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Real Time Location System Hardware Guide (RTLS)

V.200.15

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1. SETTING UP DEVICES & RF NETWORK

Rest of the manual guides you through the steps necessary for setting up and configuring your wipelot devices. Please read this manual before system setup.

1.1. Safety

The device must be used solely with its original power adaptor. Please note that the adapter is 110/220V AC

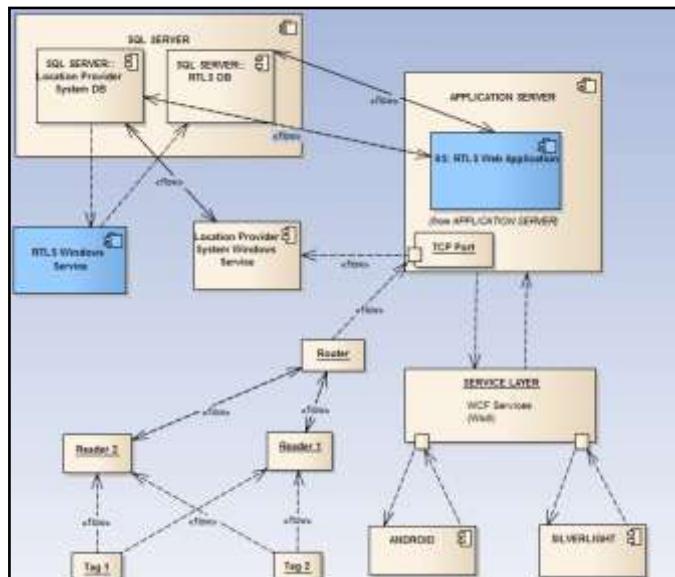
1.2. Introduction

Wipelot devices are based on 2.4GHZ IEEE 802.15.4 compliant RF wireless network. To form a minimal 802.15.4 RF Network, you should have at least 1-Router, 1-Reader and Mobile Devices.

Main coordinator (router) establishes a mesh network once it is installed. Each plugged reader (receiver), attends this network automatically and relays data for the network. All reader nodes cooperate in the distribution of data in the network.

Wipelot's small sized new born baby tag is affixed to the ankle of the new born infant to be tracked. The tag contains an RF transmitter circuit. It transmits message signal, comprising unique identity information, to receivers which are strategically placed within the hospital. The message is propagated along a path by hopping from node to node until it reaches the port which is being listened by the Location Provider Service software.

Location Provider Software calculates tags' positions by using RSSI (received signal strength indicator) levels, dimensions of there go in to be tracked and fixed position information of the receivers on that region.



Component Interoperability



Calculated positions are being written on the Location Provider System database. These positions can also be used in real time by remoting technology. This architecture provides flexibility in integration with third party softwares. Wipelot H-RTLS application comprises an independent service which listens the Location Provider System database. It interprets fetched informational and applies some business rules on it prior to UI interaction.

Tags comprise a conductive security element attachment having two ends, whose electrical state will change when stretched, severed, or removed by parting the end. When the electrical state changes an alarm code will be generated and sent to receivers. This information will then be processed as explained above.

Built in motion sensor is able to detect unnatural movements like falling, being idle for a certain period of time etc. Alarm will be generated as soon as this kind of movement is detected.

1.3. RF affecting factors

All devices's RF signals can affect some material some extent. If our devices's RF signal encounter some material especially high-level obstacle severity material as stated in Table 1. Router, Reader and Tags will be decreased range of distance. For this reason, all device have to position as far as possible from especially obstruction of high level obstacle severity material as in Table 1.

| Obstruction | Obstacle Severity | Sample Use |
|----------------------|-------------------|------------------------------|
| Wood / Wood paneling | Low | Inside a wall or hollow door |
| Drywall | Low | Inside Walls |
| Furniture | Low | Couches or office partitions |
| Clear glass | Low | Windows |
| Tinted glass | Medium | Windows |



| | | |
|-----------------|-------------|---|
| People | Medium | High-volume traffic areas that have considerable pedestrian traffic |
| Ceramic tile | Medium | Walls |
| Concrete blocks | Medium/High | Outer wall construction |
| Mirrors | High | Mirror or reflective glass |
| Metals | High | Metal office partitions, doors, metal office furniture |
| Water | High | Aquariums, rain, fountains |

Table-1 RF Obstacles Found Indoors

1.3.1. Active RFID Tag for Personnel Tag 1 (Wipelot Model No:MT-02DC)

It has two LEDs (Green, Red). If device is powered up, Blue LED blinks by each wake/sleep cycle. There is no LED indication in stand-by mode. It has one button with following functions:

- Button Short Press/Release : Send Emergency Message / Wake-up the device if in stand-by
- Button Press for 5 Seconds: Enter to stand by mode.

Power: Wipelot MT-02DC contains rechargeable lithium battery which has 1000 mAh lithium battery. Wipelot MT-02DC must charge with 5V 1A adapter that has CE certification or UL certification.

This button is also used for matching mobile devices.

Wipelot MT-02DC device has 2.4GHz RF propagation (jn 5168 chip) that 2.5 dBm output power level and it has 2.4 GHz PCB antenna. Also, MT-02DC device has UWB module (DWM1000) that has 3.1 ~ 8 GHz monopole antenna. We operate at 4.4GHz due to special reason. UWB Module output power is fully adjustable from 0 dBm to 15.5 dBm via firmware.



The device's both of PCB antenna and UWB monopole antenna are omni directional. Both of antenna are fixed on PCB, that's why it can not change reorient and relocate.

Therefore MT-02DC can take signal every direction. If Wipelot MT-02DC obstructs by obstacle of in Table 1. The device's RF signal will decrease as stated in Table 1.

MT-02DC can transmits until 200 meters to readers if RF output power is fully.

FCC Information:

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

- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause un desired operation.

Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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

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

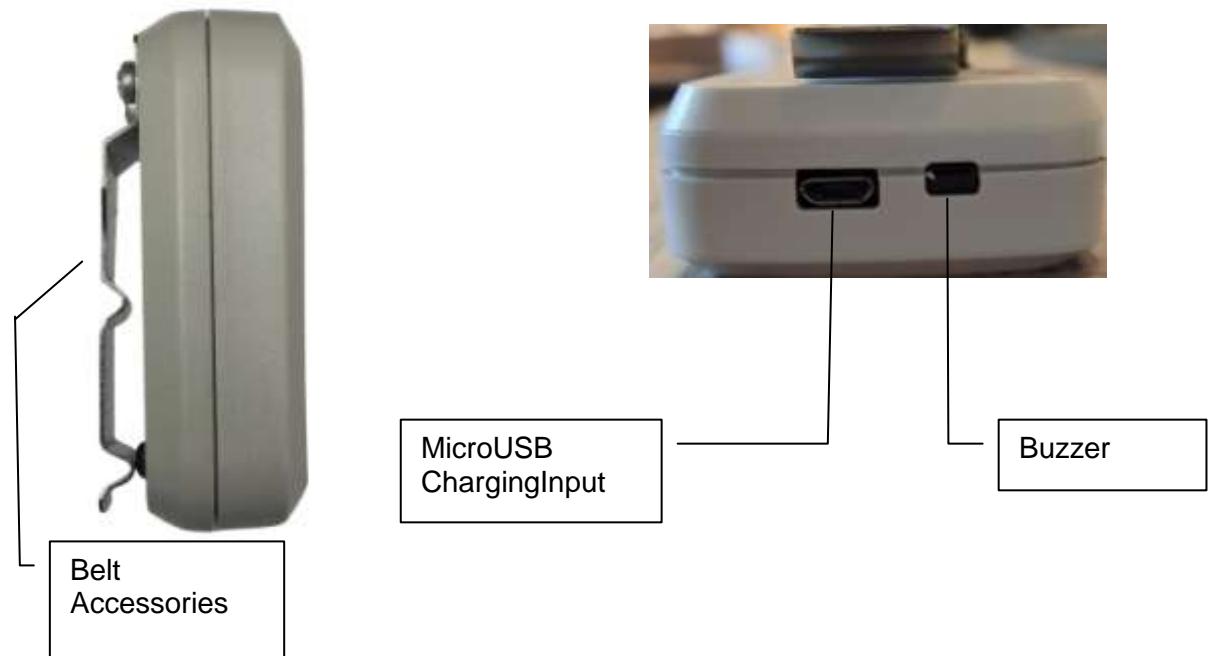


Figure 3: Wipelot MT-02DC Hardware Structure



How to comply with 10 second rule for handheld devices

When the tag is “awake” it sends out a signal from UWB. We call this “Hello” signal.

If there are anchors (readers) in the area, they send an acknowledgement signal back. When the tag receives this acknowledgement, it sends the “location” signal (actual data) to the anchor and goes into “sleeping” mode.

The tag awakens in determined period and send out a signal from UWB again.

This cycle is repeated continuously depending on the signaling frequency (in most projects the signaling frequency is 1 signal per second it could go up to 1 signal per 15 seconds)

The whole signaling process takes 5 milliseconds

If there is no acknowledgement response from the anchors, tag goes into deep sleeping mode for at least 1 minute (is parametric, can be set to be longer).

During deep sleeping mode, tags out a signal in every 10 seconds to check if there are any anchors in its range. This signal is not sent on UWB, but it is sent on 2,4 Ghz.

If it receives an acknowledgment response, the cycle starts again.