Ekahau LB1 Location Beacon

User Guide

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1. Introduction

Ekahau RTLS is designed to provide precise location capabilities over the customer's existing Wi-Fi network. Typically enterprise grade deployments support RTLS as such. However, there may be situations where sub 1 meter / 3.3 feet accuracy or room level accuracy is required yet the Wi-Fi network may not support this requirement. It is not always reasonable to use additional Wi-Fi access points to achieve very high room-level accuracy. Instead, cost-effective Ekahau LB1 Location Beacons can be used to achieve this.

The Ekahau LB1 Location Beacon is small battery-powered infrared transmitters that can be easily mounted pretty much anywhere where location accuracy is mission critical but the Wi-Fi coverage is not sufficient to support RTLS. The LB1 is designed to enhance system performance yet do not require any cabling such as power or Ethernet and do not need a permanent Wi-Fi connection as other beacon technologies might need.

The Location Beacon transmits a unique ID with either 4 second (default) or 1 second interval in a focused area that is recognized by the Ekahau Wi-Fi tags. The Wi-Fi tags transmit the ID information to the Ekahau RTLS Controller, which uses both the beacon ID and Wi-Fi to calculate the exact location. If one is not available, only the other will be used.

Currently Ekahau Location Beacons are supported by the following Ekahau Wi-Fi Tags:

- Ekahau T301BD
- Ekahau T301W

The Ekahau LB1 Location Beacon can operate in three different modes:

- **Room mode (default)** – Fills a room with the beacon signal
- **Sub-zone mode** – Creates a sub-zone inside a room to enable bed-level or bay-level accuracy
- **Micro-zone mode** – Creates a micro-zone for example over hand washing sinks and cash registers

2. Features of Ekahau LB1 Location Beacon

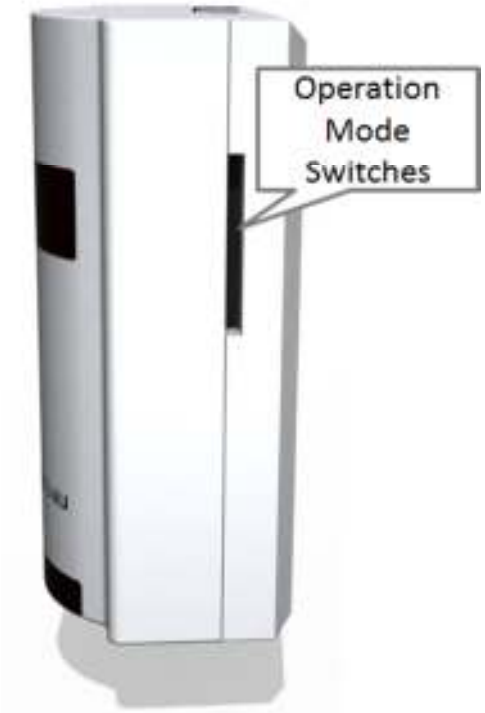
The Ekahau LB1 Location Beacon has following features:

- Battery powered with up to 5 year battery lifetime (Room Mode)
    - 2x 1.5 Volt standard alkaline C battery (included)
- Power jack for optional 3V/1A power supply
- Three operation modes for different accuracy requirements
    - Room Mode
    - Sub-Zone Mode
    - Micro-Zone Mode
- Multiple focused beams for defining precise location areas
- Adjustable blink interval
    - 4 second vs. 1 second

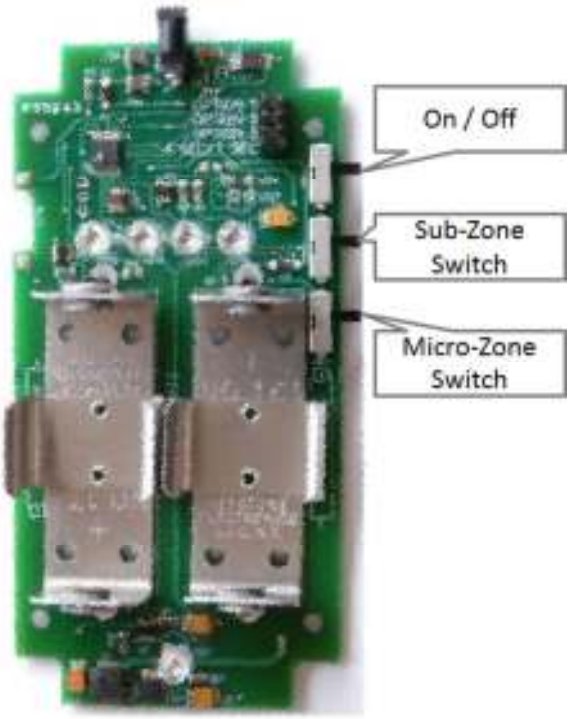
3. User Interface

3.1 Operation Mode Switches

The operation mode switches of the Ekahau LB1 Location Beacon are located on the side of the beacon. To prevent abuse, you will need a pen or a sharp tool to change the switch positions.



Picture 1: Location of the operation mode switches



Picture 2: Ekahau LB1 Location Beacon circuit board with the operation switches.

The LB1 is turned on when the **On / Off** switch is in **DOWN (↓)** position. By default, the Location Beacon operates in *Room Mode* when the other two switches are in **UP (↑)** position.

	Room Mode	**Sub-Zone Mode**	**Micro-Zone Mode**
On / Off	DOWN (↓)	DOWN (↓)	DOWN (↓)
Sub-Zone Switch	UP (↑)	DOWN (↓)	UP(↑)
Micro-Zone Switch	UP(↑)	UP(↑)	DOWN (↓)

Table 1: Operation modes with different switch setups

3.2 Power Jack

The Ekahau LB1 Location Beacon has a power jack which can be used with an optional **Ekahau C-LB1** 3V / 1A power supply. You might want to use the power supply if the C-cell batteries cannot be used or the LB1 is set to operate with 1 second blink interval and you want to ensure the LB1 does not run out of battery.

Picture 3: Location of the power jack

Alternatively, you can use your own power supply such as a battery pack. In that case, notice that the power jack connector is center pin positive! The dimensions of the cord plug are: *1.3mm I.D. x 3.5mm O.D. x 9.5mm Female*

3.3 Mounting Holes

The Ekahau LB1 has mounting holes on the base for very easy installation. Use the supplied mounting bracket to install the LB1 either on the wall or ceiling.

Picture 4: Mounting holes on the base

4. Installation

The Location Beacons are typically mounted on a wall or ceiling. Because the Location Beacons do not require any cabling, they can be moved around as needed to improve accuracy for a period of time or installed permanently in specific locations.

Picture 5: Ekahau LB1 mounting bracket

Each Location Beacon is submitted with a mounting bracket, screws, dry wall anchors, and screw plugs. Use the dry wall anchors or screw plugs if necessary. To install the mounting bracket, remove the oval shaped sticker's red plastic cover and place the bracket either on the wall or ceiling. **Finish the installation by using the submitted screws to ensure secure installation!**

As previously shown, the Ekahau LB1 has two mounting holes on the back. To install the Location Beacon on the wall, use the lower mounting hole. Respectively, to install the Location Beacon on the ceiling, use the upper mounting hole. This will give better angles for aiming the Location Beacon to the correct direction.

Picture 6: Ekahau LB1 wall installation

Picture 7: Ekahau LB1 ceiling installation

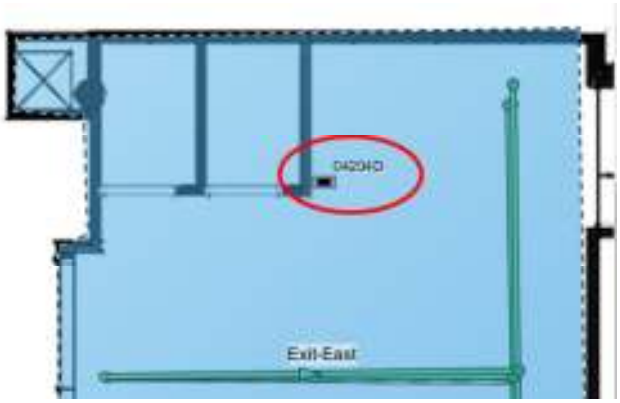
4.1 Deploying Ekahau Location Beacons with Ekahau Site Survey

1. After you have mounted the Ekahau Location Beacon, turn on the device using the upper switch on the side of the Location Beacon – See Chapter 3.1 Operation Mode Switches for more details
2. Open Ekahau Site Survey and go to RTLS tab
3. In the RTLS tab, choose the "*Location Beacon*" tool and type the six digit LB1 Serial Number identifier from the bottom the Location Beacon into the ID field

Picture 8: Ekahau LB1 SN label

Picture 9: Add the six digit serial number to ESS

4. Place the Location Beacon on the map simply clicking the its location on the map



Picture 10: Ekahau Location Beacon on the map

5. Draw a Zone over the area where you placed the Location Beacon

NOTE
Each area where you have the Ekahau Location Beacons deployed need to be defined as a Zone!

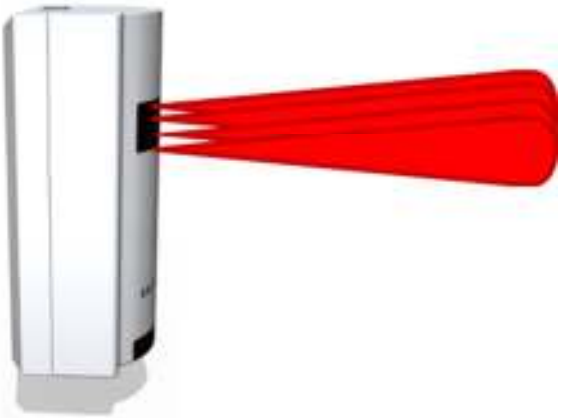
4.2 Selecting the Correct Operation Mode

As previously mentioned, the Ekahau LB1 Location Beacon can operate in three different modes:

1. Room mode
2. Sub-Zone mode
3. Micro-Zone mode

4.2.1 Room Mode

As the name implies, the Room mode is intended for covering a room with the Location Beacon signal. In this mode, the LB1 uses four top LEDs to create a large coverage area.



The line-of-sight range can be as long as 40 meters / 130 feet, but this kind of usage is not typically desirable. Instead, the long range is utilized by creating reflections from the room walls so that the whole room gets covered with the Location Beacon signal.

The Room mode does not create any particular coverage pattern. The LB1 sends the beacon ID over infrared light that is invisible to human eyes. Thus, the infrared behaves in the same way as light. The coverage pattern would look somewhat the same as when using a flashlight in a dark room.

4.2.2 Sub-Zone Mode

The Sub-Zone mode covers clearly a smaller area than the Room mode. The Sub-Zone mode is typically used to cover a bed or a smaller part of room. In this mode, the LB1 uses two top LEDs and the bottom LED to cover the area beneath it.

When the LB1 is installed for example above a bed, the LB1 creates a zone that covers the whole bed and its near surrounding.

4.2.3 Micro-Zone Mode

The Micro-Zone mode is used to create a very small coverage area. This mode is typically used to cover hand washing sinks or even cash register areas. In Micro-Zone mode, the LB1 uses only the bottom LED that is in 45 degree angle.

4.3 Enabling Location Beacon Sensor on Ekahau Tags

Before starting to use the Ekahau Location Beacons in your Ekahau Real-Time Location System, you will need to enable the location beacon sensor in the Ekahau Wi-Fi tags. Currently Ekahau T301BD and T301W Wi-Fi tags support Location Beacons.

To enable the location beacon sensor, login to Ekahau RTLS Controller. You can either enable the sensor by sending a manual command or by creating a tag configuration which the tag(s) will use when the configuration is set.

The Ekahau Wi-Fi tags can operate either in **Active** or **Passive** detection mode. In Active mode, the tag sends the Location Beacon ID immediately to ERC once it receives one. In Passive mode, the Location Beacon ID is sent to ERC only when the next location update is done.

The Passive mode is enabled manually by sending "***si 1***" command.

The Active mode is enabled manually be sending "***si 2***" command.

The location beacon sensor is disabled manually by sending "***si 0***" command.

For more information, please refer to Ekahau RTLS Controller User Guide.

5. Changing the Blink Interval

By default, the Ekahau LB1 Location Beacon sends the location beacon ID with four (4) second interval. Alternatively, the LB1 can be set to send the ID with one (1) second interval. This might be necessary in cases where the four second interval is too long such as near door exists. Using the one second interval ensures the Ekahau Wi-Fi tags can detect the Location Beacon ID in time.

To change the blink interval, open the enclosure by opening the four screws located on the back of the Location Beacon. On the circuit board, there are four jumpers from which the **4 SEC / 1 SEC** jumper adjusts the blink interval. To use one second interval, simply remove the jumper.

Picture 11: Location of the blink interval jumper

NOTE
Using the one second blink interval will drain the batteries faster. In Room mode the LB1's battery life is approximately 500 days when it normally is over 5 years.

Ekahau recommends using Ekahau C-LB1 charger with LB1 Location Beacon when one second interval is used to ensure continuous operation.

6. Estimated Battery Life

The Ekahau LB1 uses two C-cell batteries which provide approximately five year battery when the Location Beacon is in Room Mode and sending location beacon IDs with four second interval.

The below table describes how different settings effect on the battery life.

Mode / Blink Interval	**4 SEC**	**1 SEC**
Room Mode	5Y	1.4Y
Sub-Zone Mode	5.8Y	1.7Y
Micro-Zone Mode	8.6Y	2.7Y

Please notice that these numbers are estimations and based on the batteries provided with the Location Beacon!

7. Technical Specifications

- Outside dimensions (mm):
  - 125 x 67 x 51
- Weight:
  - 1.4 oz / 40 g (without batteries)
  - 9.5 oz / 268 g (with batteries)
- Power:
  - 2x C-cell batteries
  - Optional charging with 3V/1A power supply
- Operating temperature:
  - 32 to 122 °F / 0 to 50 °C
- Storage temperature:
  - -40 to 140 °F / -40 to 60 °C

8. Limited Warranty

Ekahau warrants that the Ekahau LB1 Location Beacons will operate in accordance with and substantially conform to their published specifications when shipped or otherwise delivered to the end user and **for a period of 1 year** thereafter, provided, however, that Ekahau does not warrant any claim or damage under this Warranty if such claim or damage results from:

1. Misuse, neglect, accident, or improper installation or maintenance of the Location Beacons,
2. Location Beacons that have been altered, modified, repaired, or tampered with by anyone other than Ekahau,
3. Use of the Location Beacons not in compliance with their respective documentation, user manuals, instructions, and any usage restrictions contained therein, including, but not limited to, the provisions relating to the environment and ranges where the Location Beacons must be used, or
4. Accident, fire power failure, power surge, or other hazard

Otherwise, the Location Beacons are sold AS IS. In no event does Ekahau warrant that the Location Beacons are error free or that end user will be able to operate the Location Beacons without problems or interruptions.

End User is responsible for using the Location Beacons within their specifications as contained in the Documentation.

Appendix A: Best Practices

This chapter provides best practices on how to deploy Ekahau LB1 Location Beacons.

Verify Location Beacon Coverage with Ekahau Wi-Fi Tags

Verifying the coverage of the Ekahau Location Beacon is very important to ensure the Ekahau Wi-Fi tags are capable of detecting the Location Beacons and precise location can be determined. The coverage can be easily verified with Ekahau T301W and T301BD tags.

The Ekahau T301W and T301BD tags can be set to a particular IR debug mode to ensure the Ekahau Wi-Fi tags are able to detect the Location Beacons. In this IR debug mode, the Ekahau T301W tag vibrates every time it detects a Location Beacon. When the T301BD tag detects a Location Beacon, it plays the buzzer and displays its beacon ID number. Use the tag(s) in IR debug mode and walk around in the room to ensure the Location Beacon coverage. Respectively, use the tag(s) to ensure that the Location Beacons are not audible outside the desired area such as beds etc.

The IR debug mode is enabled in T301W tag by sending "***si 3***" manual command. Please notice that the T301W should have firmware 1.0.7 or newer that supports this feature!

Enabling the IR debug mode in the T301BD tag requires a dedicated firmware. You can request this firmware by contacting Ekahau Technical Support at support@ekahau.com.

Installation Hints on How to Enhance Room Accuracy

1. Do not allow the Location Beacon signal spread outside the room

    - Do not point the LB1 Location Beacon towards windows, open doorways, or any gaps where the Location Beacon signal could leak outside the room
    - If the Location Beacon signal is leaked outside the room, there might be location errors where Ekahau RTLS Controller assumes the target is inside a room when it actually is on a corridor.
    - Use Ekahau T301W or T301BD tags in IR debug mode to verify this

2. Place the Location Beacon(s) in the corner(s) of the room

3. Point the Location Beacon(s) towards the area where the target(s) will most likely be

    - This typically includes desks and chair sets
    - Utilize reflections if possible

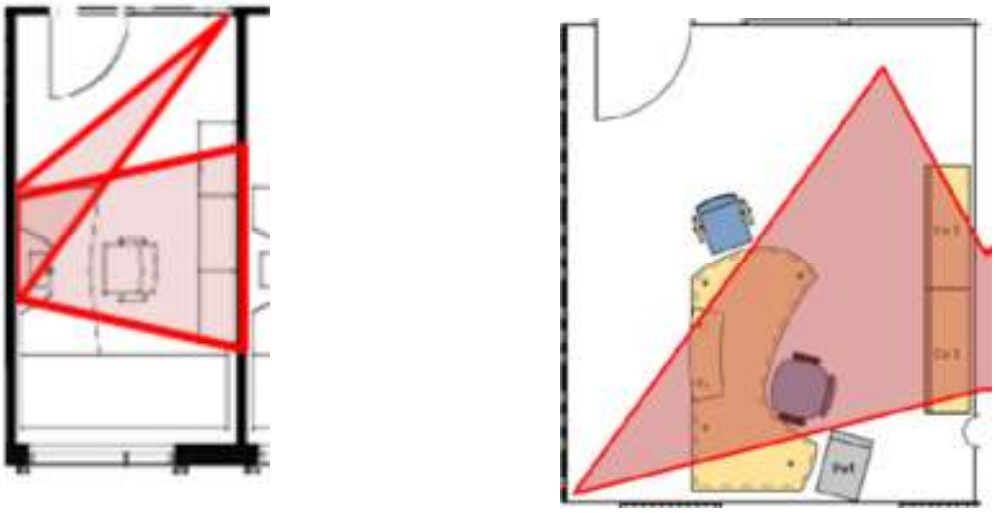


Figure 1: Reflect the signal from the wall towards the target, but make sure it does not leak outside area

4. Use reflecting walls to spread the Location Beacon signal to the whole room

5. Avoid point the Location Beacon(s) towards non-reflecting obstacles such as windows, window blinds, and dark walls

6. If there are lots of non-reflecting walls in the room, use two Location Beacons to make sure the whole room is filled with Location Beacon signal

7. In case of larger rooms where multiple people can coexist at the same time and positioned in multiple ways, use two Location Beacons to cover the whole room with Location Beacon signal from every direction (E.g. conference rooms)

    - This is required as otherwise the person(s) might be positioned back towards the Location Beacon and blocking the signal with body

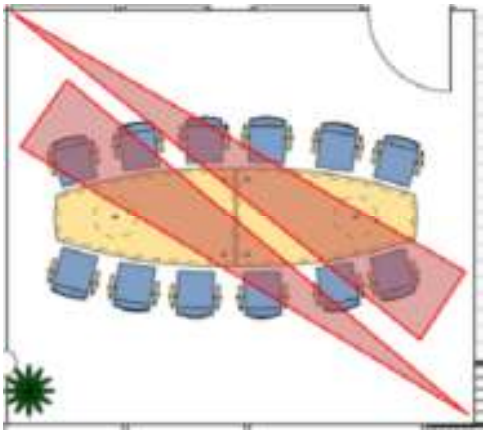


Figure 2: The above Location Beacon setup provides very comprehensive Location Beacon coverage - It does not matter which way you are standing - NOTE, the coverage does not correspond to the actual Location Beacon coverage

Installation Hints on How to Achieve Bed Level Accuracy

1. Install the LB1 Location Beacon on the ceiling above the foot end of the bed

2. Orient the LB1 the bottom LED pointing towards the wall and patient

3. Set the LB1 in Sub-zone Mode and verify the coverage to make sure the Location Beacon signal is not audible on adjacent beds or outside the desired area

4. If the coverage area is too large in Sub-zone Mode, use Micro-zone Mode instead and orient the LB1 so that the bottom LED points towards the center of the bed

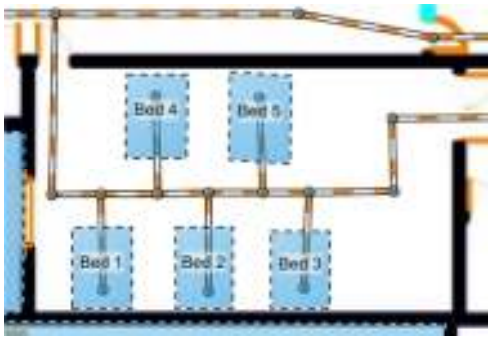
    - This might be the case if there are lots of reflecting surfaces

Figure 3: LB1 in Sub-zone Mode

Figure 4: LB1 in Micro-zone Mode

NOTICE: The actual coverage area does not correspond with the above images!

5. Create a separate zone for each bed and draw rails over them



6. Remember to gather survey data also around the bed and make sure it is associated with the rails

    - You can draw the survey route to go over the bed

NOTICE: If installation on the ceiling is not possible, you can alternatively install the LB1 on the wall above the bed's head end. In that case, orient the LB1 so that the bottom LED points toward the patient's head and the top LEDs point towards the bed's foot end. Verify the correct operation mode with an Ekahau tag running in IR debug mode.

Figure 5: LB1 installed on the wall

Using Ekahau Location Beacons to Monitor Exit Areas

Monitoring exit areas is particularly important in elderly care and in other applications where you want to prevent patients wandering out the premises. The Ekahau LB1 Location Beacons suits for this purpose very well as they improve the reliability and real-timeness of the location tracking. With LB1 Location Beacons you can configure your Ekahau RTLS to immediately alert or to perform other actions when a patient is about to exit your premises.

1. Create a dedicated zone which is used to generate an alert/action when the patient enters it

2. As an example, the below setup could be used to create an alert when the patient enters the Entrance area and to lock down the elevators if the patient enters the Elevators zone

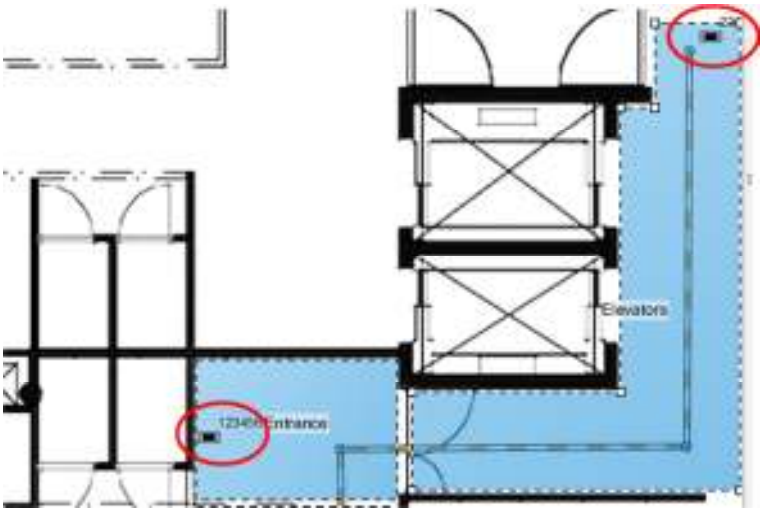


Figure 6: An example setup with two monitoring areas

3. Set the LB1 Location Beacon interval to send the location beacon ID with one (1) second interval to improve reliability

4. Set the Ekahau Wi-Fi tags' Location Beacon Sensor to active mode (*si 2*) – In this mode the tags will make a location update immediately when they detect an Ekahau Location Beacon