switching the device's network. You need to manually connect the device to the SSID of the desired band before calibrating a point for that band.

---

Use the following procedure to perform the venue calibration:

1. Download and install the Ruckus SPoT calibration app.

---

**NOTE** The device on which the calibration app is run must have Internet access.

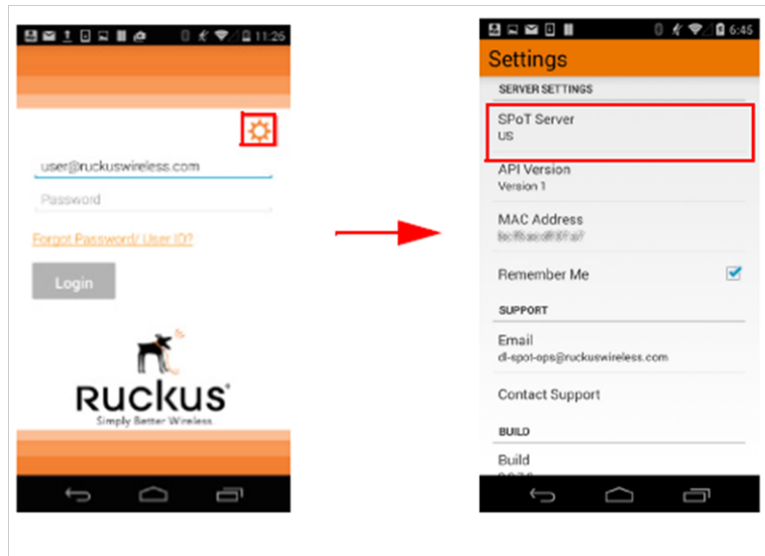
---

2. Go to **Settings > WiFi** and make sure the WiFi function is turned on.

**Performing the Wireless Positioning Calibration**  
Android SPoT Calibrator App Instructions

3. Connect to the **2.4 GHz SSID** that you created for SPoT calibration.
4. Launch the SPoT Calibrator app.
5. Click the **Gear** icon to open the Settings.

Figure 25: The Login screen (Android)



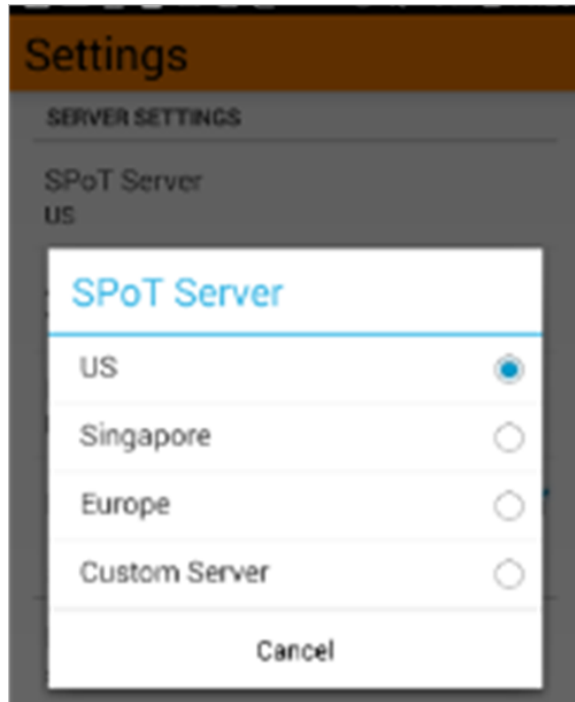
6. Select a **SPoT Server**. When you click on SPoT Server, you will be presented with a list of servers to choose from.

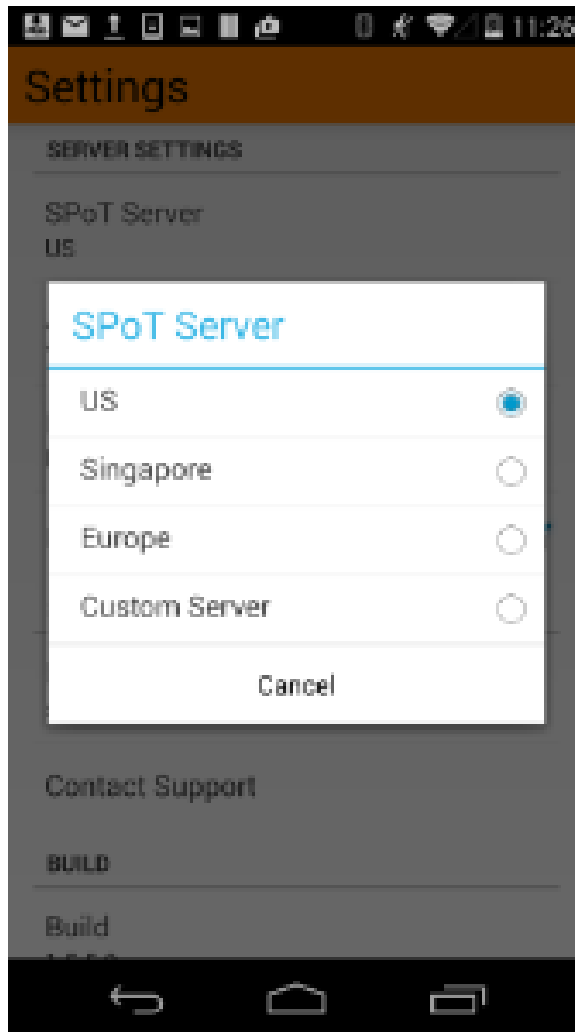
---

**NOTE** For vSPoT 3.3 and above, use **https://[IPaddress]**, instead of *http://[IP address]:8443*

---

Figure 26: Select a SPoT Server





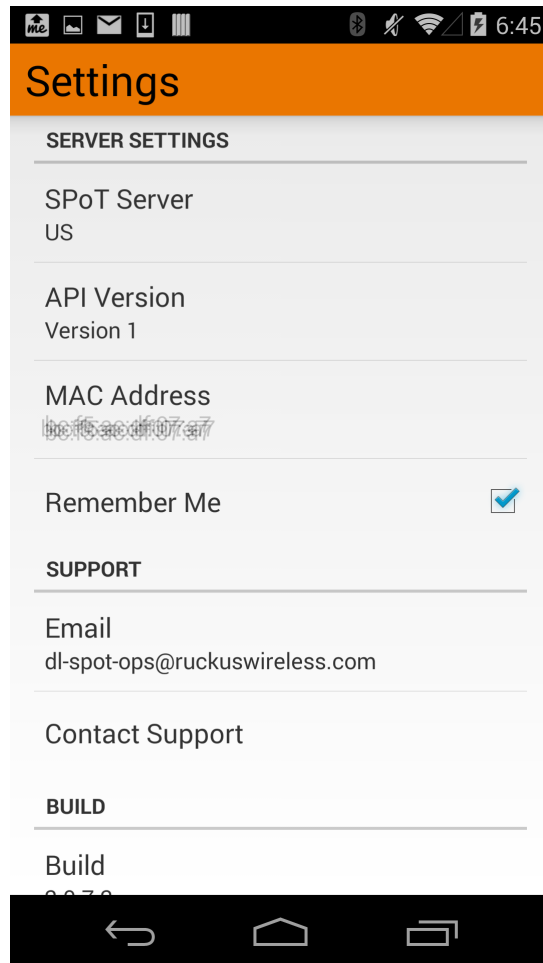
7. If you choose Custom Server from the list, you can enter a Custom Server URL in the settings page.

---

**NOTE** If you are calibrating a vSPoT deployment, select **Custom Server** and enter the address of the vSPoT server in the following format: `http://A.B.C.D:8443`, where A.B.C.D is the IP address.

---

Figure 27: Configuring a custom SPoT server

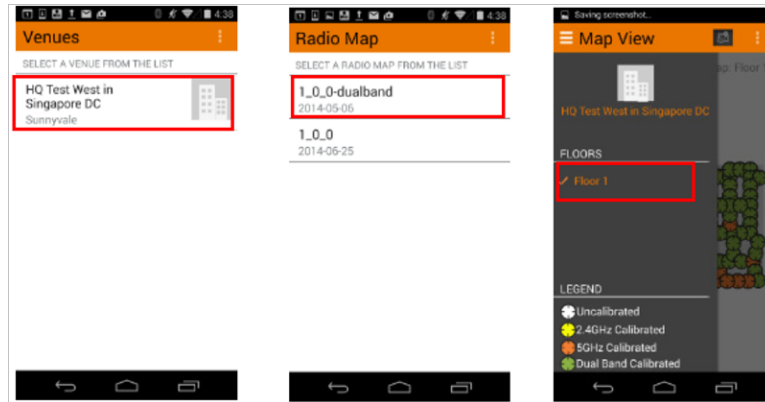


8. The MAC Address field will be auto-populated for the device.
9. Press **Contact Support** to send an email to the server team.
10. Return to the login page, enter your **User Name** and **Password** and click the **Login** button. The first page displayed is a list of venues.
11. Select a venue and then select a radio map from the list. Select a floor from the FLOORS list.

Figure 28: Select a Venue

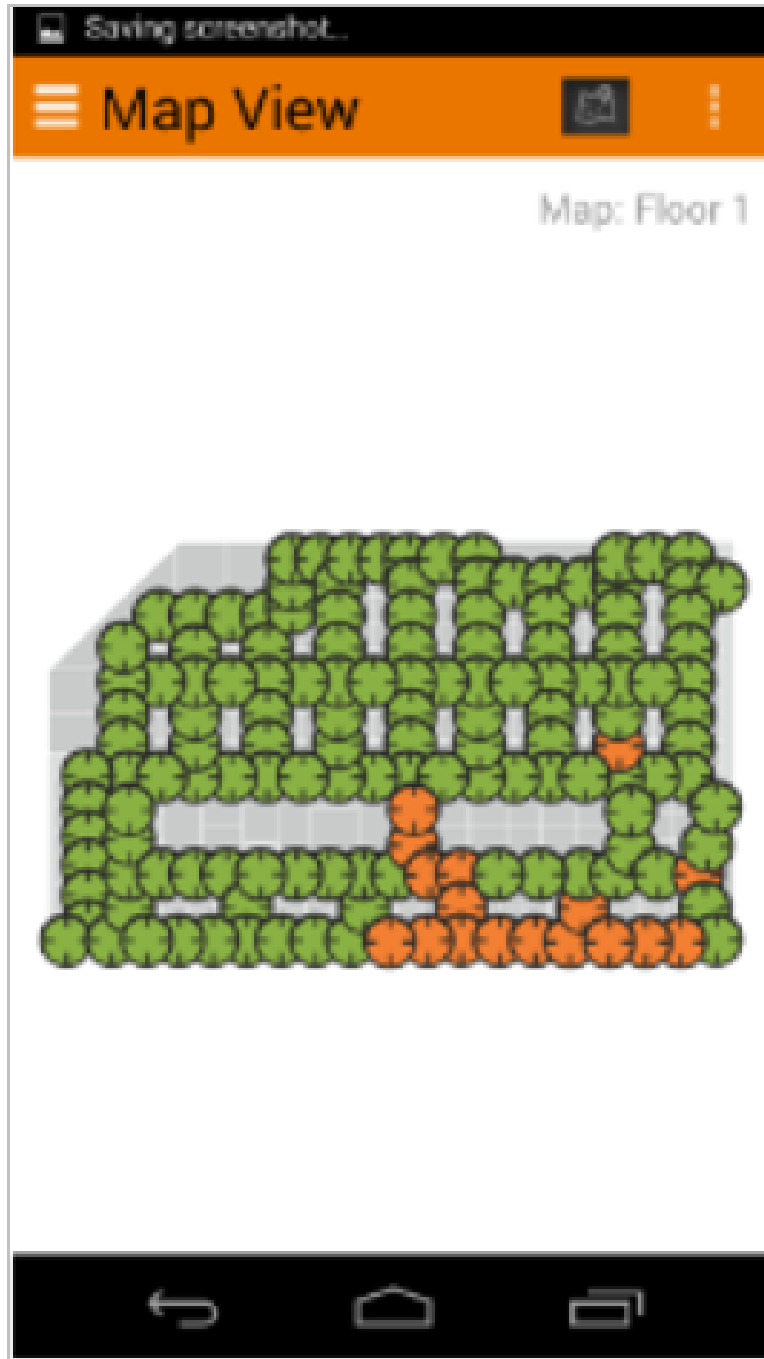
## Performing the Wireless Positioning Calibration

### Android SPoT Calibrator App Instructions



12. The Map View launches and displays a map of the selected floor with all of the calibration points (CPs) marked.

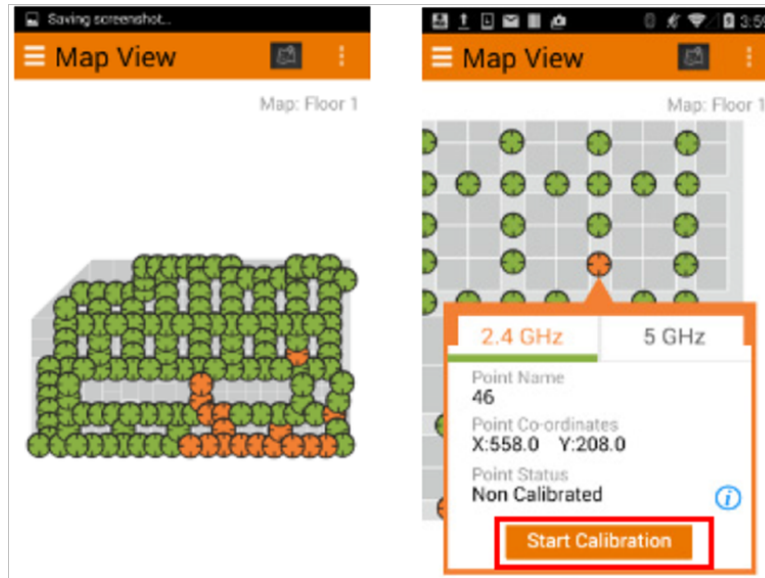
Figure 29: CPs marked



13. Connect the device to the 2.4GHz SSID from the **Device** settings.
14. Select the calibration point, select 2.4 GHz and tap Start Calibration to begin calibrating for the 2.4 GHz radio band.

**Performing the Wireless Positioning Calibration**  
Android SPoT Calibrator App Instructions

Figure 30: Start calibration



15. When the calibration process begins, the calibrator app displays a compass and a running timer to indicate the time remaining. Each calibration must be performed for 30 seconds. During this 30 seconds, the person performing the calibration should stand in place and slowly turn around 360 degrees in a clockwise direction.



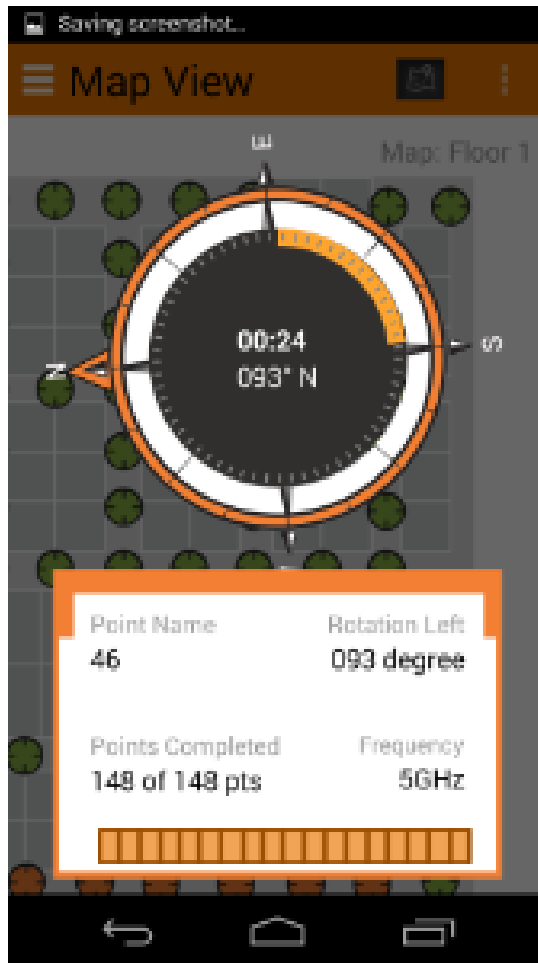


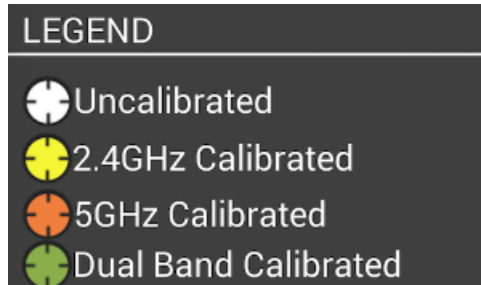
Figure 31: Calibration in progress

16. When the calibration is complete, a Calibration Complete message is displayed, and the calibration point on the Map View page changes colors to indicate its calibration status.

- White: Uncalibrated
- Yellow: 2.4 GHz calibrated
- Orange: 5 GHz calibrated
- Green: Dual band calibrated

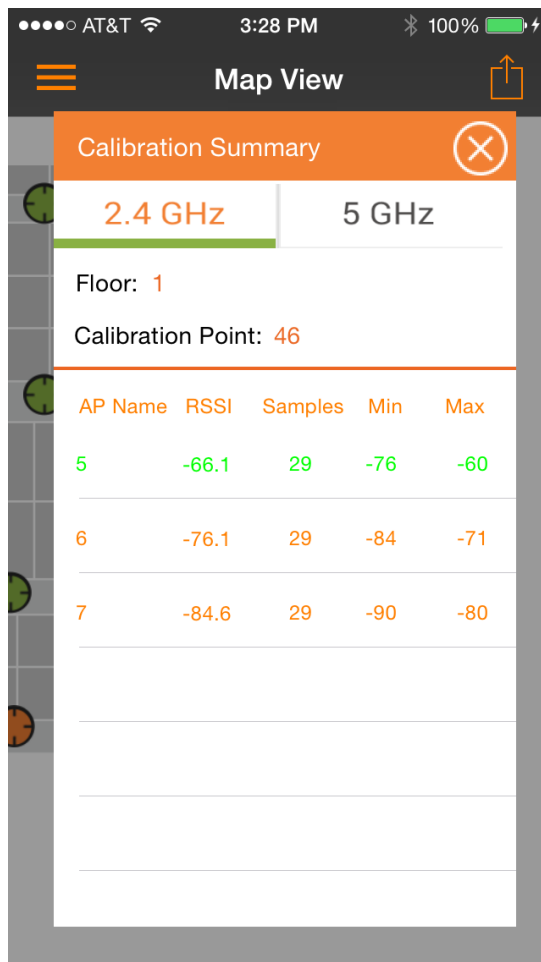
Figure 32: Calibration status legend

**Performing the Wireless Positioning Calibration**  
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17. After the point is calibrated successfully, a calibration summary is presented.

Figure 33: Calibration summary



---

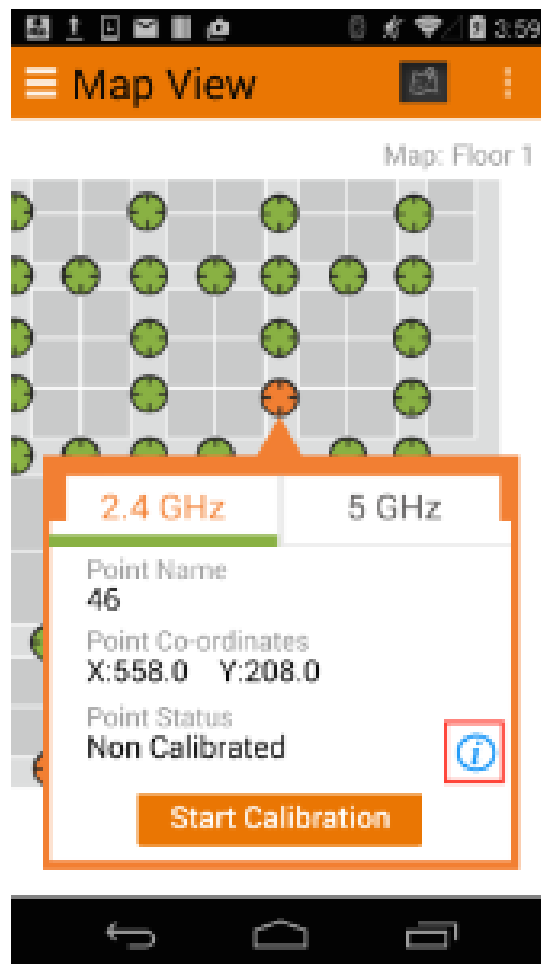
**NOTE** Calibration summary row colors indicate RSSI values, as follows:

- Values greater than -75: good (Green)
- Values between -75 to - 85: average (Amber/Orange)
- Values equal and over - 85: bad (Red)

---

The same calibration summary is presented by clicking the "i" button on the Calibration Dialog.

Figure 34: Press the "i" button to display calibration summary



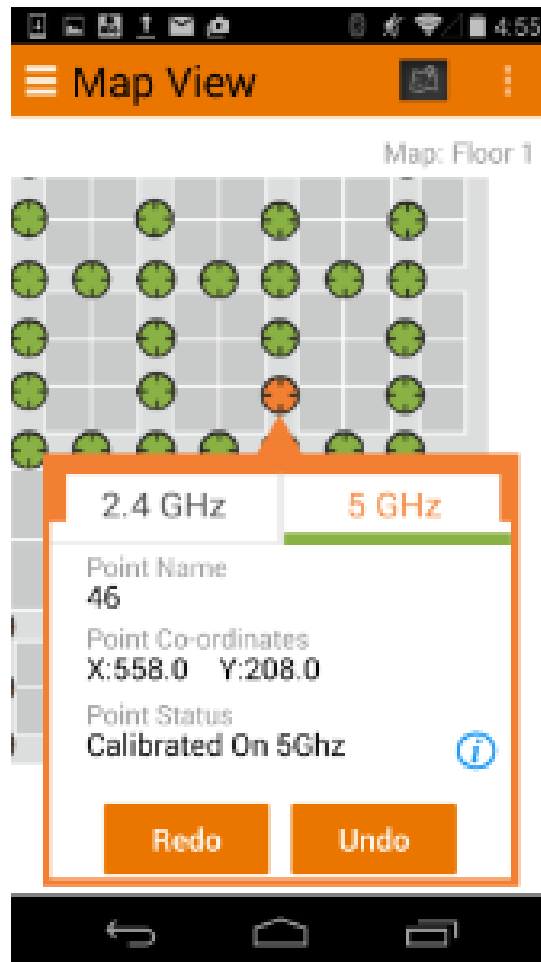
18. Connect the device to the 5 GHz SSID from the **Device** settings.

## Performing the Wireless Positioning Calibration

Android SPoT Calibrator App Instructions

19. Select the same calibration point, select 5 GHz and repeat the calibration process for the 5 GHz radio band.

Figure 35: Repeat calibration for 5 GHz radio



---

**NOTE** You can also calibrate all the Calibration Points for one band and then switch to the other band and calibrate for that other band.

---

20. Repeat these steps for each CP on the map. If a mistake is made at any of the CPs, walk back to the CP, select it from the Map View, and click Redo. The calibration data will be automatically overwritten. You can Undo or Redo a previously calibrated point for either or both radio bands at any time. You have completed the calibration process for this floor. If your venue has multiple floors, you will need to repeat the process for each floor.

---

**NOTE** After calibration is completed, return to the ZoneDirector/SmartZone web interface to configure the AP group to allow only channels 1, 6 and 11 in the 2.4 GHz radio channel selection settings. (The 5 GHz radio can be set to any 3 channels that you prefer.)

---

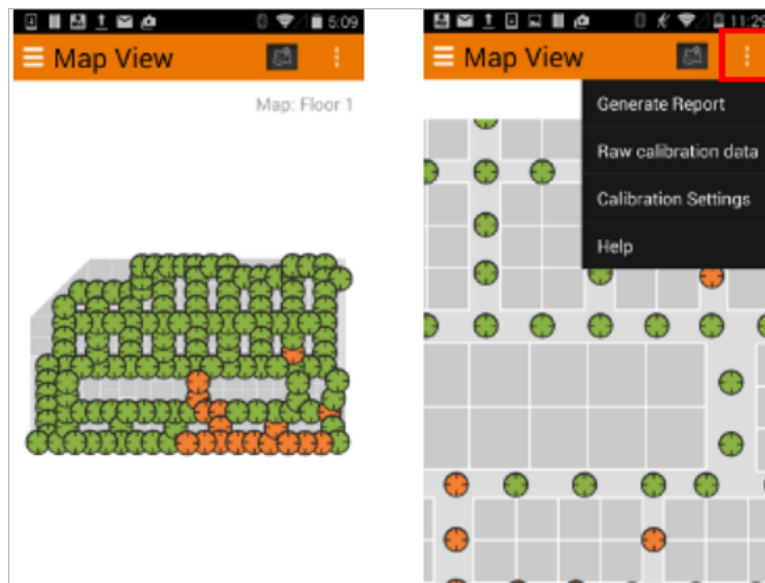
## Using the Options Icon

This section describes the functioning of the Options icon.

By clicking the icon in the upper-right corner of the map view, you can access the following three tools besides Calibration Settings:

- Generate Report
- Raw Calibration Data
- Help

Figure 36: Options



1. On the map view click on the navigation item on the top bar and select **Generate Report** to show the Calibration Report for the floor.

Figure 37: Calibration Report

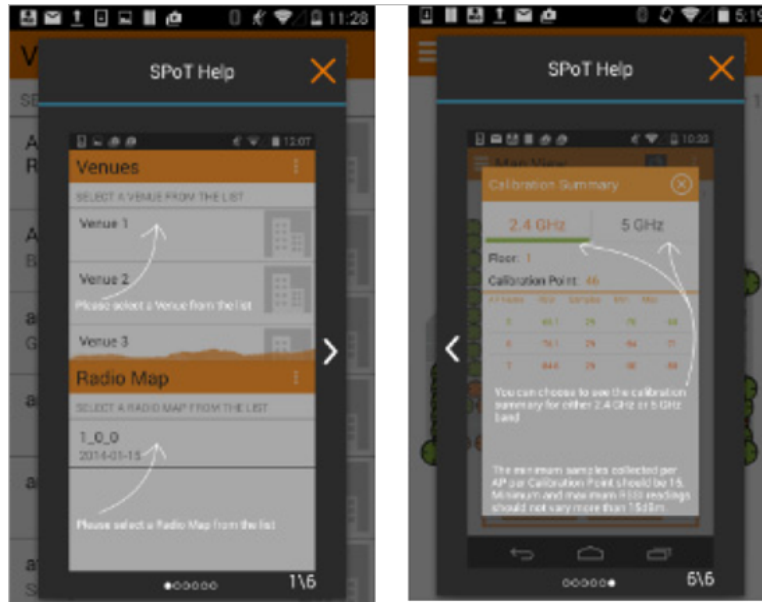
## Performing the Wireless Positioning Calibration

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2. Clicking the **Raw Calibration Data** button retrieves a calibration.yml file containing detailed results on each calibration point. This will open the native browser where you will need to enter your SPoT username/ password to see the Raw calibration file. You can use this information to define outliers and minimum RSSI values to trigger floor selection, nearest AP selection, etc. See Advanced Configuration Options for more information.
3. Click the **Help** button to launch an in-app tutorial that guides you through the calibration process. The Help screens can also be used to determine healthy calibration vs. unhealthy calibration.

Figure 38: Using the in-app Help



## Finding Your Location on a Floor Map

If at any time during the calibration process you need to find your location on the map, you can click the location icon and a blue dot will indicate your current location.

---

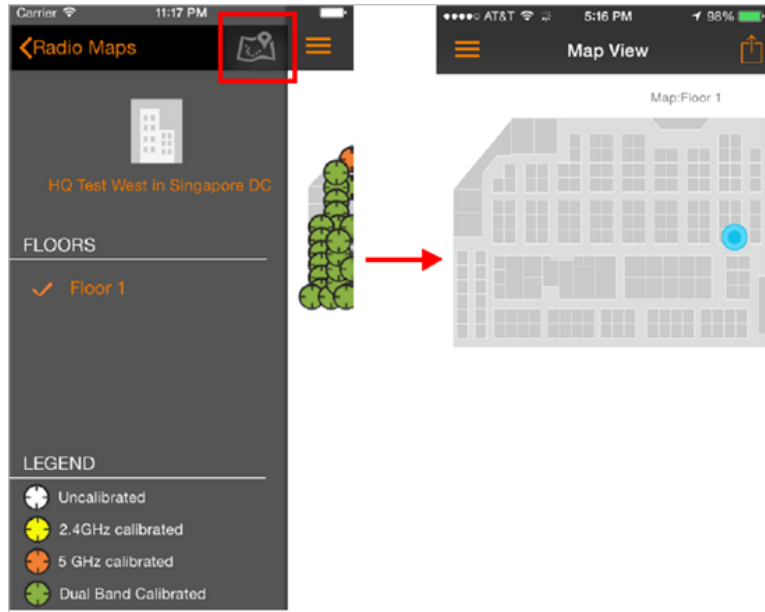
**NOTE** If your device is not locatable on the map, an “Unable to locate device” message will appear at the bottom.

---

Figure 39: Finding your location on a floor map

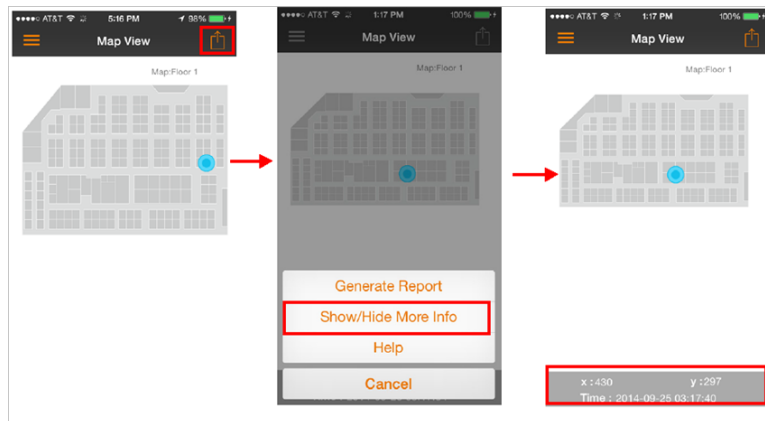
## Performing the Wireless Positioning Calibration

### Android SPoT Calibrator App Instructions



You can click the Options icon (top-right corner of the screen) and select **Show Locator info** to view your location information (x,y coordinates and timestamp) for your current location.

Figure 40: Show Locator information - Menu



## Locator Test Feature - Android SPoT Calibrator App

The locator test feature is an enhancement of the existing locator feature.

The locator test feature is an enhancement of the existing locator feature. Where the locator is currently able to show the latest location of a device, the locator test feature



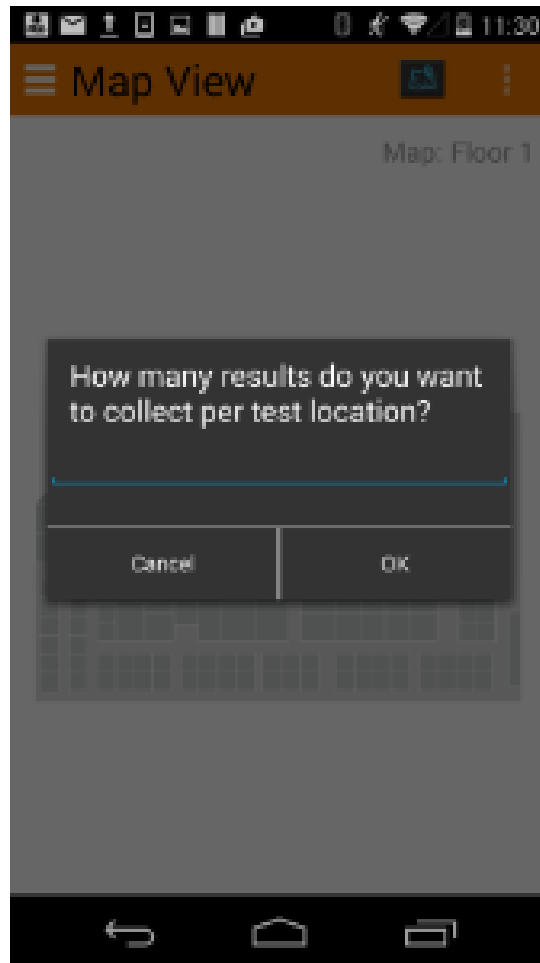
will enable users to collect  $n$  number of locations for  $n$  number of test points, before presenting it as a report for end-users to statistically determine the accuracy of a SPoT deployment.

The locator shows the latest location of a device and test feature enables users to collect  $n$  number of locations for  $n$  number of test points, before presenting it as a report for end-users to statistically determine the accuracy of a SPoT deployment.

This is how it works:

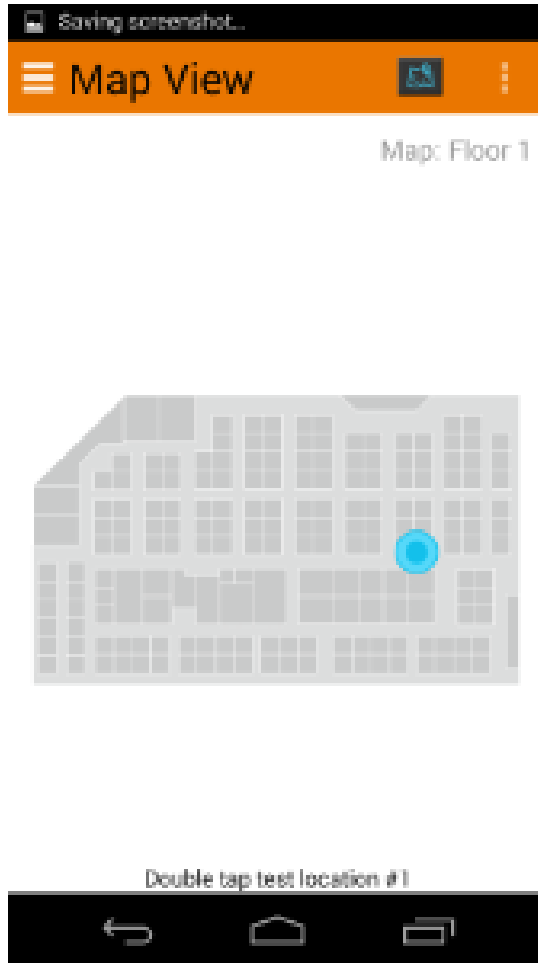
1. The device should be locatable on the map. (blue dot should be visible on the locator view).
2. Click the **Options** button on the top right bar. A menu is presented.
3. Click "**Start Locator Test**".
4. The application shows a popup asking user "How many results for you want to collect per test location?"

Figure 41: Enter number of results per test location



5. Enter a number and press **OK**. (The number entered will be the number of samples collected for each test location.)
6. The test begins now and the map view appears.
7. To zoom in/zoom out the user will use multitouch to pinch the map. The user will not be able to double tap for zooming in because the double tap feature during the test is used to drop the test location on the map.
8. The app presents the message "Double tap test location #1"

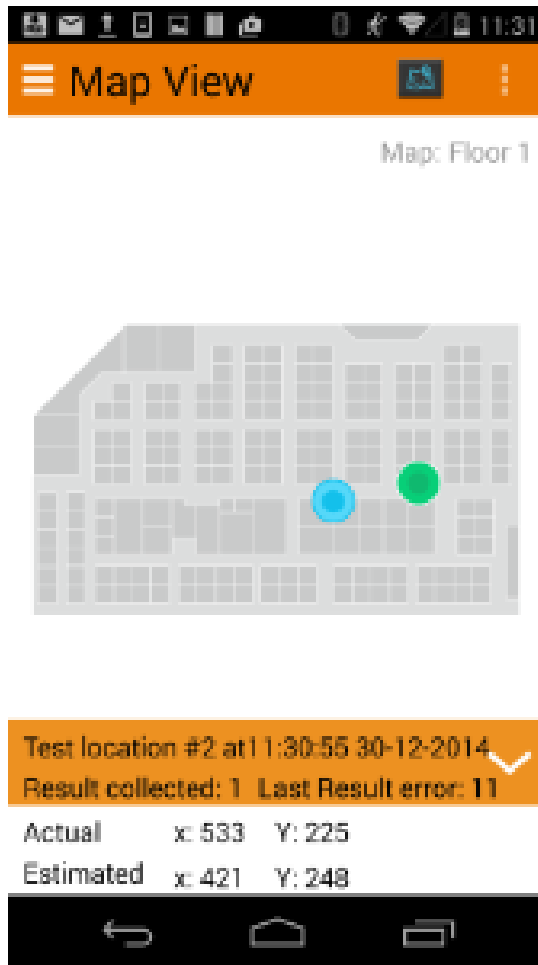
Figure 42: Double tap test location



9. Double-tap your current location on the map.
10. A green circle is drawn at your current location.

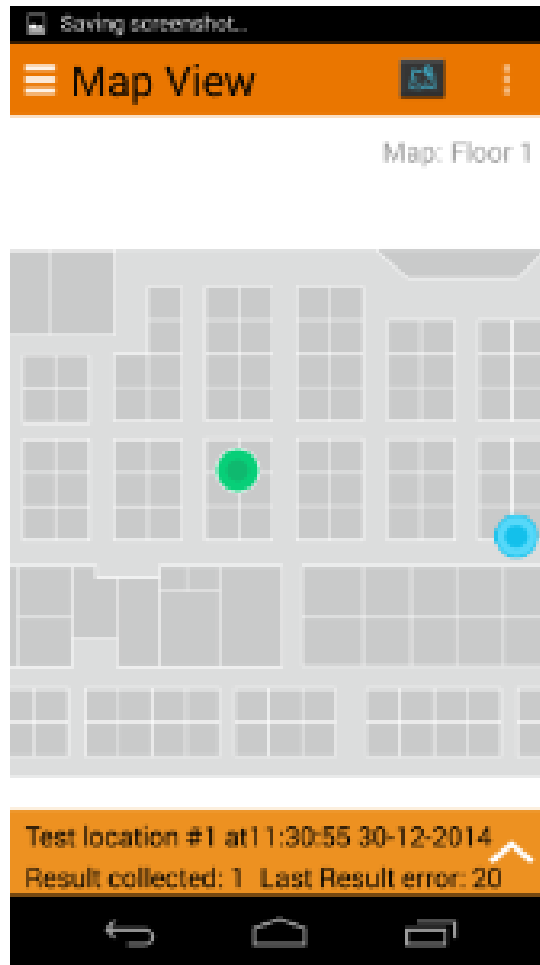
Figure 43: Green dot indicates your location

**Performing the Wireless Positioning Calibration**  
Android SPoT Calibrator App Instructions



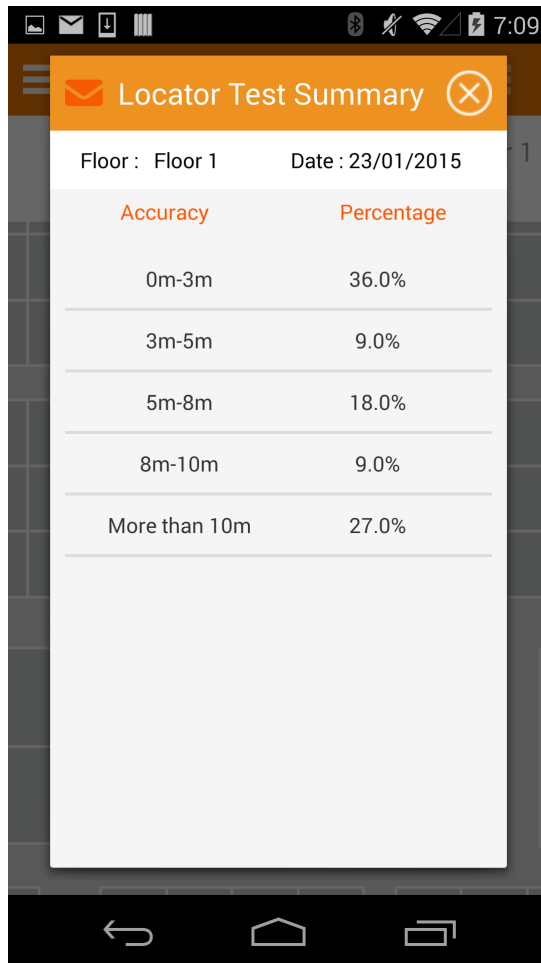
11. For each test location the number of samples selected before are collected.
12. The app calculates the error distance between the user's actual position (green dot) and the location returned from the server (blue dot). As the test is ongoing and samples are collected they are shown at the bottom of the screen.
13. You can show and hide extra details as preferred.

Figure 44: Show/hide extra details



14. When enough data for the test locations has been collected, click on the **Options** button (on top right) and hit the **Stop Locator Test** button. The test will end and a summary view is shown. The summary at the first glance shows the floor number, the date and a legend highlighting Actual and Estimated rows.

Figure 45: Locator Test Summary



15. Hitting the email icon on the summary will allow the user to email the results in CSV format to the SPoT team along with the specifics of their venue.

## iOS SPoT Calibrator App Instructions

The following are the steps required for performing SPoT venue calibration using the iOS version of the SPoT Calibrator App.

Use the following procedure to perform the venue calibration:

1. Download and install the Ruckus SPoT calibration app.

---

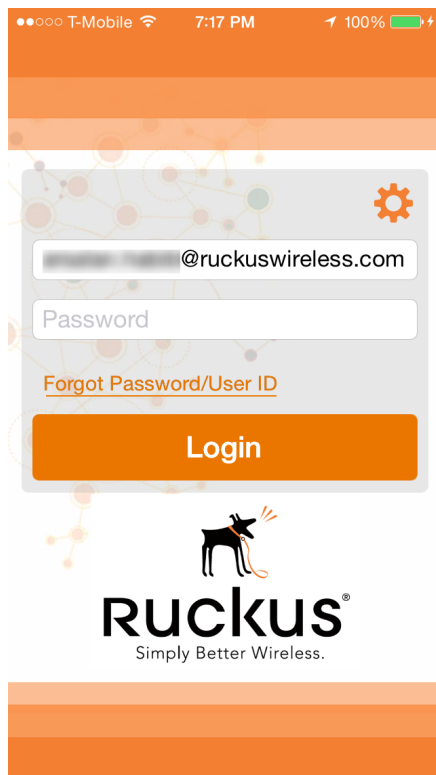
**NOTE** The device on which the calibration app is run must have Internet access.

---

2. Go to **Settings > WiFi** and make sure the WiFi function is turned on.

3. Connect to the **2.4 GHz SSID** that you created for SPoT calibration.
4. Launch the SPoT Calibrator app. The Login page appears.
5. Click the **Gear** icon to access the Settings page.

Figure 46: Login page



6. The Settings page appears. Click **SPoT Server** to select your SPoT server from the list. If you are calibrating a vSPoT deployment, select **Custom Server** and enter the address of the vSPoT server

---

**NOTE** For vSPoT 3.3 and above, use **https://[IPaddress]**, instead of *http://[IP address]:8443*.

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## Performing the Wireless Positioning Calibration

### iOS SPoT Calibrator App Instructions

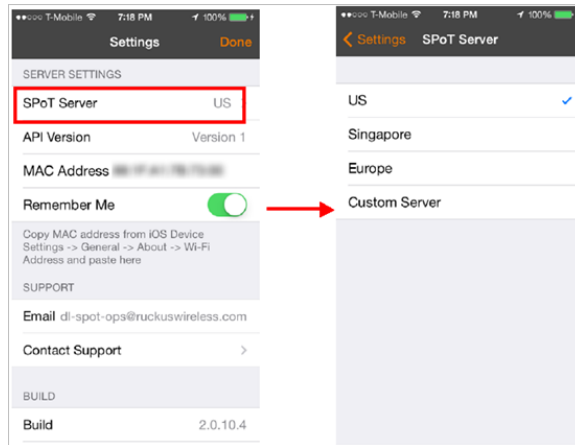
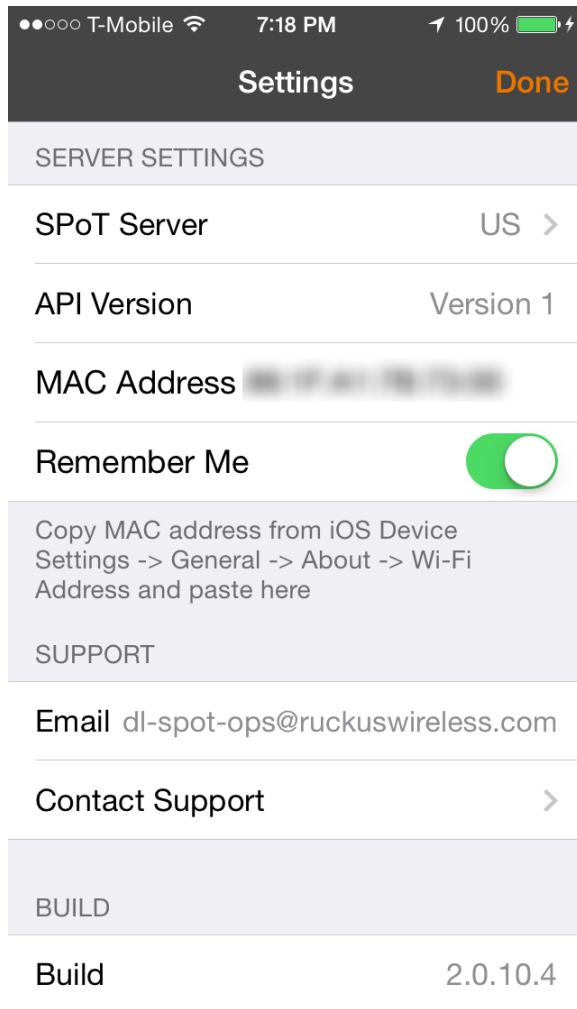


Figure 47: Click SPoT Server from the Settings page to select your SPoT server

7. Go back to Settings, and click **Done**.

Figure 48: Click Done to save your SPoT Server selection and continue





8. When the Login page appears, enter your User Name and Password, and click Login.
9. The next page displayed is the Venues page. Select a Venue from the list.

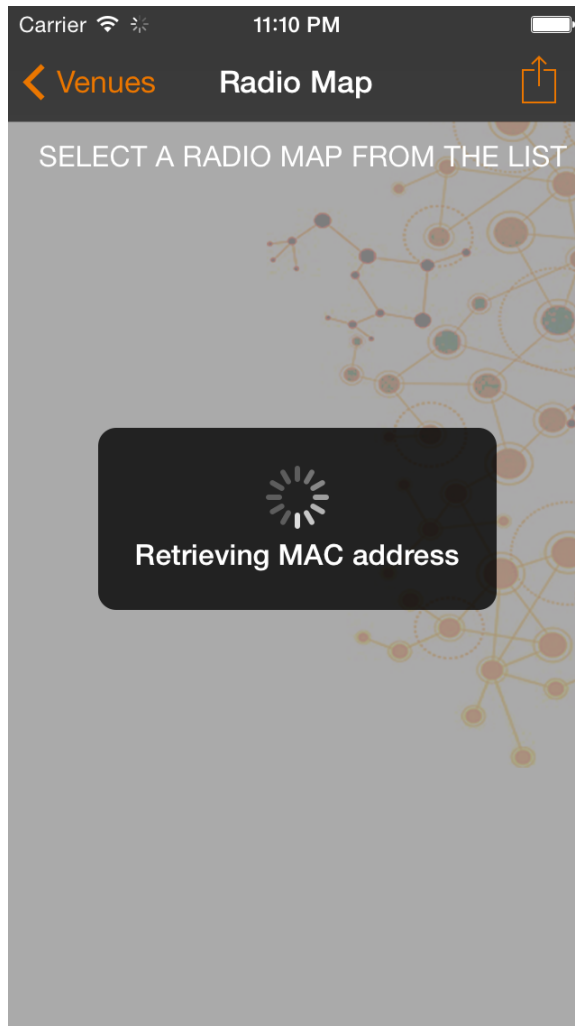
Figure 49: Select a Venue from the list

**Performing the Wireless Positioning Calibration**  
iOS SPoT Calibrator App Instructions



10. Once you have selected a Venue, the Calibrator App attempts to retrieve your iOS device's WiFi MAC address from the SPoT server.

Figure 50: Retrieving MAC address



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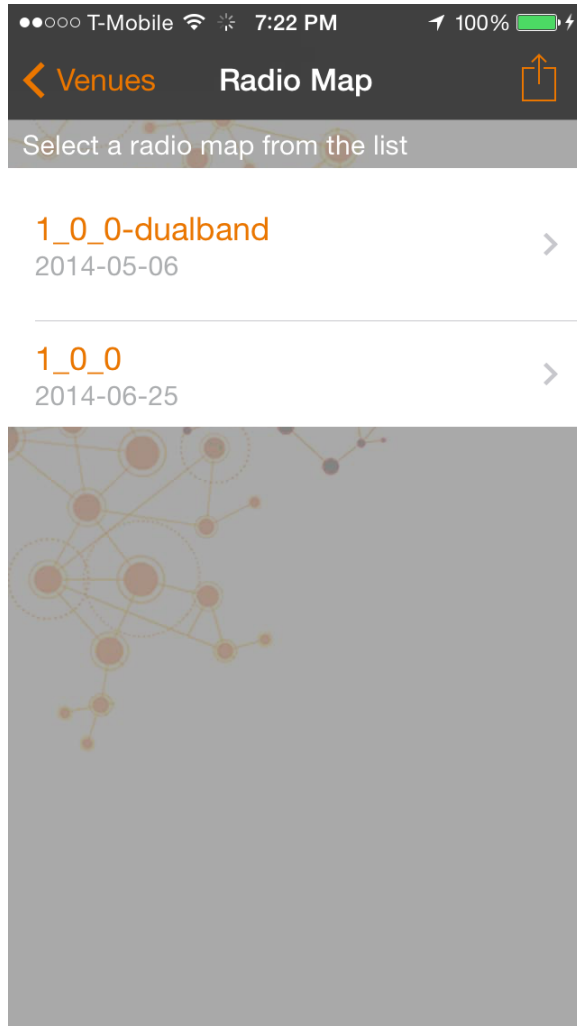
**NOTE** If for some reason the MAC address is not retrievable automatically, you will have to copy/paste your device's MAC address to the SPoT Calibrator app's settings. See [Copying Your MAC Address to the SPoT App](#) for instructions.

---

11. After selecting a Venue (and confirming that the Calibrator App knows your MAC address), you will be presented with a Radio Map selection screen. Select a Radio Map to continue.

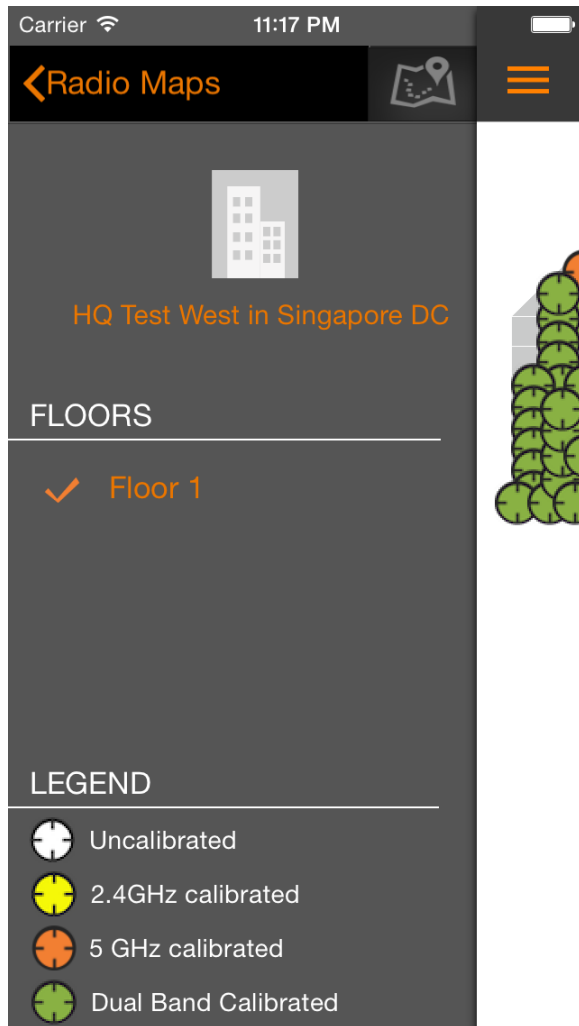
Figure 51: Select a Radio Map

**Performing the Wireless Positioning Calibration**  
iOS SPoT Calibrator App Instructions



**12** Select a floor from the Floors screen.

Figure 52: Select a floor



13. The Map View launches and displays a map of the selected floor with all of the calibration points (CPs) marked.
14. Refer to the floor plan with CPs and stand at the location of CP1.
15. Select the calibration point, select **2.4 GHz** and tap **Start Calibration** to begin calibrating for the 2.4 GHz radio band.

Figure 53: Start Calibration

**Performing the Wireless Positioning Calibration**  
iOS SPoT Calibrator App Instructions

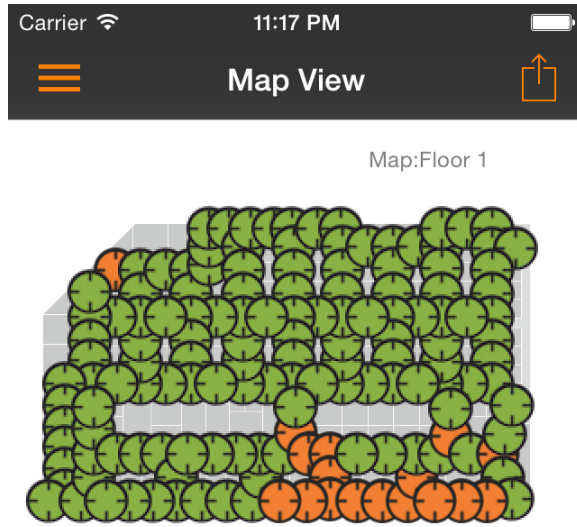
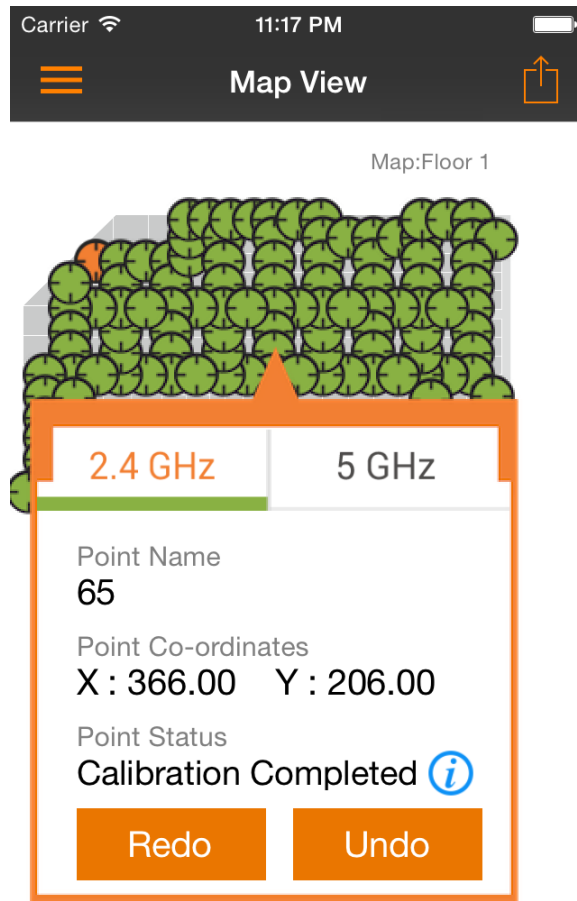


Figure 54: Calibration is Complete

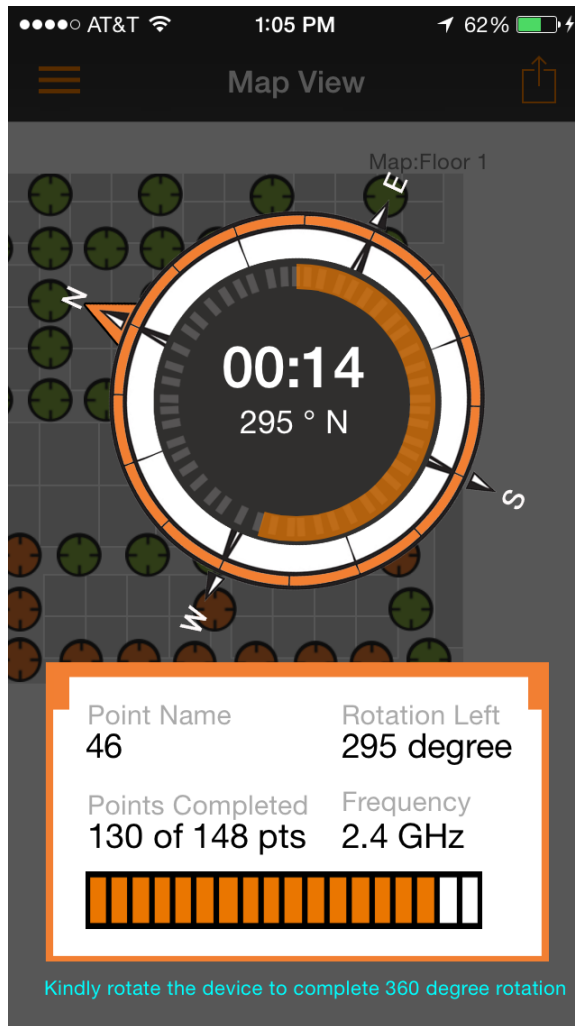


16. When the calibration process begins, the calibrator app displays a compass and a running timer to indicate the time remaining. Each calibration must be performed for 30 seconds. During this 30 seconds, the person performing the calibration should stand in place and slowly turn around 360 degrees in a clockwise direction.

Figure 55: Turn slowly around 360 degrees on the spot

## Performing the Wireless Positioning Calibration

iOS SPoT Calibrator App Instructions

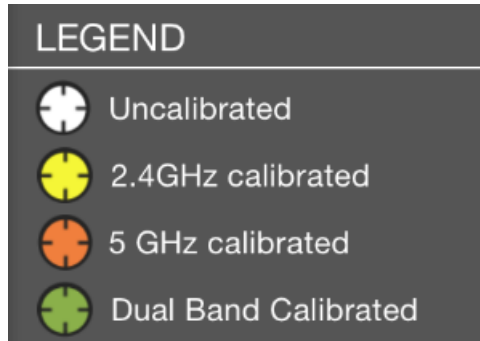


17. When the calibration is complete, a **Calibration Complete** message is displayed, and the calibration point on the Map View page changes colors to indicate its calibration status.

- White: Uncalibrated
- Yellow: 2.4 GHz calibrated
- Orange: 5 Ghz calibrated
- Green: Dual band calibrated

Figure 56: Calibration status legend



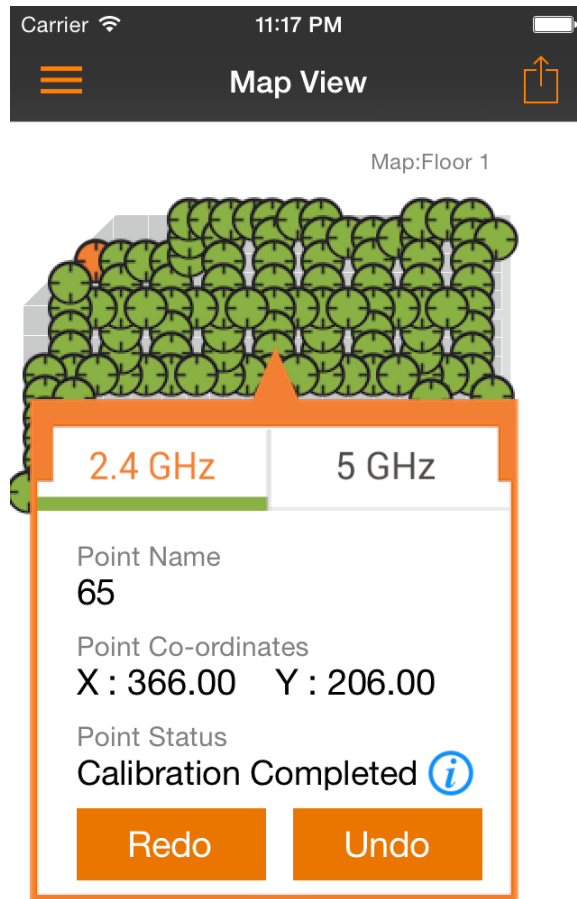


18. Go to your WiFi settings and connect to the **5 GHz SSID** that you created for calibration.
19. Select the same calibration point, select **5 GHz** and repeat the calibration process for the 5 GHz radio band.

Figure 57: Repeat the calibration process for the 5 GHz radio

## Performing the Wireless Positioning Calibration

iOS SPoT Calibrator App Instructions



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**NOTE** You can also calibrate all the Calibration Points for one band and then switch to the other band and calibrate for that other band. Additionally, multiple devices can be used to calibrate the two bands separately. As of version 1.4, the CP status is refreshed every 30 seconds, so that if you have calibrated an uncalibrated point (white) on the 2.4 GHz band (turning it yellow) and someone else has calibrated the same point for 5 GHz, then once the auto refresh kicks in, you will be able to see the point as green (meaning it has been completely calibrated).

---

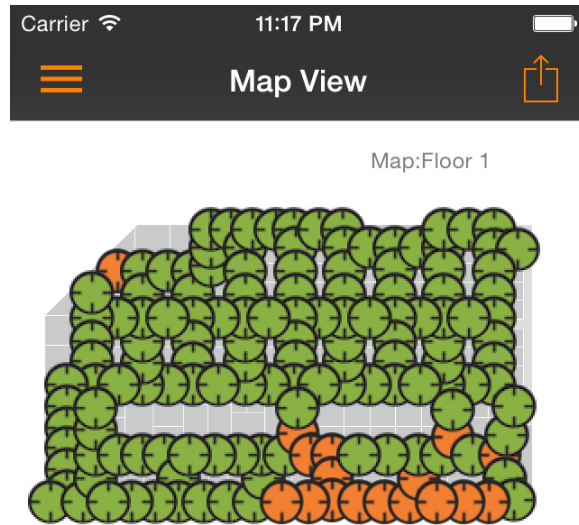


Figure 58: Green dots indicate calibration completed

20. Once a CP has been calibrated, a Calibration Summary dialog appears displaying a summary of the CP's calibration statistics, including a list of the APs that were used, the number of samples collected, and the min/max/average RSSI values for each. You can also view the status of any calibration point by clicking the "i" icon on the Calibration Point dialog box.

Figure 59: Calibration Point Summary

**Performing the Wireless Positioning Calibration**  
iOS SPoT Calibrator App Instructions

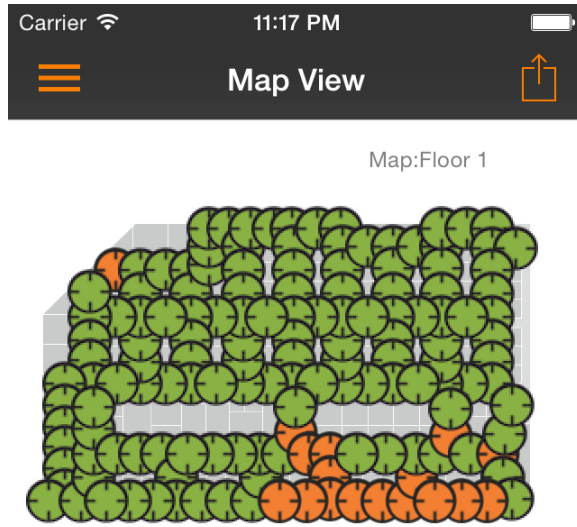
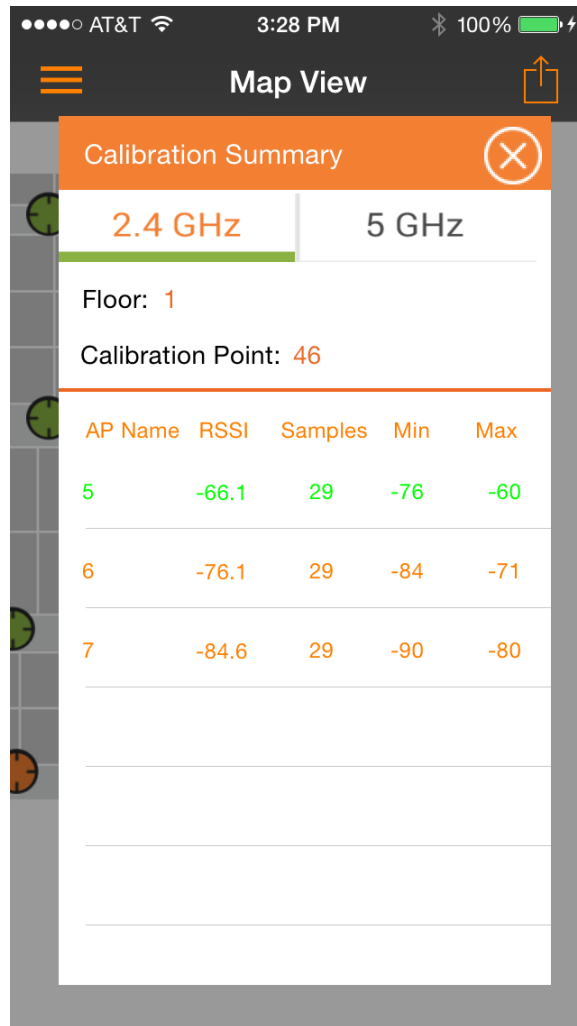


Figure 60: Calibration Point Summary



**NOTE** Calibration summary row colors indicate RSSI values, as follows:

- Values greater than -75: good (Green)
- Values between -75 to - 85: average (Amber/Orange)
- Values equal and over - 85: bad (Red)

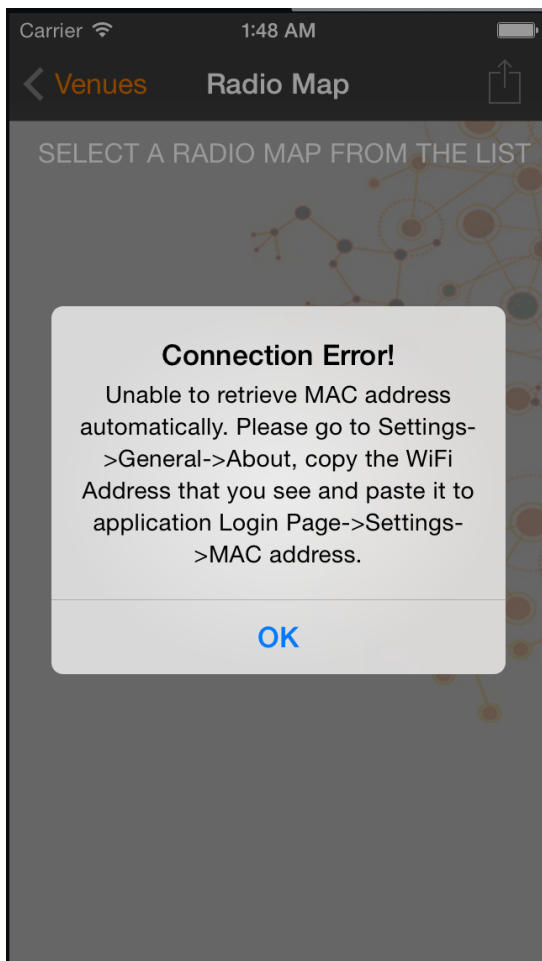
21. Repeat these steps for each CP on the map. If a mistake is made at any of the CPs, walk back to the CP, select it from the Map View, and click Redo. The calibration data will be automatically overwritten. You can **Undo** or **Redo** a previously calibrated point for either or both radio bands at any time.

## Copying Your MAC Address to the SPoT App

After selecting a venue, the iOS Calibrator App attempts to connect to the SPoT Location Server to retrieve your device's MAC Address.

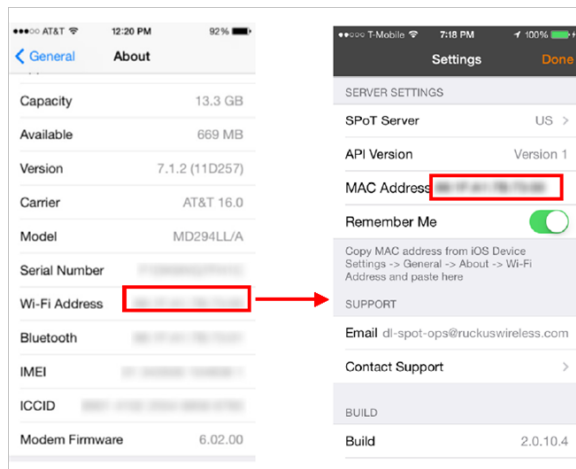
If for some reason the server is unable to retrieve your MAC address, you will see the following error message

Figure 61: Unable to retrieve MAC address error message



If you encounter this error, click **OK** and then minimize the Calibrator app. Next, In the iOS Settings application go to **General > About** and copy the WiFi MAC Address. Paste this address into the MAC Address field in SPoT Settings.

Figure 62: iOS Settings page



1. After selecting a Venue (and confirming that the Calibrator App knows your MAC address), you will be presented with a Radio Map selection screen. Select a Radio Map to continue.

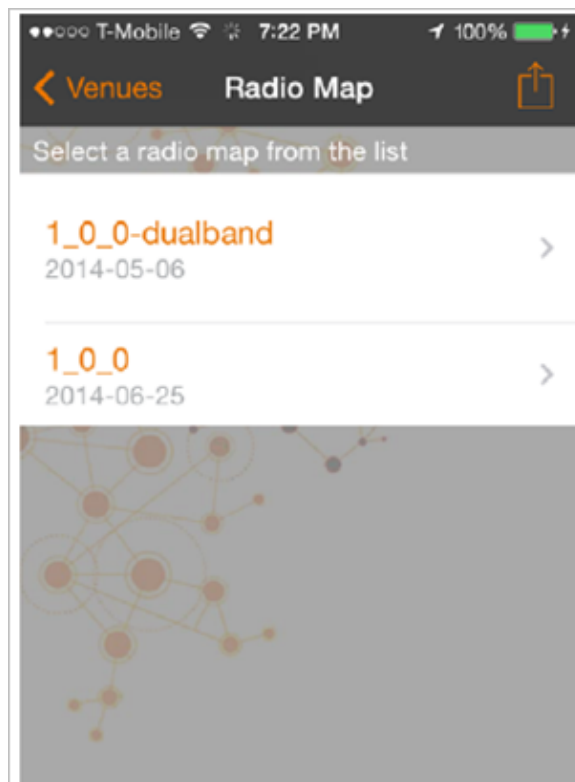
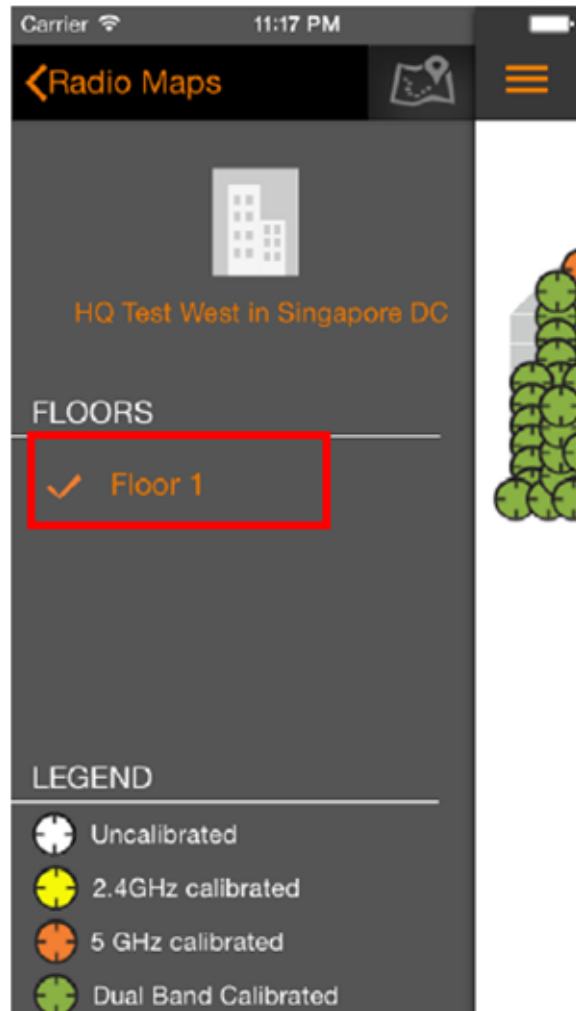


Figure 63: Select a Radio Map

2. Select a floor from the Floors screen.

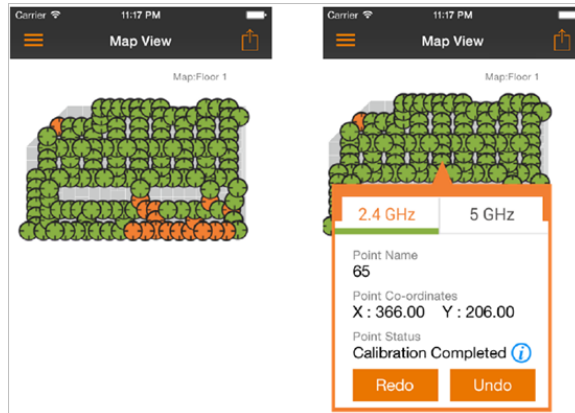
Figure 64: Select a floor



3. The Map View launches and displays a map of the selected floor with all of the calibration points (CPs) marked.
4. Refer to the floor plan with CPs and stand at the location of CP1.
5. Select the calibration point, select 2.4 GHz and tap Start Calibration to begin calibrating for the 2.4 GHz radio band.



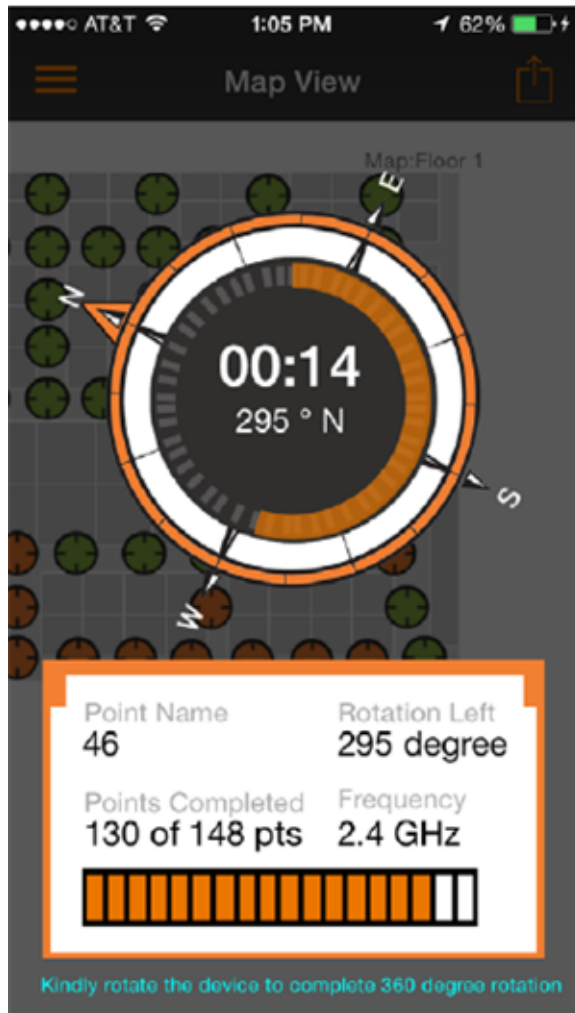
Figure 65: Start calibration



6. When the calibration process begins, the calibrator app displays a compass and a running timer to indicate the time remaining. Each calibration must be performed for 30 seconds. During this 30 seconds, the person performing the calibration should stand in place and slowly turn around 360 degrees in a clockwise direction.

**Performing the Wireless Positioning Calibration**  
iOS SPoT Calibrator App Instructions

Figure 66: Turn slowly around 360 degrees on the spot



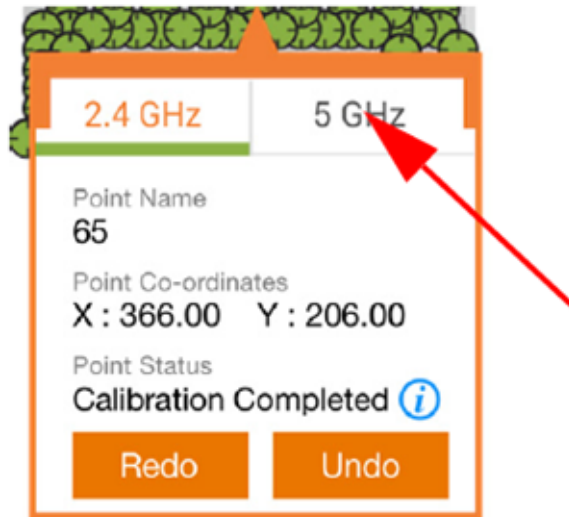
7. When the calibration is complete, a Calibration Complete message is displayed, and the calibration point on the Map View page changes colors to indicate its calibration status.
  - White: Uncalibrated
  - Yellow: 2.4 GHz calibrated
  - Orange: 5 Ghz calibrated
  - Green: Dual band calibrated

Figure 67: Calibration status legend



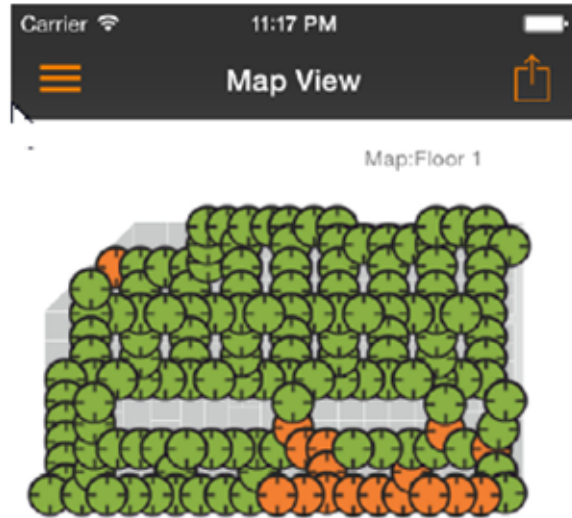
8. Go to your WiFi settings and connect to the 5 GHz SSID that you created for calibration.
9. Select the same calibration point, select 5 GHz and repeat the calibration process for the 5 GHz radio band.

Figure 68: Repeat the calibration process for the 5 GHz radio



**NOTE** You can also calibrate all the Calibration Points for one band and then switch to the other band and calibrate for that other band. Additionally, multiple devices can be used to calibrate the two bands separately. As of version 1.4, the CP status is refreshed every 30 seconds, so that if you have calibrated an uncalibrated point (white) on the 2.4 GHz band (turning it yellow) and someone else has calibrated the same point for 5 GHz, then once the auto refresh kicks in, you will be able to see the point as green (meaning it has been completely calibrated).

Figure 69: Green dots indicate calibration completed



10. Once a CP has been calibrated, a Calibration Summary dialog appears displaying a summary of the CP's calibration statistics, including a list of the APs that were used, the number of samples collected, and the min/max/average RSSI values for each. You can also view the status of any calibration point by clicking the "i" icon on the Calibration Point dialog box.

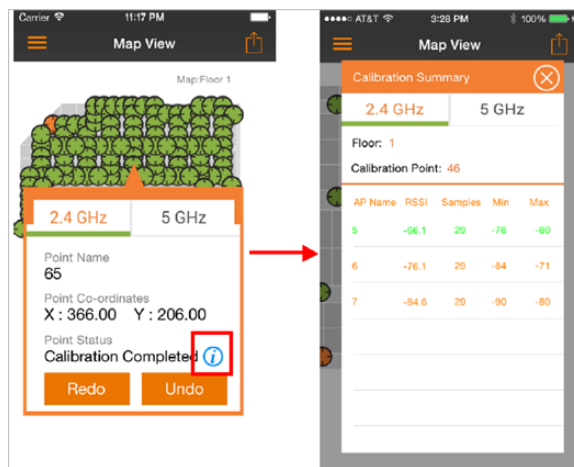


Figure 70: Calibration Point Summary

**NOTE** Calibration summary row colors indicate RSSI values, as follows: - Values greater than -75: good (Green) - Values between -75 to -85: average (Amber/Orange) - Values equal and over -85: bad (Red)

11. Repeat these steps for each CP on the map. If a mistake is made at any of the CPs, walk back to the CP, select it from the Map View, and click Redo. The calibration data will be automatically overwritten. You can Undo or Redo a previously calibrated point for either or both radio bands at any time.

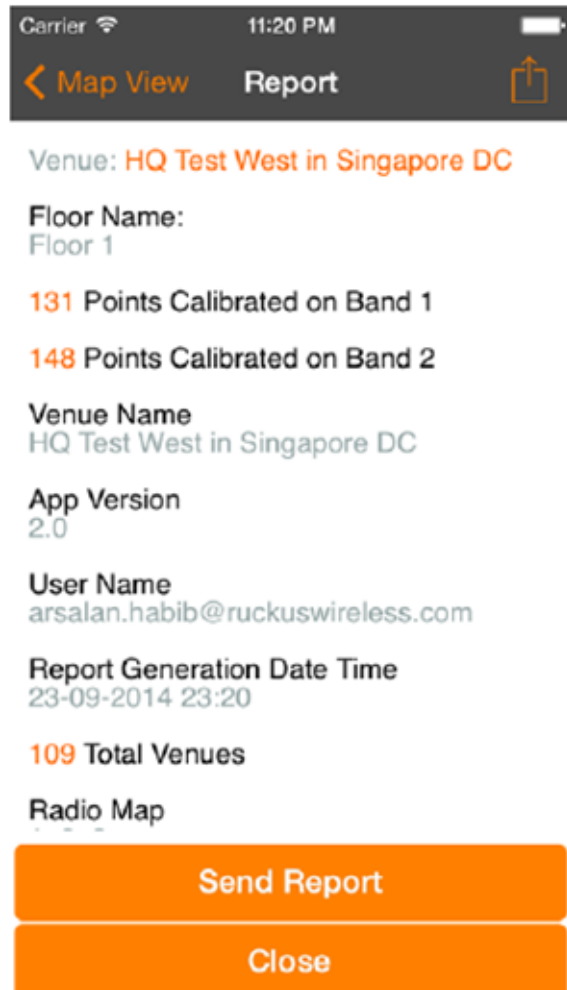


Figure 71: Calibration Report

You have completed the calibration process for this floor. If your venue has multiple floors, you will need to repeat the process for each floor.

---

**NOTE** After calibration is completed, return to the ZoneDirector/SmartZone web interface to configure the AP group to allow only channels 1, 6 and 11 in the 2.4 GHz radio channel selection settings. (The 5 GHz radio can be set to any 3 channels you prefer.)

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## Finding Your Location on a Floor Map - iOS

If at any time during the calibration process you need to find your location on the map, you can click the location icon and a blue dot will indicate your current location.

**NOTE** If your device is not locatable on the map, an “Unable to locate device” message will appear at the bottom.

Figure 72: Click the location icon to display your current location on the map

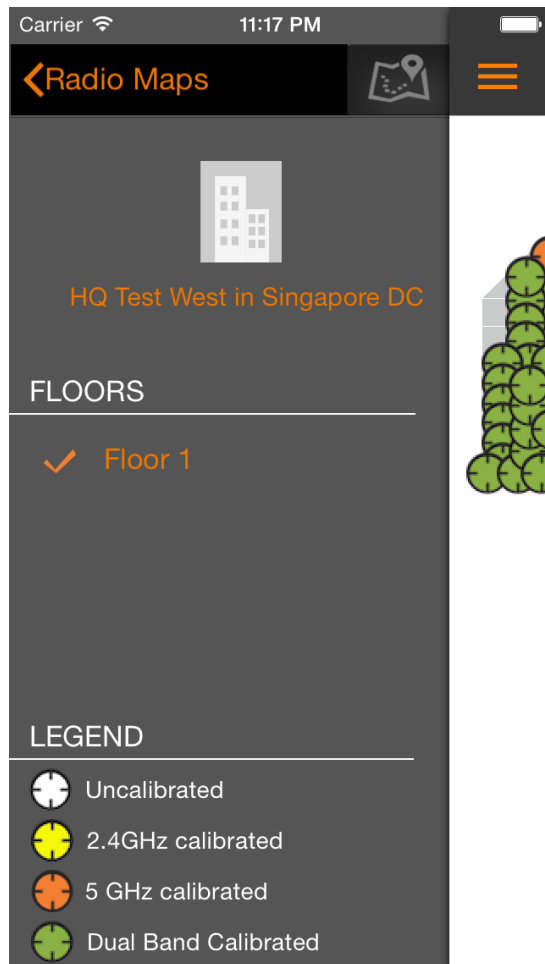
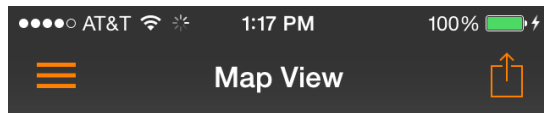
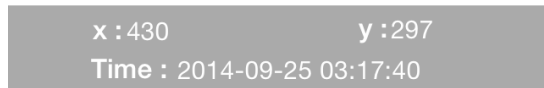
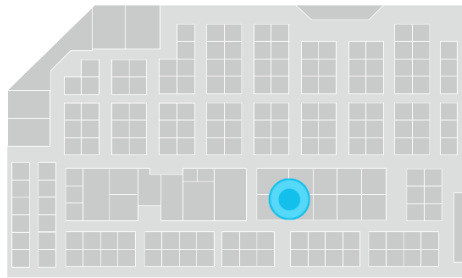


Figure 73: Location - Blue dot



Map:Floor 1



You can also click the Options icon (top-right corner of the screen) while viewing your location to display more information (x,y coordinates and timestamp) for your current location.

Figure 74: Click the Options icon while viewing your location to display more info

## Performing the Wireless Positioning Calibration

iOS SPoT Calibrator App Instructions

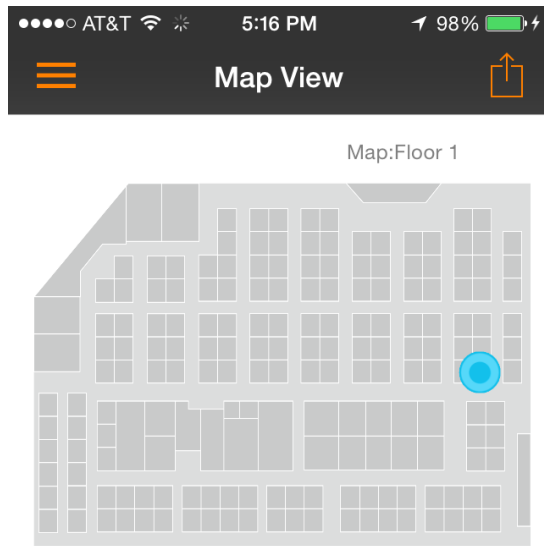


Figure 75: Select Show/Hide More Information



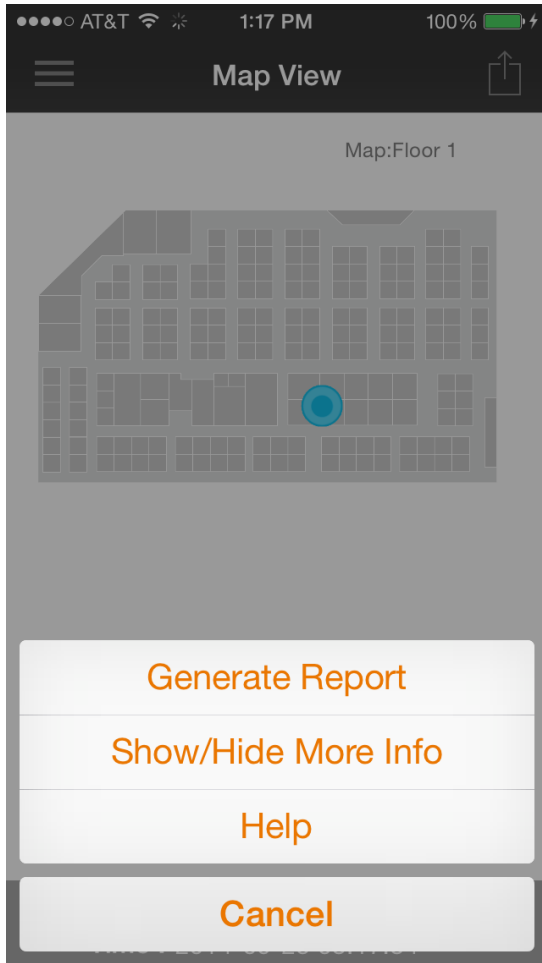
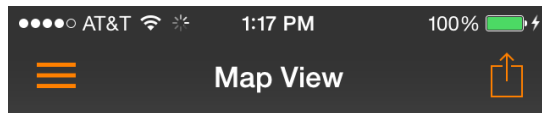


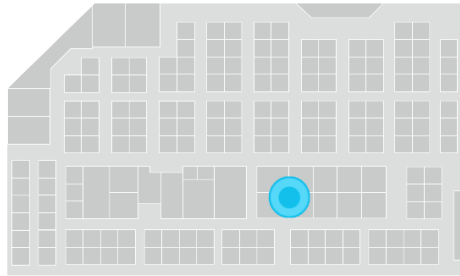
Figure 76: View Location - Blue dot

## Performing the Wireless Positioning Calibration

iOS SPoT Calibrator App Instructions



Map:Floor 1



x : 430                      y : 297  
Time : 2014-09-25 03:17:40

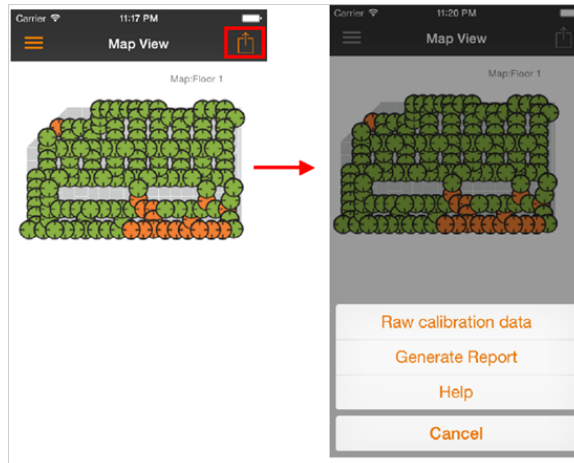
## Using the Options Icon - iOS

This section describes the functioning of the Options icon.

By clicking the icon in the upper-right corner of the map view, you can access the following three tools:

- Generate Report
- Raw Calibration Data
- Help

Figure 77: Click the Options icon to access the Help, Generate Report and Raw Calibration Data tools



1. Clicking the **Raw Calibration Data** button retrieves a calibration.yml file containing detailed results on each calibration point. This will open the native browser where you will need to enter your SPoT username/ password to see the Raw calibration file. You can use this information to define outliers and minimum RSSI values to trigger floor selection, nearest AP selection, etc. See [Advanced Configuration Options](#) for more information.
2. Click the **Generate Report** button to generate a full calibration report. This report can then be emailed to yourself, for future reference, or to Ruckus Support to help with issue resolution in case of problems with your SPoT deployment.

Figure 78: Raw Calibration Data

**Performing the Wireless Positioning Calibration**  
iOS SPoT Calibrator App Instructions

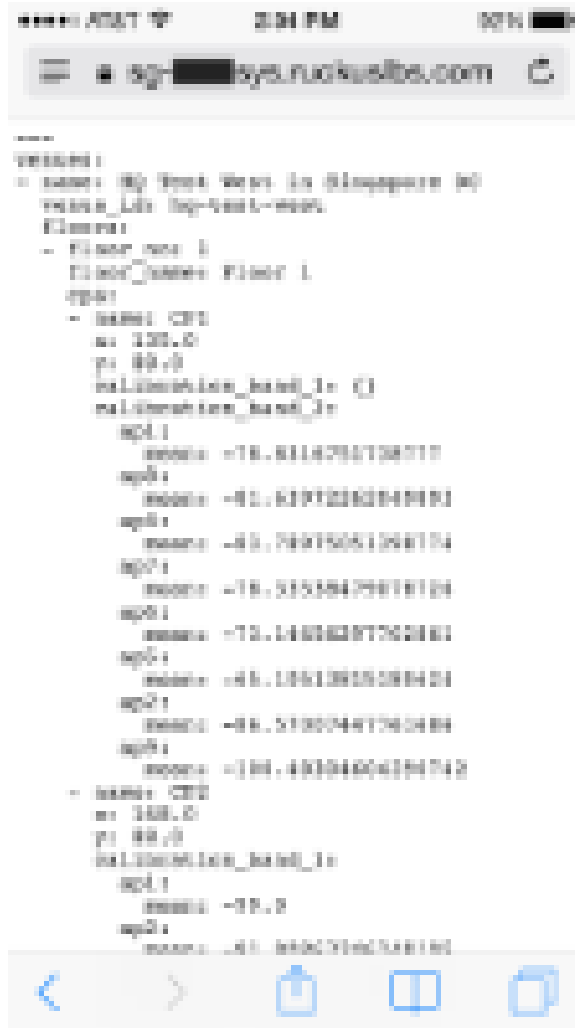
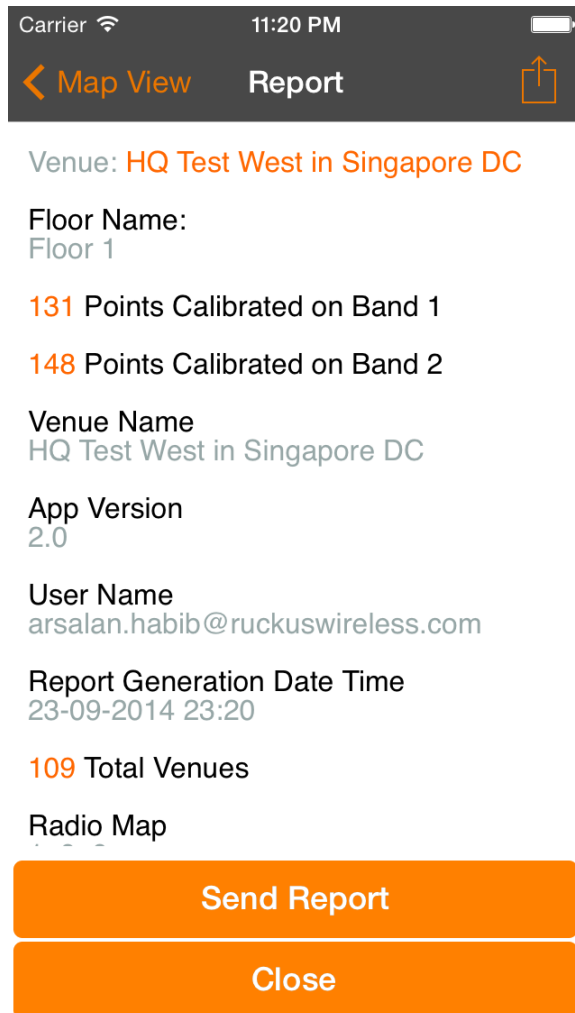
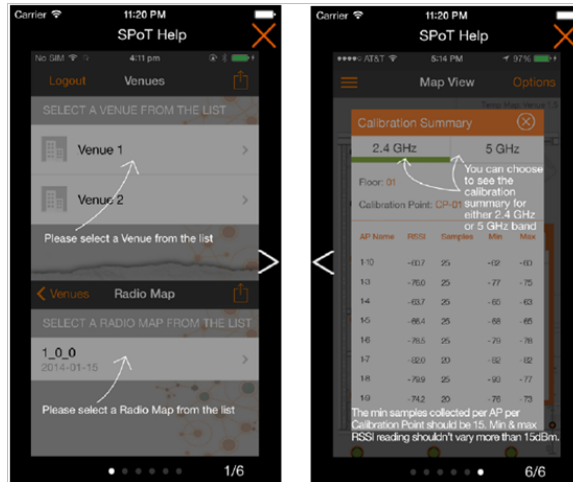


Figure 79: Generate Report Output



3. Click the **Help** button to launch an in-app tutorial that guides you through the calibration process. The Help screens can also be used to determine healthy calibration vs. unhealthy calibration.

Figure 80: Help Screen



## Locator Test Feature

The locator test feature is an enhancement of the existing locator feature.

The locator test feature is an enhancement of the existing locator feature. Where the locator is currently able to show the latest location of a device, the locator test feature is used to test location accuracy within a venue.

The locator shows the latest location of a device and test feature enables users to collect  $n$  number of locations for  $n$  number of test points, before presenting it as a report for end-users to statistically determine the accuracy of a SPoT deployment.

## Location Accuracy in the Venue

The location accuracy in the venue will only be as good as per the data collected during calibration, which is the basis of RF Fingerprinting technique used by SPoT.

The elements that affect this are detailed below.

The locator test reports the error between actual positioning of the device and where SPoT positions the device. If there is good location accuracy in the venue, the test results will reflect this and vice versa.

A number of factors causes the variations in the location accuracy of the venue, which reflects in the test results.

- 1. Device used:** The device used during calibration should be used during the locator test. The Calibration data collected is resultant from the device used and so the best reflection of location accuracy is seen when the same device is used during the locator test. The device should be charged fully or have at a minimum 50% battery

power. Most devices send weaker RSSI (received signal strength indicator) as the battery life deteriorates.

2. **Time of locator test:** The RSS within a venue fluctuates depending on multiple factors. The locator test should be taken in an environment that best reflects when the calibration was done.
3. **Position of test points:**

- a. The accuracy within a venue is not static due to:

- a. The nature of WiFi as a radio wave
- b. RSS is different in every part of the venue
- c. The dynamic environment of each venue.

Some areas will therefore have better accuracy than others. Typically, the accuracy would be best when the test device is near an AP and visible to another two (2) APs that are on the same channel. In areas where the device can only be seen by 1 or 2 APs, the accuracy results will be poor.

## Locator Test Feature - How It Works

Workings of location test feature.

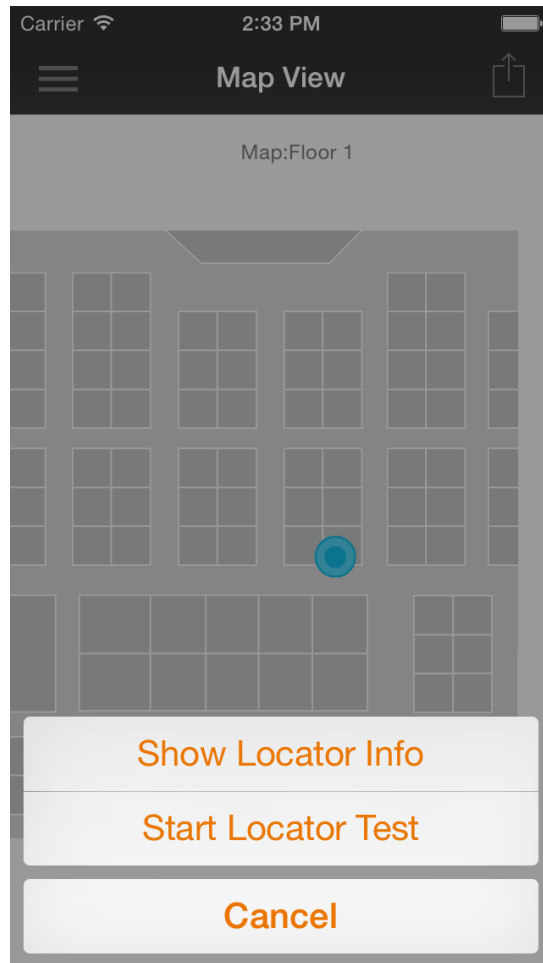
This is how it works:

1. The device should be locatable on the map. (blue dot should be visible on the locator view).
2. Click the **Options** button on the top right bar. A menu is presented at the bottom of the screen.

Figure 81: Beginning the Locator Test

## Performing the Wireless Positioning Calibration

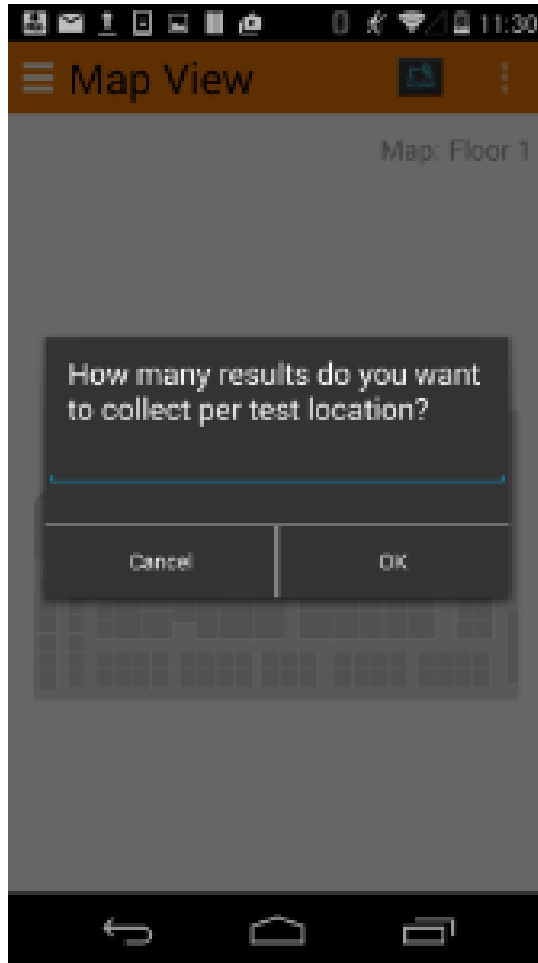
Locator Test Feature



3. Click "**Start Locator Test**".
4. The application shows a popup asking user "How many results for you want to collect per test location?"

Figure 82: Select number of results to collect



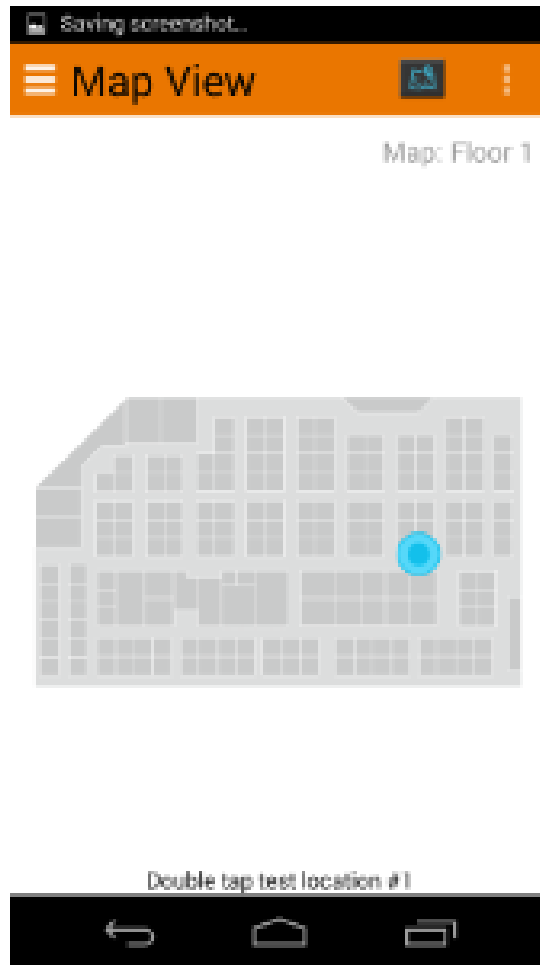


5. Enter a number and press **OK**. (The number entered will be the number of samples collected for each test location.)
6. The test begins now and the map view appears.
7. To zoom in/zoom out the user will use multitouch to pinch the map. The user will not be able to double tap for zooming in because the double tap feature during the test is used to drop the test location on the map.
8. The app presents the message "Double tap test location #1"

Figure 83: Double tap test location

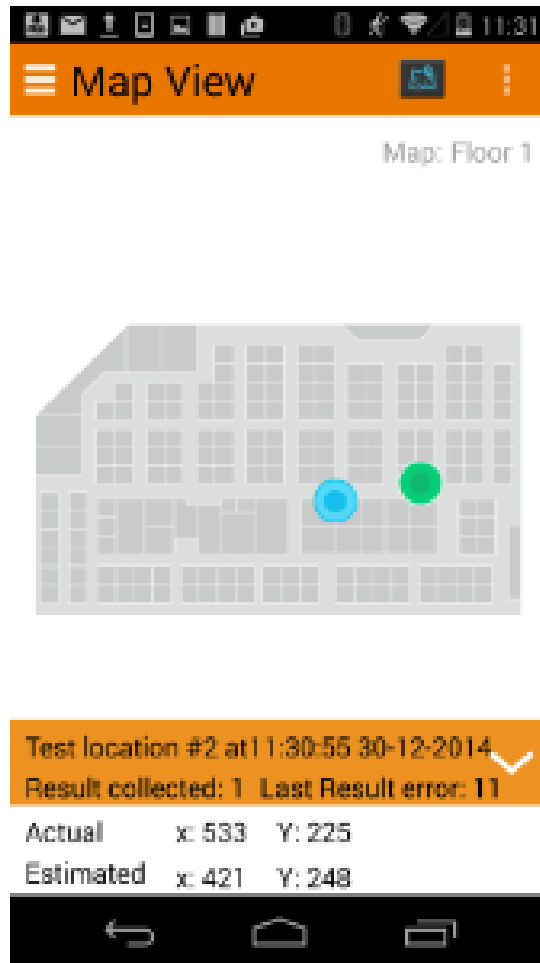
## Performing the Wireless Positioning Calibration

Locator Test Feature



9. Double-tap your current location on the map.
10. A green circle is drawn at your current location.

Figure 84: Green dot denotes your location

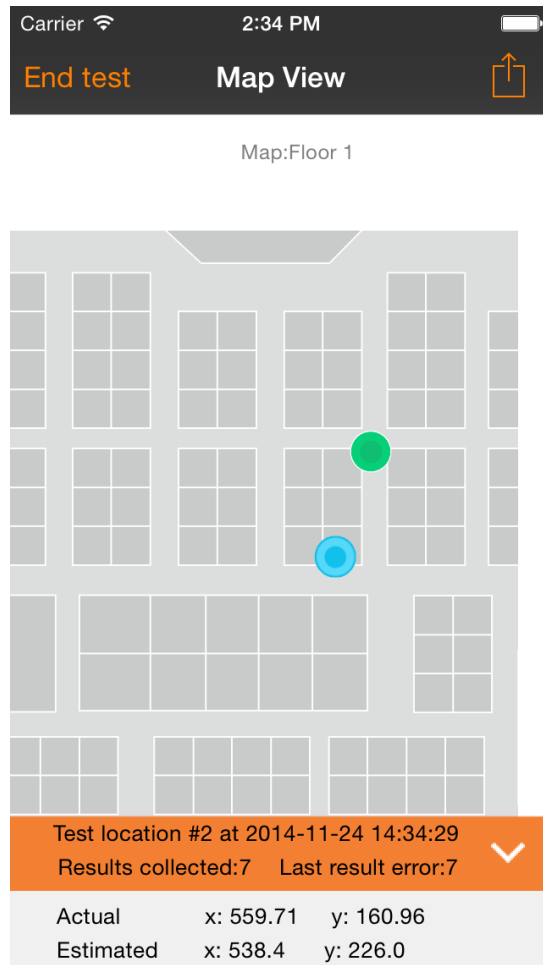


11. For each test location the number of samples selected before are collected.
12. The app calculates the error distance between the user's actual position (green dot) and the location returned from the server (blue dot). As the test is ongoing and samples are collected they are shown at the bottom of the screen.
13. You can show and hide extra details as preferred.

Figure 85: Test location results shown at bottom of screen

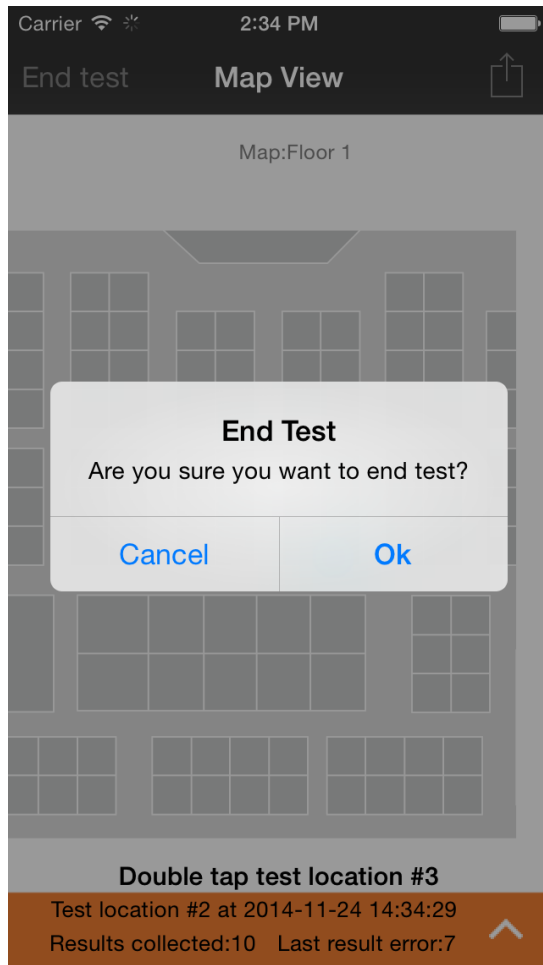
## Performing the Wireless Positioning Calibration

Locator Test Feature



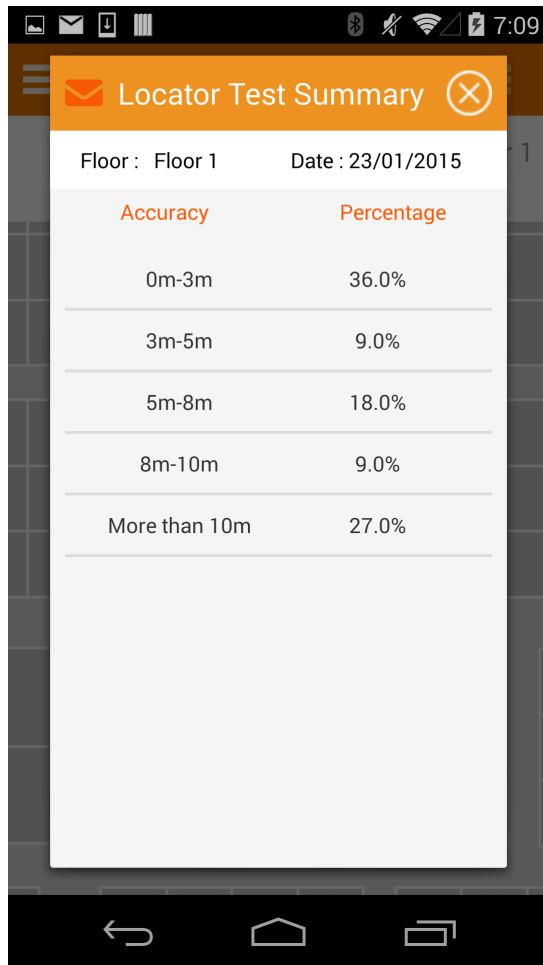
14. When enough data for the test locations has been collected, hit the **End test** button on the top left in the navigation bar. The test will end and a summary view is shown. The summary at the first glance shows the floor number, the date and a legend highlighting Actual and Estimated rows.

Figure 86: End Test



15. The table at the bottom shows the test location ID, time, whether the row is actual data or estimated, the x and y coordinates and the error distance in meters.

Figure 87: Locator Test Summary



16. Hitting the email icon on the summary will allow the user to email the results in CSV format to the SPoT team along with the specifics of their venue.

# Introduction to SPoT Presence

# 4

SPoT Presence provides customers with the ability to use SPoT location data from a ZoneDirector AP group or SmartZone AP zone for estimating client locations without having to perform the calibration steps.

SPoT Presence provides a less precise - but lower cost - option for customers who do not need precise location data on a map. The typical SPoT deployment (after calibration) provides up to 3-8 meter accuracy (90% confidence level, when the network is designed for SPoT).

SPoT Presence, on the other hand, does not require calibration but provides only clients' estimated proximity to an AP. The SPoT Presence deployment is completely automated - APs begin sending location data to the location server immediately after configuring the ZoneDirector AP group or SmartZone AP zone with SPoT location server information. No site survey, map configuration or calibration is required.

The primary differences between SPoT and SPoT Presence are summarized in the following table.

Table 4: Differences Between SPoT and SPoT Presence

	SPoT	SPoT Presence
Location Accuracy	Point with calibration: 3m to 10m accuracy. 80% confidence. Point without calibration: average 10m	Able to detect WiFi devices up to 20-30 meters away from AP. WiFi device positioned at the nearest AP.
Location Details	Actual x/y coordinates on a map, in/out of zone on a map, geo-fencing.	Distance from AP.
Target Markets	Large venues with multi-AP deployments.	Single-AP retail venues, outdoor sparse deployments.
Analytics	Precise details on a map.	Number of clients near the AP.
Real-time tracking	Yes, with up to 3-8m possible.	Only indicates AP location on a map, not user location in relation to APs. Device to be tracked located at nearest AP.

	<b>SPoT</b>	<b>SPoT Presence</b>
Benefits	Precise positioning in large venues.	No calibration required. Lower cost solution for smaller venues.

## How it Works

SPoT Presence works the same way as SPoT - APs send client location data to the SPoT Location Server, which then delivers that information to the SPoT Analytics Engine, which in turn produces output for monitoring client location (proximity) statistics in the Analytics Dashboard.

The location server considers each AP group as a venue, and each AP within that AP group as a zone within the venue.

## Overview of the Setup Process

The setup process for SPoT Presence is considerably simpler than for SPoT.

The required steps are as follows:

1. Create Your SPoT Account (as described in [Step 2: Obtain SPoT License and Log In to Your SPoT Account](#)).
2. Create your venue maps (as described in [Step 4: Map Creation and Venue Server Instantiation](#)).
3. Access the SPoT Admin Dashboard (as described in [Step 3: Access the SPoT Admin Dashboard](#)).
4. Configure the ZoneDirector AP Group or SmartZone AP zone for communication with the SPoT Location Server (as described in [Step 6: Prepare the Controller/Access Point Deployment for SPoT Calibration](#)).
5. Begin using SPoT Presence for monitoring client association to your APs.

## Calibration Process

Calibration is not required for SPoT Presence.

Once your SPoT Presence account is set up and your ZoneDirector AP Group or SmartZone AP zone has been configured with the SPoT location server information, APs will begin sending location data to the SPoT location server.



## Map Management

Map management is required for SPoT Presence. AP locations must be plotted on the venue map, however AP calibration is not required.

## Using the Analytics Dashboard for SPoT Presence

SPoT Presence provides all of the Dashboard views available to a typical SPoT deployment on the Analytics Dashboard.

Specifically, the Analytics Dashboard for SPoT Presence includes:

- Unique Visitors
- Average Dwell Time
- Repeat Visitors (including new vs. repeat, repeat count views)
- Days Since Last Visit
- Heatmap
- Real-time Asset Tracking

---

**NOTE** See [Using the Analytics Dashboard](#) for more information on these analytics pages.

---

## **Introduction to SPoT Presence**

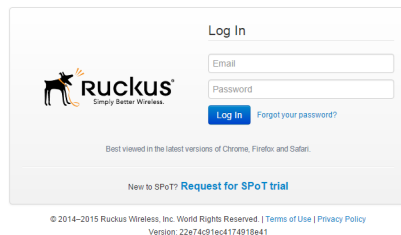
Using the Analytics Dashboard for SPoT Presence

# Using the SPoT Administration Portal 5

The SPoT Administration Portal provides tools for use in managing all aspects of your SPoT deployment.

It contains configuration pages for managing user accounts, venues, radio maps and access points. It also provides a link to the SPoT Analytics Dashboard.

Figure 88: The Administration Portal login page



## Requesting an Account


There are two ways to begin using SPoT:

- Request a SPoT trial: This can be done via <http://www.ruckuswireless.com/products/smart-wireless-services/spot>. Click the **Request SPoT Trial** button and fill in the requested information. Our Ruckus Sales team will contact you. Once the SPoT Trial has been approved, you will be sent a Sales Purchase Agreement (SPA) email from Ruckus with instructions on the next steps.
- Purchase a SPoT License for your venue: After your order has been processed by Ruckus, you will receive a SPA email from Ruckus with instructions on the next steps.

Once you have received the SPA email, use the following procedure to access your trial or purchased SPoT account:

1. Click the link in the SPA Email to go visit the “Register” page.

Figure 89: Register an account page



### Register

Group Name ?

Used to uniquely identify your organization. Only lowercase letters, numbers, underscores and dashes are accepted.

First Name

Last Name

Email

Password

Re-enter Password

**Register** ?

Already have an account? [Log in to SPoT](#)

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2. Enter a Group Name and your registration information to register.
3. Click **Register**.
4. The “Thank you for Registering” page appears.
5. A registration email is sent to the email address entered. Follow the instructions in the email to confirm your SPoT admin account registration.
6. After clicking the link in the registration email, the following Terms and Conditions acceptance page appears.
7. Click the check box next to “**Yes, I accept the SPoT service Terms and Conditions.**” Click **Submit**.

---

**NOTE** The link to the Terms and Conditions will expire after 7 days.

---

Figure 90: Terms and Conditions page



**Register**

**RUCKUS WIRELESS, INC.**  
Smart Positioning Technology (SPoT) Software License

PLEASE READ THIS SOFTWARE LICENSE CAREFULLY. RUCKUS WIRELESS, INC. ("RUCKUS") IS WILLING TO LICENSE THE SOFTWARE TO YOU ("LICENSEE") ONLY ON THE CONDITION THAT THE LICENSEE ACCEPTS ALL OF THE FOLLOWING TERMS AND CONDITIONS.

IF A USER ACCEPTS THIS LICENSE, OR DOWNLOADS, USES OR INSTALLS THE SOFTWARE, AS AN EMPLOYEE OF, OR AS AN AGENT OR CONTRACTOR FOR THE BENEFIT OF, A COMPANY, THAT COMPANY SHALL BE DEEMED THE LICENSEE AND THE USER REPRESENTS THAT IT HAS THE POWER AND AUTHORITY TO ACCEPT THIS AGREEMENT ON BEHALF OF THE COMPANY.

BY DOWNLOADING, INSTALLING AND/OR USING THE SOFTWARE, LICENSEE ACKNOWLEDGES THAT IT HAS READ THIS LICENSE AND AGREES TO BE BOUND BY ITS TERMS AND CONDITIONS. IF LICENSEE DOES NOT AGREE TO THE TERMS AND CONDITIONS OF THIS LICENSE, RUCKUS IS UNWILLING TO LICENSE THE

Yes, I accept the SPoT service terms and conditions.

**Register**

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8. Upon acceptance of the Terms & Conditions, you will be directed to the Venue List page of the SPoT Admin Dashboard.

Figure 91: The SPoT Admin Dashboard

## Using the SPoT Administration Portal

### Activating Licenses for Cloud Hosted SPoT

The screenshot shows the Ruckus SPoT Admin interface. At the top, there is a navigation bar with the Ruckus logo and 'SPoT Admin' text. Below the navigation bar, there are tabs for 'Venues', 'Groups', 'License', and 'Accounts'. The 'Venues' tab is selected. The main content area shows a 'List' view of venues. The table has the following data:

Venue ID	Name	Details	Config	Access Points	Radio Maps	Utilization	Delete
act-code-venue	act code venue						
apple-reviewer	Apple App Store Review - 1						
arisg	aricent SG						
aricent	aricent_plot6						
aricent01	aricentGgnDevLab						
aricentsgtestlab	aricentsgtestlab						
phal-venue	at HQ						
bdc-ruckus1	BDC Ruckus						
biadogs1asvegas	Big Dogs Las Vegas 2014						

## Activating Licenses for Cloud Hosted SPoT

The License page is where Client Capacity Licenses are activated. Key in the activation code and click on Save. The Licenses will be added to the Group for use across venues set up under the Group.

Along with the Activation codes, the license page will display the License SKU, quantity of the SKU, order date and expiry date.

This page will also display the total number of Client Capacity for the Group.

---

**NOTE** This page does not apply to vSPoT users.

---

Figure 92: The License page

**Ruckus** SPoT Admin Edit Account Analytics API Explorer Log Out

Venues Groups **License** Accounts

SPoT Resources including the Best Practice Guide, User Guide, and more are available at [Ruckus Wireless Support](#). We encourage you to read these resources before deploying SPoT. If you have any questions, please contact your Local Ruckus Sales team for assistance or go to [Ruckus Wireless Contact](#) to look for a contact.

### License

LICENSE ACTIVATION

Group:

Activation code:

Please refer to the Activation Code in your SPA Order email.

**Save**

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Version: 4.1.2

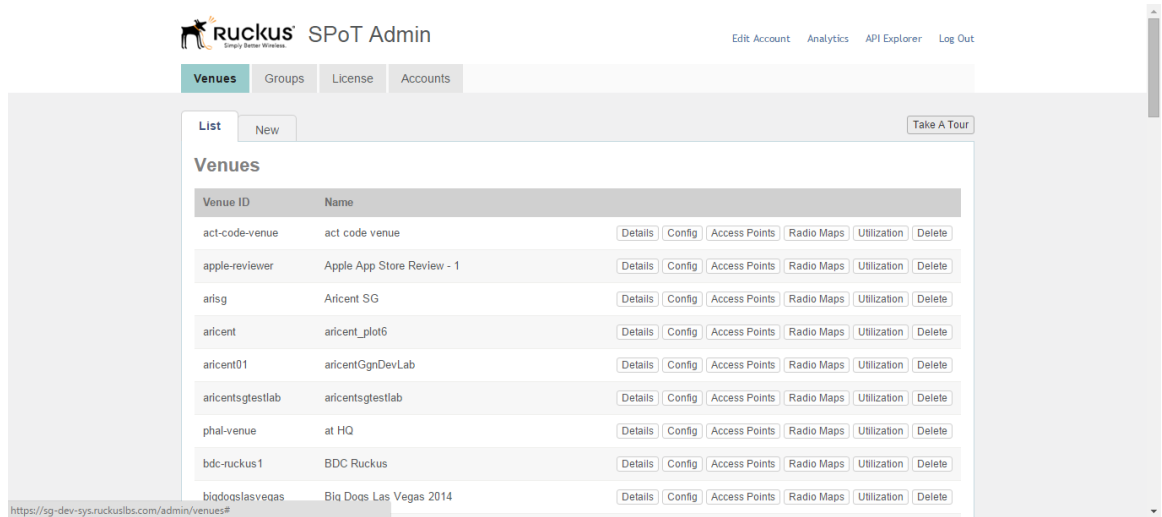
## Managing Venues

The Venues page displays a list of all of your configured venues.

From this page, you can create a new venue or edit venue settings such as venue name, street address and latitude/longitude coordinates. This page also provides links to the access point and radio map settings pages from which you can display or configure the APs that are associated with a venue, and display or modify radio map settings including timestamps and floor number display settings.

See [Access Points](#) and [Radio Maps](#) for more information on these configuration pages.

Figure 93: The Venues page



## Creating a New Venue

Use the instructions in this section to create a new venue.

Click the **New** link near the top of the page to open the New Venue configuration page.

1. Enter a unique `Venue ID` for your venue. Venue IDs cannot include spaces, capital letters or other special characters. Only lowercase letters, numbers and dashes are accepted.
2. Enter a descriptive `Name` for the venue. Names can include spaces, capital letters and other special characters.
3. In License Allocation, select whether this venue is to be a `SPoT Point` or a `SPoT Presence Venue`.
4. Key in the number of Clients/Min to be allocated in the Venue. The available clients /min will be shown above.

---

**NOTE** Steps 3 and 4 are only for Cloud Hosted SPoT (not relevant for vSPoT).

---

5. In Venue Information, fill in the number of APs in the venue and the type of venue it is.
6. In Locality, use **Assisted Mode** to allow Google Maps to assist with geolocation. Enter the physical address of the venue and press **Enter**. If Google Maps can locate the address, it will automatically fill in the latitude and longitude coordinates along with City, State/Province/Region, Postal Code, Country and Time Zone fields. If the address cannot be geolocated, use **Manual Mode** to fill in the fields manually.
7. Click **Save** to save your changes.



---

**NOTE** To reallocate client capacity to the venue in Cloud Hosted SPoT, fill in the new number of clients/min into the field and Save. The new license capacity will be reflected in the Utilization chart after the next hour.

---

Figure 94: Creating a new venue

The screenshot shows the 'New Venue' form in the SPoT Administration Portal. The form is titled 'New Venue' and has tabs for 'List' and 'New'. A 'Take A Tour' button is in the top right. The form is divided into several sections:

- ACCESS CONTROL:** A 'Group:' dropdown menu.
- ORDER INFORMATION:** An 'Activation Code:' field with a help icon. Below it, a note says 'Please refer to the Activation Code in your SPA Order email.'
- NAMING:** A 'Venue ID:' field with a help icon. Below it, a note says 'Only lowercase letters, numbers and dashes are accepted (for example, you are Starbucks in MarketStreet in San Francisco, you could use sbms-01 as your Venue ID)'. Below that is a 'Name:' field with a help icon. Below it, a note says 'A descriptive label for your Venue, which will be the display name on your Analytics Dashboard (e.g. Starbucks in MarketStreet in San Francisco)'.
- VENUE INFORMATION:** An 'Approximate number of access points to be deployed:' field.

## Using Manual Mode

This section explains how you can enter geolocation information manually.

Click the **Toggle Manual Mode** button to enter geolocation information manually.

Figure 95: Toggle Manual Mode


**Using the SPoT Administration Portal**  
Managing Venues

LOCALITY Toggle Manual Mode

Enter an address to automatically fill-in locality details. If the address can't be geocoded, use manual mode to fill-in the fields manually.

**Address:**

10 Downing Street, 10 Downing Street, London SW1A 2AA, UK



**City:**

London

**State/Province/Region:**

Figure 96: Enter geolocation details manually

LOCALITY Toggle Assisted Mode

Enter an address to automatically fill-in locality details. If the address can't be geocoded, use manual mode to fill-in the fields manually.

**Address:**  
10 Downing Street

**City:**  
London

**State/Province/Region:**  
England

**Postal code:**  
SW1A 2AA

**Country:**  
United Kingdom

**Geolocation:**

Longitude

Latitude

**Time zone:**  
London (Europe)

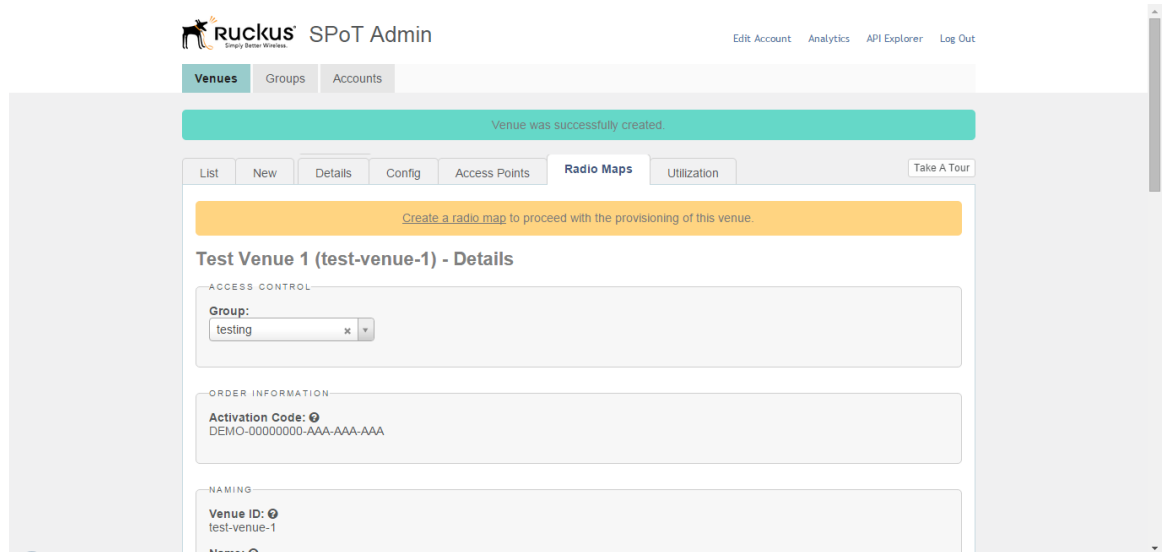
After creating a venue, the “Venue was successfully created” dialog appears, and the UI prompts you to **Create a radio map** to proceed with the provisioning of this venue.

---

**NOTE** Ensure that the Time Zone selected is correct before proceeding to [Radio Maps](#).

---

Figure 97: Venue was successfully created



## Editing Venue Settings

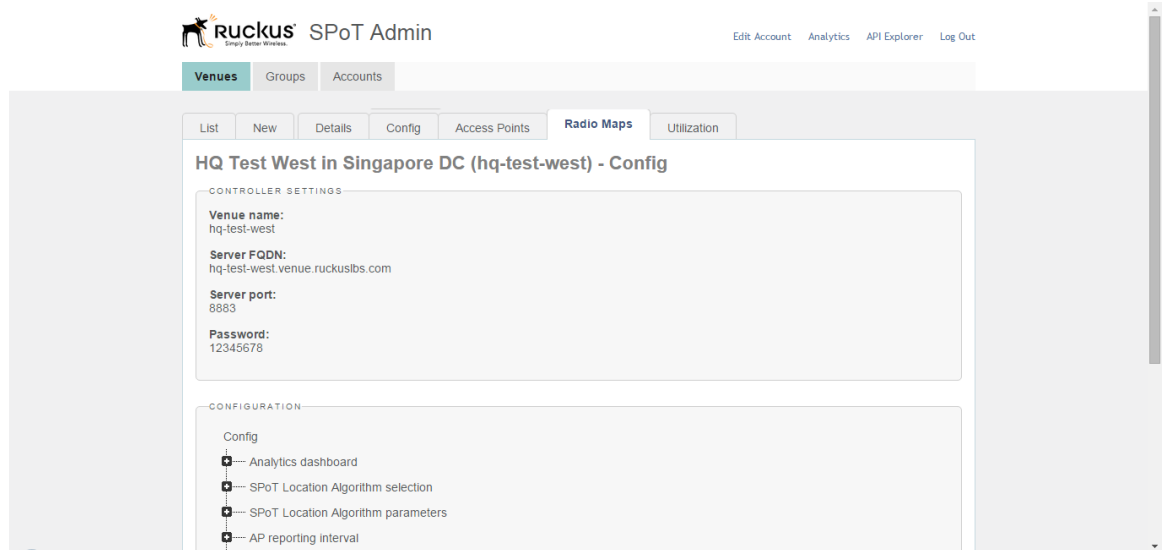
This section explains how you can edit venue settings.

To edit settings for an existing venue, click the **Config** link on the **Venues** page for the venue that you want to configure.

The following options are available:

1. **Venue Name:** This is the unique venue name you assigned when creating the venue.
2. **Server FQDN:** This is your venue's domain name. Use this FQDN when configuring the location services in the controller's AP group settings.
3. **Server Port:** This is the port number for communicating with ZoneDirector/SmartZone and the APs. Use this port number when configuring location services the controller's AP group settings.
4. **Password:** This is the shared secret (MQTT PSK) for securing communications between the SPoT server and ZoneDirector/SmartZone and its APs. Use this password when configuring location services in the controller's AP group settings.

Figure 98: Edit venue settings



## MQTT PSK Reset / Rotation

From vSPoT version 3.4.x, you can reset the MQTT PSK password, which is used for (1) pre-engine API with APs or Controllers, and (2) Location Push API. This functionality is available in both SPoT and vSPoT.

After reset, the new MQTT PSK must be updated in (1) the management portal for Ruckus AP controllers, and (2) any MQTT broker/client applications that subscribe to SPoT. The following is the procedure for resetting the MQTT PSK password.

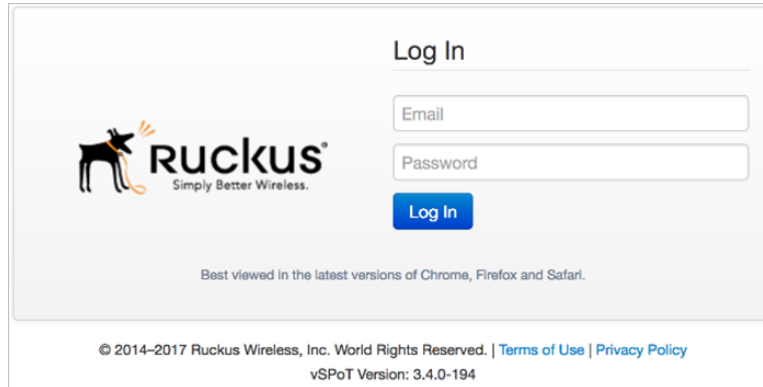
### Pre-requisites

- Administrator accounts for accessing (1) SPoT Admin Dashboard for venue configuration, and (2) management portal for Ruckus AP controllers.
- Administrator needs to have relevant knowledge and permissions to update the changed MQTT PSK to any MQTT broker/client applications that subscribe to SPoT.

**Procedure**

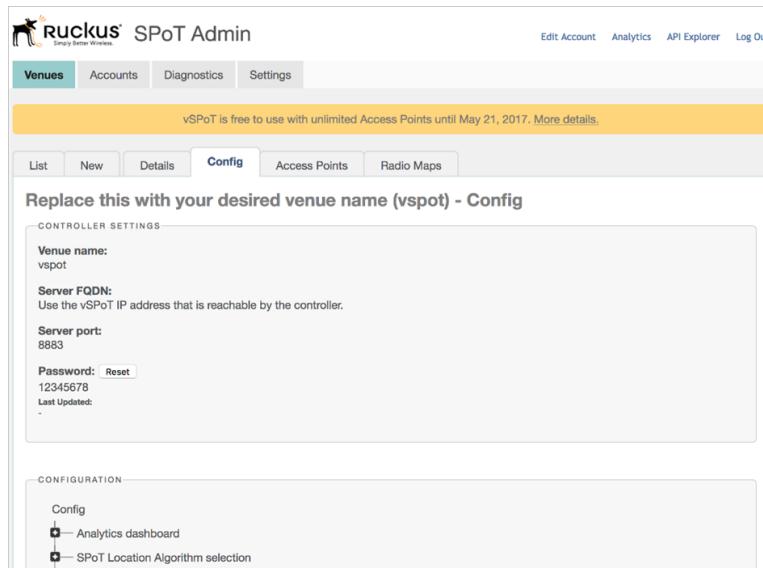
1. Login to the vSPoT Admin Dashboard using the administrator account credentials.

Figure 99: vSPoT login



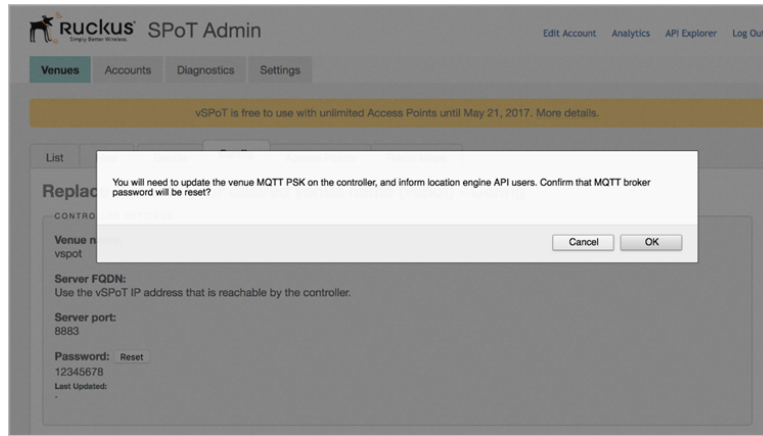
2. On successful login navigate to **Venue > Config** page.

Figure 100: Venue configuration



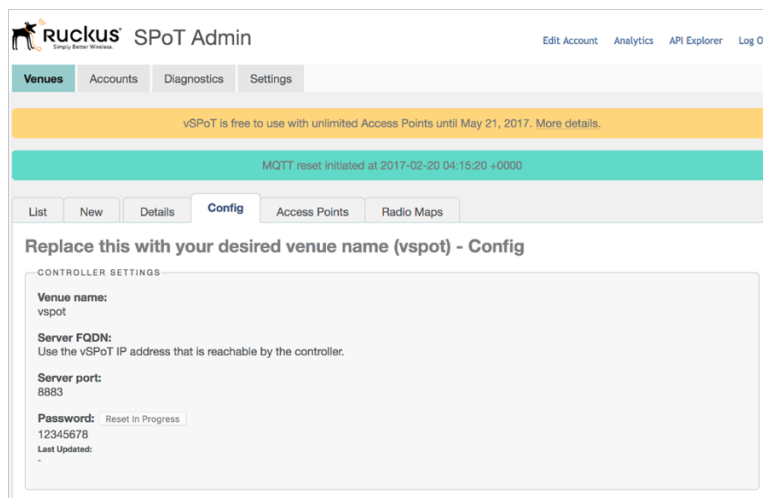
3. Under the Controller settings segment for Venue, click on the **Reset** button to re-generate the new MQTT PSK password. A prompt appears for confirming the reset procedure.

Figure 101: Reset password



4. On confirmation, you will get a feedback that the process has been initiated. The **Reset** button gets disabled and the label text changes to **Reset in Progress**.

Figure 102: Reset in progress



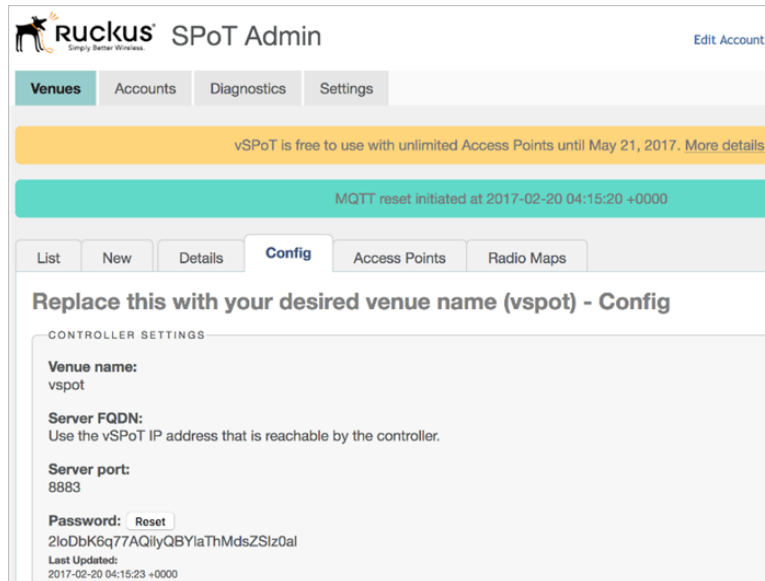
---

**NOTE** In the background, the new MQTT PSK password will be saved to the MongoDB database, and updated in the mosquitto broker configuration file. The mosquitto broker server process will also be restarted.

---

5. Upon successful update, the **Last Updated** field will be updated to the recent timestamp. The **Reset** button will now be *enabled*.

Figure 103: Successful MQTT PSK update



6. If the PSK reset process fails (due to time-out or errors in persisting to MongoDB or updating the Mosquitto broker configuration file), an error message appears beside the **Reset** button, and the **Reset** button will now be *enabled*. You can click on the **Reset** button to try again. If a subsequent MQTT PSK reset attempt is still unsuccessful, do contact vSPoT support.

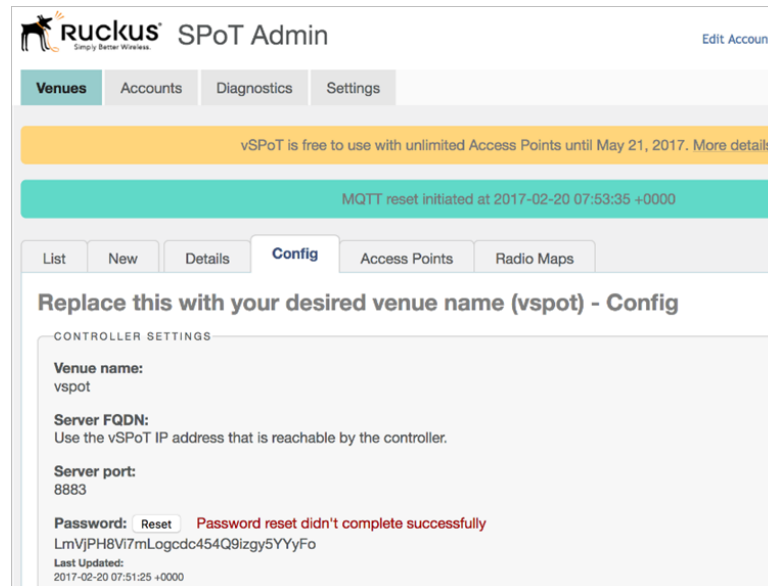
---

**NOTE** If the MQTT PSK reset procedure is unsuccessful, the original MQTT PSK will still be in use, and no changes are applied to the system or mosquitto broker.

---



Figure 104: Failed MQTT PSK Update



## Editing Configuration Settings

This section explains how you can edit the configuration settings.

The following configuration settings can be configured from the **Venues > List > Edit Config** page:

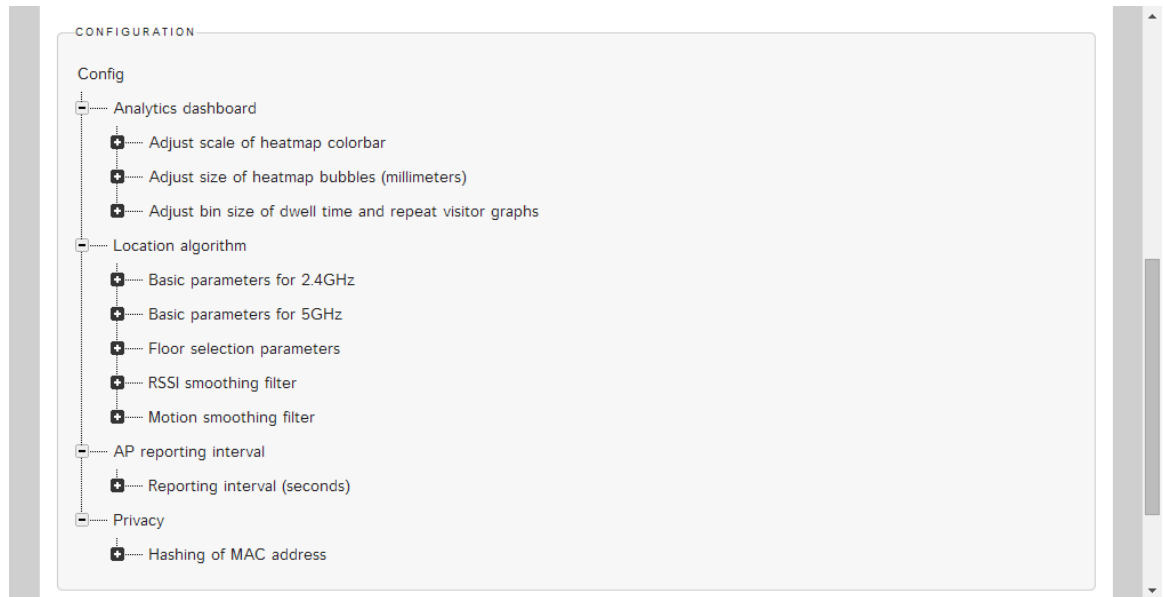
1. **Analytics Dashboard:** Configure settings for adjusting the display of heatmap and graphs in the SPoT Analytics dashboard.
2. **Location Algorithm:** Configure SPoT location algorithm settings such as number APs to use for location calculation, outlier definition and algorithm sensitivity.
3. **AP Reporting Interval:** Configure the AP reporting interval in seconds. Refer to [AP Reporting Interval](#) on page 165.
4. **Cache:** Configure the number of days for retaining the detected device locations in cache, to reduce memory utilization. Refer to [Cache](#) on page 166.
5. **Privacy:** Set whether hashing of MAC addresses is performed. Refer to [Privacy](#) on page 167.

---

**NOTE** See [Advanced Configuration Options](#) for detailed information on configuring these options.

---

Figure 105: Managing configuration settings for a venue



## Access Points

The SPoT Admin Portal provides options for configuring the APs that are associated with a venue.

To view a list of APs in a venue, click the **Access Points** link on the same line as the venue you want to configure.

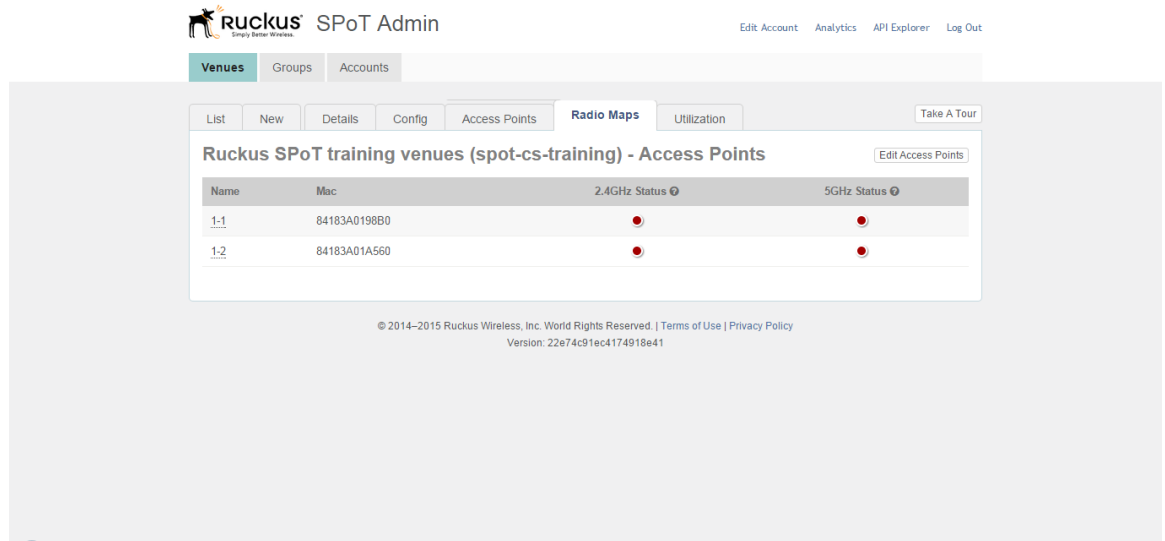
The list displays the AP's Name, MAC address and connection status. A green status icon indicates that the AP is communicating with the SPoT server. A red light indicates that a connectivity, configuration or network issue is preventing the AP from successful communication with the SPoT server.

---

**NOTE** If the status icon is **amber**, this means that the time is out of synchronization with the AP by more than +/-5 seconds. Ensure that the controller is configured with a valid NTP server and perform a time sync between the APs and the controller.

---

Figure 106: Clicking Manage Access Points brings up a list of the APs configured for a venue



## Editing Access Point MAC Addresses

This section explains how you can edit an access point MAC address.

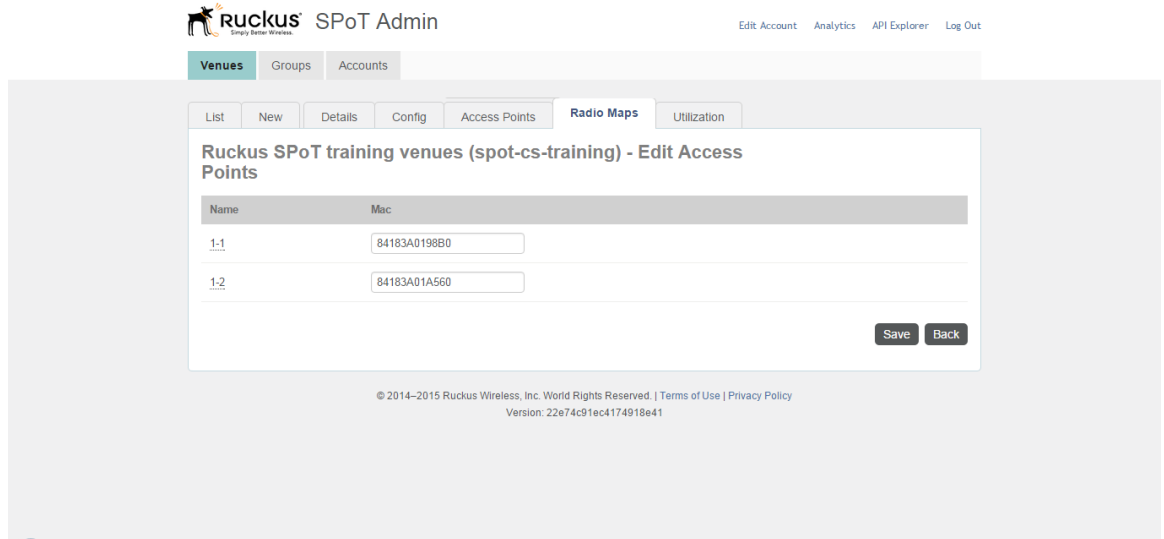
In the event that you need to replace an access point's MAC address (for example, if there was an error made when entering the AP's MAC address), you can do so using the following procedure.

To edit an AP's MAC address:

1. From the Venues list, click the **Access Points** link for the venue you want to edit. A list of the APs for this venue is displayed.
2. Click **Edit Access Points**. The **Edit Access Points** page appears.
3. Mouse over a Name to display the AP's floor number and X and Y coordinates on the floor map.
4. Clear and replace the MAC address of the AP you wish to update.
5. Click **Save** to confirm your changes.

Figure 107: Manage APs - Edit

## Using the SPoT Administration Portal Managing Venues

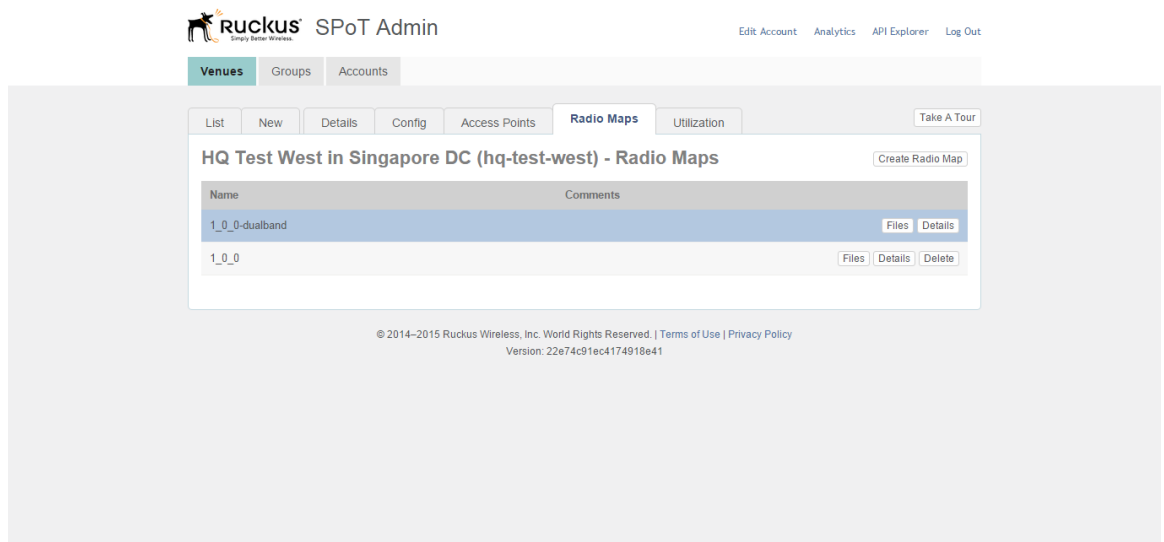


## Radio Maps

The SPoT Admin Portal provides options for configuring the radio maps that are associated with a venue.

To view a list of radio maps for a venue, click the Radio Maps link on the same line as the venue you want to configure.

Figure 108: Managing Radio Maps



If you click the **Files** link, you can view a list of map files for a venue. This page provides links to map files in PNG format and YAML files (YAML markup language) so that you can download the map files and view them in a browser or YAML parser.

If you click the **Details** link, you can configure a time frame for when the SPoT service will be executed. If **Set as production** is checked, **Start timestamp** is set and **End timestamp** is empty, the radio map will be used as the current production version.

Figure 109: Managing radio maps - downloading map files

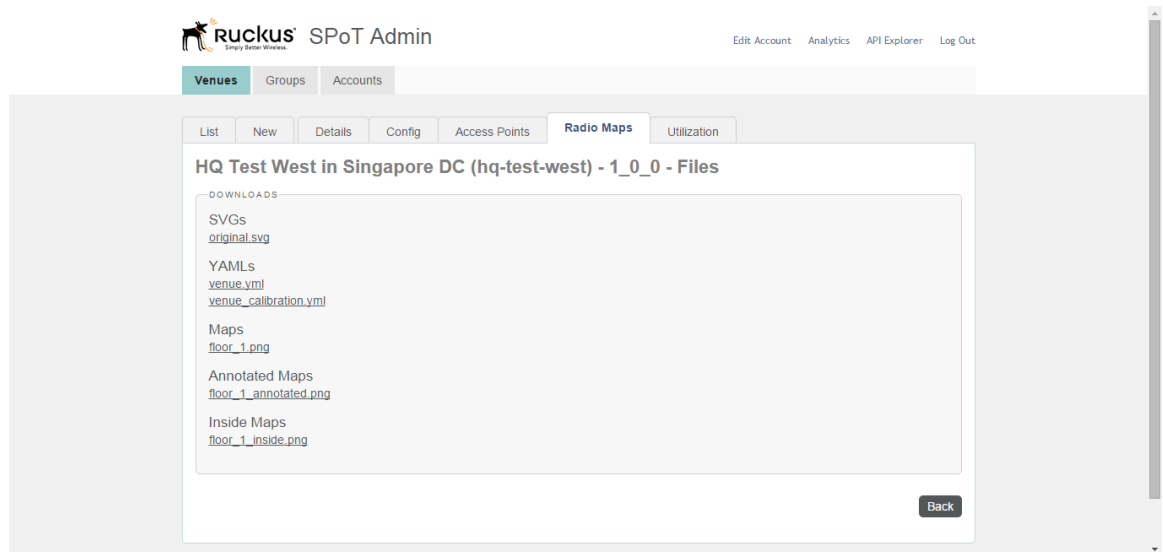
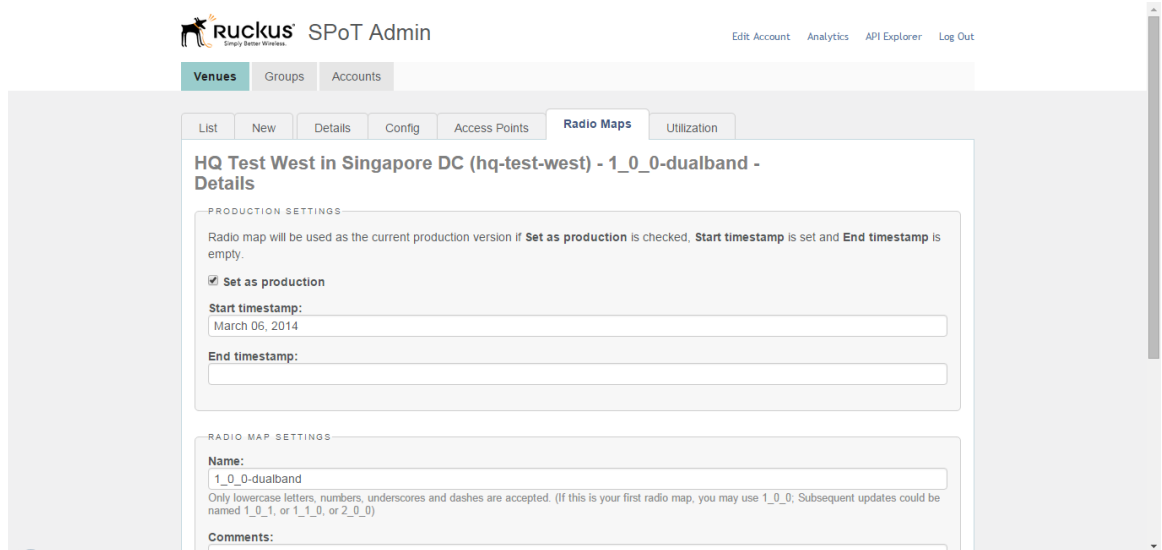


Figure 110: Managing radio maps - editing timestamps and map names

## Using the SPoT Administration Portal

### Viewing Utilization Graphs



To delete a radio map, first remove the radio map from production. After a map is removed from production, the option to delete the map appears.

---

**NOTE** Radio maps are not recoverable once deleted.

---

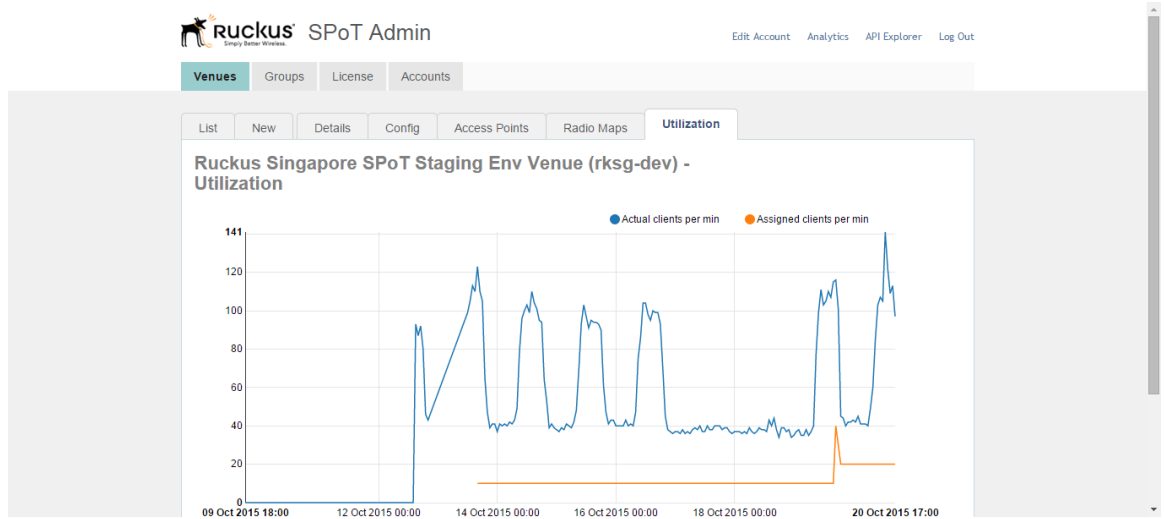
## Viewing Utilization Graphs

In the Utilization Tab, a chart will show the Peak number of Clients in a venue every hour versus the Client capacity allocated.

Users may decide to allocate more or less capacity to the venue in the Details page of the SPoT Admin Portal.

When Client capacity has been changed in the Details Page, the change will be reflected in the Utilization chart after the next hour.

Figure 111: The Utilization tab



## Managing User Accounts

Use the Accounts page to create, delete or edit user accounts.

Each account can be assigned to one of the following roles: Admin, Calibrator or Consumer.

Figure 112: The All Accounts list page

Ruckus SPoT Admin

Venues Groups **Accounts**

List New

### Accounts

Email	First name	Last name	Details	Delete
admin@ruckus.com	Admin	Admin	Details	Delete
admin@ruckus.com	Admin	Admin	Details	Delete
admin@ruckus.com	Admin	Admin	Details	Delete
admin@ruckus.com	Admin	Admin	Details	Delete
admin@ruckus.com	Admin	Admin	Details	Delete
admin@ruckus.com	Admin	Admin	Details	Delete
admin@ruckus.com	Admin	Admin	Details	Delete
admin@ruckus.com	Admin	Admin	Details	Delete
admin@ruckus.com	Admin	Admin	Details	Delete
admin@ruckus.com	Admin	Admin	Details	Delete

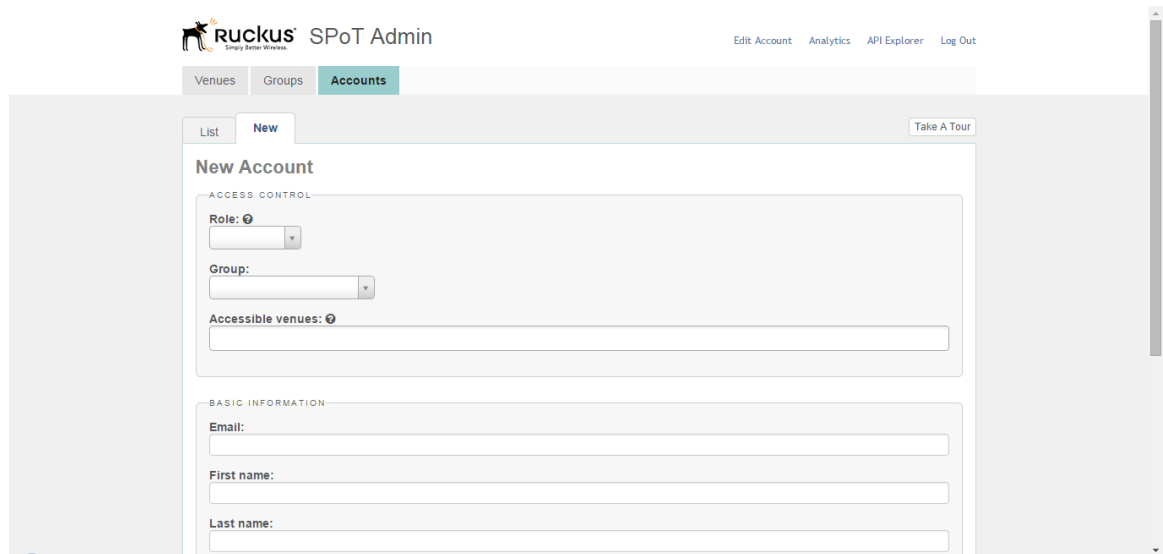
## Creating a New User

This section explains how you can create a new user.

To create a new user account, go to Accounts and click the New button. The New Account page provides the following fields:

- **Role:** Set the user's role as Admin, Calibrator or Consumer. Admin accounts have full privileges, Calibrator accounts have calibration and viewing privileges, and Consumer accounts are restricted to viewing the SPoT Analytics report pages.
- **Accessible Venues:** Enter the venue names for which this account has access.
- **Email:** Enter the user's email address. The email address is used as the user's login name.
- **First Name:** Enter the user's first name.
- **Last Name:** Enter the user's last name.
- **Password:** Enter the password in both fields. Once created, the user can change his/her own password after logging in.

Figure 113: The new user creation page



## Editing User Account

This section explains how you edit a user account.

Click the **Edit** link next to a user's name to modify the account settings that were created in the [Creating a New User](#) section.



Figure 114: Edit a user account

The screenshot displays the Ruckus SPoT Admin interface for editing a user account. The top navigation bar includes the Ruckus logo, 'SPoT Admin', and links for 'Edit Account', 'Analytics', 'API Explorer', and 'Log Out'. Below this, a secondary navigation bar shows 'Venues', 'Groups', and 'Accounts' (the active tab). The main content area is titled 'test@test.com - Details' and contains three sections: 'ACCESS CONTROL' with 'Role' set to 'Admin' and 'Group' set to 'demo'; 'BASIC INFORMATION' with 'Email' as 'test@test.com', 'First name' as 'Test', and 'Last name' as 'Test'; and a 'CHANGE PASSWORD' link at the bottom.

**Using the SPoT Administration Portal**  
Managing User Accounts

# Navigating the Dashboard

# 6

The SmartPositioning Analytics Dashboard provides a simple and intuitive interface for monitoring location data such as footfalls, unique visitors, repeat visitors and visitor dwell time.

**NOTE** The Analytics Dashboard is not supported on Internet Explorer. It is best viewed using Chrome, Firefox or Safari.

Figure 115: The Analytics Dashboard

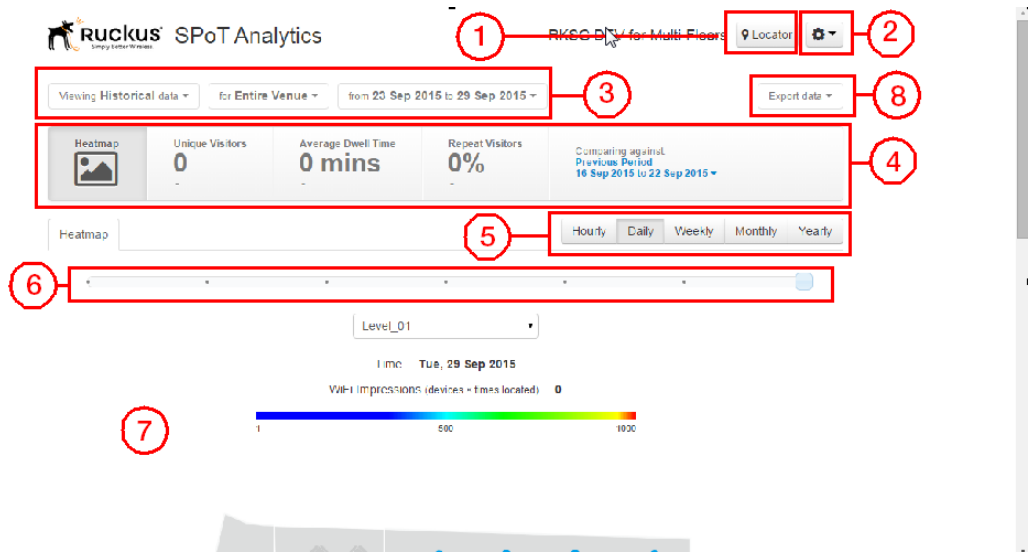


Table 5: Dashboard elements

No	Description
1	<b>Locator:</b> Use the Locator to track individual MAC addresses in real time.
2	<b>Options:</b> Choose the venue to view. Also change account password settings and sign out from this menu.
3	<b>Data Scope:</b> Choose the timespan for which to display statistics. Also select whether to view historical or real-time data, and select venue sub-zone, if any.

No	Description
4	<p><b>Heatmap/Graph Display:</b></p> <ul style="list-style-type: none"> <li>• <b>Heatmap:</b> Displays a heatmap to illustrate the concentration of WiFi devices throughout the venue for the selected timespan.</li> <li>• <b>Unique Visitors:</b> Displays the number of unique WiFi devices detected over the selected timespan. Click this button to display a graph plotting number of unique visitors by hour, day, week, etc.</li> <li>• <b>Average Dwell Time:</b> Displays the average duration visitors were detected in the venue. Click to display the graphs for visitor dwell duration and dwell time distribution (% of visitors in each of 5 duration categories: 1-5 mins, 6-10 mins, 11-30 mins, 31-60 mins and over 60 mins).</li> <li>• <b>Repeat Visitors:</b> Displays the percentage of visitors who were repeat visitors for the selected timespan. Click to display graphs plotting new vs. repeat visitors, repeat visitor count and days since last visit.</li> <li>• <b>Comparing Against:</b> Select whether to compare against the previous period or the same period last year.</li> </ul>
5	<p><b>Time Unit:</b> Select the units of time display: hourly, daily, weekly, monthly or yearly.</p>
6	<p><b>Heatmap Slider:</b> Click any point on the slider to show a specific time interval. You can also select a time interval and then use the arrow keys to “walk through” the heatmap and view visitor concentrations over time.</p>
7	<p><b>Main Window:</b> Displays the heatmap or graph selected. See the following sections for more information.</p>

No	Description
8	<b>Export data:</b> Export data to a zip file. The zip file contains visitor data in CSV file format, organized into the following folders: unique visitors, repeat count, new vs. repeat visitors, heatmap, dwell time distribution, days since last visit and average dwell time.

## Using the Heatmap

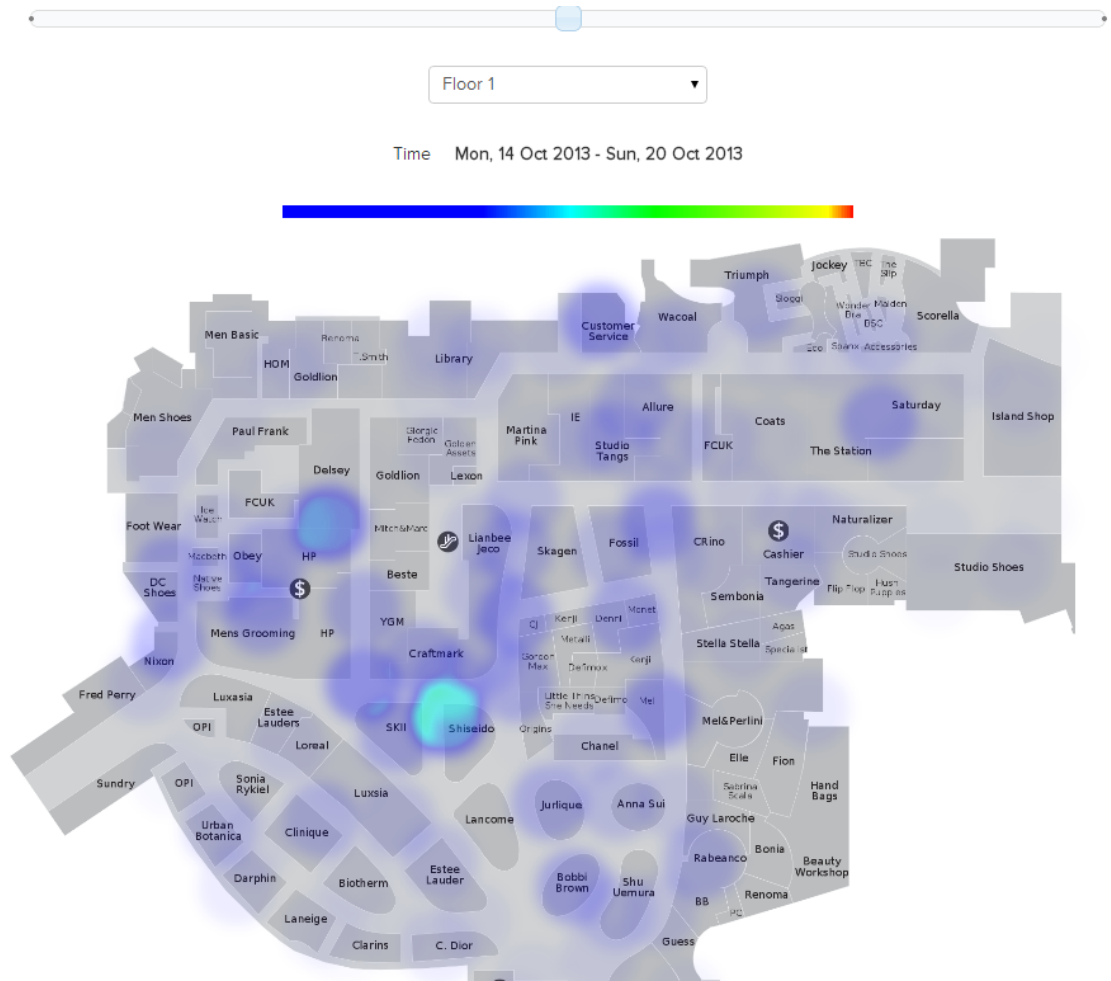
The Heatmap displays concentrations of footfalls throughout a venue.

Select a floor (if a multistory venue) and a time unit to display, and the Heatmap will display the relative concentrations of locations where visitors congregated.

Figure 116: Heatmap

## Navigating the Dashboard

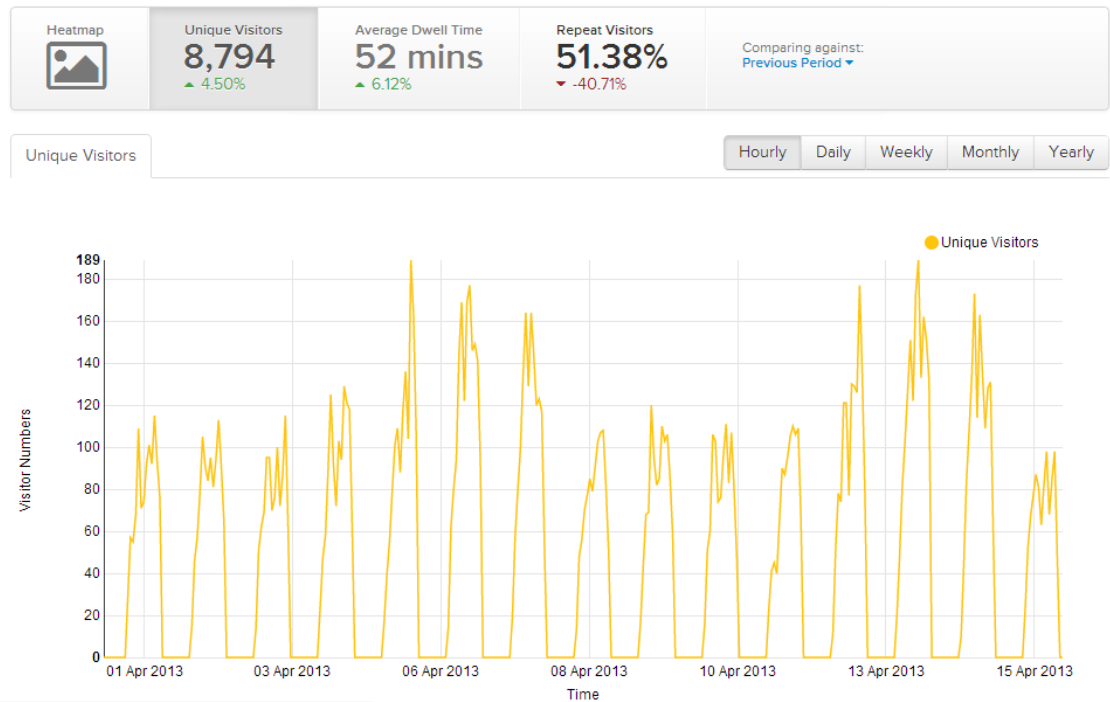
### Unique Visitors



## Unique Visitors

The Unique Visitors graph displays the number of unique Wi-Fi devices detected during the selected time period.

Figure 117: Unique Visitors



## Average Dwell Time

The Average Dwell Time graph displays the average amount of time each visitor spent in the venue.

You can also click the **Dwell Time Distribution** link to display the distribution of visitors according to time spent in the venue.

Figure 118: Average Dwell Time

## Navigating the Dashboard

### Average Dwell Time

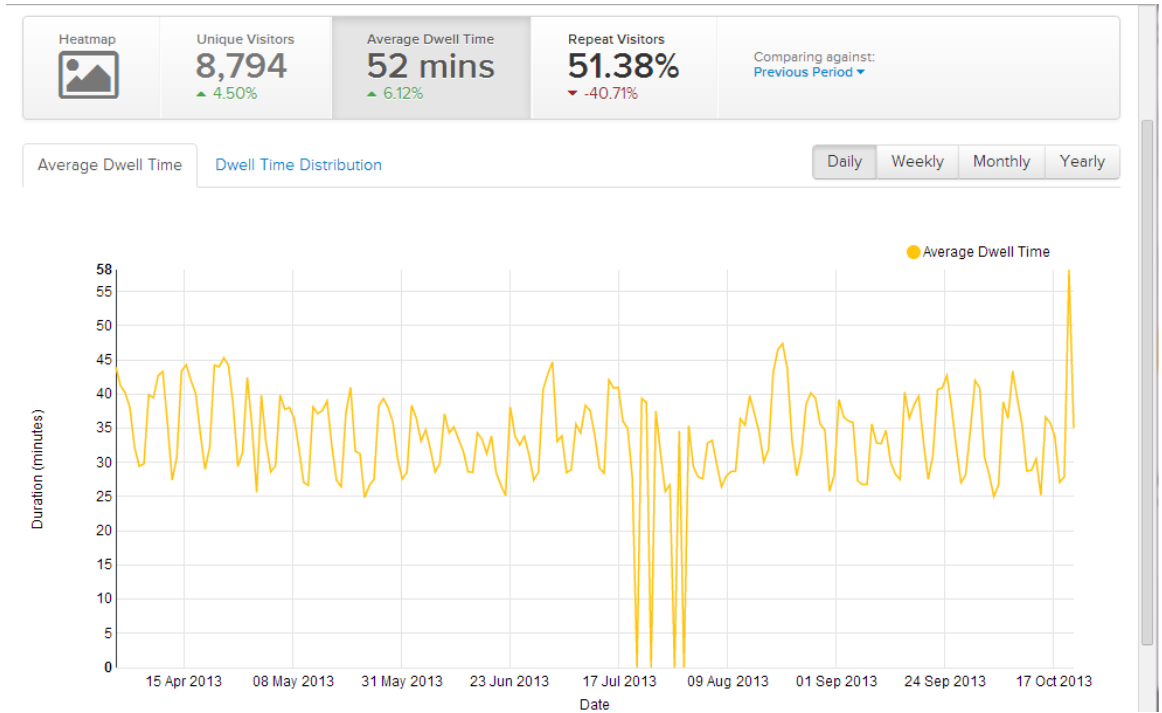
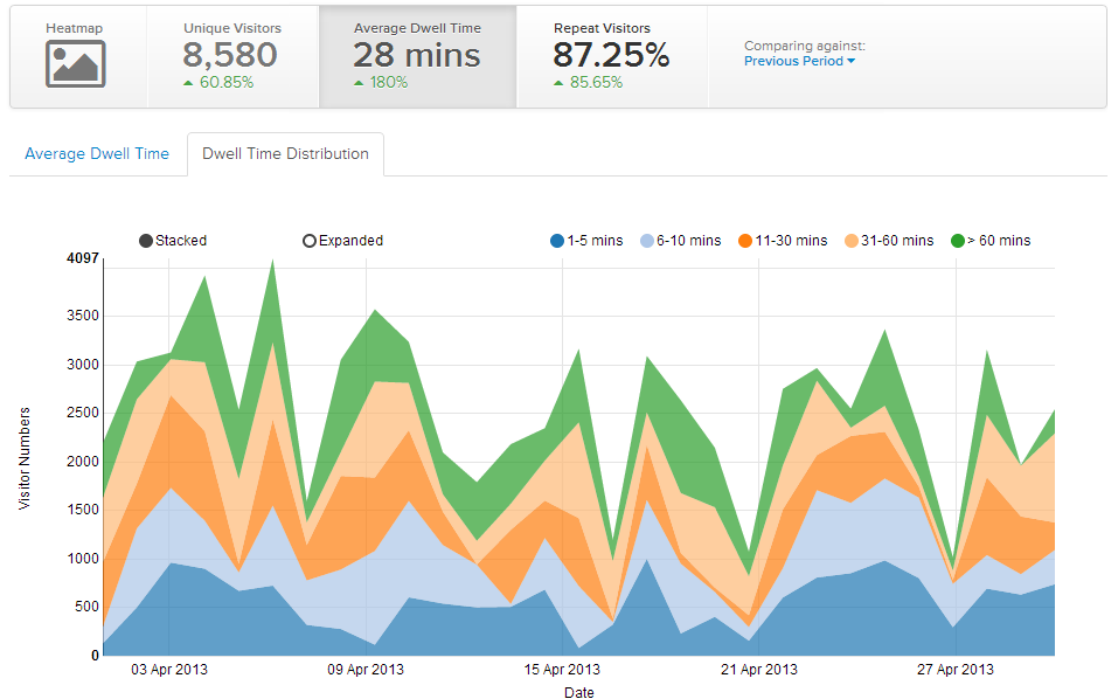


Figure 119: Dwell Time Distribution





## Repeat Visitors

Three Repeat Visitors graphs display statistics about the numbers of new and repeat visitors per time interval.

The “[New vs. Repeat](#)” graph divides provides insight into how the ratio of new vs. repeat visitors changed over time. Two other related graphs, [Repeat Count](#) and [Days Since Last Visit](#), provide more detailed information on repeat visitor behavior.

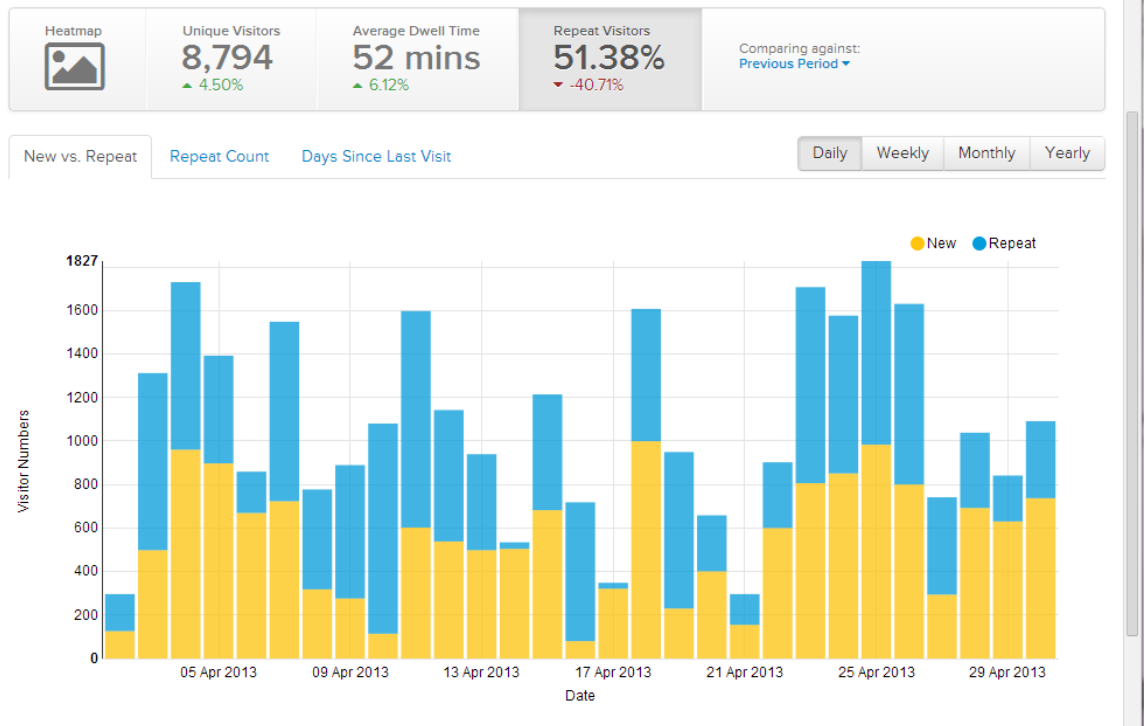
## New Versus Repeat

This section describes new versus repeat visitors.

Figure 120: New vs. Repeat Visitors

## Navigating the Dashboard

### Repeat Visitors

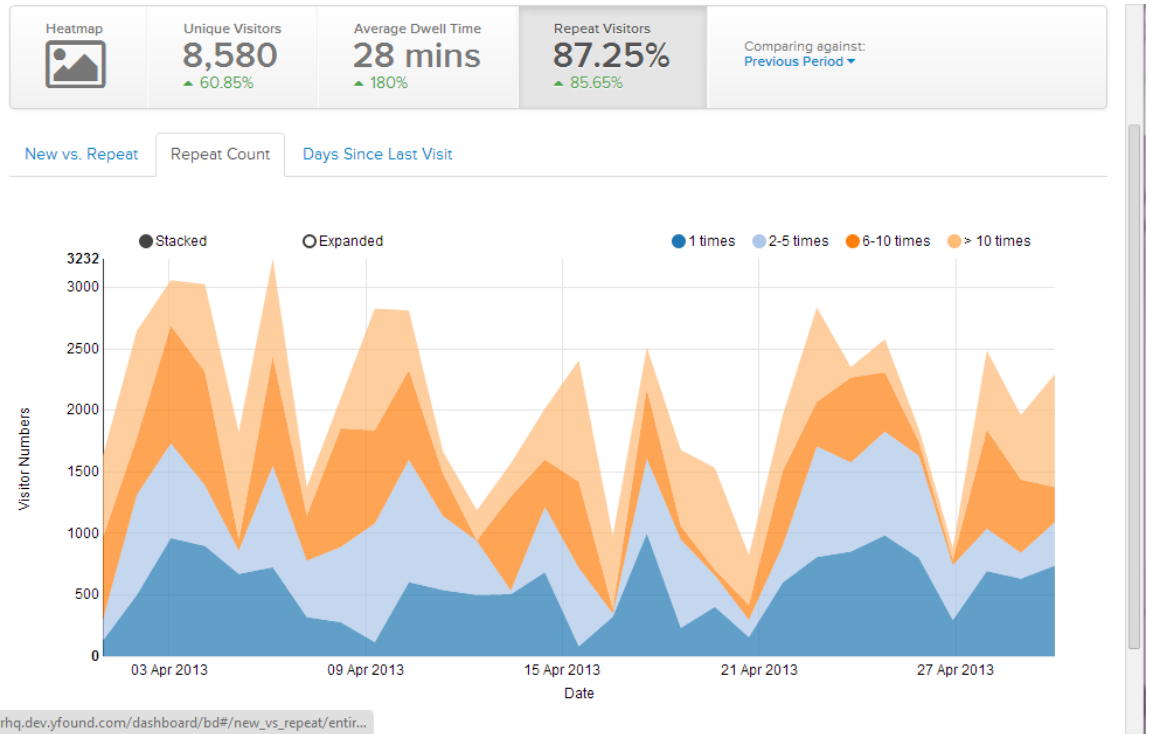


## Repeat Count

The Repeat Count graph plots the distribution of repeat visitors by number of repeat visits to the venue.

You can view this graph in Stacked or Expanded mode, to show absolute visitor numbers or percentage of the maximum.

Figure 121: Repeat Count



## Days Since Last Visit

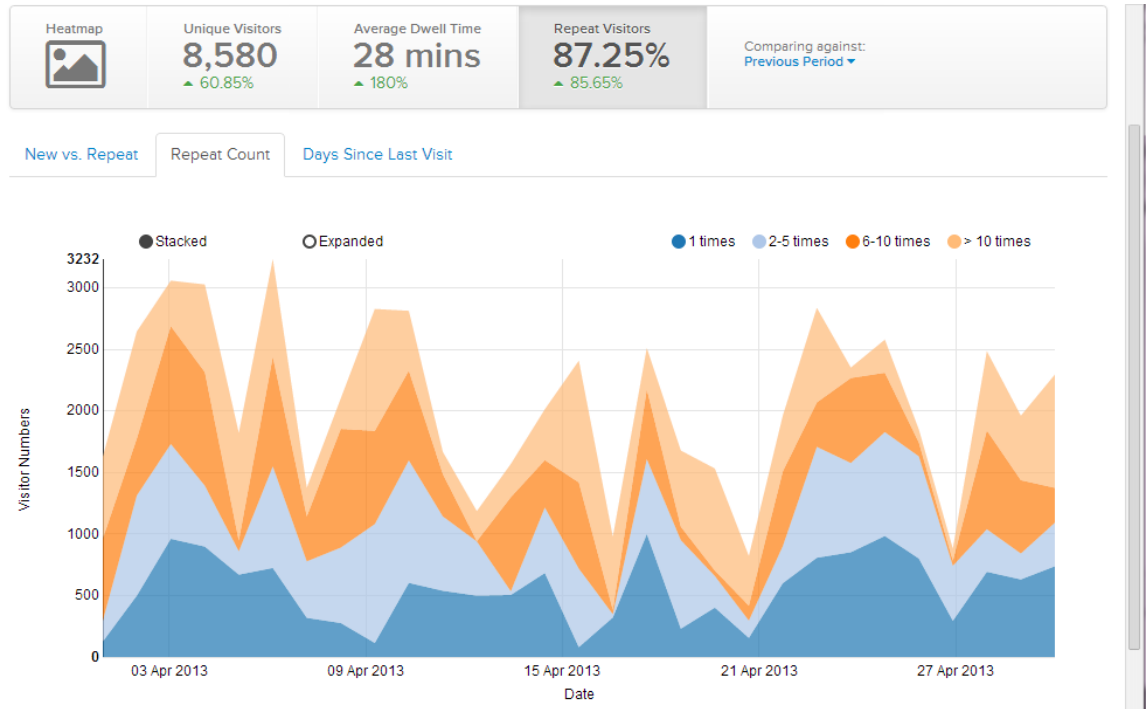
The second repeat visitor-specific graph plots how many days have passed between a repeat visitor's previous and current visits.

You can view this graph in Stacked or Expanded mode, to show absolute days since last visit or percentage of the maximum.

Figure 122: Days Since Last Visit

## Navigating the Dashboard

Using the Locator to Track Clients in Real Time



## Using the Locator to Track Clients in Real Time

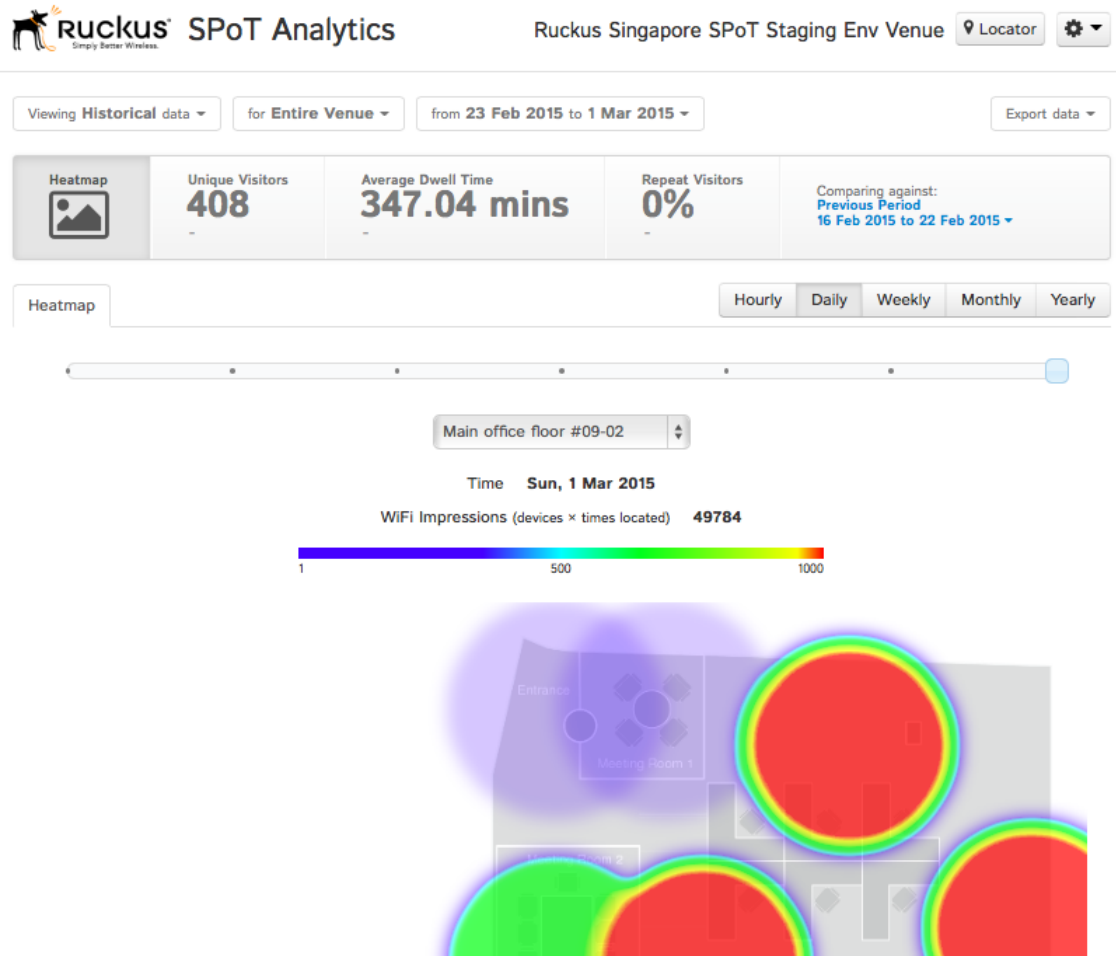
This feature allows you to track individual MAC addresses in real time.

1. Click the Locator button in the top right corner of the SPoT Analytics Dashboard.

Figure 123: Click the Locator button to begin real time client tracking

## Navigating the Dashboard

Using the Locator to Track Clients in Real Time

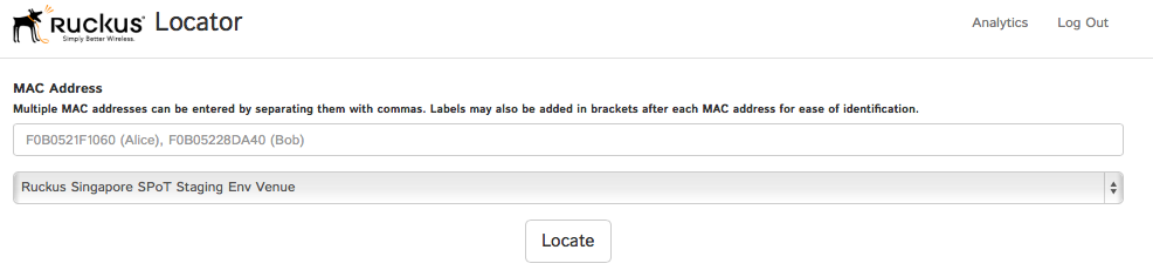


2. Enter the MAC addresses that you would like to track.
3. If you are tracking more than one MAC address, separate the MAC addresses using commas.
4. You can also name devices by appending display labels to each MAC address using parentheses.

Figure 124: Enter MAC addresses of clients to track

## Navigating the Dashboard

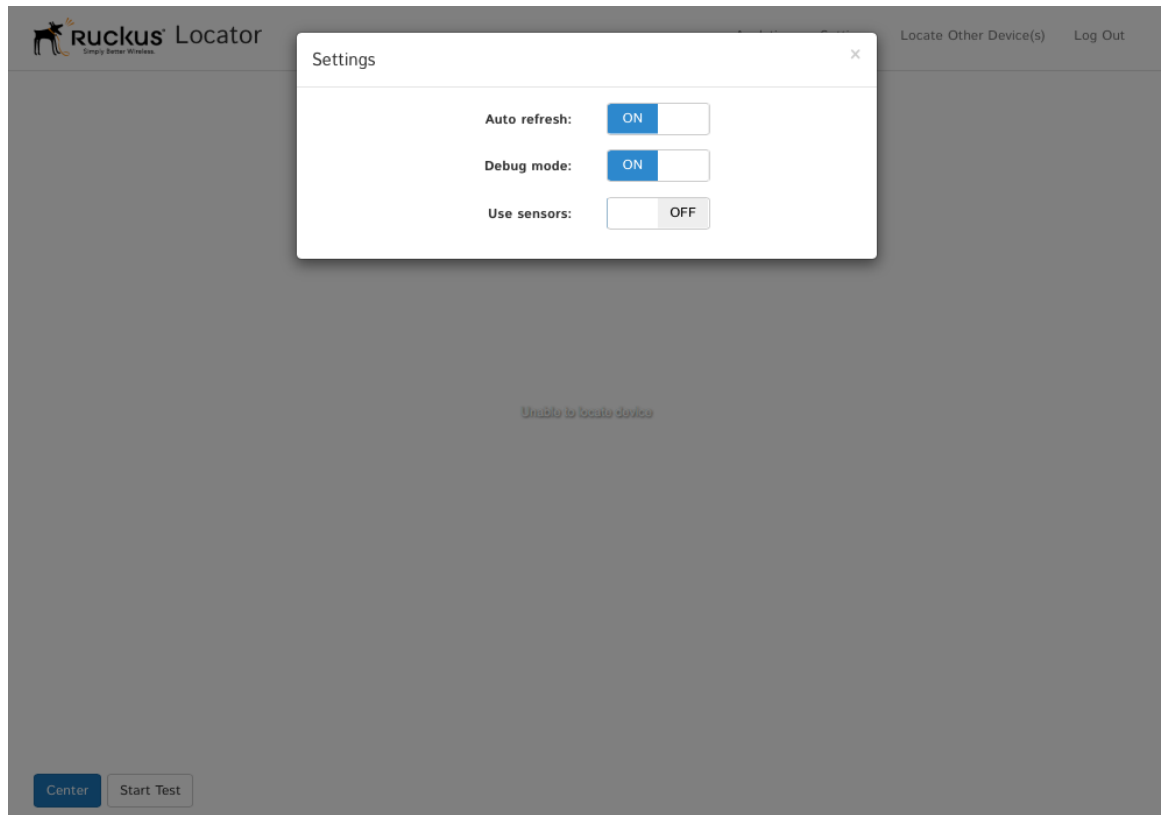
Using the Locator to Track Clients in Real Time



The screenshot shows the Ruckus Locator web interface. At the top left is the Ruckus logo with the tagline 'Simply Better Wireless'. At the top right are links for 'Analytics' and 'Log Out'. Below the header, there is a section titled 'MAC Address' with a sub-instruction: 'Multiple MAC addresses can be entered by separating them with commas. Labels may also be added in brackets after each MAC address for ease of identification.' A text input field contains the example text 'F0B0521F1060 (Alice), F0B05228DA40 (Bob)'. Below the input field is a dropdown menu showing 'Ruckus Singapore SPoT Staging Env Venue'. A 'Locate' button is positioned below the dropdown.

5. Click **Locate**.
6. On the Settings screen, configure the following:
  - **Auto refresh** (default on): Toggle between auto-refresh and static display.
  - **Debug mode** (default on): When enabled, the timestamp and (x,y) coordinates will be displayed.
  - **Use Sensors** (not used): The Use Sensors toggle is a placeholder for future options.

Figure 125: Locator Settings



7. Click the **Start Test** button at the bottom left corner to perform a location accuracy test. The steps involved are the same as the locator test feature in the SPoT Calibrator App.

## Viewing Real-Time Data

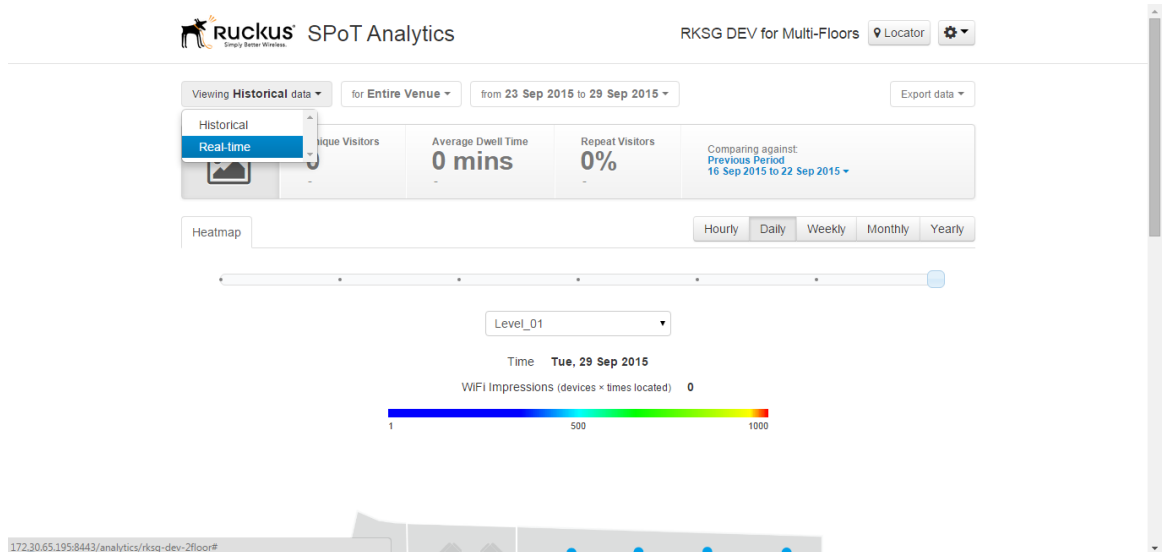
To view real-time data, click the “Viewing Historical Data” drop-down menu and select Real-Time.

The menu changes to say “Viewing Real-time data,” and the page refreshes to display a different set of options from that of the historical data view.

Figure 126: Select Real-Time to view real-time data

## Navigating the Dashboard

### Viewing Real-Time Data



## Real-time Data View Options

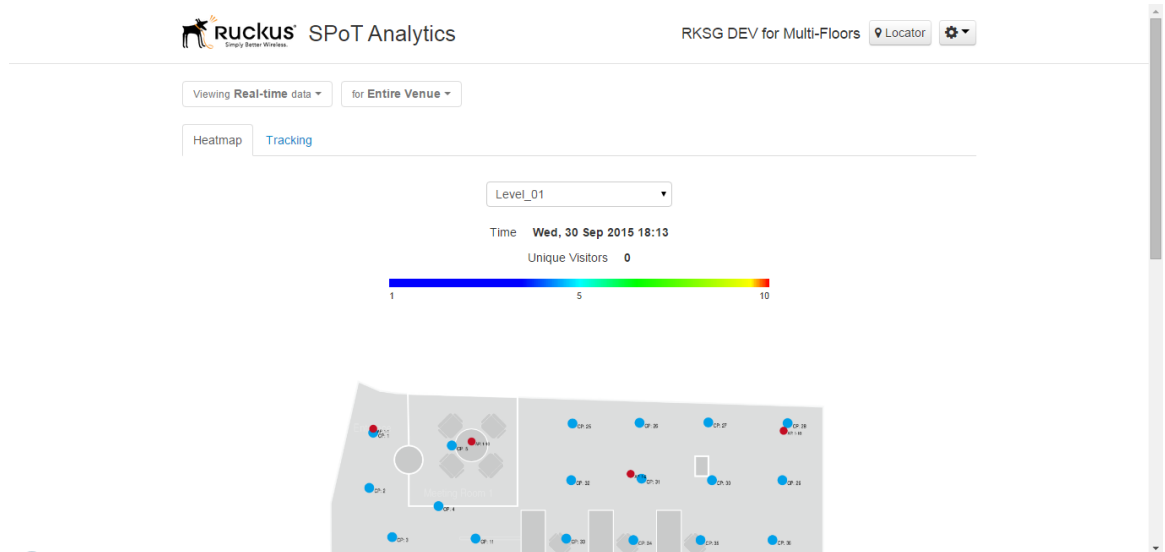
This section explains the real-time data view options available, namely Heatmap and Tracking.

The Real-time data view contains two tabs at the top of the page - **Heatmap** and **Tracking**. The Heatmap display is the same as the Heatmap view on the Historical Data view (see [Using the Heatmap](#)), except that it only displays the current, real-time information, and therefore does not provide options for adjusting the time period to view.

The **Tracking** tab allows you to track assets in real-time in your venue.

Figure 127: The Real-time data view contains two tabs - Heatmap and Tracking





## Asset Tracking

SPoT and vSPoT can be used for real-time device tracking purposes.

By providing a catalog of WiFi devices to be tracked via a CSV file upload, the real time position of these Devices will be displayed on the Analytics Dashboard under **Real-Time > Tracking**. Devices not listed in the Catalog will also be displayed as Unlisted devices.

### Uploading a List of Devices to be Tracked

In the SPoT Admin Portal under the **Config** tab, users can upload a CSV list of devices to be tracked in the **Device Catalogue** section. The format of the list should be as follows.

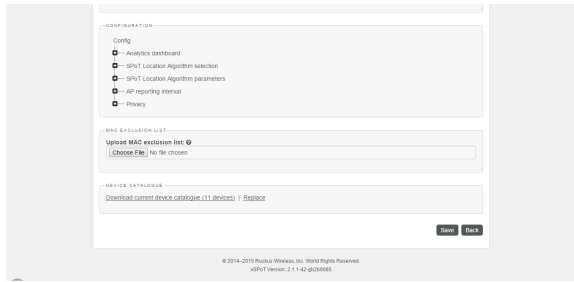
- Column 1: Group – Allows the user to categorize and group devices for easier search
- Column 2: Device ID - Arbitrary description for the device
- Column 3: MAC address – WiFi MAC address of device. This is the only compulsory information needed.

Group and Device ID may be left blank.

Figure 128: Use the Device Catalogue section on the Admin Portal Config page to manage the device MAC address list for real-time tracking

## Navigating the Dashboard

### Viewing Real-Time Data



After the CSV file has been uploaded, SPoT will validate the MAC addresses. Invalid MAC addresses will be filtered to the top of a CSV file that can be downloaded by the user. The user may choose to edit the MAC addresses and upload the edited .csv file or choose to leave it as is. If the MAC address is not correct, the device will not be trackable.

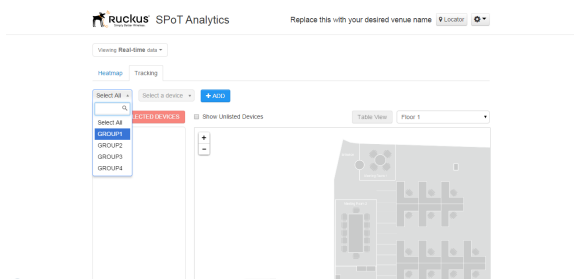
### WiFi Device Tracking

To view the Tracker in the Analytics Dashboard, select **Real-time** data and click the **Tracking** tab.

To see all devices that have been cataloged in the CSV upload, choose **Select All** from the first drop-down menu and click **Add**.

To view the real time position of a group of devices within the catalogue, select the Group from the first menu. You can also display only specific devices within a Group using the second drop-down menu, by selecting each device's MAC address and clicking **Add**.

Figure 129: Select a Group for asset tracking



Cataloged devices detected within the last 1 minute will be shown with a Blue Icon. If devices are not detected within the current minute and were last detected within the last 7 days, the last known position of the device will be shown as an Orange Icon. For both Blue and Orange Icons, The Group, Device ID and MAC address of the device is available next to the Icons to help users identify the device. Users who want to see the real time position of unlisted devices may check the Show Unlisted Devices box. The position of

the devices is indicated with a Black Icon on the map and the MAC Address of the device will be displayed next to it.

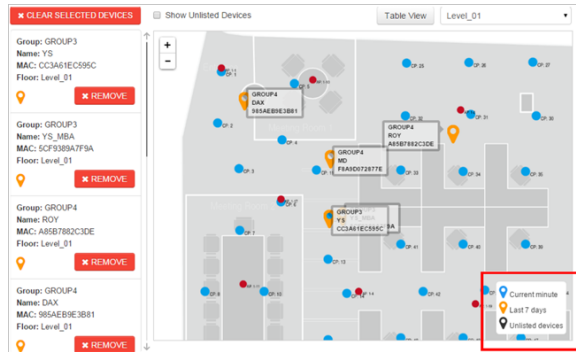


Figure 130: Asset Tracking Legend - colored icons indicate current devices, last seen within 7 days, and unlisted devices

When devices located are on separate floors, a “There are more devices detected on other floors” notice will be displayed below the floor selector. There will be instances where WiFi devices are detected but SPoT is unable to determine their location. These are referred to as outliers. For such occurrences, Outlier will be indicated next to the Device information. A table view is also available for users who prefer to view the asset tracking information in table format. Click the **Table View** button to view the asset Tracking Table.

Figure 131: Tracking Table

The screenshot shows a 'Tracking Table' window. The table has the following columns: #, GROUP NAME, DEVICE NAME, MAC, X, Y, FLOOR NUMBER, and TIME STAMP. The first five rows contain data for groups GROUP3 and GROUP4. The last five rows (6-10) show placeholder data with 'DEV1' through 'DEV5' and various characters for the device name and MAC address. At the bottom of the table, there are filters: 'LOGGED IN CURRENT MINUTE', 'LOGGED IN LAST 7 days', 'NOT FOUND', and 'UNLISTED DEVICES'. A 'CLOSE' button is in the bottom right corner.

#	GROUP NAME	DEVICE NAME	MAC	X	Y	FLOOR NUMBER	TIME STAMP
1	GROUP3	YS	CC3A61EC595C	1795.18	742.43	Level_01	Wed Sep 30 2015 11:22:03 GMT-0800
2	GROUP3	YS_LBA	5CF9389A7F9A	1840.82	734.33	Level_01	Wed Sep 30 2015 11:22:03 GMT-0800
3	GROUP4	RD	A8B782C3C0E	2210.73	458.56	Level_01	Wed Sep 30 2015 11:22:03 GMT-0800
4	GROUP4	DAX	95A4E93E3B81	1512.56	347.53	Level_01	Wed Sep 30 2015 11:22:03 GMT-0800
5	GROUP4	RD	F8AC0272877E	1795.82	541.81	Level_01	Wed Sep 30 2015 11:22:03 GMT-0800
6	GROUP4	DEV1	AAAAAAAAAAAA	-	-	-	-
7	GROUP4	DEV2	BBBBBBBBBBBB	-	-	-	-
8	GROUP4	DEV4	DDDDDDDDDDDD	-	-	-	-
9	GROUP4	DEV6	FFFFFFFFFFFF	-	-	-	-
10	GROUP4	DEV5	CCCCCCCCCCCC	-	-	-	-

## **Navigating the Dashboard**

Viewing Real-Time Data

# Advanced Configuration Options

# 7

The Configuration page on the SPoT Admin portal provides a number of options that allow you to configure various parameters for your SPoT venue according to your needs.

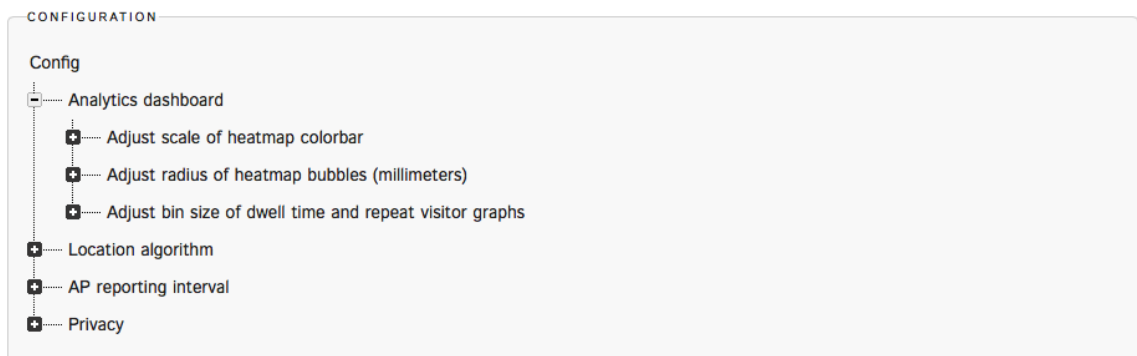
## Configuring Analytics Dashboard Settings

The Analytics Dashboard configuration settings allow you to configure the Heatmap, Dwell Time and Repeat Visitor distribution graphs.

You can configure the following:

- Adjust the scale of the heatmap colorbar
- Adjust the radius of the heatmap bubbles
- Adjust the bin sizes of the Dwell Time and Repeat Visitor distribution graphs

Figure 132: Dashboard configuration options



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**NOTE** All numerical values entered for the Analytics Dashboard configuration settings must be positive integers.

---

## Adjusting the Scale of the Heatmap Colorbar

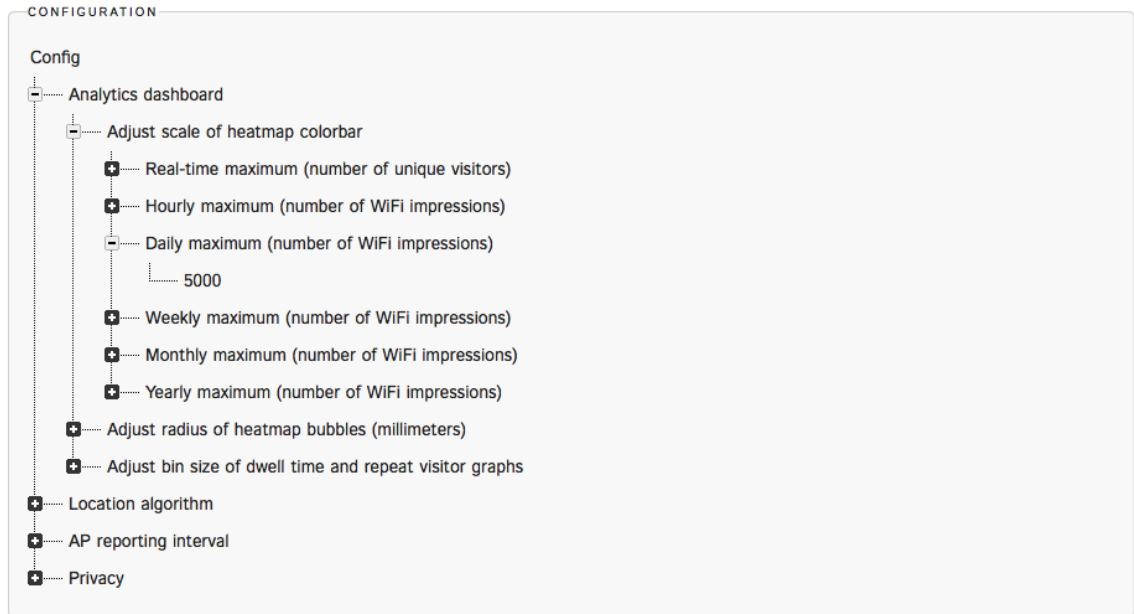
You can control the contrasts of the heatmap colors according to the crowd level of your venue, by adjusting the scale of the colorbar in the heatmaps.

You can do this adjustment for all the heatmaps with different time periods, namely real-time, hourly, daily, weekly, monthly and yearly heatmaps.

Figure 133: Adjusting colorbar maximum for various heatmaps

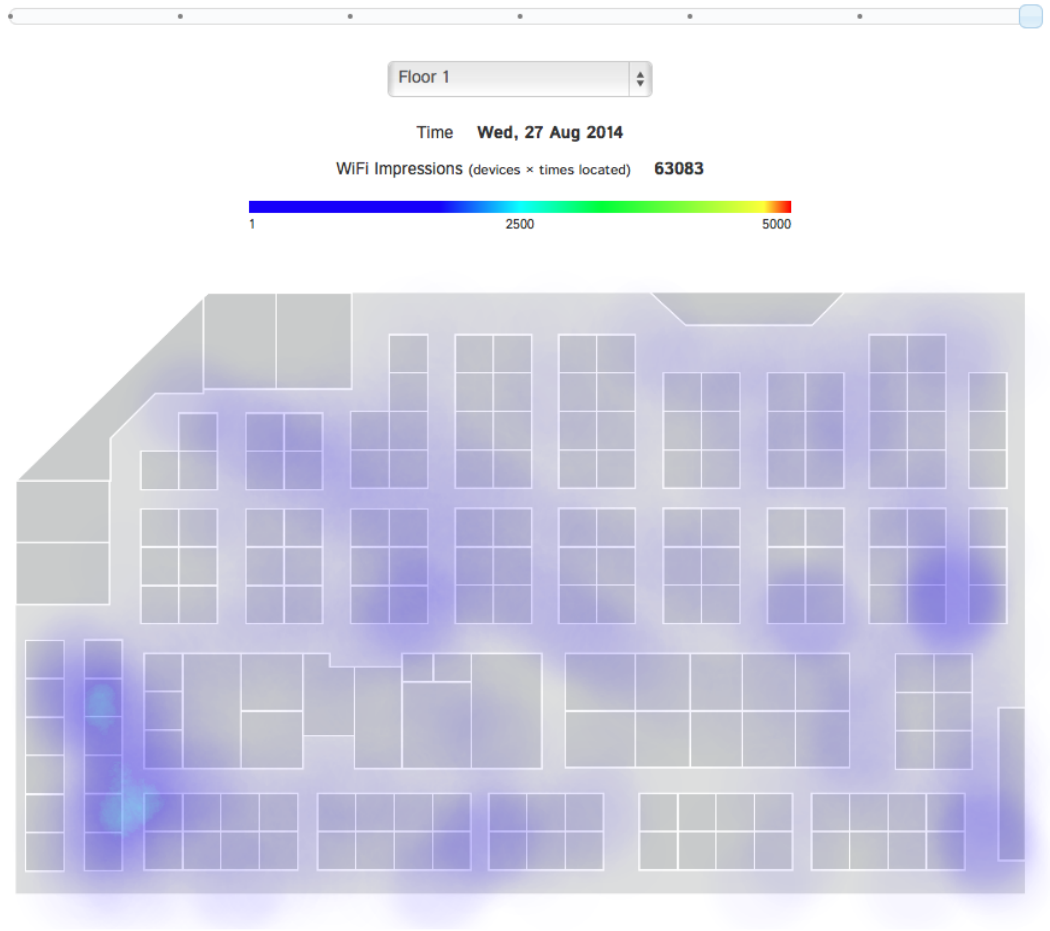
## Advanced Configuration Options

### Configuring Analytics Dashboard Settings



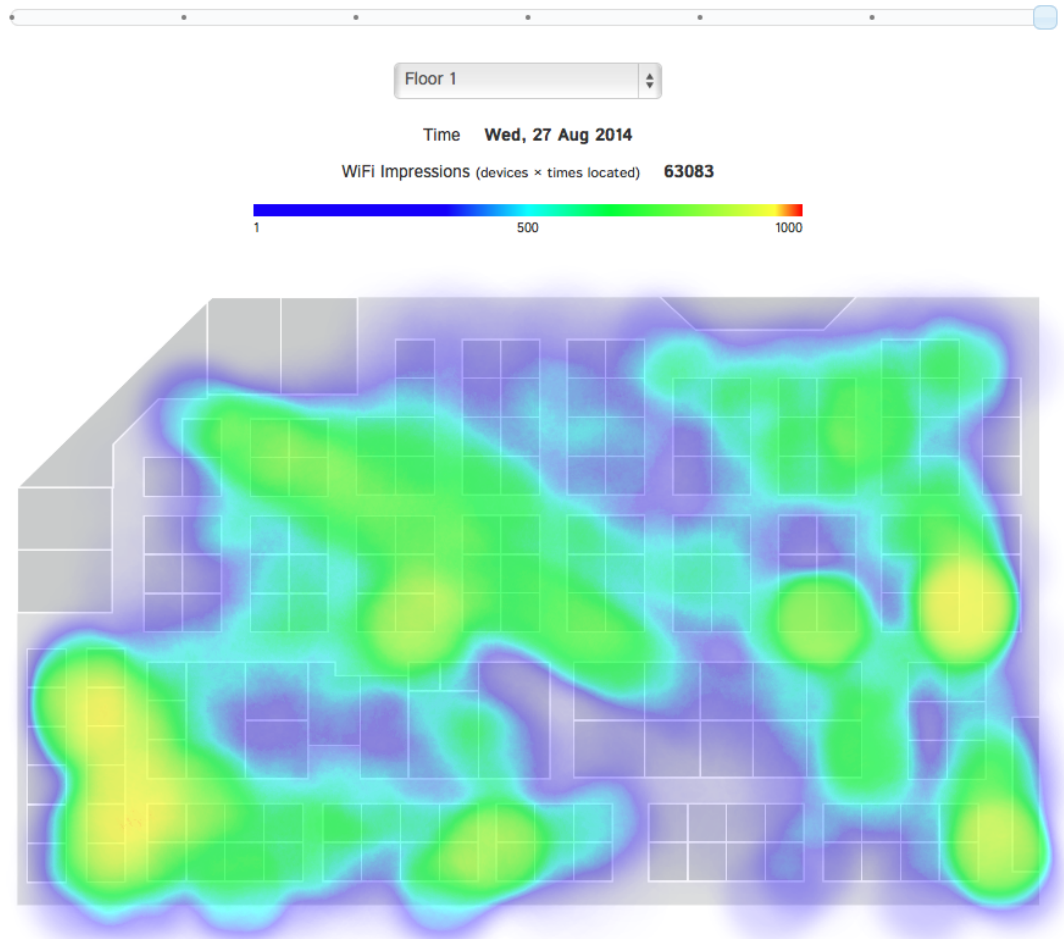
For example, the screenshot shows the daily heatmap with the maximum colorbar value set to 5000. As you can see, the color contrast is low and is predominately blue, which does not help to elucidate the hotspots.

Figure 134: Daily heatmap with colorbar maximum set to 5000



In the figure, we change the maximum value to 1000 and we are able to better visualize with a large contrast in colors.

Figure 135: Daily heatmap with colorbar maximum set to 1000.



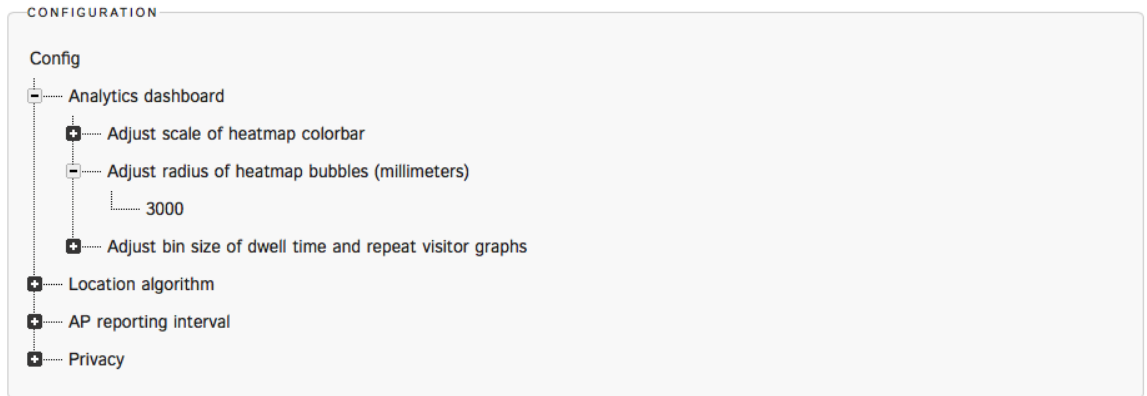
## Adjusting the Radius of Heatmap Bubbles

This parameter allows you to adjust the size of the heatmap bubble used to represent a detected device and will change the outlook of the heatmap. The unit is millimeters.

For example, in the figure, the radius is set to 3000mm, i.e. each detected device is represented by a bubble with a radius of 3m. And when neighboring bubbles overlap, they will be fused to create a larger bubble and the impression count number will be summed up accordingly.

Figure 136: Heatmap bubble radius of 3000mm.

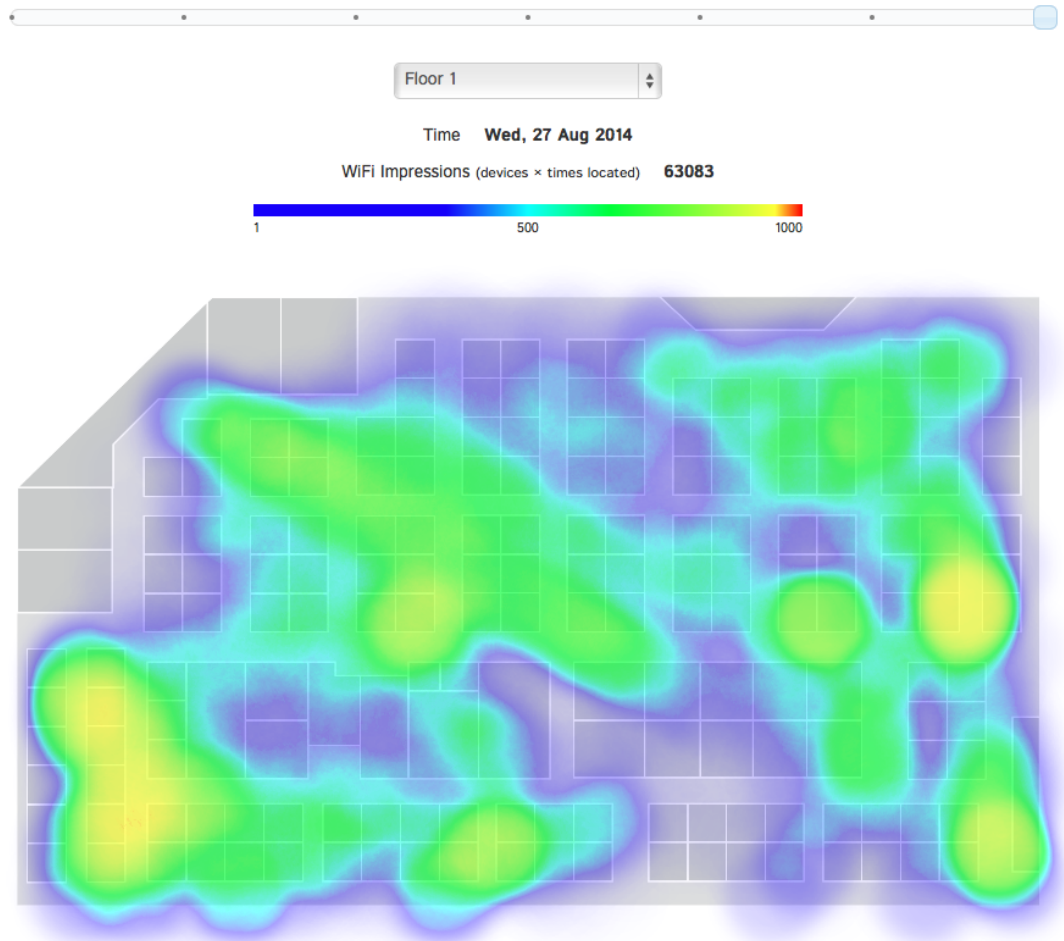




The figure shows an example where the radius is at 3000mm.

Figure 137: Heatmap bubble radius of 3000mm and colorbar maximum of 1000.

**Advanced Configuration Options**  
Configuring Analytics Dashboard Settings



The figure shows an example where the bubble radius is reduced to 1500mm. Notice how the bubbles have become smaller and the count number has reduced for each bubble. This is because when the bubbles do not overlap, the impression counts will not be summed up too.

Figure 138: Heatmap bubble radius of 1500mm and colorbar maximum of 5000.



By adjusting both the radius and scale of the color bar simultaneously, you can zoom in and out of the dataset – think of it as adjusting the scale of a graph.

### **Adjusting the Bin Size of Dwell Time and Repeat Visitor Graphs**

In the dwell time and repeat visitor distribution graphs, statistics are grouped into bins.

For example, in the figure below for dwell time distribution, the bins are:

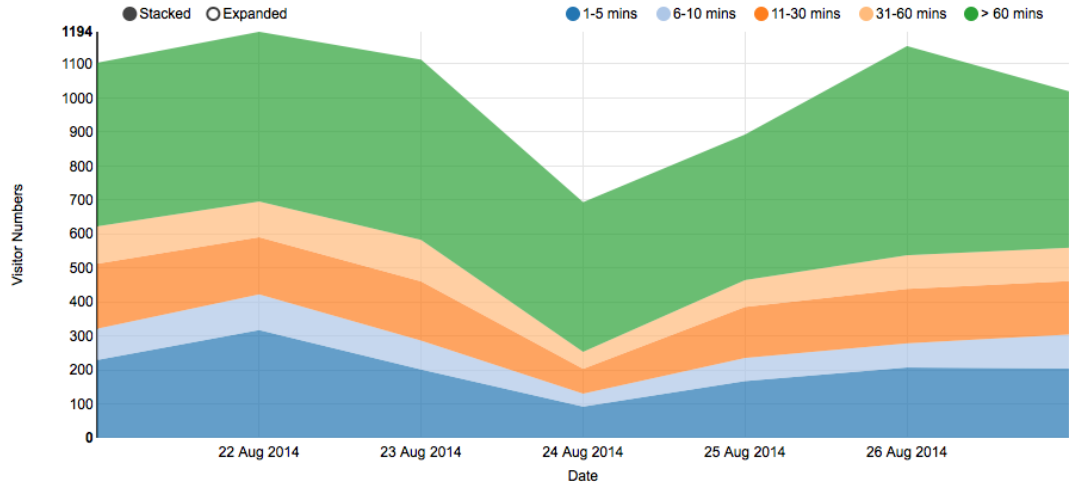
- 1 – 5 mins
- 6 – 10 mins
- 11 – 30 mins
- 31 – 60 mins
- > 60 mins

Figure 139: Dwell time distribution

## Advanced Configuration Options

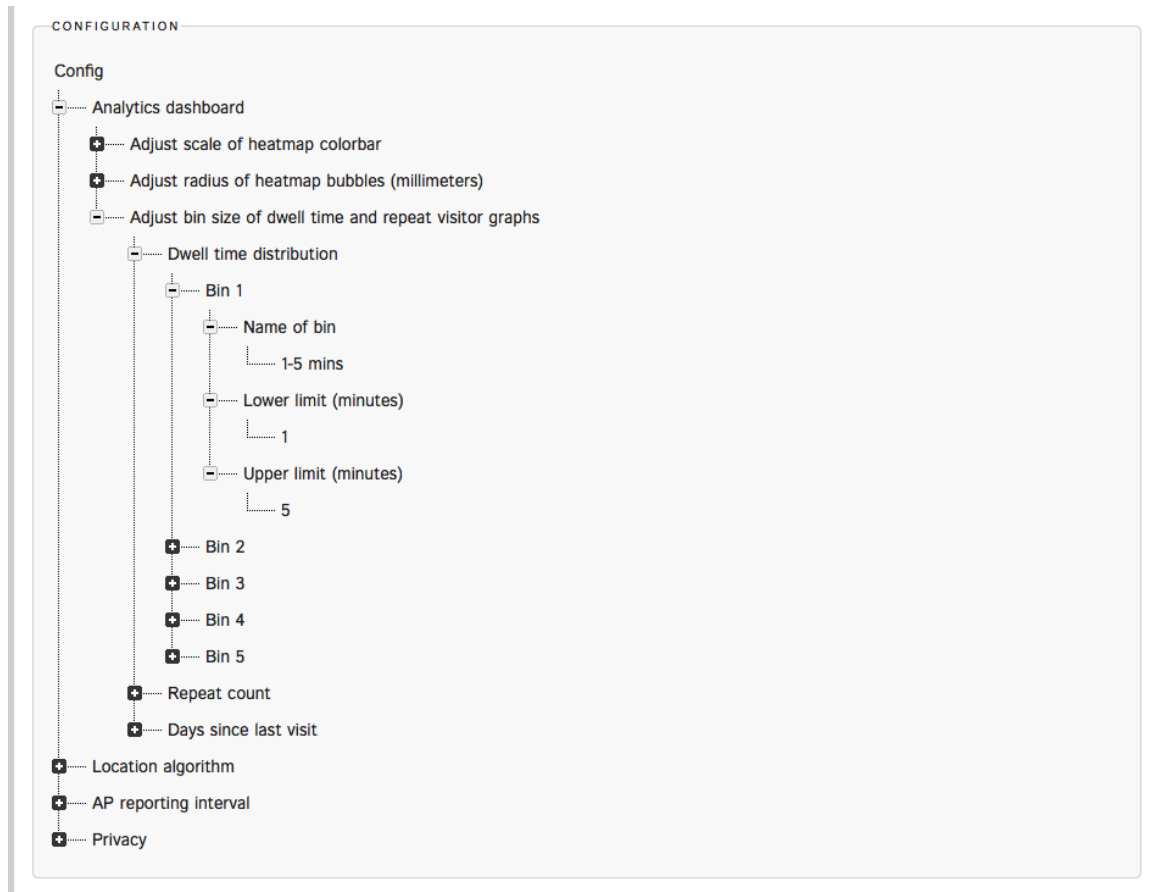
Configuring Analytics Dashboard Settings

Average Dwell Time Dwell Time Distribution



The display name, minimum and maximum values for each bin can be configured as shown in the figure.

Figure 140: Configuring the bin sizes



The same configuration method also applies to the Repeat Count and Days Since Last Visit distribution graphs.

## Locator Type Selection

SPoT provides a selection of three locator types to suit different application requirements.

The table for a summary of these locator types.

- SPoT Point without Calibration
- SPoT Point with Calibration
- SPoT Presence

Figure 141: Locator Type selection

## Advanced Configuration Options

### Locator Type Selection

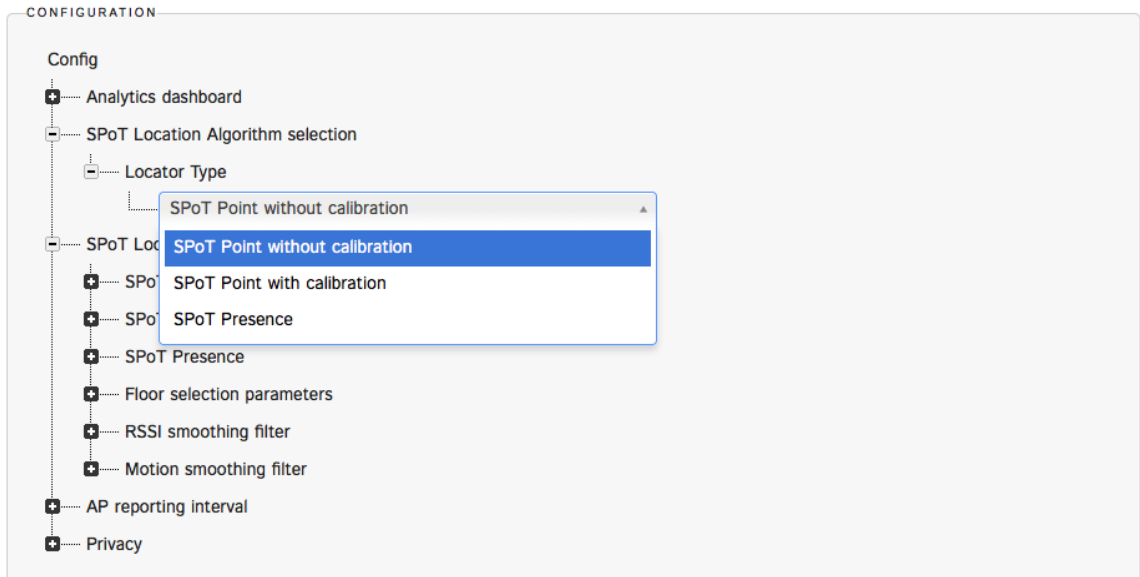


Table 6: SPoT Locator Types

Locator Type	Average Accuracy	Calibration	Radio Map
SPoT Point with Calibration	3 - 10 meters 80% Confidence	Required	Insertion of calibration points is required when creating the radio map.
SPoT Point without Calibration	10 meters	Not required	Calibration points not required.
SPoT Presence	10 - 20 meters	Not required	Calibration points not required.

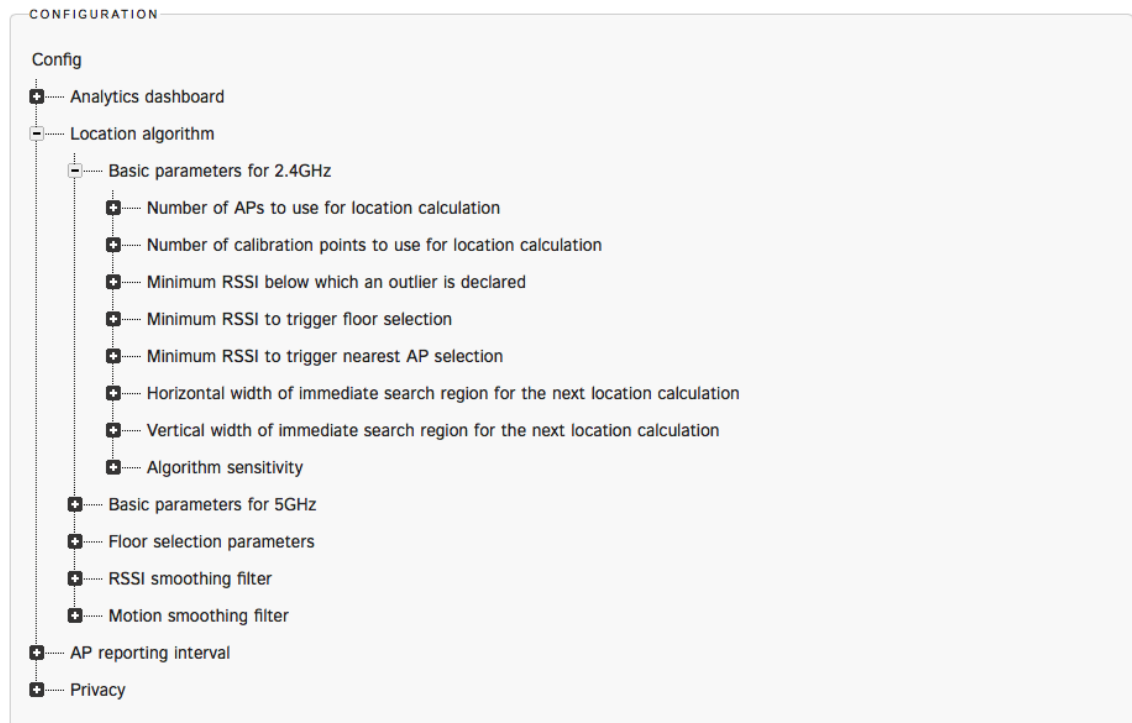
**NOTE** If you switch from either “SPoT Point without Calibration” or “SPoT Presence” to “SPoT Point with Calibration,” please ensure that the radio map has calibration points inserted and proper calibration has been completed.

## Fine Tuning the Location Algorithm to Improve SPoT Location Accuracy

The core location engine in SPoT is a highly sophisticated algorithm that includes several parameters that can be adjusted to optimize location accuracy.

The figure shows a summary of the menu list under the Location algorithm heading.

Figure 142: Location algorithm menu list



In general there are 5 categories:

1. Basic location parameters for the 2.4 GHz band.
2. Identical set of parameters for the 5 GHz band.
3. Parameters for floor selection in multi-floor venues.
4. RSSI smoothing filter to adjust the trade-off between latency and accuracy.
5. Motion smoothing filter to set the average walking speed to further fine-tune the algorithm.

## Basic Parameters for 2.4 GHz / 5 GHz for SPoT Point with Calibration

### Number of APs to use for location calculation

This parameter determines how many APs you would like to use for location when the APs are arranged in a descending RSSI order. For example, if you enter 4, it means that we want to use the top 4 APs with the strongest RSSI for location calculation.

Even though you have, say 20 APs in a venue, and 12 APs are able to detect a particular WiFi client, most of these 12 APs will have a very low RSSI as they will be far away from this WiFi client. Thus, we would want to use just the nearest 3 – 4 APs for location purposes and ignore those with lower RSSI which can only introduce more noise into the algorithm.

The table lists recommended values for this parameter.

Table 7: Recommended number of APs for location

No. of APs in venue	No. of APs to use for location calculation
1	1
2	2
3-4	3
more than 5	4

Due to the way we deploy APs, it is highly unlikely that there will be more than 5 APs which are deployed close together (less than 10m apart). Thus in most situations, there is no advantage in using more APs.

Nevertheless, feel free to try with numbers outside the recommended numbers above because every venue is different.

---

**NOTE** All numerical values entered for number of APs to use for location calculation must be positive integers.

---

### Number of calibration points to use for location calculation

---

**NOTE** Not applicable to SPoT Presence.

---

Calibration points (CP) are the discrete points that have been overlaid on the venue for calibration purposes and you can see them from the Ruckus SPoT calibrator app or under Radio Map in SPoT Admin.



When this parameter is set to 1, the location algorithm will return the location of the CP closest to the estimated location of the WiFi client. In other words, all estimated locations will be discretized and fall on a particular CP.

For a more natural user experience, you should set the parameter to 2 or 3. In this case, the location algorithm will give a weighted average of the 2 or 3 closest CPs as the estimated location for the WiFi device. In other words, the estimated locations may fall anywhere within the venue, even in-between CPs.

---

**NOTE** Important: All numerical values entered for number of calibration points to use for location calculation have to be positive integers.

---

### **Minimum RSSI below which an outlier is declared**

The purpose of this parameter is to set a threshold for RSSI such that poor RSSI readings due to occasional extreme wireless fluctuations can be discarded. The location algorithm will then return an outlier instead of giving a location estimate with poor accuracy.

For instance, if this parameter is set to -85 [dBm], it means that when all the APs that can hear a WiFi client report a RSSI below -85 dBm, an outlier will be declared.

This parameter is a good way for you to adjust the trade-off between accuracy and responsiveness of the location algorithm. If the minimum RSSI is set higher, the location estimates will be better as only the strong readings are used for estimation, but the downside is there will be many instances of outliers.

On the other hand, if the minimum RSSI is set too low, there will be no outliers, but some of the location estimates will have large errors.

An easy way to set this parameter is to look at your calibration data from **SPoT Admin > Radio Map > Files > venue\_calibration.yml** as shown below.

Figure 143: Calibration data can be found in venue\_calibration.yml

## Advanced Configuration Options

Fine Tuning the Location Algorithm to Improve SPoT Location Accuracy

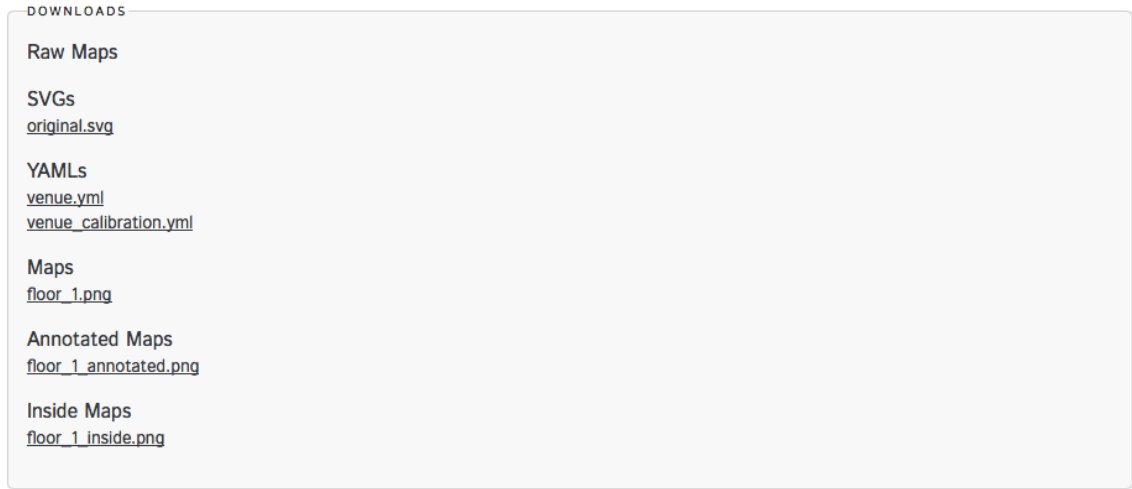


Figure 144: A snippet of the venue\_calibration.yml file

Quickly scroll through the `venue_calibration.yml` file and determine the approximate average highest RSSI value recorded at each CP. Note that these RSSI values are negative numbers (with dBm as units), so for example, -63 is larger than -86. The table below lists recommended values for this minimum RSSI parameter.

Table 8: Recommended minimum RSSI values for outlier declaration

Approximate average highest RSSI value	Minimum RSSI for outlier declaration
-60	-75
-70	-85
-80	-90
-90	-95

Avoid using a value lower than -95 as it will mean including many weak RSSI reports for location calculation which will lead to poor accuracy.

If you find that the approximate average highest RSSI value is close to -90 dBm, you should re-evaluate the AP density and locations as the RSSI values are too low for good location accuracy.

---

**NOTE** All numerical values entered for minimum RSSI below which an outlier is declared must be negative integers.

---

### Minimum RSSI to trigger floor selection

If you have a multi-floor venue, the location algorithm will need to decide which floor each and every detected device is on, and this logic is triggered based on a minimum RSSI value.

For example if minimum RSSI to trigger floor selection is set to -75, it means that the floor selection logic will be triggered whenever the highest RSSI within a report is more than -75.

Again, there is a trade-off here. If this parameter is set lower, the floor selection will be more sensitive and responsive, but there could be more cases of the wrong floor being selected. On the other hand, if the parameter is set higher, floor selection will be less sensitive and there could be a few seconds time lag, but the probability of error in floor selection will be lower. However, if the parameter is set too high, the floor selection logic might never be activated, so be careful not to set this value too high.

Below is a recommendation for this parameter based on the approximate average highest RSSI value recorded at each CP.

## Advanced Configuration Options

Fine Tuning the Location Algorithm to Improve SPoT Location Accuracy

Table 9: Recommended RSSI values for floor selection

Approximate average highest RSSI value	Minimum RSSI to trigger floor selection
-60	-70
-70	-80
-80	-85
-90	-90

**NOTE** All numerical values entered for minimum RSSI to trigger floor selection have to be negative integers.

### Minimum RSSI to trigger nearest AP selection

This option allows you to bypass the location algorithm and push the location estimate directly to the nearest AP. This is useful in use cases where you are only interested in location data on a per-AP level.

Set this value to an unrealistically high RSSI if you don't want to use this feature (for example, -20).

If you would like to use this feature, the table below lists the recommended values for this parameter based on the approximate average highest RSSI value recorded at each CP.

Table 10: Recommended RSSI values for nearest AP selection

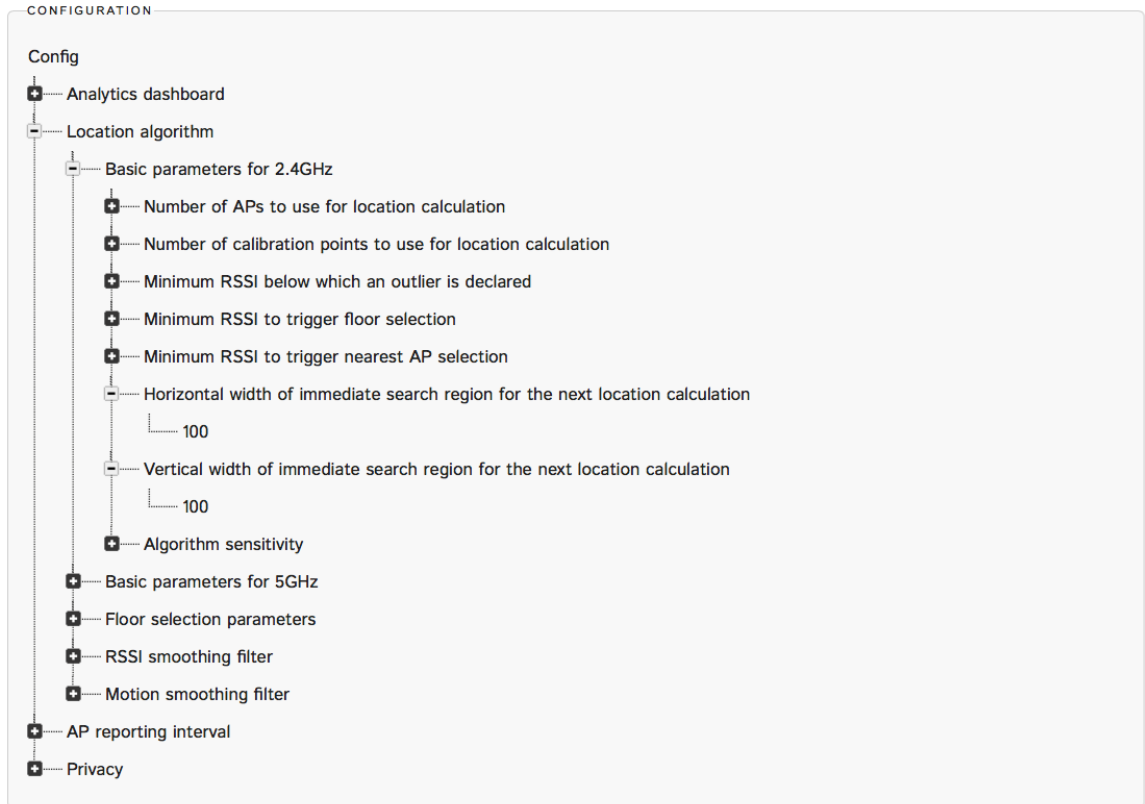
Approximate average highest RSSI value	Minimum RSSI to trigger nearest AP selection
-60	-65
-70	-75
-80	-80
-90	-90

**NOTE** All numerical values for minimum RSSI to trigger nearest AP selection must be negative integers.

### Horizontal/Vertical width of immediate search region for the next location calculation

These two parameters define the size of the rectangle for the immediate search region.

Figure 145: Horizontal and vertical widths



As the location algorithm is a real-time location engine, it makes use of the current estimated location to decide on the search region for the next location. This helps to reduce the computation load and prevent sudden “jumps” in location estimates due to wild RSSI fluctuations caused by environmental factors.

The recommended value is 100 for both horizontal and vertical widths. The unit for this parameter is in pixels and can be converted to physical distances by looking at the scale info in **SPoT Admin > Radio Map > Files > venue.yml**, as shown in the figure.

Figure 146: An example of scale info in the venue.yml file

## Advanced Configuration Options

Fine Tuning the Location Algorithm to Improve SPoT Location Accuracy

```
---
version: '1.1'
venue_id: hq-test-west
radio_map_name: '1_0_0'
date: '2014-05-06 06:43:32 +0000'
width: 700.0
height: 420.0
scale: 100
geo:
  pt1:
    x: 0.0
    y: 0.0
    lat: 0.0
    lon: 0.0
  pt2:
    x: 0.0
    y: 0.0
    lat: 0.0
    lon: 0.0
  test_pt:
    x: 0.0
    y: 0.0
    lat: 0.0
    lon: 0.0
  rotation: 0.0
  multiplier: 0.0
floors:
  floor1:
    number: 1
    zones: {}
    fsroi: {}
  aps:
    ap10:
      name: '10'
      pt:
        - 5A
```

Most venues have a scale of 100, which is 1 pixel:100mm. Thus, if the horizontal/vertical widths are set to 100 [pixels], this corresponds to 10,000mm = 10m on the ground.

---

**NOTE** All horizontal/vertical width values must be positive integers.

---

### Algorithm sensitivity

The default value is 1e-07 and this value should not be changed except in special circumstances (generally for troubleshooting purposes). In specific cases, Ruckus

Customer Support will assist you in adjusting this value if the location accuracy is consistently poor.

**Floor selection parameters**

The default values are 3 for sliding window size and 30 for sliding window timeout. In specific cases, Ruckus Customer Support will assist you in adjusting this value if the location accuracy is consistently poor.

## Location Algorithm Parameters for SPoT Point without Calibration

This section describes the Location Algorithm Parameters for SPoT Point without Calibration.

**Basic Parameters for 2.4GHz/5GHz**

The basic parameters for 2.4GHz/5GHz are as follows:

**Minimum number of APs to use for location calculation**

SPoT Point without calibration works on the principle of identifying the AP with the strongest received RSSI from a client device, and then use the RSSI data from neighbouring APs to compute a location estimate.

For this algorithm to work, we will need at least 1 neighbouring AP. Thus this parameter should not be set below 2.

---

**NOTE** All numerical values entered have to be positive integers.

---

In a dense WiFi deployment, you may increase this parameter to 3 or 4 for better accuracy, but this will also increase the probability of outliers. If the density of WiFi AP is low or normal, setting this parameter to 2 is optimal.

Limitation: In SPoT 2.0, please do not select SPoT Point without calibration if the venue has only 1 AP on any floor. For SPoT Point without calibration to function, there should be at least 2 APs on each floor. However, given that the APs will most likely be operating on different channels, SPoT Point without calibration works best in venues with more than 4 – 5 APs (per floor).

**Maximum number of neighbouring APs to use for location calculation**

Using more APs does not necessarily lead to better accuracy as some of these APs might have very low RSSI which will lead to fallacious location estimate. The default setting of 3 is optimal in most cases.

## Advanced Configuration Options

### Location Algorithm Parameters for SPoT Point without Calibration

For a dense WiFi deployment, you may increase it to 4 or 5 to improve the accuracy.

---

**NOTE** All numerical values entered have to be positive integers.

---

#### Minimum RSSI below which an outlier is declared

The purpose of this parameter is to set a threshold for RSSI such that poor RSSI readings due to the occasional extreme wireless fluctuations can be discarded. The location algorithm will then return an outlier instead of giving a location estimate with poor accuracy.

For instance, if this parameter is set to -85 [dBm], it means that when all the APs that can hear a WiFi client report a RSSI below -85 dBm, an outlier will be declared. Thus, this parameter is a good way for you to adjust the tradeoff between accuracy and responsiveness of the location algorithm. If the minimum RSSI is set higher, the location estimates will be better as only the strong readings are used for estimation, but the downside is there will be many instances of outliers.

On the other hand, if the minimum RSSI is set too low, there will be no outliers, but some of the location estimates will have large errors.

An easy way to set this parameter is to look at your calibration data from **SPoT Admin** -> **Radio Map** -> **Files** -> **venue\_calibration.yml** as shown below.

Figure 147: Calibration data can be found in venue\_calibration.yml

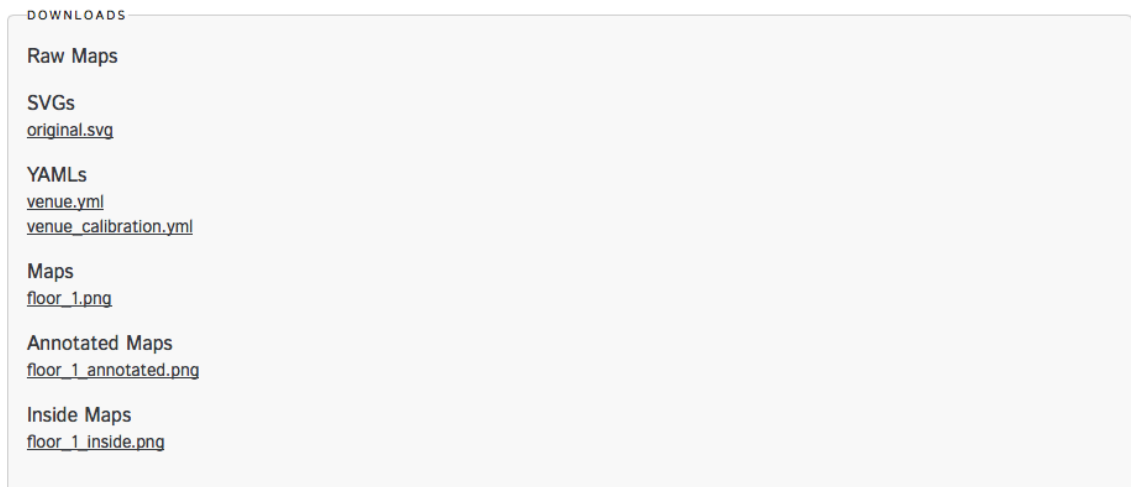


Figure 148: A snippet of the venue\_calibration.yml file



```
---
venues:
- name: HQ Test West in Singapore DC
  venue_id: hq-test-west
  floors:
  - floor_no: 1
    floor_name: Floor 1
    cps:
    - name: CP1
      x: 135.0
      y: 88.0
      calibration_band_1:
        ap7:
          mean: -79.90177921227547
        ap6:
          mean: -75.86368456271828
        ap1:
          mean: -80.52354046221147
        ap5:
          mean: -65.81146635173131
        ap8:
          mean: -81.9345099003641
        ap4:
          mean: -84.0
        ap2:
          mean: -86.0
      calibration_band_2:
        ap1:
          mean: -78.8316751738777
        ap8:
          mean: -81.63972262049893
        ap4:
          mean: -83.78975051398774
        ap7:
          mean: -78.33538479078726
        ap6:
          mean: -73.14656297702861
        ap5:
          mean: -65.10513815180624
        ap2:
          mean: -86.57007447761686
        ap9:
          mean: -100.48304604390742
    - name: CP2
      x: 168.0
      y: 88.0
      calibration_band_1:
        ap1:
          mean: -99.0
        ap2:
          mean: -91.90862246248105
        ap3:
          mean: -84.2922770884866
        ap4:
          mean: -71.51228654329402
        ap5:
          mean: -84.02470990177864
        ap6:
          mean: -92.86315637716767
        ap7:
          mean: -86.0
```

Quickly scroll through the venue\_calibration.yml file and determine what is the approximate average highest RSSI value recorded at each CP. Do note that these RSSI values are negative numbers (with dBm as its units), so for example, -63 is larger than -86.

Below is a recommendation for this minimum RSSI parameter.

## Advanced Configuration Options

Location Algorithm Parameters for SPoT Point without Calibration

Table 11: Suggested minimum RSSI values

Approximate average highest RSSI value	Minimum RSSI for outlier declaration
-60	-75
-70	-85
-80	-90
-90	-95

Avoid using anything less than -95 as it will mean using many weak RSSI reports for location which will lead to poor accuracy.

If you find that the approximate average highest RSSI value is close to -90 dBm, you should re-evaluate the AP density and locations as the RSSI values are too low for good location accuracy.

---

**NOTE** All numerical values entered for minimum RSSI below which an outlier is declared have to be negative integers.

---

### RSSI difference threshold from strongest AP

This parameter is to mitigate cases where there are two APs with the strongest RSSI. In theory, this is possible (if you stand in the middle of the 2 APs), however in practice, the probability of this happening is almost null. Default setting of 1 [dBm] is optimal for most cases.

---

**NOTE** All numerical values entered have to be positive integers.

---

### Neighboring APs RSSI difference threshold

In the algorithm, we avoid using neighbouring APs with RSSI that are too much lower than the strongest AP as a low RSSI indicates that the AP is physically far away from the client device and thus not able to contribute to an accurate location estimate.

The default setting of 15 [dBm] approximately corresponds to inter-AP distance of about 10 – 20m. If the average inter-AP distance in your venue is higher, you will have to increase this parameter accordingly.

Below is a recommendation for various inter-AP distance.

Table 12: Recommended inter-AP distances

Inter-AP distance	Neighbouring APs RSSI difference threshold
10 – 20m	15

<b>Inter-AP distance</b>	<b>Neighbouring APs RSSI difference threshold</b>
20 – 30m	20
> 30m	25

---

**NOTE** All numerical values entered have to be positive integers.

---

#### **Path loss factor**

This parameter is a proxy to the RF attenuation in your venue. The default setting of 1 is optimal for most typical environments, such as office, shopping malls, retail stores, libraries, etc.

However, if you find that the location estimates in your venue are close to the AP locations, you may increase the path loss factor to adjust the path loss model.

---

**NOTE** All numerical values entered have to be positive integers.

---

## **Location Algorithm Parameters for SPoT Presence**

This section describes the Location Algorithm Parameters for SPoT Presence.

#### **Basic Parameters for 2.4GHz/5GHz**

The basic parameters for 2.4GHz/5GHz are as follows:

#### **RSSI cutoff**

The RSSI cutoff allows you to decide the listening range of each AP in SPoT Presence mode. Below is a recommendation based on the radial distance from an AP.

Table 13: Recommended RSSI cutoff values

<b>RSSI cutoff [dBm]</b>	<b>Radial distance from AP [m]</b>
-80	25
-85	35
-95	50

---

**NOTE** All numerical values entered have to be negative integers.

---

## Advanced Configuration Options

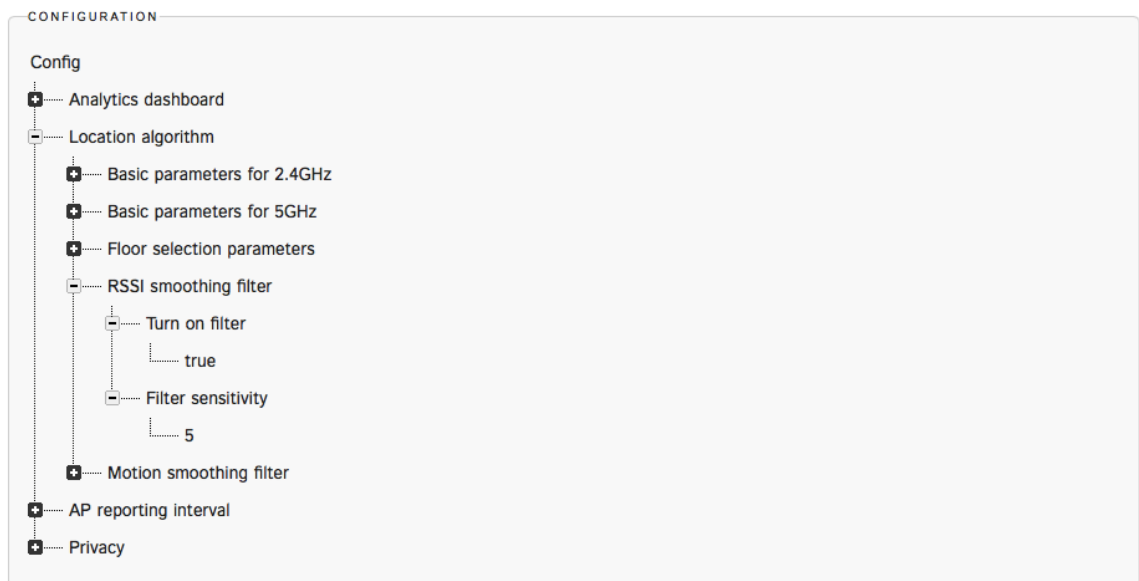
### Location Algorithm Parameters for SPoT Presence

#### RSSI smoothing filter

This is a pre-location engine filter that smoothens out any abrupt RSSI fluctuations to ensure accuracy and stability of the location estimates. Turn on the filter by entering “true” as shown in the figure below. To turn it off, enter “false”. The filter sensitivity parameter allows you to adjust the trade-off between stability and latency. If the filter sensitivity is set to a low value (e.g., 2), latency will be low, but the location estimate may appear jumpy at times. On the other hand, when the filter sensitivity is set higher (e.g., 10), the location estimate will be very stable, but latency will be high and location estimates will appear very sluggish in keeping up with movements across the venue.

The default value is 5, and the recommended range is between 2 and 8.

Figure 149: RSSI smoothing filter



---

**NOTE** All filter sensitivity values must be positive integers.

---

#### Motion smoothing filter

The motion smoothing filter smoothens abrupt large changes in location estimates within a certain time window. Turn on the filter by entering “true”. To turn it off, enter “false”.

For example, if the new location estimate is just 2 seconds after the previous estimate, then the difference in distance between the two estimates should not be more than 20m. If the difference is 4 seconds, then the distance should not be more than 40m. This will

help present a more reasonable location estimate, especially in environments with high attenuation, interference and RSSI fluctuations.

The average speed parameter allows you to configure the distance limit with respect to time. For example, if the average speed is set at 1200, it indicates that the stipulated speed of movement is 1200mm per second. In other words, within a second, the distance between two consecutive location estimates cannot be more than 1200mm = 1.2m.

The recommended range is 1000 – 2000, depending on the average speed of movement in your venue. All numerical values entered for motion smoothing filter sensitivity must be positive integers.

---

**NOTE** All numerical values entered for motion smoothing filter sensitivity must be positive integers.

---

## Other Parameters

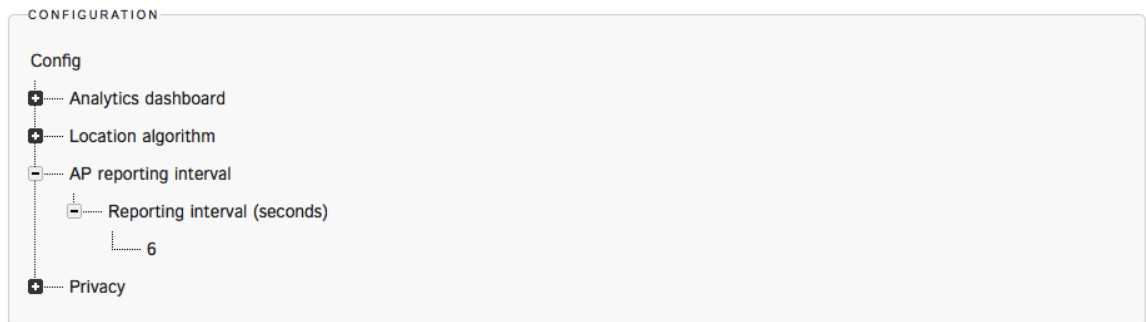
This section describes the other parameters required for configuration.

### AP Reporting Interval

This parameter configures the reporting interval from the AP to the SPoT location engine.

In short, this parameter decides the time granularity of the location system. The default value is 6 [seconds]. You may choose to lower it if you require a higher time resolution.

Figure 150: AP reporting interval



---

**NOTE** All numerical values for AP reporting interval must be positive integers.

---

## Cache

Configure the number of days to store detected device locations in cache.

These parameters affect the memory performance of SPoT and vSPoT. Large configuration values provide a large data buffer, which significantly increases the memory usage and reduces the performance of SPoT and vSPoT.

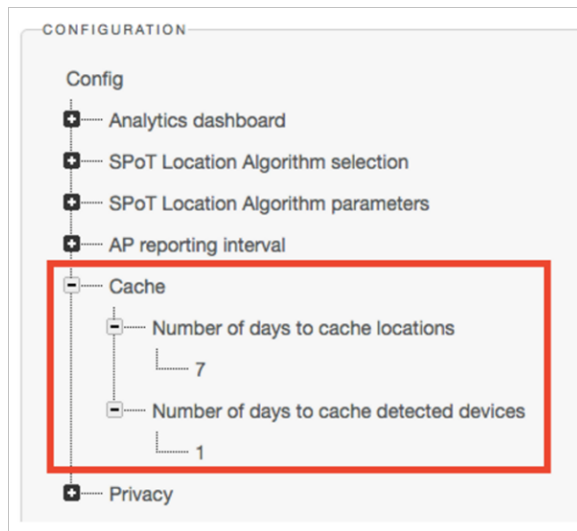
---

**NOTE** Before changing these parameters, do consult with your operations and system administrators teams to ensure that the necessary monitoring tools and processes are in place.

The following are the key parameters.

- 1. Number of days to cache locations** (default 7 days): Locations stored in cache provides a backup in the event that *ImportLocations Resque* jobs fails to execute correctly, or fails to restart through the *Resque* user interface. Up to 7 days of locations can be recovered. Changing the configuration to 1 day will help reduce the memory usage..
- 2. Number of days to cache detected devices** (default 1 day): Stores last known detected devices, which are shown in the device tracking user interface. Setting to 1 day implies that device tracking will only show devices last detected to one day ago. This is configurable up to 7 days.

Figure 151: Configuring cache parameters



---

**NOTE** Number of days to cache detected devices is reflected in the device tracking user interface as seen below.

Figure 152: Cache device tracking

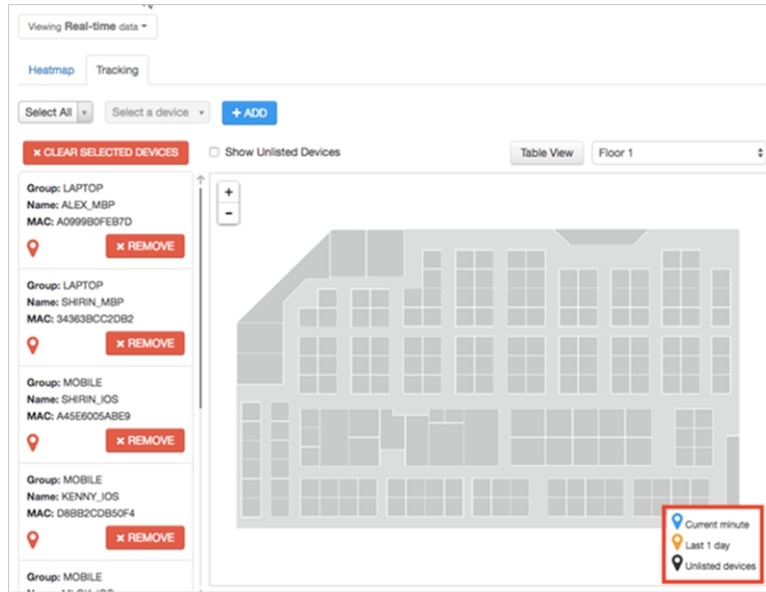


Figure 153: Cache tracking table

#	GROUP NAME	DEVICE NAME	MAC	X	Y	FLOOR NUMBER	TIME STAMP
1	LAPTOP	ALEX_MBP	A0999B0FEB7D	-	-	-	-
2	LAPTOP	SHIRIN_MBP	34363BCC2DB2	-	-	-	-
3	MOBILE	SHIRIN_IOS	A45E6005ABE9	-	-	-	-
4	MOBILE	KENNY_IOS	D8BB2CDB50F4	-	-	-	-
5	MOBILE	MLOK_IOS	20A2E406D058	-	-	-	-
6	MOBILE	IPADMINI	BC926B73358B	-	-	-	-
7	TV	PANASONIC	2477033B6BA4	-	-	-	-
8	CAMERA	DLINK_CAM	28107B0E5B81	-	-	-	-

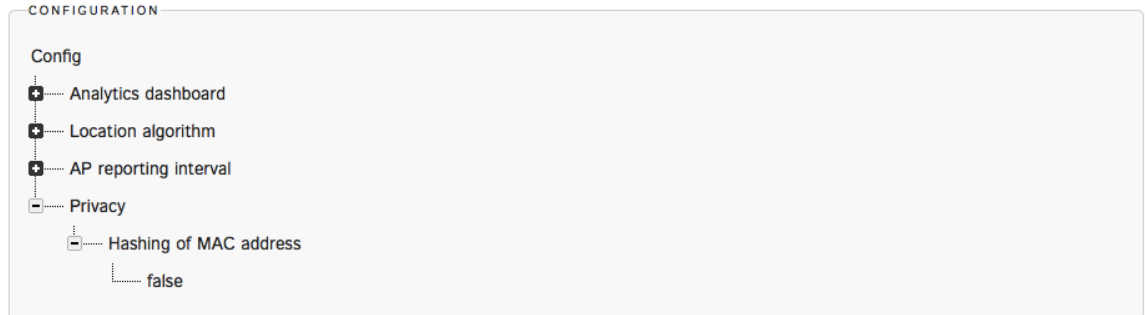
Below the table, there are four buttons: 'Located in current minute', 'Located in last 1 day' (highlighted with a red box), 'Not found', and 'Unlisted devices'. A 'Close' button is also present.

## Privacy

This parameter allows you to do a one-way hashing of all the MAC addresses being collected for privacy purposes.

By default, it is set to “false” as shown in the figure below.

Figure 154: Privacy settings



A few important notes regarding hashing of MAC addresses:

- Once a MAC address is hashed, you will not be able to retrieve the original MAC address. This is a non-reversible hashing.
- Hashing is not retrospective. In other words, MAC addresses collected before hashing is turned on will not be hashed.
- If hashing is turned on after the SPoT service has been running for a while, statistics related to repeat visitors will be affected as the hashed MAC addresses will be all treated as new visitors when compared against the non-hashed MAC addresses. Allow 1-2 weeks for the statistics to accumulate and return to normal.

## MAC Address Exclusion

Users who wish to exclude certain MAC Addresses within their venue from being included in their Location Analytics may upload a .csv file into the SPoT Admin Portal Config page.

The exclusion will take place upon the uploading of the .csv file.

The .csv will require a single MAC Address per row and may include as many MAC Addresses as desired.

After the .csv has been uploaded, SPoT will validate the MAC Addresses. Invalid MAC Addresses will be filtered to the top of a .csv file that can be downloaded by the user. The user may choose to edit the MAC Addresses and upload the edited .csv file or choose to leave it as is.



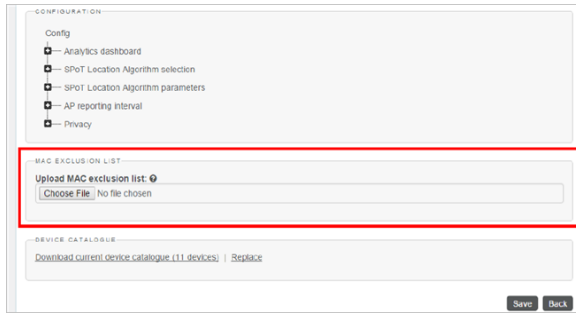


Figure 155: Uploading a MAC Address Exclusion list

## Advanced Configuration Options

MAC Address Exclusion

# API Explorer

# 8

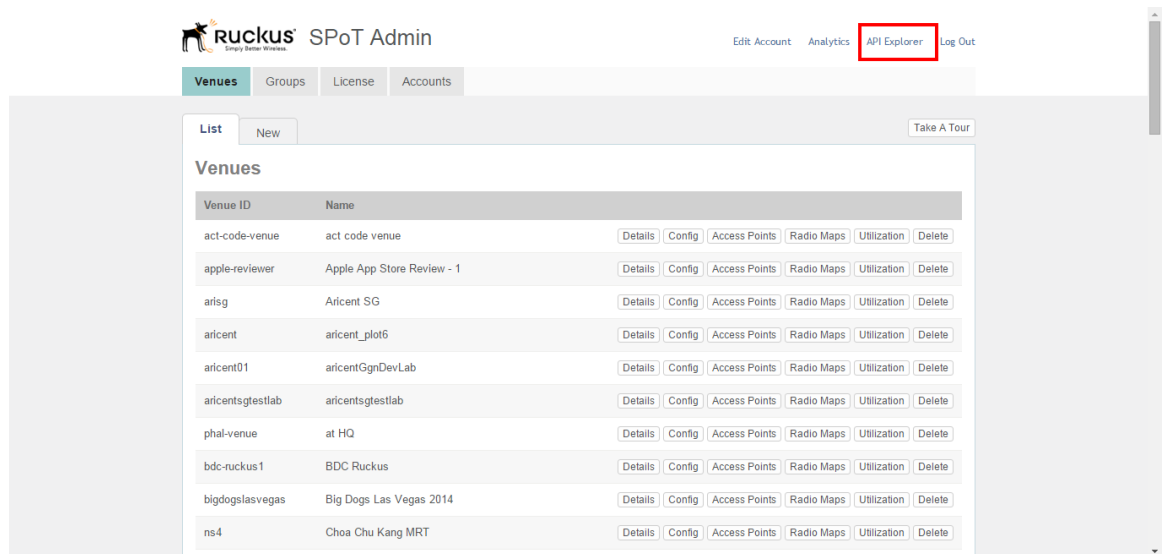
The SPoT™ location services API (“SPoT API”) provides access to resources from a SPoT location services deployment. The SPoT API is implemented as JSON over HTTPS and versioned through the URL.

Using the API Explorer, you can interact directly with the API via a simple GUI for your SPoT deployment. The API Explorer can be accessed via the following URLs (select the URL based on the Data Center in which your venue is configured):

- US: [https://us-sys.ruckuslbs.com/api\\_explorer](https://us-sys.ruckuslbs.com/api_explorer)
- Europe: [https://eu-sys.ruckuslbs.com/api\\_explorer](https://eu-sys.ruckuslbs.com/api_explorer)
- Singapore: [https://sg-sys.ruckuslbs.com/api\\_explorer](https://sg-sys.ruckuslbs.com/api_explorer)

Alternatively, you can access the AP Explorer using the link at the top of the Admin Portal, as shown in the figure below.

Figure 156: Launch the API Explorer from the Admin Portal



The API Explorer web page provides instructions on using the SPoT API to connect SPoT to third-party applications.

Figure 157: API Explorer - Top

### Ruckus SPoT

The SPoT™ location services API ("SPoT API") provides access to resources from a SPoT location services deployment as shown in Figure 1.

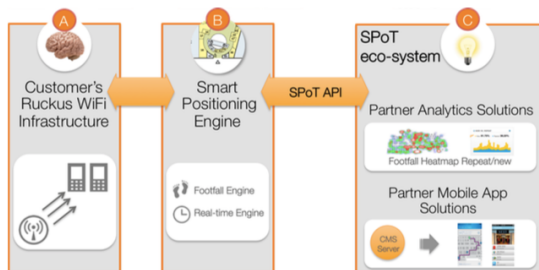


Figure 1. the three main components of the Ruckus SPoT solution comprises of the "A" customer owned (on-prem) Ruckus WiFi equipment (APs & controllers) that stream raw wifi data to the SPoT location engine "B". The SPoT engine calculates clients' location in real-time and the same data is available via the SPoT API to component "C". Component C is where our eco-system partners such as yourself would be creating innovative location based services (analytics s/w, content driven mobile app engagement solutions, north-bound business intelligence integration etc.) using the SPoT API referenced in this document.

## Using the API Explorer

This section shows you how to use the API Explorer.

Scroll down to the bottom of the page to see a list of API categories. Each of the following sections can be expanded to display additional information:

- API Keys
- Venues
- Radio Maps
- Locations
- Metrics
- Devices

Figure 158: API Explorer page - Bottom

**Input Parameters**

For endpoints requiring input parameters, the format of the parameters depends on the endpoint's method type.

For **GET** requests, the parameters should be sent via query strings. An example request using cURL will be:

```
curl https://us-sys.ruckuslbs.com/api/v1/venues/ruckus-hq/radio_maps.json?production=true
```

For other method types, the parameters should be in **application/json** format. An example request using cURL will be:

```
curl -X POST -H 'Content-Type: application/json' -d '{"email": "abc@def.com", "password": "12345678"}' https://us-sys.ruckuslbs.com/api/v1/api_keys.json
```

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<b>api_keys</b> : API Keys	Show/Hide	List Operations	Expand Operations
<b>venues</b> : Venues	Show/Hide	List Operations	Expand Operations
<b>radio_maps</b> : Radio Maps	Show/Hide	List Operations	Expand Operations
<b>locations</b> : Locations	Show/Hide	List Operations	Expand Operations
<b>metrics</b> : Metrics	Show/Hide	List Operations	Expand Operations
<b>devices</b> : Devices	Show/Hide	List Operations	Expand Operations

[ BASE URL: /api/v1 , API VERSION: 1.0.0 ] VALID {→}

Click the **Show/Hide** link to expand the section and view more detailed information on each section, including Implementation Notes, Response Class, and Response Messages. Click **List Operations** to view a simple list of parameters in json format for each section, or click **Expand Operations** to view a detailed explanation of the operations in each section.

Figure 159: Click List Operations to view a simple list of operations for each section

```
curl https://us-sys.ruckuslbs.com/api/v1/venues/ruckus-hq/radio_maps.json?production=true
```

For other method types, the parameters should be in **application/json** format. An example request using cURL will be:

```
curl -X POST -H 'Content-Type: application/json' -d '{"email": "abc@def.com", "password": "12345678"}' https://us-sys.ruckuslbs.com/api/v1/api_keys.json
```

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<b>api_keys</b> : API Keys	Show/Hide	List Operations	Expand Operations
<b>POST</b> /api_keys.json			Retrieve API key
<b>venues</b> : Venues	Show/Hide	List Operations	Expand Operations
<b>GET</b> /venues.json			List manageable venues
<b>GET</b> /venues/{venue_id}.json			Get venue details
<b>radio_maps</b> : Radio Maps	Show/Hide	List Operations	Expand Operations
<b>locations</b> : Locations	Show/Hide	List Operations	Expand Operations
<b>metrics</b> : Metrics	Show/Hide	List Operations	Expand Operations
<b>devices</b> : Devices	Show/Hide	List Operations	Expand Operations

[ BASE URL: /api/v1 , API VERSION: 1.0.0 ] VALID {→}

Figure 160: Click Expand Operations to view a detailed explanation of each API section

**locations : Locations** Show/Hide List Operations Expand Operations

**GET** /venues/{venue\_id}/locations/by\_date.json List locations of devices by date

**Implementation Notes**  
Records are available from current date till 7 days ago.

**Outliers**  
There are times when the reported signal strengths provided to the locator algorithm are insufficient to provide a good location. In such case, the location will be deemed an outlier, which is represented with the `floor_number`, `x` and `y` attributes of the location being reported as `0`. It is up to the application consuming the location data to decide how to handle such cases.

**MAC Address Hashing**  
SPoT software provides a mechanism to obfuscate the MAC address of the client device. The SPoT administrator for a venue can choose to turn on hashing of MAC addresses via the [SPoT admin portal](#). When enabled, all detected MAC addresses are hashed before storage and this process is non-reversible, i.e. once a MAC address is hashed, it will not be recoverable.

For such venues, if the `macs[]` filter is not provided in the API call, the return `mac` attribute for each record will be in hash-digests. If the filter is provided with `macs[]` in clear, the return `mac` attribute will be in clear. In other words, if a clear MAC address is provided to the server, the server will reply with the clear MAC address. Otherwise, all MAC addresses returned from the server will be in hash-digests.

**Response Class (Status 200)**  
Model | Model Schema

```
[
  {
    "mac": "string",
    "timestamp": "string",
    "floor_number": 0,
    "x": 0,
    "y": 0,
    "located_inside": true,
    "zones": [
```

For more information on each of the API categories, refer to the Implementation Notes, Response Class, Parameters and Response Messages subsections displayed under each API category after expanding the section.

# Index

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