

# Ruckus and Ekahau Solution for RTLS



## Ekahau RTLS

Real time location tracking systems (RTLS) provide critical insight to allow organizations to manage assets, improve utilization rates, streamline workflow and enhance safety. They enable essential capability for a range of industries, including health care, retail, logistics and manufacturing as well as government and education.

Ekahau provides the easiest, most cost effective and accurate positioning solutions for locating people and assets, as well as monitoring temperature and humidity, using wireless enterprise networks. Working over a Ruckus Wireless Wi-Fi infrastructure, Ekahau is the best of breed RTLS solution.

## The Ruckus System

The Ruckus ZoneFlex system is a centrally managed WLAN system comprising controllers and 802.11 a/b/g/n access points (APs). The APs leverage unique antenna features for reliable and enhanced communication for real-time applications such as voice and video, as well as location tracking systems. BeamFlex combines a compact internal antenna array with expert control software to continuously optimize connectivity for each associated client and reconfigure in real-time to bypass interference and physical barriers. Together with other features such as Airtime Fairness and SmartCast, Ruckus ZoneFlex is the Wi-Fi network of choice for real time applications.

## ZoneFlex 7300 Series APs

The Ruckus ZoneFlex 7300 series delivers high-performance and reliable 802.11n wireless networking. The ZoneFlex 7300 combines patented dynamic beamforming and automatic interference mitigation to deliver consistent, predictable performance at extended ranges with 4dBi of signal gain and -10dB of interference rejection. The ZoneFlex 7300 delivers a 2- to 4-fold increase in signal range with lower packet error rates

while reducing the number of APs required to deliver dependable Wi-Fi service.

## Zone Director Series

The Ruckus Wireless ZoneDirector series is the first enterprise-class Smart Wireless LAN management system that delivers a secure, robust and easily expandable WLAN solution. Capable of managing up to 500 ZoneFlex Smart Wi-Fi access points from a single location, the Ruckus ZoneDirector series is designed for simplicity and ease of use.

The ZoneDirector series integrates the Ruckus Smart/OS application engine that delivers advanced features such as smart wireless meshing, hot spot authentication, elegant guest networking and dynamic Wi-Fi security.

## The Ekahau System

The Ekahau RTLS makes enterprises more safe and efficient by locating assets and people, and delivering the right information to the right person at the right time. It is a complete solution for asset management, people tracking and safety, as well as temperature and humidity monitoring. The full solution consists of the following components. The user can select the required components from Ekahau RTLS installer file during installation.

## Ekahau Vision Application

Ekahau Vision is an easy-to-use, graphical enterprise application for visualizing, managing, and optimizing the enterprise. As a key component of the Ekahau Real-Time Location System, the Ekahau Vision application provides visibility over assets, personnel, and visitors. With Ekahau Vision, locating assets and people in real time, monitoring condition-critical assets, as well as generating alerts and reports is as easy as using a web browser. Since Ekahau Vision runs on the browser, it can be accessed from anywhere in the world.



Server requirements – Minimum of 3GHz CPU, 2GB of RAM, Windows XP Professional, Windows 2000, Windows 2003 server or Windows 2008 server.

## Ekahau RTLS Controller

Ekahau RTLS Controller (ERC) is a real-time location software platform that works over a Ruckus ZoneFlex Wi-Fi network to track assets and people. ERC monitors an enterprise to improve visibility, productivity, mobility, and communications. Anything that emits a Wi-Fi signal can be tracked for real-time position and motion as well as historical location data. ERC tracks Ekahau Wi-Fi tags and badges, but it also tracks Wi-Fi tags from other vendors and Wi-Fi enabled laptops, PDAs and barcode scanners.

ERC comes with Ekahau Site Survey (ESS), an easy-to-use, point and click application that creates positioning models during system set-up. Ekahau’s innovative, patented algorithms calculate asset tracking based on signal strength measurements from APs during the calibration process, turning location data into actionable information.

Server requirements for ERC – Minimum of 3GHz CPU, 2GB of RAM, Windows XP Professional, Windows 2000, Windows 2003 server or Windows 2008 server.

## Ekahau Wi-Fi Asset Tags

Ekahau offers Wi-Fi RFID tags for location tracking of assets and people and temperature monitoring. Wi-Fi tags may be used from healthcare to retail to industrial applications, to track assets and people, providing two-way communications. Most common tags are:

- Ekahau A4 Asset Tag – Location tracking tag
- Ekahau T301BD – Location tag capable of sending and receiving messages

## Bringup and Best Practices

The following sections describe best practices and ways to configure Ruckus Wireless AP, Ruckus ZoneDirector WLAN Controller together with RTLS devices and positioning engine (EPE) from Ekahau.

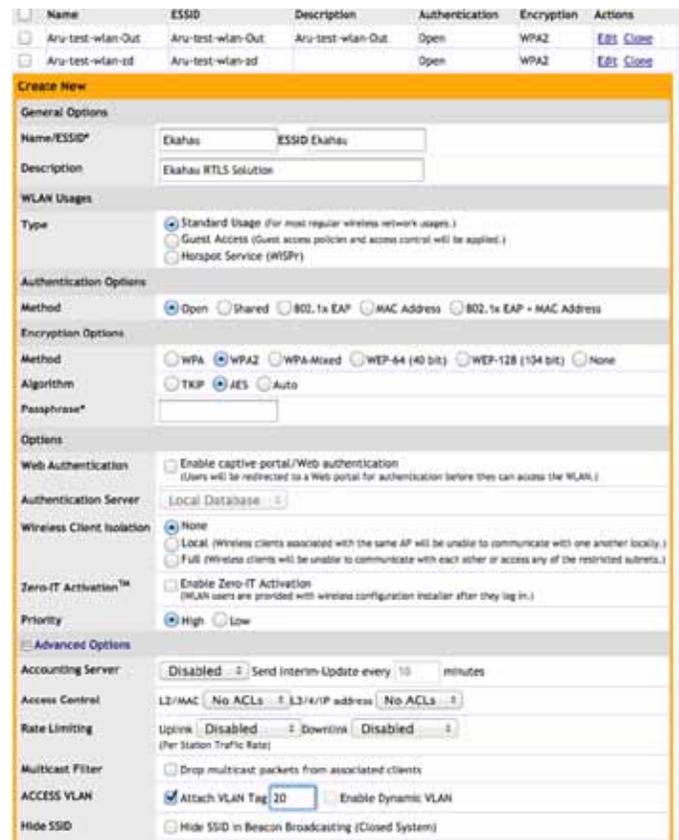
## Ruckus Configuration

It is recommended to create a separate WLAN for the Ekahau RTLS system — separate from other data WLANs.

Typically traffic from this WLAN is also tagged with a unique VLAN for the Ekahau traffic over the wired network.

To create a separate SSID/VLAN for Ekahau system on ZoneFlex, go to Configure-->WLAN-->Create New and create an SSID with required security settings.

Next, under the Advanced Options, select Attach VLAN Tag and enter the appropriate VLAN number, as shown below.



## Site Survey Consideration

Now that an SSID for Ekahau has been created, it is time to look at site survey considerations for good performance. WLAN site survey is performed using standard tools to determine optimal placement of Ruckus AP with minimal interference. Site survey guidelines for RTLS application is equivalent to that of “voice” application considering that real time tracking is involved. Site survey and calibration are the important steps to an accurately performing RTLS network. Detailed calibration steps for Ekahau tags are discussed later under section “RTLS Calibration”. In addition to the calibration steps detailed in this document, it is recommended that Ekahau implementation and deployment documents be referenced for optimum results.

### AP Placement

Before calibration, it is important to determine how many APs are required, where should they be placed and what is the expected coverage for RTLS application. Location accuracy is the prime consideration in any RTLS application and that is only possible through reliable communication. As part of site survey, AP placement need to be considered for effective coverage.

### Number of APs

For any given location within tracking environment, Ekahau tag needs to hear signal from atleast one AP at -70dbm and from at least three APs at any given time. This increases accuracy, as signal strength is stronger with close proximity and signal strength is directly proportional to accuracy. In summary, the signal strength for RTLS application should be the same or close to what would be designed for any voice-capable application.

### Security

Ekahau RTLS Wi-Fi tags support WPA2 (AES), WEP and open authentication. Configure WLAN security setting in Ruckus system accordingly to reflect matching security profile with Ekahau devices.

### Additional Configurations and Settings

In addition to the above settings, there are a few advanced settings to consider:

#### Mesh Mode

Ruckus does not recommend running a Ekahau RTLS over a mesh network — hence mesh must be disabled on the controller for a RTLS application. If mesh is already enabled, factory reset the ZoneDirector controller, and do not select mesh operation while reconfiguring.

#### Quality of Service Settings

Ruckus prides itself on being simple to deploy and manage. In the case of QoS, traffic will be automatically classified by the SmartCast traffic engine and placed in the appropriate 802.11e queue. For Ekahau system, only association mode is supported. Blink mode is not supported.

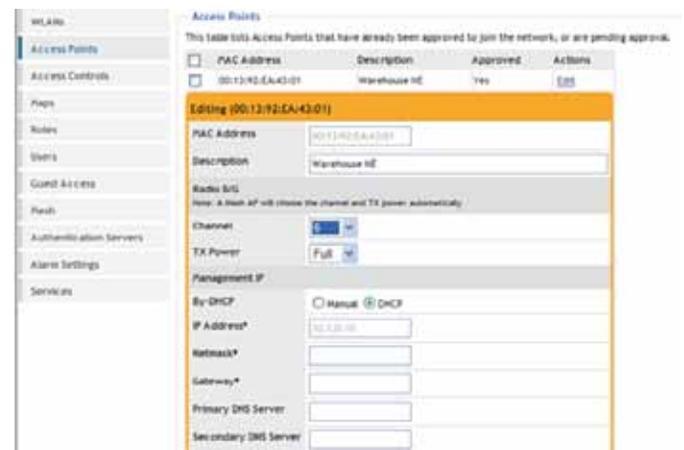
#### Background Scanning

Background scans are performed by APs to evaluate radio channel usage. The process is progressive; one frequency

is scanned at a time. This scanning enables rogue device detection, AP locationing, and self-healing. The default background scan setting is 20 seconds. Ruckus recommends using the default setting.

### AP Automatic Channel Settings

The Ruckus ZoneFlex system will automatically select the best channel settings for the APs in the WLAN. These automatic settings work well for an Ekahau RTLS implementation. However, there are times when a hard-coded channel plan may be desired. Do this by going to Configure -> Access Points and selecting a specific channel, as shown below:



### AP Automatic Power Settings

The Ruckus ZoneFlex system will automatically select the best power settings for the APs in the WLAN. These automatic settings generally work well for Ekahau implementation.

### RTLS Calibration

Calibration is the process in which a site survey of the WLAN environment is conducted to enable location services in the ERC. In this document you may see "Survey" and "Calibration" to describe the process. The calibration survey is conducted with the Ekahau Site Survey application and can be done in several ways depending on the environment and system use case. Choosing the appropriate method is a critical part of achieving the best-possible performance with the system. To successfully conduct a calibration survey the following must be determined:

- Calibration Client
- Calibration Method
- Data Collection Mode

## 1. Choose the Correct Calibration Client

A calibration client is the Wi-Fi device being used to record signal strength measurements on a wireless network. The Ekahau Site Survey allows you to connect a custom client, either onboard or mobile, to survey a network with that device's antenna.

The calibration client is chosen in the client properties window in the Ekahau Site Survey. Click on the adapter icon to access the window. Available devices are listed in the "Devices" view. By default, the Site Survey will display a list of connected (onboard) devices in the available device list (1). In addition, Ekahau tags can be connected to the Site Survey (2). \*\* what do the numbers refer to?



To activate a device for scanning, the device must first be "connected" to the laptop. This can be a NIC card installed on the laptop, Ekahau RTLS Controller, or a tag connected to the survey in "survey mode". Connected devices will be displayed in the "Devices" list. Simply select the desired device and select "Use for Scanning".

## Calibration Client Options

As a general rule, tracking is most accurate when calibration is conducted with the type of device being tracked in production. The first step in achieving this is selecting the appropriate calibration client. The following device "types" can be used to survey with the Ekahau Site Survey.

### Ekahau Tag

- Most accurate client to utilize when tracking Ekahau tags.
- Fair tracking accuracy for mixed environments.
- 2.4 GHz only

### Ekahau NIC-300

- Provides fair to moderate tracking accuracy for Ekahau tags or for mixed-client environments.
- Allows surveys on multiple bands: 802.11 a/b/g/n

## Ekahau RTLS Controller

- When combined with the appropriate client, this is the most accurate method for calibrating the ERC.
- Utilizes a Wi-Fi connection from the Site Survey directly to the ERC to stream real-time scan data from any device connected to the engine to the survey application.

## 2. Choose the Correct Calibration Method

For calibration with the Ekahau tag, the method of surveying should coincide with the intended location update method for the tags in production. When activating a tag for conducting a calibration survey, activate or program the tag for the appropriate communication method before selecting it as the calibration client in Ekahau Site Survey. Following are the methods to consider for calibration.

- Wi-Fi Engine Mode
- Tag Survey Mode

### Wi-Fi Engine Mode

This is the recommended method for calibrating for tags tracking in associated mode. This method involves the activation of a tag in "Engine" mode to connect to the Ekahau RTLS Controller over the network. The tag is then programmed on a short update interval to update to the server rapidly. The Ekahau Site Survey should then utilize the "Ekahau RTLS Controller" option in the Devices list to connect to the ERC to record data from the tag into the survey.

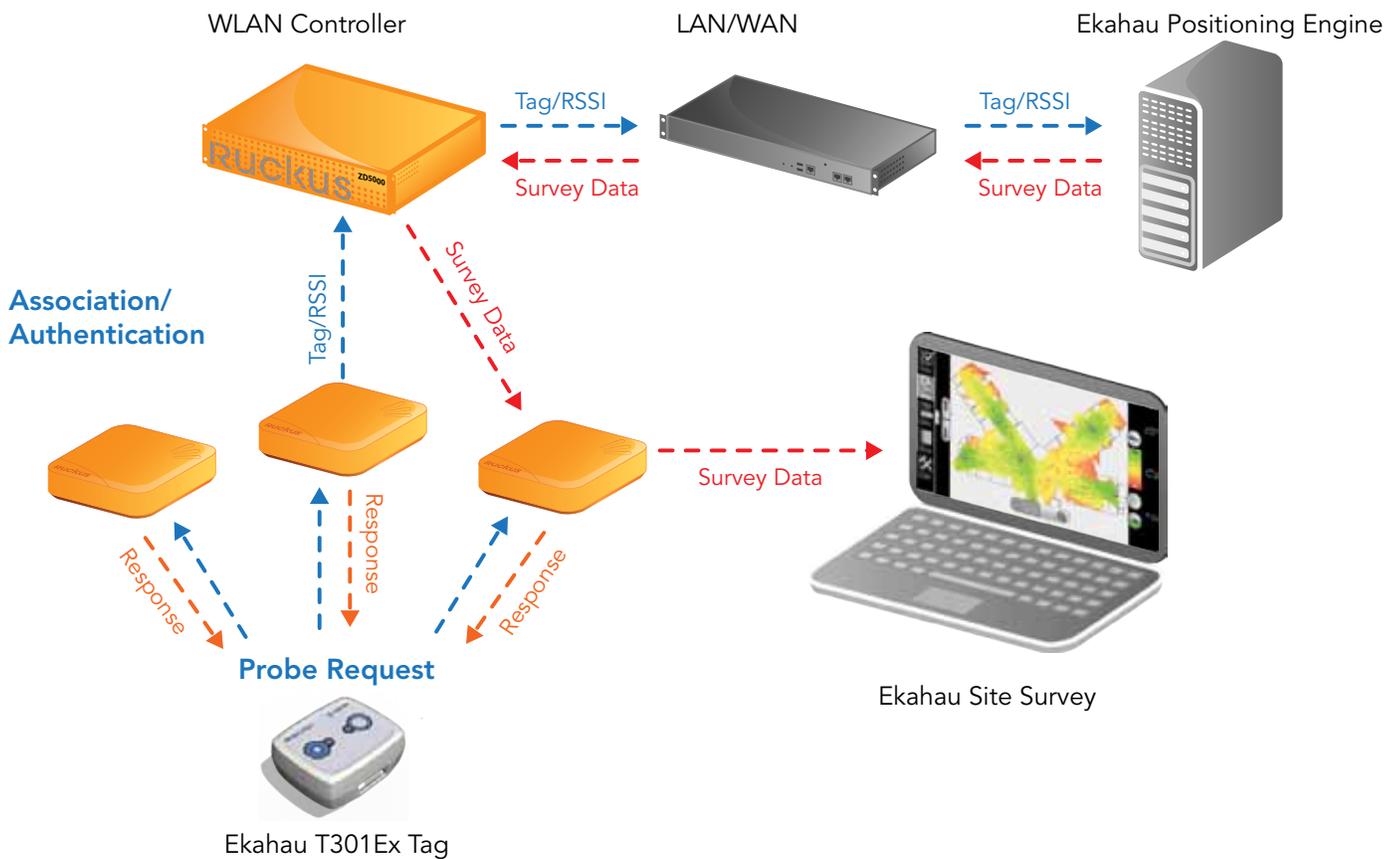
This method can be effective for calibration with any Ekahau tag, such as the T301BD tag. Additionally, this method can be effective for any device communicating to the Ekahau RTLS Controller.

For step-by-step instructions on calibration with Wi-Fi Engine Mode, please refer to the document: Wi-Fi Engine Mode Calibration with Ekahau RTLS.

In Wi-Fi engine mode the tag is programmed as an associated client on the WLAN to communicate to the Ekahau RTLS Controller server.

### Tag Survey Mode

If a reliable connection to the ERC is not available, the solution can also be calibrated in tag "survey mode".



A tag in Wi-Fi Survey Mode scans APs on the WLAN and transmits AP and RSSI information to the site survey via wireless connection to the Ekahau NIC card.

In Survey mode the tag sends probe requests out to the WLAN. APs responding to the probes via probe response are recorded and measured by the tag. The tag then sends the scan results to the Ekahau Site Survey.

Surveying with a tag-to-Site Survey connection conducts a “client” based survey. In other words, the tag is performing measurement of the network and passing that information on to the survey application.

For step-by-step instructions on tag survey mode, please refer to the document: Tag Survey Mode Calibration with Ekahau RTLS.

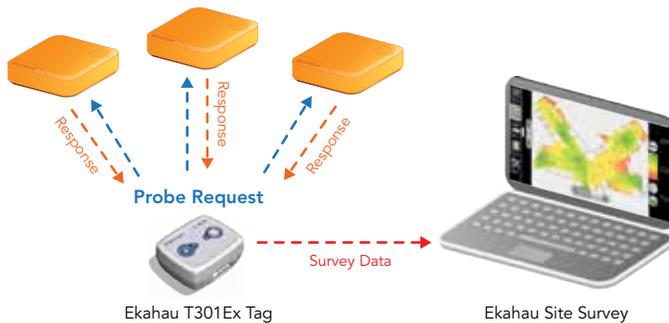
### 3. Understanding the Process

Calibration with an Ekahau T301 tag or an Ekahau NIC begins as soon as you click the “record” button in ESS and click your current location on the map. Once this has been done, ESS will continue to record RSSI data and store it in

the project file (.esx) until recording is stopped. So understand that ESS is recording even when you are not clicking on the map. Clicking on the map creates a “Survey Point,” which is visualized by a green dot. During recording “Measurement Points,” which contain actual RSSI data, are being recorded in between survey points? The following best practices apply to calibration:

- Calibrate at a consistent, steady speed equivalent to a normal walking pace
- Maintain constant device orientation and avoid shielding with anything more than your body.
- Although not a requirement, to avoid errors, we recommend that you click on the map at least every 10 to 15 feet along the rail, and always click on the map whenever you change direction or speed.

- When calibrating in hallways and small rooms, it is recommended to survey in both directions where possible to account for body shielding during calibration. If multiple sample points are taken in one position, ERC will average the measurement data for that segment of the rail or open space.



#### 4. Divide Calibration between Multiple Engineers

More than one person can calibrate at a time, however, not on the same physical map. As a best practice, divide your model up by floor (map) or by building and assign maps or buildings to individual engineers. This practice saves on calibration time and also ensures that engineers are not working with files that may become overly large. Once each file is saved, conduct accuracy analysis on the individual files using ESS, and then merge the files into a final ESX file for uploading to ERC 4.0. Note: you can only merge files containing data for separate maps. Calibration data gathered by separate surveyors for the same map cannot be merged into a single map.

#### 5. Calibrate Everywhere along Established Rails and Open Spaces

For accurate location tracking, it is important that you record survey data along your established rails and open spaces. ERC, to some degree, will infer locations in “off rail” positions, however, as a best practice, it is recommended to collect sufficient data throughout the area by calibrating along well-established. Utilize the “Calibration Quality” visualization in ESS to determine if you have gathered enough survey and measurement data along rails and in open spaces.

Do not leave empty rails and/or open spaces in a calibration file. Ensure that all rails have been surveyed. The ERC treats any rail or open space as a potential location. For ERC to make reliable location estimates for “possible locations” rails need to have survey data associated with them.

#### 6. Save Your Work Periodically During the Survey

It goes without saying, but there is no harm in pausing your work by stopping your recording, saving your progress, and then starting the recording process again. ESS does not currently perform an automatic “auto save.” It is also highly recommended to utilize “SAVE AS” and save each time as a new, incremented name. This will allow you to save your work, and revert to previous file versions if necessary.

#### 7. Check Calibration Quality

Once calibration is completed, check that the Calibration Quality visualization shows that enough calibration data has been gathered along rails and in open spaces. Areas that show red, or low, calibration quality should be revisited and additional calibration data should be gathered. In some cases when a particular area within open spaces cannot be calibrated effectively due to obstructions, the open space may be redrawn, or rails may be substituted, in order to ensure that available calibration data is managed correctly.

Calibration quality indicates areas in the positioning model where insufficient survey data has been gathered for RTLS.

#### 8. Calibration Quality and Rail Width

The default rail width in ESS is 7.9 feet (the width of a common hallway). This means that, depending on the scale of your map, any survey data plotted (by clicking on the map) to within roughly 4 ft. of either side of the rail in ESS will be “assigned” to the rail and that data will be used in generating location estimates in ERC. Survey data plotted outside of the rail width will not be assigned to a rail, and the resulting Calibration Quality will appear as “Low,” and the rail will appear “blank” to ERC as no data will be associated with it. To correct this, ensure that data is plotted carefully along the rail, within the rail width, and if necessary, adjust the rail width in ESS.

#### 9. Check Measurement Data

To analyze the signals in a given measurement point and to better understand which APs are audible in a particular area; double-click any measurement point using the inspection tool. Double clicking a measurement point will display the list of access points and signal values it contains. These values represent the RSSI data gathered

for that point at the time of calibration. The list of displayed APs and RSSI values can help verify that the appropriate APs and SSIDs are being recorded during the calibration survey.

A second recommended method for checking to ensure that the proper SSIDs are being recorded during calibration is to check the AP list in ESS as it will display any/all SSIDs currently being recorded. If, for example, you notice that an incorrect band (such as 802.11a) is displayed in the list, review the settings on your NIC and ensure that only the necessary band(s) are enabled or disabled. If unwanted data has already been recorded during the survey, it can also be removed from the model by un-checking the Survey containing the unwanted data from the Survey list (see ESS Best Practice 4.1).

### 10. Check Accuracy Analysis from Test Surveys

Once survey files have been saved, review Location, Map, Zone, and quality visualizations to allow ESS to give you an automatic interpretation of expected system accuracy. These visualizations require having at least one "test survey" recorded for any map being evaluated. Areas showing low overall accuracy should be checked for access point coverage, correct rail and open space allocation, and calibration quality.

To conduct a test survey, follow the procedures outlined in the ESS User Guide to connect a T301 in "survey mode" to the laptop running the model in ESS. Once calibration data has been saved, go back and record one to three test surveys, in which the survey path mimics a tracked device moving through the environment. Once the test surveys are gathered, rename them in the Survey List and check the "test" box and uncheck the "calibration" box. This will enable you to visualize location, map, and zone accuracy from the visualization drop-down window.

Test surveys typically cover 20% to 30% of the calibration model for accurate testing. The areas you choose should cover a full cross-section of the environment, including rooms, open spaces, hallways, etc.

To determine location accuracy, map accuracy and zone accuracy, ESS utilizes an embedded version of the positioning engine location algorithm. The difference between actual position and calculated position can also be visualized for each measurement point in the test survey as an error vector by going to View à Error Vectors and selecting the location accuracy visualization.

Error Vectors show actual device positions in the test survey as plotted on the map as orange measurement points. The calculated location for each measurement point is visualized as the position at the end of the blue error vector. By selecting, View ->Accuracy Statistics, a simple table can be generated for reporting purposes on the statistical accuracy of the system.

### 11. Remove Unwanted APs from the AP list

During calibration, ESS may detect and record APs from networks outside of those being managed for the RTLS. Following calibration, these unwanted SSIDs can be removed from ERC by un-checking them as "My" in the AP list. It is not necessary to uncheck MAC addresses belonging to VLANs on the same physical access point. Rather, remove APs that may be bleeding into the project area from other businesses, networks, etc.

### Tag Installation and Deployment

Upon calibration of devices, the next step is to install and deploy individual Ekahau Wi-Fi devices. For detailed procedure on Ekahau installation and deployment, please refer to the installation guide of that particular Ekahau device.

### Conclusion

RTLS has gained popularity in a handful of vertical markets with front-runners being HealthCare and Retail. Location tracking systems are not only used for tracking but also for realtime monitoring and reporting of temperature, humidity etc. Ruckus and Ekahau together provide a comprehensive RTLS solution to meet location accuracy and monitoring needs of each vertical market.

Ruckus Wireless, Inc.

880 West Maude Avenue, Suite 101, Sunnyvale, CA 94085 USA

(650) 265-4200 Ph \ (408) 738-2065 Fx

