« IIDRE: geolocation solution by UWB »

Instruction manual
RTLS by IIDRE

Review	Date	Description
1.0	12/11/2018	- Document creation.

Table of contents

Illustrations index

I. Software installation

The open source software *RTLS by IIDRE* allows for supervision and configuration of the geolocation system. It is written in *C++* with *Qt5*.

A Framework Qt5 installation

Qt.io supplies an online installation tool which makes *Qt framework* and *QtCreator IDE* installations easier. This tool is available following this link: https://www.qt.io/download-qt-installer

B Sources download

The project sources are hosted on *GitHub*. Download is available following this link: https://github.com/IIDRE/uwbSupervisor

C Compilation

The project has no third party dependencies. It is automatically compiled with *QtCreator.*

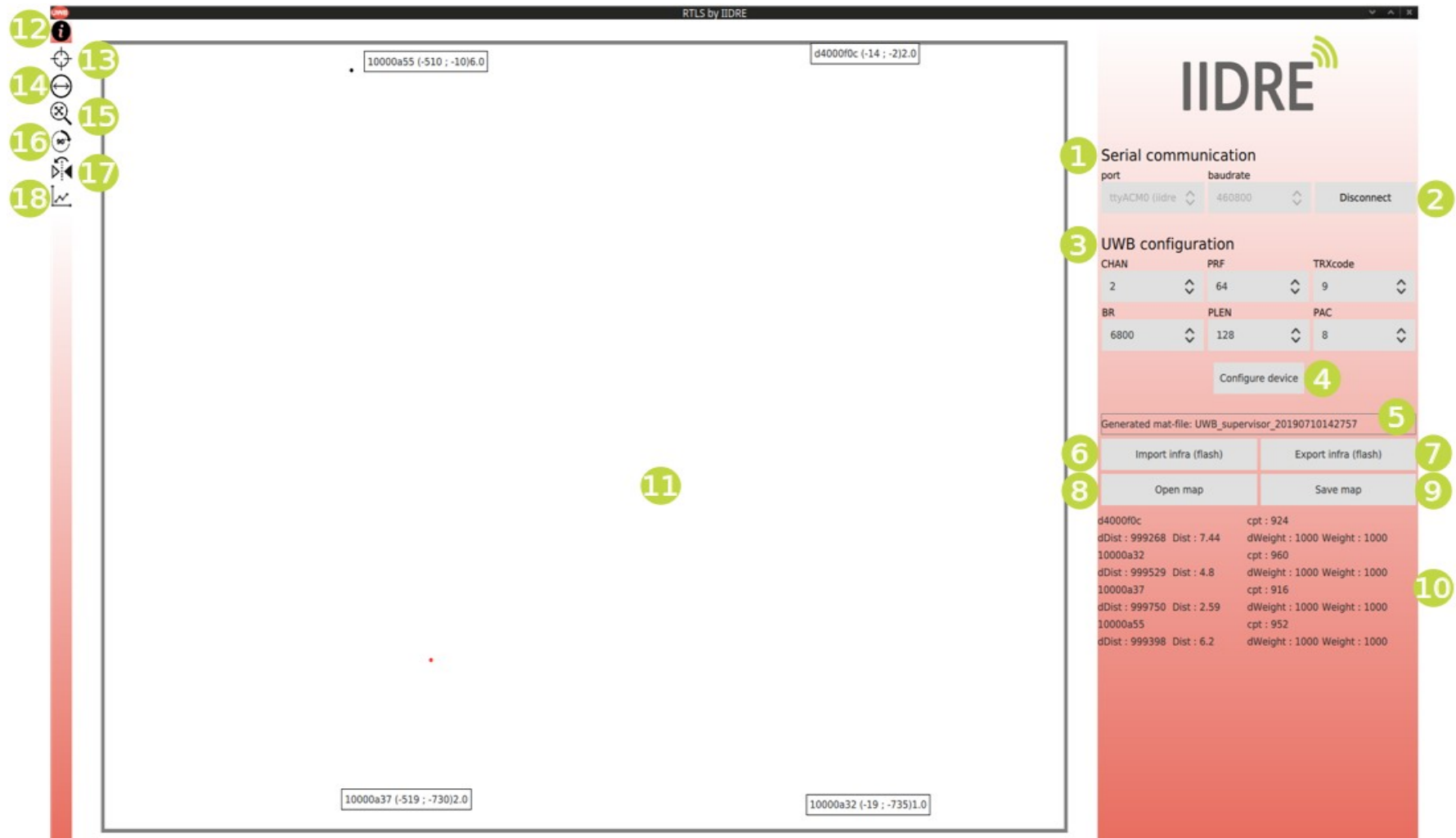# II. Software presentation

Illustration 1: UWB supervisor user interface

IIDRE software offers features required for a good use of the geolocation solution. The overhead illustration 1 presents the user interface:
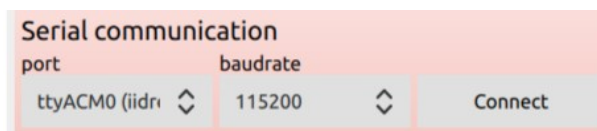
1. Configuration of the port and the baud rate of the serial link. Connection is automatically detected when the device is plugged in. Baud rate can be chosen among 115200 and 460800 bauds.

2. Button allowing the user to connect or disconnect the device. This button is only accessible when a device is plugged to the computer.

3. UWB parameters configuration by using drop-down menus. The device parameters CHAN, PRF and BR are automatically detected at the connection. In order to keep a coherent configuration, values offered by TRXcode, PLEN and PAC drop-down menus evolve according to validated values for CHAN, PRF and BR. All those parameters are detailed in the *user guide*.

4. Button allowing the user to send selected configuration according to drop-down menus in the device. When the button stays down, the automatic detection of the configuration during devices connection is disabled. This feature enables the user to set up successively several devices, without using the drop-down menus. The new configuration becomes active after the device disconnection and reconnection.

5. Indication of the log file name generated at each session. The generated file uses a *.mat extension and is directly suitable with *Octave*. The name follows the format: *UWB_supervisor_YYYYMMDD_HHMMSS*.

6. Button allowing the user to import infrastructure configuration from the device flash memory. The generated file has to use a *.json extension.

7. Button allowing the user to export infrastructure configuration to the device flash memory. The selected file has to use a *.json extension.

8. Button allowing the user to open a map file with a DXF or JSON format. When the file is opened, clicking on a point opens a menu to select its nature: anchor or map (map type is a point of interest used as a reference marker).

9. Button allowing the user to back up a map file with a JSON format.

10. Summary of the UWB communications in progress. For each anchor, display of the distance in real time (Dist) and first-path (Radio) reception level. Display also of the change between low and high values on a 30 seconds interval (dDist and dRadio).

11. Map visualization area, anchors (black points) and real time tag position (red point).

12. Button allowing the user, when highlighted, displays the visualization box for each anchor containing its ID, its coordinates (X_cm; Y_cm) and the first-path reception level of the last measure (in dBm).

13. Button allowing the user, when highlighted, to display the mouse pointer coordinates (X_cm; Y_cm) in the visualization area.

14. Button allowing the user, when highlighted, to illustrate the multilateration principle computed in the embedded system, in real time.

15. Button allowing the user to adjust the map to the visualization area size.

16. Button allowing the user to rotate the visualization area by 90° clockwise.

17. Button allowing the user to apply to the visualization area a mirror effect.

18. Button allowing the user to open the supervision graphs (30 seconds distances history, first-path levels and positions computed by the tag).

III. UWB configuration

Although the devices are delivered with a default UWB configuration, the user is free to modify it as wanted. To that end, follow the steps below for each device, after launching the *RTLS by IIDRE* application.

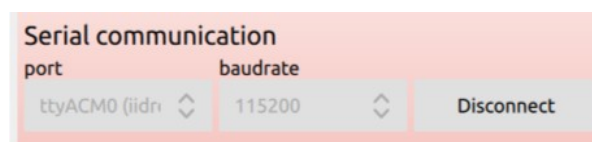## A   Serial communication

1.   CONNECTION

Illustration 2: Device connection

Connect a device to the computer. In the Serial communication section (shown below / Illustration 3), the port is automatically detected. Select the baud rate with the drop-down menu and click on the *Connect* button.

2.   DISCONNECTION
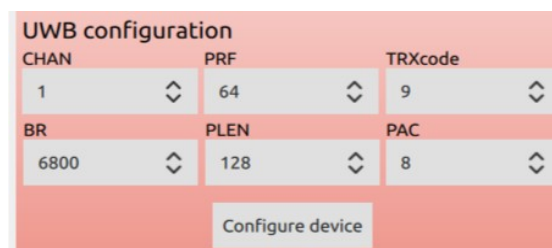
Disconnect the device with the *Disconnect* button.

Illustration 3: Device disconnection
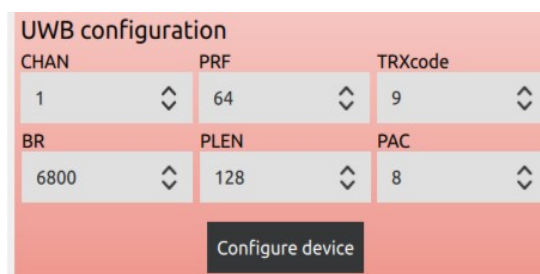
B   UWB radio configuration

The UWB configuration section is shown on the Illustration 5: UWB device configuration. The CHAN, PRF and BR parameters currently configured in the device are displayed in drop-down menus. Once all settings are selected, the configuration is updated by clicking on the *Configure device* button.

Illustration 4: UWB configuration

If the *Configure device* button stays highlighted, check the Illustration 6: UWB supervisor, configure point of map, displayed parameters stay fixed at the device connection, which makes connection of several devices easier with the same UWB configuration.

Illustration 5: UWB device configuration

IV. Infrastructure configuration

A   Configuration with a JSON file

After installing the infrastructure composed of at least 3 anchors and collected the coordinates (X; Y) of each one, it is necessary to provide the configuration to the tag in order to compute its position. To that end, after launching the *RTLS by IIDRE* application, follow the steps described below:

- Plug and connect the tag.

- Click on the *Import infra* button *(*flash*)*. A dialogue box will open, choose the log file folder and name with a *.json extension.

- Open the file with a text editor, such as Notepad. The list of N anchors known by the tag displays in a JSON format. The IDs are specific to the kit and the coordinates are initialized to 0.

- Fill up the X and Y coordinates (in cm) of the different anchors (Z can stay at 0).

- Save the file keeping its *.json extension.

- Click on the *Export infra* button *(*flash*)*. A dialogue box will open, select the file saved before and click on *Open*. The different anchors coordinates are automatically modified in the tag memory.

B   Configuration with a dxf file

It is possible to transfer the anchors coordinates with a measurement tool which features DXF format. To that end, after launching the *RTLS by IIDRE* application, follow the steps described below:

- Click on the *Open map* button. A dialogue box will open, select the file *.dxf created before and click on *Open.* Points described in the file display in the visualization area of the map.

- Click on a point, a window allows to specify the type of this point (Anchor or Map) according to radio buttons. In anchor case, select its ID in the drop-down menu and click on *OK*. Check the Illustration 6: UWB supervisor, configure point of map.
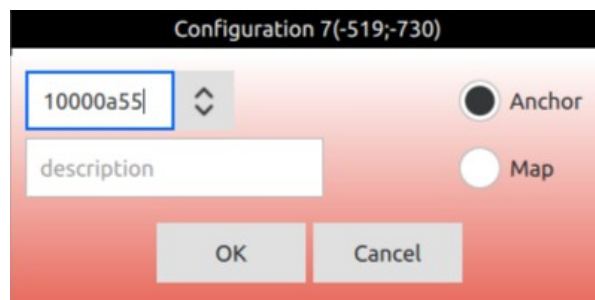

Illustration 6: UWB supervisor, configure point of map

- Restart the previous step for all the points.

- Click on the *Save map* button. A dialogue box opens, choose the folder and the file name. Save the file with *.json extension.

- Click on the *Export infra* button *(*flash*)*. A dialogue box opens, select the file previously saved and click on *Open*. The different anchors coordinates are automatically modified in the tag memory.

V. Tools

The icons located on the left corner of the visualization area allow the user to access to several features to manage the map display, view measured values or multilateration principle. When the mouse pointer is on one of those icons, a tooltip displays to precise the icon function. Check the
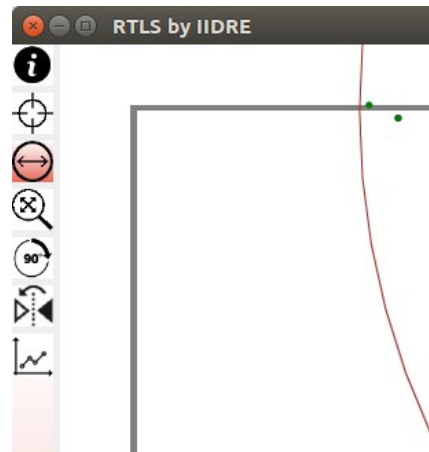
Illustration 7: UWB supervisor, tools.

Illustration 7: UWB supervisor, tools

A   Information display and anchors coordinates

When highlighted, the icon allows the user to display ID, coordinates and reception level (in dBm) of the last received signal. Check the Illustration 8: UWB supervisor, coordinates and reception level.
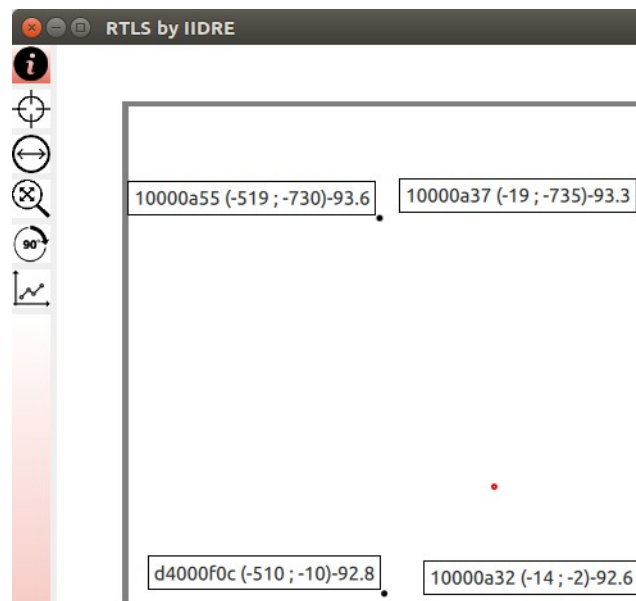

Illustration 8: UWB supervisor, coordinates and reception level

B   Display of the pointer coordinates

When highlighted, the icon ![icon] allows the user to display the mouse pointer coordinates on the positions visualization area.

C   Visualization of the multilateration

When highlighted, the icon ![icon] allows the user to illustrate multilateration principle in the embedded system. Thus, centred on each anchor position, a circle whose radius is equal to the last distance measured is drawn. The t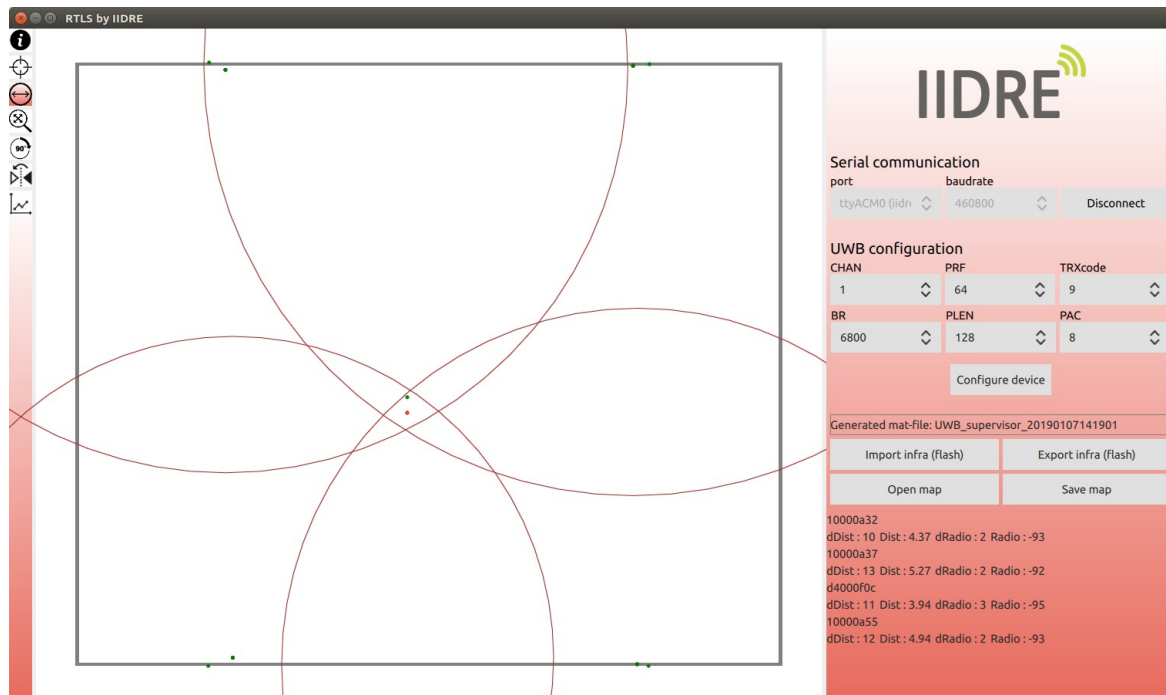ag position is at the intersection of those different circles. Check the Illustration 9: UWB supervisor, multilateration visualization

9

Illustration 9: UWB supervisor, multilateration visualization

D   Adaptation of the visualization area of the map

One click on the icon allows the user to adjust the visualization area map, after having zoomed in or out with mouse wheel for instance.

One click on the icon rotates the visualization area by 90° clockwise.

One click on the icon , applies a mirror effect to the visualization area.

E   Visualization of distances and power reception

One click on the icon allows the user to open two windows:

- The first one presents distances (in blue) and first-path power receptions (in green) on the last 30 seconds. Check the Illustration 10: UWB supervisor, radio power and distance.

- The second one presents, in a Cartesian coordinate system, the tag position over the last 30 seconds. As time goes on, points progressively disappear. Check the Illustration 11: UWB supervisor tag positions.
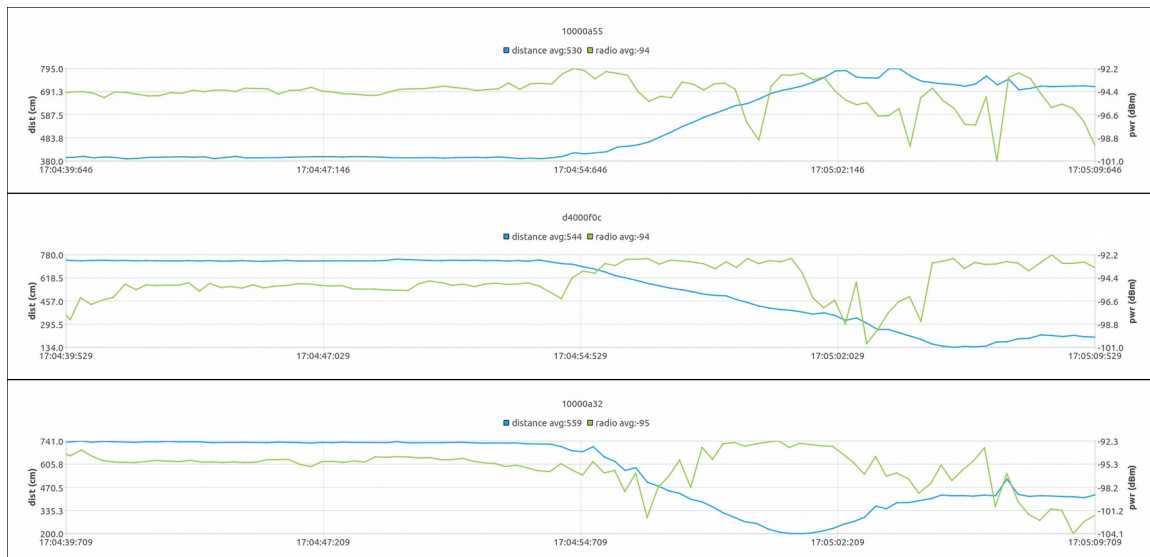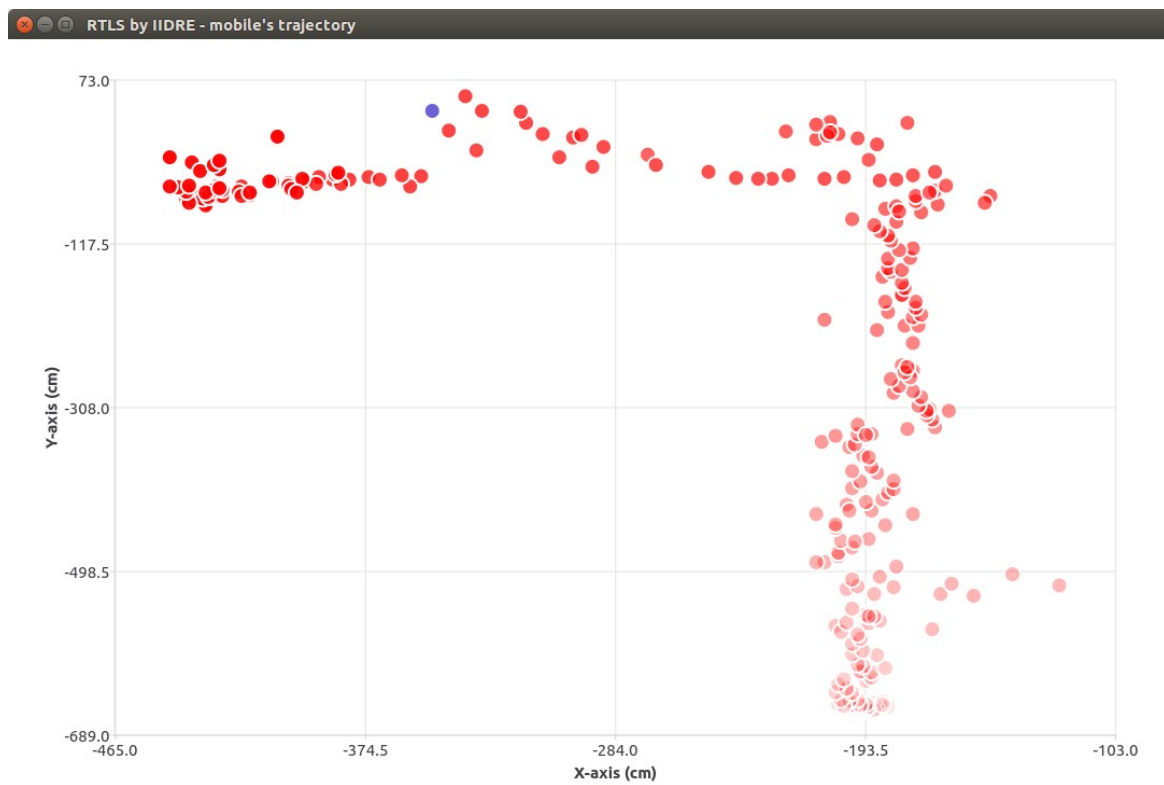
Illustration 10: UWB supervisor, radio power and distance

Illustration 11: UWB supervisor tag positions