

# Location Deployment Guide

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# **Table of Contents**

Table of Contents	2
Introduction	3
How the Mist Location Works for Engagement	3
Location Use Cases	6
Best Practices	8
Engagement	9
AP Design	11
Sample AP Designs	18
Asset Visibility	23
Enabling Asset Visibility	24
Deployment Validation (The Four Steps)	28
vBLE Details	38
Location Deployment Mistakes	38
Support	39

# Introduction

Welcome to the Mist vBLE Deployment Guide. In this guide we learn about how Mist location works, go over basic understandings of the Mist vBLE array, best practices for deploying location, use cases, asset visibility and the four steps for location. This guide will also reference certain sections back to the Mist support pages for easy access to additional information related to the section.

Mist is the first company to introduce an enterprise-grade platform for indoor BLE location services with groundbreaking features including a dynamic BLE 16 antenna array integrated into Mist's Access Points, machine learning in the Mist cloud eliminating the need for expensive site surveys, and patented virtual beacon (vBLE) technology. The Mist architecture is also unique in its ability to both send and receive BLE signals, which makes it ideal for the following BLE services (offered by Mist):

- 1. Contextual engagement services, such as wayfinding, alerts, and proximity messaging via BLE
- 2. Operational efficiency applications, like asset & people visibility leveraging 3rd party BLE (Bluetooth Low Energy).

## How the Mist Location Works for Engagement

Mist works off this idea of "Probability Surfaces" instead of triangulation. Where the more beams your client hears from the Mist APs the more RSSI (Received Signal Strength Indicator) data there is for location engine to work with in creating a sum of probability surfaces, which provides the best possible location accuracy in real time with sub second latency.

Essentially your mobile device, with the Mist SDK, listens to the BLE coming from the beams from the Mist AP, once the Mist SDK receives the beams the SDK will then send the mobile information to the cloud where location engine will calculate and respond back with an x,y coordinate to your mobile device.



So the more beams your client sees from neighboring APs the more accurate your location will be as these probability surfaces builds up. This leads into the machine learning aspect where machine learning is taking in this RSSI data and changing the Path Loss Formula (PLF) constantly, eliminating the need for site surveys.

Below is an example of the probability surface where the center of the red blob is the peak of the surface and the highest probability of where you are and the blue is the least probability where you can be.



When deploying for location you would want to follow the **Best Practices and AP Design** section and make sure that your deployed APs are deployed in a way that encompasses the user in the areas of interest for location. This is known as the Rubber Band Model, where the idea is you want to be inside the "Perimeter" of your deployed APs for the best location accuracy possible.



You want your <u>*Client*</u> to be enclosed inside the <u>*Rubber Band Model*</u> of the deployed <u>*APs*</u> for the best location accuracy possible. Going outside the Band will decrease in accuracy the further you go away.

Note: <u>Assets</u> are the opposite when comparing to an SDK client. Instead of the SDK client listing and receiving RSSI information from the beams of the Mist vBLE array assets instead beacon out and the APs receive the RSSI information from the when the assets beacon based on how many beams were heard from the asset at the time. Please see "**Asset Visibility**" section for more in depth details.

# **Location Use Cases**

There are primarily three uses cases when it comes to deploying for location, which are Way-finding, Proximity Messaging with Virtual beacons and Asset Visibility.

**Wayfinding** is the most common use case revolved around having a location estimate stick to a way-finding path as the user walks towards a destination. This is very similar to google maps but for indoor solutions.



**Blue Dot & virtual beacons for proximity messaging** is all about an accurate location estimate in an open xy space. The blue dot is your SDK client where the location engine is essentially voting on your location from neighboring Mist APs and building up a probability surface of where you are at given location. This in turn gives the user free motion to move around and can be able to trigger a push notification when approaching a virtual beacon.



**Asset Visibility** is a location feature where the Mist AP can operate in either a concurrent transmit / receive mode or a dedicated receive only mode, listening to any device transmitting within the vicinity of the deployed Mist APs such as smart watches, fitbits, headsets as well as off the shelf 3rd party BLE asset tags. The basic principle applies for "assets" as they do for SDK clients, where the more RSSI information is sent to location engine in the Mist cloud the more accurate the location estimate.



# **Best Practices**

#### • Mounting the AP

- The Mist APs must be mounted on the ceiling with the LED facing toward the ground. Please avoid putting APs on the walls (vertical mounted), on top of objects, inside of objects, or having the LED facing up towards the ceiling.
- You cannot point the AP up towards the ceiling because the system assumes the AP is always facing down. Doing so will result in your location being flipped and inaccurate.
- Link to Hardware Installation guide for AP61, AP41, AP21 and BT11 https://www.mist.com/support/

#### • AP Height

- Placing APs between 8 to 15 feet (2.5 to 4.5 meters) high is highly recommended. Higher heights will work as well, and will require potentially more density of APs to deliver high accuracy, depending on the environment and use case.
- Keep in mind though the higher the APs are deployed the more their directioanlity is lost and becomes more like an omni regardless if your client can hear all the beams.

#### • Line of Sight

- Line of sight from your device to at least 2 APs is highly recommended.
- It is best to place the AP at junction points whenever possible. This will help maximize both coverage and line of sight for corners.
- Deploying Mist APs above ceilings is not recommended but it is highly recommended to contact a Mist SE (<u>support@mist.com</u>) for guide for non-line of sight deployments.
- In-room accuracy will require an AP being inside said room to guarantee location accuracy.

#### • AP Distance from other APs

- Deploy APs between 25 to 50 feet (8 to 15 meters) from neighboring APs for optimal coverage in a spread out offset fashion.
- Keeping each AP with line of site of the other neighboring APs is highly recommended.
- Keep in mind, all you are doing is blanketing an area with BLE energy. Don't spread the APs too far apart, as the location error on the edges of the coverage range degrades quickly.

 If APs are too far from each other, then we call the non-coverage area in between the APs "no man's land" -- meaning there is no optimal coverage. Location accuracy will suffer if a device is in "no man's land."

#### • AP Coverage Range

- The APs have a BLE coverage range of around 2,500 square feet (15 meters).
- Keep in mind that the further away you are from an AP, the lower the RSSIs are from the device the less your accurate your location will be. This is why having APs within line of sight of neighboring APs -- and spreading them out to create an overlap of BLE coverage -- helps improve accuracy; when a client moves further away from one AP, in turn, it moves closer to another.

#### • APs must be on floor plan:

• An AP must be placed on the map for location to happen. APs that are powered up but not placed on a map will be ignored for location.

#### • APs in rooms

• For any location accuracy to be guaranteed in room an AP must be placed in the middle of the room.

## Engagement

How to enable engagement for location services for SDK clients and turning the vBLE arrays for all Mist APs on on an site level.

Please Note: This feature is only available if you purchased the location license. If you didn't purchase the license then Engagement will be disabled until a license is purchased.

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4	Settings Basic organization information and security settings Apply consistent configuration across multiple sites	ae an area of interest to Zoom In)	
ANALYTICS	Site Configuration Labels Create and manage sites and site groups Define org labels for users, APs, WLANs, etc.	900 am 1200 pm Data Rate	
:	RF Templates Apply consistent RF Settings across multiple sites Configure administrator accounts and access levels	3 Mbri 2 Mini 1 Mbri	
NETWORK	Mobile SDK         Audit Logs           Configuration for the mobile SDK         View the audit logs for your organization		
	AP Inventory View and manage AP inventory	10:30 am - 10:40 am, Jun 7: 2.7 MB, 0.04 Mbps	
	Site Events 0		
	There are no events to display		
	Access Points 1 Total 1 Connected		
	Name Connected Reboot Disconnected MAC Ad	dress Uptime Clients Bytes & LLDP Name LLDP Port	
	• AP41 5c:5b:3	5:0e:07:c1 7d 4h 44m 4.4 GB	
	Clients 3 Total 0 Connected		
	There are no Clients to display		

### 1. Go to "Organization" and select "Site Configuration"

Kevin's Home 😛						THU, 03:07 PM
Site Configurat	ion					[
Name Kevin's Home 😅		RF Template 	Time Zone America/Los_Angeles	Address Cupertino, CA, USA	Labels	Notification

1. Select the site of interest



- 1. Select "Engagement" under "Bluetooth based Location Services"
  - a. This will enable the vBLE array on ALL Mist APs for the selected site

## **AP** Design

In this section we will go over an example of where to deploy Mist APs and in turn how many APs you need for you deployment based of a customers **Use Case** and following **Best Practices**. This will be a step-by-step process, which should be simple and straightforward. Even though the AP designs might vary depending on certain use the cases the same principle applies, follow **Best Practices** and the **Rubber Band Model**.

**Important Note:** Make sure to scale the map properly before starting your AP design. Please review the first section of "The Four Steps" titled "Scale Floor Plan". You may also check the link

(<u>https://support-portal.mist.com/hc/en-us/articles/234751268-Loading-and-scaling-floor-plan-and</u> <u>-adding-AP-s</u>) as well. This needs to be done first as the correct scale of the map will give the most accurate calculations for the BLE coverage range.



#### Adding vBeacons to simulate AP placement:

- 1. Go to the scaled map of interest you want to to do the AP design
- 2. Click on Beacon and Zones
- 3. Click Add vBeacon
- 4. Add a couple vBeacons on the map (These will be used as a simulated AP placement), follow the **Best Practices** section for AP placements.
  - You may have noticed that there is one vBeacon is a room. If you require any for of location for in-room accuracy you must put an AP in the room.
- 5. Click the grey square to select all recently created vBeacons and edit them at once
- 6. and then click **Edit**.

# Showing what the way-finding paths would look like with the current AP placement above with regards for BLE coverage



#### Editing selected vBeacons

Mist Test Lab		TUE, 02:00 PM 🖉 🕐
Hospital	Quick Edit Virtual Beacon X	Save
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- 1. Once editing the vBeacons click "Transmit Power".
- 2. Select the scale and move it till it says "17dBm"
- 3. Make sure the power is set to 17dBm and that the "near" value is 14.3 meters (you only want to focus on the "near" measurement)
- 4. Once done click "Save"



#### Viewing edited vBeacons placements and coverage range

- 1. You should now be able to see your simulated AP placement and BLE coverage
- 2. You want a good amount of BLE ovlerplay as the helps with the provide adequate coverage throughout your deployment
- 3. If you don't see the red circles for the BLE coverage range don't worry. In the top right hand corner of the screen click the **Hamburger Menu**, which will take you to the **Location Settings**

### **Location Settings**

< Live View : Hospital	Location Settings ×	16:51:53 Ⅱ @ ≡
	Show App Clients     Setup Floorplan     Solution     Show WiFi Clients     Show BLE Clients     Show Assets	Clients Assets APs Beacons Zones O Clients
	Show Random Clients     Show WiFi Clients Associated AP	
	Show client trails for the most recent     IO locations     Show Access Points     Connected     Disconnected     Restarting, Upgrading, or Provisioning	
	Show Access Point minors on map Show Access Point minors on map Co Show Virtual Beacons Show Virtual Beacons Coverage Co Show 3rd Party Beacons	
	Show Zones     Location Origin     Map Contrast: 100	
<ul> <li>▲</li> <li>+</li> <li>-</li> </ul>		

- 1. Once in the location settings look for **Show Virtual Beacon Coverage**
- 2. Select Show Virtual Beacon Coverage
- 3. Click the **Cancel Icon** in the top right hand corner to apply the settings
- 4. You should see the red circles

#### Validating AP design



- 1. Once all said and done you can double check the distance between APs
- 2. Remember you want to place APs anywhere between 8 15 meters AP from each other
- 3. Select Ruler and click and drag from one AP to the next AP
- 4. In the top left hand corner you should see the length of the line you have created. Telling you what the distance is in meters.

Congratulations you just did you first AP design. Once more familiar with this process it is a nice method to quickly see how many APs would you need and where to put them and gives you a sense of the density for deployments. It also is a nice way to visualisation seeing the BLE coverage range as well.

## Sample AP Designs

We will take a look at a couple of sample AP designs for each main use case, way-finding, Blue Dot & virtual beacons for proximity messaging and assets.

#### Way-finding



This is for the use case of wayfinding, where SDK clients locations will snap to a path (blue lines) as the client walks the main paths.

Blue Dot & virtual beacons for proximity









This is for the use case of blue dot & virtual beacons for proximity, where the SDK client can prompted up a message through push notifications to alert users when entering a certain area.

Asset Visibility



This is for the use case of asset visibility, where the Mist APs passively listen to the RSSI signal of BLE devices.

## **Asset Visibility**

Here we will go through how to set up for "Asset Visibility" and understand some basic principles of "BLE clients" aka asset tags / beacons as well as tag vendors and configurations. Figure 1 shows the difference between and SDK and BLE client in how RSSI information is collected, same idea as SDK clients, the more beams heard the more RSSI information is used to give the best location accuracy.

Please Note: This feature is only available if you purchased the asset license. If you didn't purchase the license then Asset Visibility will be disabled until a license for assets is purchased.

Figure 1:

3.



- - C. Mist cloud displays location

4 Unlimited virtual beacons can be created anywhere

Mist cloud sends real-time location and map info to app

## Enabling Asset Visibility

1. To enable the "Asset Visibility" feature go to your "Organization" and select "Site Configuration".

Mist	THE TRUE Mist Office [PRODUCT	ION]					MON, 02:50 F	м 2 (	?	
0	Monitor WiFi Service Levels Loca	tion Service Levels Insights Site Office [PR	ODUCTION]	rs 24 Hrs 7 Days						
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4	Settings Basic organization information and security settings	Config Templates Apply consistent configuration across multiple sit	ag an area of interest to Zoom in)							
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:	RF Templates Apply consistent RF Settings across multiple sites	Administrators Configure administrator accounts and access leve	ets		M	$\sim$	20 Mags			
	Mobile SDK Configuration for the mobile SDK	Audit Logs View the audit logs for your organization								
	License View and manage licenses									
	Site Events o		-				=			
	There are no events to display									
	Access Points 14 Total 10	Connected								
	Name	Connected Disconnected	MAC Address	Uptime	Clients	Bytes	✓ Interference			
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	Mist: Sales		5c:5b:35:0e:03:11	4d 9h 8m	8	6.1 GB	-			
	Mist: QA Testing		5c:5b:35:0e:04:42	4d 9h 9m	23	5.2 GB	-			
	Mist: Board Room		5c:5b:35:0e:04:b0	4d 9h 8m	3	3.6 GB				

2. In "Site Configuration" select which site you would like to enable "Asset Visibility" for.

Mist	THE TRUE Mist Offic	e [PRODUCTION]				MON, 02:43 PM 🙎 🅐 🖌 ALL IS GOOD
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MONITOR	Name		RF Template	Time Zone	Address	Labels Notification
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_	Office [PRODUCTION]	United States	-	America/Los_Angeles	1655-1687 S De Anza Blvd, Cupertino, CA 95014, USA	8
ACCESS POINTS						
NETWORK						

3. In your selected site under "Bluetooth based Location Services" you can enable "Asset Visibility" by simply clicking on the check box and pushing "Save" once done.

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-	Office [PRODUCTION]	Street address or latitude, longitude	
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<b>Q</b>	Time Zone	Loyola 💿 Santa Clara	
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		Permanente Cupertino	
Areactrica	RF Template	Campbell	
NETWORK	No RF template \$	Saratoga	
Ø	Site Groups	Los Gatos	
ORGANIZATION	+	Google Map Satellite Map data 62017 Google Terms of Use	
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		Webhooks	
	Bluetooth based Location Services Engagement	Enable	
	Sensor Fusion App Wakeup	Management Connection	
	Asset Visibility	L2TP Management Tunnel	
		Create a Tunnel	

4. Once saved you will be able to see "Newly Discovered Assets" in BLUE and "Name Assets" in GREEN on the "location live view" of your selected floor plan.



5. You can you also go to "BLE Clients" in the "Clients" section tab to view a list of all "Newly Discovered Assets" and "Named Asset".

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Tag Vendors / Configuration:

- Tag Vendors:
  - Any tag vendor will work with Mist as long as the APs are able to detect the tags. Tag vendors we've worked with the most;
    - Blue vision, kontakt.io and Radius Networks.
- Tag / Beacon Configuration:
  - For configuration for both tags and beacons we recommend setting tags to anywhere between 1000 500 ms interval rates and 0 dBm for power.

Notes:

- **APs transmitting / Receiving:** Please be aware that when both "Engagement" (aka APs transmitting) and "Asset Visibility" (aka APs receiving) in the "Bluetooth based Location Services" under "Site Configuration" are enabled the AP is in a coextensive state of transmitting / receiving, meaning you are able to do both "SDK clients" and "Assets" simultaneously.
  - For more optimal performances for "Assets" disable "Engagement". This will put the AP into a pure receive mode, which means the APs have more time to scan the room.
- Bluetooth on Phones/Devices acting as a beacon: Please note that when a phone's Bluetooth is enabled that does "NOT" mean the phone is advertising itself as a beacon. Phones do not typically transmit at the same rate as a beacon does, and only really receive unless explicitly told to do so. Hence the need many, if not all, of the times to have a 3rd party application on the phone to be able to perform that intended function of turning a phone into a beacon.
  - Link to Bluetooth LE Resource Center https://www.mist.com/bluetooth-le-resources/

## **Deployment Validation (The Four Steps)**

For any location deployment, these four steps shown below should be verified before proceeding with using location. After correctly performing these four steps, the system is then ready for machine learning to find an PLF (path loss model) for the area that the Mist AP is deployed and different client device models. The four steps are as follows:

#### 1. Scale Floor Plan

- To scale the floorplan,
  - i. Select "Live View" from the "Location" side navigation menu



- ii. Select the site and floor plan you want to scale

### iii. Click on "Setup floor plan"



#### iv. Select the "Set Scale" option



v. Scale the floor plan and push done

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сцента	Done Set Origin	APs	
<u> </u>	The current image is scaled to 30m wide by 36m long	APs on the Floorplan	
ACCESS POINTS	Click and drag a line on the map to check or set the scale Done	Edit Remove	
	The line has a length of 12.1 meters Enter a new length to scale image	Mist: Board Room	5c:5b:35:0e:04:b0
<b>Q</b>	L L L L L L L L L L L L L L L L L L L	Mist: Conference Room 1	5c:5b:35:0e:03:ed
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		Mist: QA Testing	5c:5b:35:0e:04:42
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-1-	8 8	Mist: Think Corner	Sc:5b:35:0e:06:59
NETWORK		Available APs Drag an AP onto the floorplan	to add
Q	76	Anonymous	5c:5b:35:0e:07:12
ORGANIZATION		Mist: Marketing	5c:5b:35:0e:2c:d3
Mišt			

- Scale can be thought of as the foundation for your location accuracy. If, for example, a room is 10 meters long but you scale the room to be 1000 meters long in the system, then when you physically walk 5 meters, the system UI would only reflect you as moving one inch. This gives the false impression that location is broken, but location has actually placed you correctly based on the provided scale. Thus, it is crucial that your floorplan is scaled properly.
- One trick if you don't know the scale of a floor plan is to look for a standard door and scale that door to be 0.91 meters (3 feet). This should scale the floor plan appropriately.

#### 2. Set AP Placement

• To place an AP on the floor plan

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	Access Points 9 Total Name Mist: Engineering Mist: Board Room	8 Connected	nnected	MAC Address Sc:5b:35:0e:04:ab Sc:5b:35:0e:04:b0		<b>Uptime</b> 5d 10h 57m 5d 10h 57m	Clients 14 1	Bytes 6 GB 5.9 GB	¥
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i. Select "Live View" from the "Location" side navigation menu

ii. Select the site and floor plan you want to scale



### iii. Unlock the floorplan for editing



### iv. Select the AP from the "Available APs" option

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Mišt		•	



#### v. Drag and drop the AP on the floor plan

- AP placement is simple yet important. In the UI, just drag and drop the AP onto the floor plan where the AP is deployed in the real world. For example, let's say you have a 10 x 10 meter room and physically deploy the AP in the center of the room. You would do the same in the system by placing the AP on the middle of the floorplan in the UI. If you physically move that AP to the upper-right corner of the room, then you would also need to update the system by moving that AP to the upper-right corner of the floorplan.
- It is important to ensure that the MAC address of the AP placed in the system matches that of the AP in the physical deployment. If the APs and their placements do not match, this will give the false impression that location is broken; the system will show your location in a different area on the floor plan.

#### 3. Set AP Orientation

• Setting the AP orientation (rotation)

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- i. Select "Live View" from the "Location" side navigation menu

ii. Select the site and floor plan you want to scale



iii. Click "unlock for editing", select the AP you want to set the orientation, and rotate the small green dot on the outer ring of the selected AP. You can also select all APs and set all selected APs orientation in the "edit"

#### section for a quick mass orientation edit.

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<b>Q</b>				Mist: Conference     Room 1	5c:5b:35
LOCATION				🗌 🖪 Mist: Engineering	5c5b:35
4				🗌 🎴 Mist: QA Testing	
AMALYTICS				🗌 📔 Mist: Reception	5c.5b:35
		<b></b>		🗌 🎴 Mist: Sales	5c:5b:35
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ORGANIZATION				Mist: Marketing	
				Selected Access Point	*
				Name	Mist: QA Testing
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				Minor	9856
		÷		x, y (m)	9, -22
	a			Rotation	50*
Mišt				AP Details + B	dit + Remove

- AP orientation is a crucial part of location accuracy. Wherever the AP's LED is pointing in relation to the map's perspective, that AP's orientation (or rotation) in the UI must match its orientation in the real world. If done incorrectly, the location engine will place your client's location somewhere else.
- Please note your map does not have to face true north. The easiest way to determine the AP's orientation is to find a reference point on the floorplan when comparing the UI with the real world.
- When setting the orientation in the UI, make sure the small green dot points in the same direction as the AP's LED. A good tip is to orient all of the AP's in a common space in the same direction, as this makes it easier to spot problems down the road.
- Imagine drawing a line from the Mist logo towards the LED and continuing drawing that line past the LED. This is your imaginary line of where the LED is facing.

#### 4. Set AP Height

• Setting the AP Height



i. Select "Live View" from the "Location" side navigation menu.

ii. Select the site and floor plan you want to scale.





iii. Select the AP you want to set the height and click "Quick Edit"



You can now change the height of the AP

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cupins		Name Mist: QA Testing	Undo Redo APs
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COESS POINTS	<b>•</b>	9 -22	Edit Remove
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<b>Q</b>			C Sc5b;35
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Mist			AP Details + Edit + Remove

- AP height is the last step in the initial deployment process and is important since the location engine takes this into account for machine learning.
- By default, we set all APs to 2.75 meters (9.02231 feet). Make sure to set the AP's height appropriately in the "Quick Edit" section of the Live View.

All in all, the message is simple; the system and real world deployments must match as closely as possible. They do not necessarily have to be perfect, but the closer the UI deployment reflects reality, the better location accuracy will be. After this, machine learning will continuously adjust and find a more optimal path loss formula (PLF) that works for your deployment. If you find your location experience is not ideal revisit these four steps. The majority of location issues comes from an incorrect AP setup. Below is a link to a video on how to do the setup for these four steps.

### **vBLE** Details

#### • Mist vBLE Array

- The Mist AP has a vBLE array, which consists of a 16 Directional Antennae Bluetooth Array. Eight *unique* antennas are reflectors to help with directing the BLE energy outward away from the AP, and the other eight *unique* antennas are directional antennas that point in eight different directions, transmitting BLE energy in a flashlight-like fashion.
- To better visualize this, imagine a flashlight shining narrow beams in eight different directions.
- AP Directional Beam Angle
  - The best directionality comes from about a 45 degree angle, with the AP's LED facing down towards the ground. Anything below 45 degrees acts more like an null radius, since you are directly under the AP at 0 degrees.
  - This is why the higher an AP is placed, the null radius under the AP increases and the RSSI from the client decreases.

#### • AP Beams

- Each AP is transmitting on eight *unique* directional beams.
- The Mist SDK on the device hears these beacons from the beams, and sends the RSSI and device sensor information back to the Mist cloud. Through either Wifi or cellular.
- The more beams your device hears the more accurate your location will be, as there is more data for the location engine to make a better location estimate.

## **Location Deployment Mistakes**

- DO NOT install APs on the ground or on any object with the AP facing up or down.
- DO NOT install APs on the walls with the AP vertical to the wall.
  - You can install APs horizontally on walls as long as the LED is still facing down.
- DO NOT install two or more APs 1 meters from each other.
  - This is just poor use of coverage.
- DO NOT install APs near or up against metal, glass or concrete.

- DO NOT install APs more than 15 feet high.
  - If you do need to install APs more than 15 feet high please contact Mist ( <u>support@mist.com</u>) to have a Mist SE help advise as certain uses cases may require more dense AP deployment for higher ceiling deployments.
- DO NOT install APs above the ceiling.
  - Only certain use cases call for this, which would require advice from a Mist SE (<u>support@mist.com</u>) on how to best deploy for such a use cases.

## Support

If you have any questions that were not answered in this guide or you have a very specific question that this guide did not cover you can go to our support page and email to submit a ticket. Below are two ways you can submit a ticket.

- 1. You can email your questions at <a href="mailto:support@mist.com">support@mist.com</a>
- 2. You can go to https://support-portal.mist.com/hc/en-us/requests/new