



Indoor Radio Mapper

User Guide

Version 4.7

Important Information

Notices

Topics:

This section contains document notices.

- [Legal Notices](#)
- [Document Information](#)

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Document Information

Product

Name: Indoor Radio Mapper

Version: Version 4.7

Document

Name: Indoor Radio Mapper User Guide

ID: bee51e1-1530177801-25e03a7f

Status: FINAL

Date: 2018-Jun-28, 9:25 (GMT)

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Chapter 1

Introduction

Topics:

- [What is HERE Indoor Radio ...](#)

This document provides information on how to use the HERE Indoor Radio Mapper to

- access HERE Private and Public Venue Maps
- import and align your own custom indoor maps
- collect radio data inside and outside of venues by using the indoor maps
- manage the collected radio data
- analyze the quality of data collection and radio infrastructure in the venue
- publish the collected radio data for HERE Mobile SDK
- test indoor positioning performance at the venue after the radio data collection

What is HERE Indoor Radio Mapper?

HERE Indoor Radio Mapper is an Android-based tool for collecting geo-referenced radio data on the WiFi access point and Bluetooth beacon signal strengths inside buildings. The tool also supports collecting signal strength data outdoors in the vicinity of the venue in case smooth indoor-outdoor transitions are required.

To use this tool, you need to have an indoor map of your venue (either a HERE Venue Map or a custom image-based indoor map of your own) and WiFi access points or Bluetooth beacons installed in your building. As soon as you meet these preconditions, you can use this application to collect the radio data.

Radio data collection with the HERE Indoor Radio Mapper is a prerequisite for making the applications using the HERE Mobile SDK (Android or iOS) location-aware even inside buildings. The collected radio data is processed in the HERE Cloud to create an understanding of the radio signal behavior within the building. We call this understanding as the *radiomap* of the building. The radiomap is downloaded and used by the HERE Mobile SDK to locate the device running the location-aware application with a few-meter accuracy in 3D.

For a full description of the related concepts and the entire ecosystem, see the HERE Indoor Positioning Installation Guide. The same document also instructs, how to install and configure the Bluetooth beacons, if necessary, as well as how to test the system end-to-end.

Chapter 2

Quick start

Topics:

- [Prerequisites](#)
- [Quick Start Workflow](#)
- [Logging In](#)
- [Demo mode](#)

This section gets you started with the HERE Indoor Radio Mapper in just a few minutes.

Prerequisites

Before you start working with the HERE Indoor Radio Mapper:

- HERE Indoor Radio Mapper needs to be installed to a device running Android version 5.0 (API level 21) up to 8.0.
- The device you intend to use must be suitable for the radio data collection. The main criteria for a high-quality measurement device is the support for dual-band WiFi, i.e. compatible with 2.4-GHz and 5-GHz WiFi bands, and a Bluetooth radio. Other quality criteria include high radio scanning rate (e.g. once per two seconds for WiFi), high sensitivity and accuracy of signal strength measurements as well as low measurement noise.

For further information on the devices recommended for the radio data collection, see the [HERE Indoor Positioning Installation Guide](#).

- You have access to an indoor map for a venue, where you want to test or deploy HERE Indoor Positioning.

In case you intend to use a HERE Private Venue Map, this needs to be deployed to your HERE Account by HERE.

If you intend to use your own custom image-based indoor map, please refer to [Custom Image-Based Venues](#) on page 19 for supported image formats and other requirements.

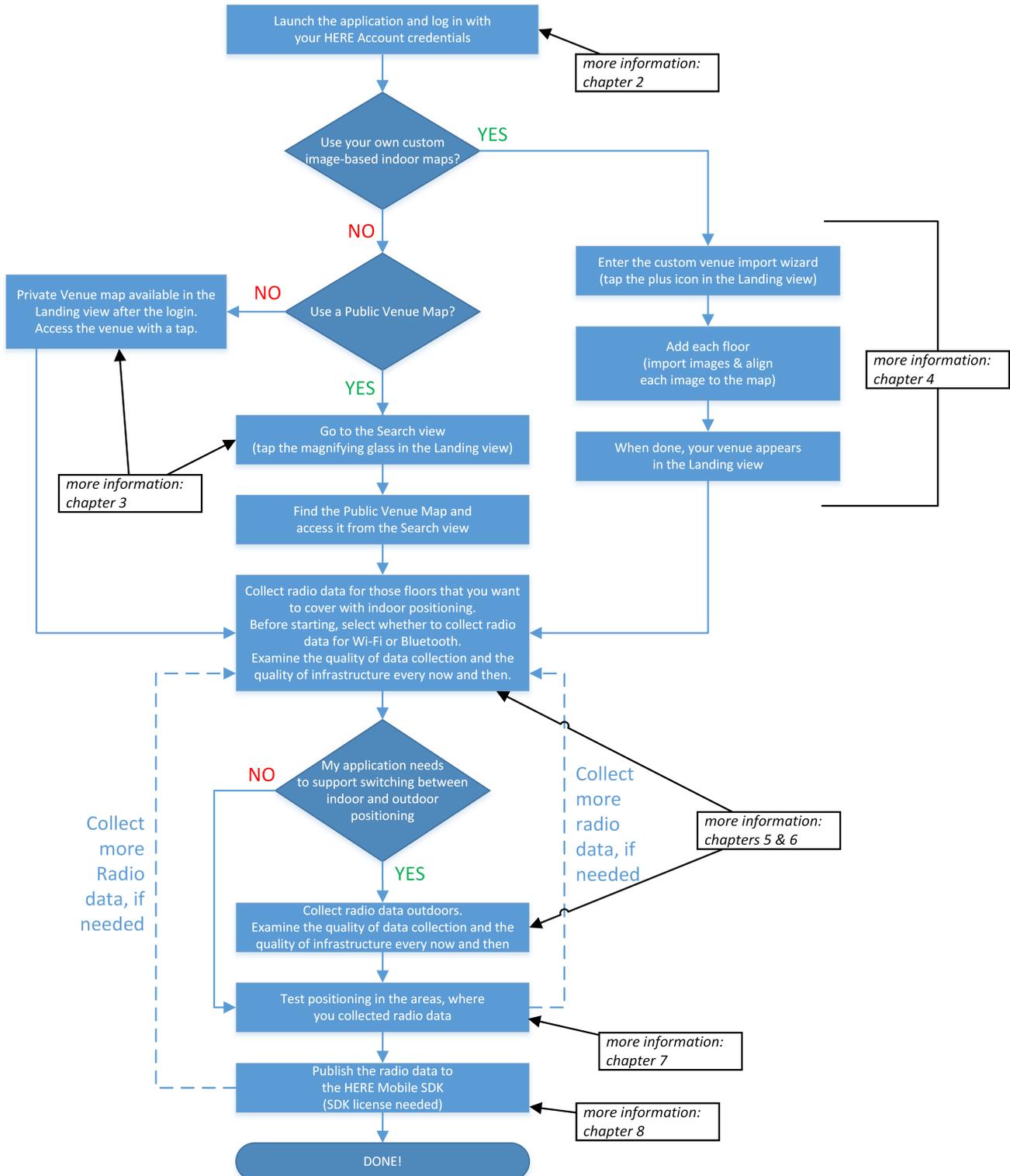
If you intend to use any of HERE Public Venue Maps, they are available in HERE Indoor Radio Mapper in case you have HERE Indoor Positioning evaluation or indoor-public feature enabled in your HERE Indoor Positioning license.

- HERE Indoor Radio Mapper supports testing HERE Indoor Positioning right away after the radio data collection. However, if you want to test HERE Indoor Positioning through the HERE Mobile SDK too, you need to register for the 90-day free trial for the HERE Mobile SDK Premium for Android and/or iOS at [HERE Developer Portal](#). For straightforward testing of the HERE Mobile SDK, please check out the example source codes for [Android](#) and [iOS](#) at GitHub.

Quick Start Workflow

The following figure shows the basic workflow for using the HERE Indoor Radio Mapper.

Figure 1: Quick start workflow



The usage can be summarized in a few simple steps:

1. Install the application from Google Play and log in
2. Pick the indoor map to use
 - HERE Private Venue Map will be accessible right from the Landing view
 - HERE Public Venue Map will be accessible through the search
 - Your own custom image-based venue can be imported through the wizard
3. Collect radio data indoors and, if necessary, also outdoors, every now and then checking both the data collection and radio infrastructure quality views
4. Test positioning throughout the building
5. If there are any problems, go back to the step 3 and repeat radio data collection in problematic areas
6. Publish the positioning data for the HERE Mobile SDK
 - 📄 **Note:** This is only possible, if you have evaluation/commercial license for the HERE Mobile SDK. To sign-up for the evaluation, access the [HERE Developer Portal](#).

Logging In

To log into the HERE Indoor Radio Mapper, you must have HERE Account credentials. You can create a HERE Account, for example, [here](#).

Before logging into the application, make sure your device is connected to a data network.

To log into the HERE Indoor Radio Mapper:

1. Launch the HERE Indoor Radio Mapper.
2. In the **Login** view, enter your HERE Account credentials.

Your credentials are checked and the **Landing** view appears.

Demo mode

To make the evaluation of the HERE Indoor Positioning as easy as possible, it is possible to use HERE Indoor Radio Mapper in the *demo mode* without the HERE Mobile SDK license.

The *demo mode* supports all the HERE Indoor Radio Mapper features with the only exception being the inability to publish the positioning data for consumption by the HERE Mobile SDK. To do this, you will need to have either an evaluation or commercial license to the HERE Mobile SDK. To sign-up for the evaluation, access the [HERE Developer Portal](#).

Chapter 3

Navigating in the Indoor Radio Mapper

Topics:

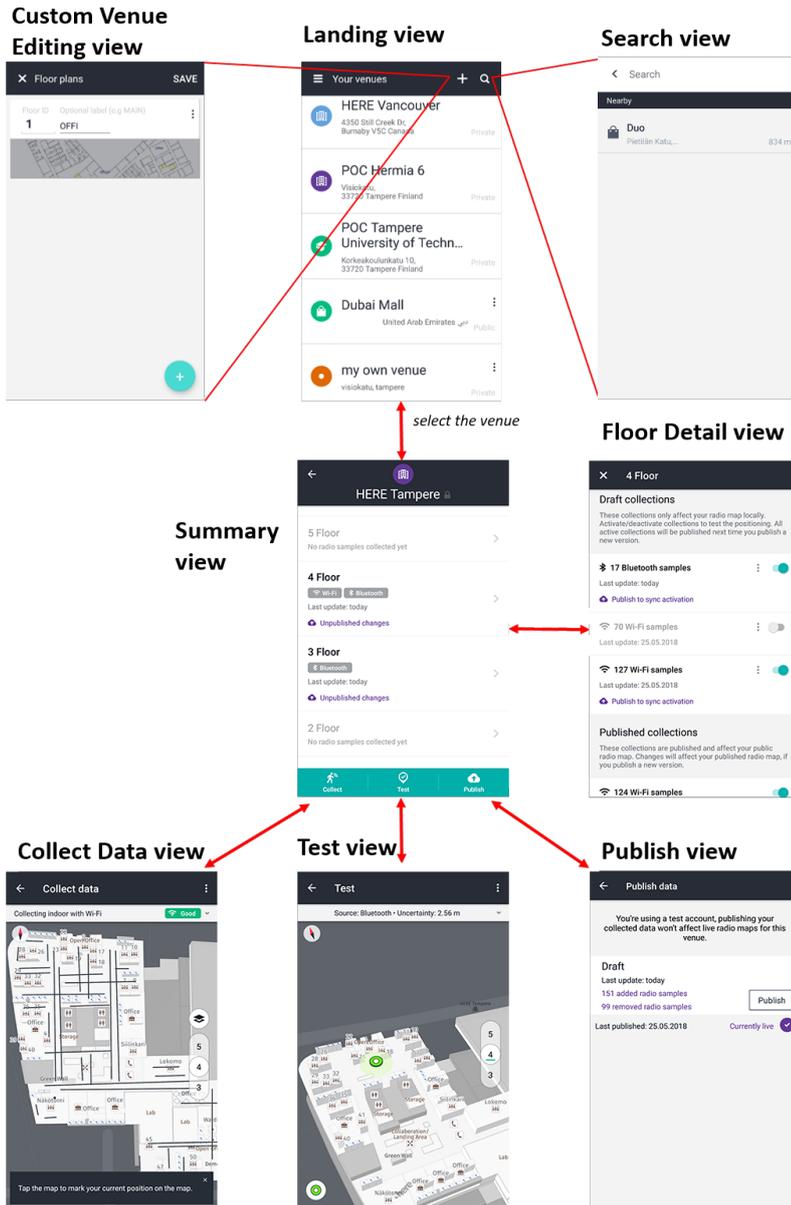
- [Basic Navigation](#)
- [Selecting and Managing Ven...](#)
- [Selecting and Managing Act...](#)

This section provides an overview on navigating in the HERE Indoor Radio Mapper and other basic functions.

Basic Navigation

The HERE Indoor Radio Mapper has three levels of views, as indicated by the figure below.

Figure 2: Navigating between views



The levels are as follows:

- Top Level – **Landing view**

The **Landing** view allows you to quickly see and access the indoor maps that are relevant to you. The view shows any HERE Private Venue Maps that have been associated with your account and any custom image-based venues that you have imported to the tool. Moreover, the view shows the recently accessed

HERE Public Venue Maps. Note that if there are no HERE Private Venue Maps associated with your account, the view is empty when you log in for the first time.

☰ **Note:** The outlook of this view changes depending upon the features enabled in your HERE Indoor Positioning license. In case HERE Private Indoor Positioning feature is not enabled in your license, HERE Private Venue Maps will not be shown in the **Landing** view even if they were associated with your HERE Account. Moreover, in case HERE Public Indoor Positioning feature is not enabled in your license, HERE Public Venue Maps search shall be disabled.

☰ **Note:** In the demo mode, you will have an access to HERE Public Venue Maps.

Additionally, the basic operations accessible from the **Landing** view include:

- To select a venue for the radio data collection, performance testing or radio data management, select the desired venue from the **Landing** view. For more information, see [Selecting and Managing Venues](#) on page 16.
- To search for and access the HERE Public Venue Maps, access the **Search** view by tapping the magnifying glass.
- To add your own image-based custom venue to the HERE Indoor Radio Mapper, access the **Custom Venue Editing** view by tapping the plus-sign. See [Custom Image-Based Venues](#) on page 19 for further details.
- The three dots on the right side of HERE Public Venue Maps and custom indoor maps allows deleting an indoor map from the **Landing** view and accessing the **Custom Venue Editing** view for a particular custom venue. HERE Private Venue Maps cannot be removed from the view.
- To log out, open the **menu** in the **Landing** view by sliding it from the left and select **Log out**
- To manage your settings, open the **menu** in the **Landing** view and select **Settings**. The important items in the **Settings** are:
 - *Units* - switch between metric, Imperial UK and Imperial US units
 - *Offline test track* - Enables or disables the test track functionality. See [Advanced features](#) on page 44 for further details.
 - *Clear recent venues* - clears the HERE Public Venue Maps and custom venues from the **Landing** view

- Second Level – **Summary** view

The **Summary** view provides the access to

- Collect radio data for each floor
- Manage radio data for each floor
- Test indoor positioning
- Publish positioning data for the HERE Mobile SDK

For more information, see [Selecting and Managing Activities](#) on page 17.

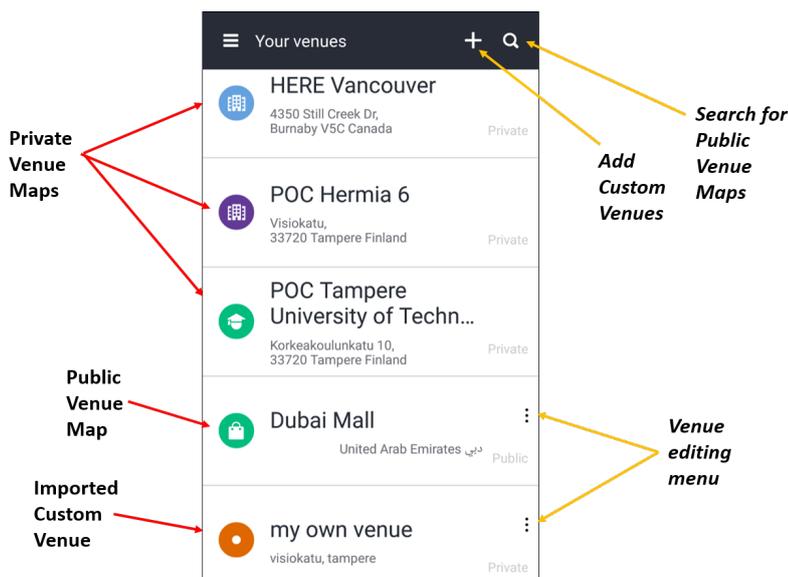
- Third Level – **Collect, Test, Publish** and **Floor Detail** views

For more information, see [Collecting Radio Data](#) on page 23, [Testing Positioning Performance](#) on page 39, [Publishing Radio Data](#) on page 42 and [Managing Radio Data in Floor Detail view](#) on page 36.

Selecting and Managing Venues

The figure below shows a sample **Landing** view when there are HERE Private Venue Maps associated with your HERE Account (*HERE Vancouver*, *POC Hermia 6*, *POC Tampere University of Technology*). Also, the view shows that you have accessed a HERE Public Venue Map (*Dubai Mall*) and imported your own custom venue to the tool (*my own venue*).

Figure 3: Exemplary Landing View



The **Landing** view may contain the following items:

- HERE Private Venue Maps (like the *HERE Vancouver*, *POC Hermia 6* and *POC Tampere University of Technology* in the sample above)

To have a HERE Private Venue Map added to your HERE Account, please contact your HERE representative. When a new HERE Private Venue Map has been added to your account, log out and log in to see the new HERE Private Venue Map in the **Landing** view.

You cannot remove HERE Private Venue Maps from the **Landing** view.

- HERE Public Venue Maps (like the *Dubai Mall* Venue Map in the sample above)

To add a HERE Public Venue Map from the HERE Public Venue Map database to the **Landing** view, tap the **search** icon (magnifying glass) and enter a search term.

You can remove HERE Public Venue Maps from the **Landing** view through the **Venue editing menu**. Note that this does not delete the radio data collected for the venue.

- Custom image-based venues (like the *my own venue* in the sample above)

To import your own image-based custom venue map, tap the **plus** icon. For more information, see [Importing Custom Indoor Maps](#).

You can remove custom venues from the **Landing** view through the **Venue editing menu**. If you have radio data collected for your custom venue, you will be required to confirm the deletion of the whole venue including any collected radio data.

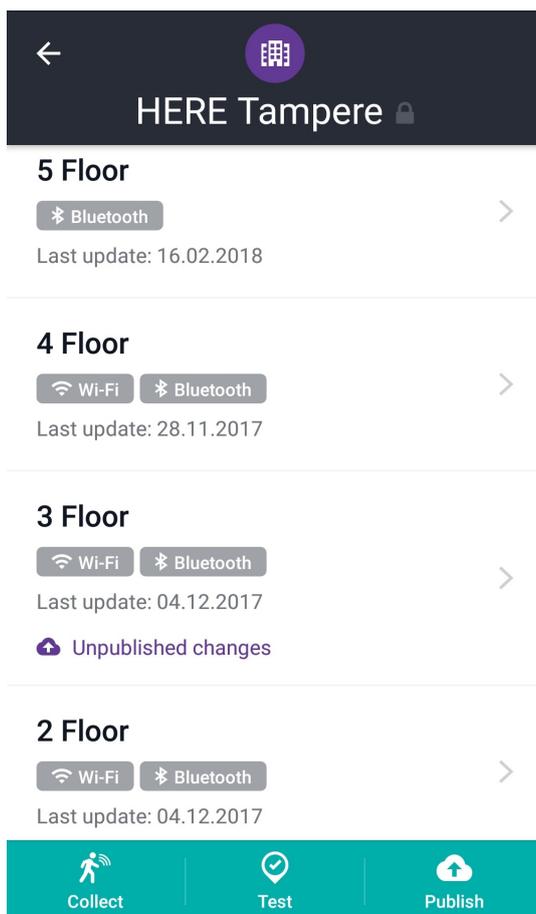
Selecting and Managing Activities

To collect, test, publish and manage radio data for a venue, select the desired venue in the **Landing** view or select a venue from the **Search** view (HERE Public Venue Maps only). This will take you to the venue **Summary** view that displays the radio data collection and testing status for each floor in a venue.

The screenshot below provides an exemplary **Summary** view and shows the following characteristics:

- Bluetooth radio data has been collected for the floors 2-5
- WiFi radio data has been collected for the floors 2-4
- The 3rd floor radio data (Bluetooth and/or WiFi) have been changed since the last Publish (indicated by the text *Unpublished changes*)

Figure 4: Exemplary Summary view



The important features of the **Summary** view include:

- Collect radio data indoors (see [Collecting Radio Data Indoors](#) on page 26) or outdoors (see [Collecting Radio Data Outdoors](#) on page 28) by tapping the **Collect** icon in the lower bar

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► Navigating in the Indoor Radio Mapper



- Manage the collected radio data on the floor level (see [Floor Radio Data Management](#) on page 37) by tapping the **floor**
 - Test the positioning performance (see [Testing for Performance](#)) after the radio data collection by tapping the **Test** icon in the lower bar
 - Publish the radio data (see [Publishing Flow](#) on page 43) to be consumed by the HERE Mobile SDK by tapping the **Publish** icon in the lower bar
- 📄 **Note:** Please note that this is a necessary step before the HERE Mobile SDK is able to locate itself indoors

Chapter 4

Custom Image-Based Venues

Topics:

- [Prerequisites for Using Cu...](#)
- [Importing Custom Indoor Ma...](#)
- [Manual Calibration](#)

The following section provides information on using your own custom image-based venues in HERE Indoor Radio Mapper. The tool allows you to import, align and use your own custom image-based indoor maps for the radio data collection and positioning testing.

Prerequisites for Using Custom Image-based Indoor Maps

The prerequisites for using your own custom image-based indoor maps in HERE Indoor Radio Mapper are

- You have one image per floor in one of the supported formats. HERE Indoor Radio Mapper supports at least `.bmp`, `.gif`, `.jpeg` and `.png` image formats.
 - **Note:** Each image needs to describe the floor without any tilting and stretching.
 - **Note:** If the dimensions of the image are greater than 2048px but smaller than 4096px, HERE Indoor Radio Mapper will downscale the image to 2048px in the largest dimension. Larger images are not accepted.
 - **Note:** The image needs to have the same scale in both directions, i.e. one pixel must correspond to the same number of meters in all the directions
 - **Note:** Radio data collection should be performed in all the floors between the lowest and the highest floors you are interested in. For example, assume your building has six floors, but you are only interested in positioning in floors 3 and 5. In this case, it is advisable to also import the image for the floor 4 and perform radio data collection also in that floor in order to have smooth floor changes, when moving between the floors.
- It is recommend to use an image processing software to make the area outside of the building transparent in the image. This will make it easier to align the image on the HERE Map or satellite images.
- You have copied the custom indoor map images to your device
 - **Note:** Copy your indoor map images directly to an arbitrary folder in the device as described in [Transferring and Installing HERE Indoor Radio Mapper](#). Alternatively, you may send the images as an email attachment and save them to a folder in the device.

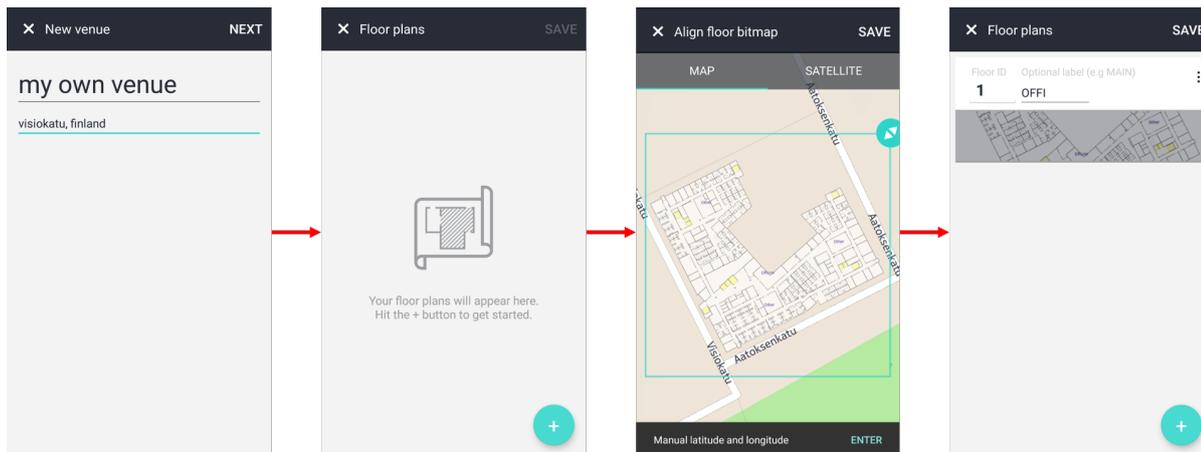
Importing Custom Indoor Maps

1. Tap the + icon in the **Landing** view to open the dialog to enter the **Venue name** (left-most screenshot below). You may also optionally input the address. We will lookup the address in the HERE database, which will help you in aligning the image on the map.
 - **Note:** Use as descriptive name as possible. The HERE Mobile SDK Positioning API reports this name as the `building` name. You cannot change the building name afterwards.
2. Having completed the naming, you can start adding the floors. Once you tap + in the lower right corner (see the second screenshot from the left), a dialog prompts you to select an image representing the floor plan from the device folders.
3. After selecting the image, you can scale and rotate the image either on the HERE Map or satellite images (see the second screenshot from the right). When done, tap **SAVE** in the upper right corner. Alternatively,

you can enter the Latitude and Longitude coordinates of the two points in the image manually (see [Manual Calibration](#) on page 21 for further details).

4. Select the **Floor ID** and give the floor an optional four-letter label (see the right-most screenshot)
5. Repeat the steps 2-4 for each floor you want to add to the venue
6. Having added all the floors, tap **SAVE** in the upper right corner to add the venue to the **Landing** view. Note that you can return later on to add new floors to the venue so not all floors need to be added at the same time.

Figure 5: Importing and aligning a bitmap



Note that a single floor image location can be recalibrated on the map as long as the changes are not saved in the **Custom Venue Editing** view. After saving, it is possible to change the floor image as long as there is no radio data collected for that floor or all the previously collected radio data has been deleted.

Manual Calibration

In case you are unable to align the image using a map or satellite images, it is also possible to align the image manually using two calibration points. To do this, you must know the WGS-84 Latitude and Longitude coordinates of two points for each image in decimal format.

You can resolve coordinates from another map or online satellite image service, such as HERE Maps web or Google Earth. Do not use the device GPS to resolve the building corner point coordinates due to the uncertainties involved in GPS positioning. In case the coordinates are erroneous, the indoor and outdoor positioning will not match. The accuracy of the coordinates should be a few meters.

To align an image-based indoor map to the geographical Latitude-Longitude coordinate system using manual alignment points, do the following:

1. In the floor image alignment view, press **ENTER** next to the text *Manual Latitude and Longitude* (see the 2nd screenshot from the right above). The view shown in the screenshot below appears.
2. Input the Latitude and Longitude coordinates of the **first** point and tap its location on the screen (black marker, see below)

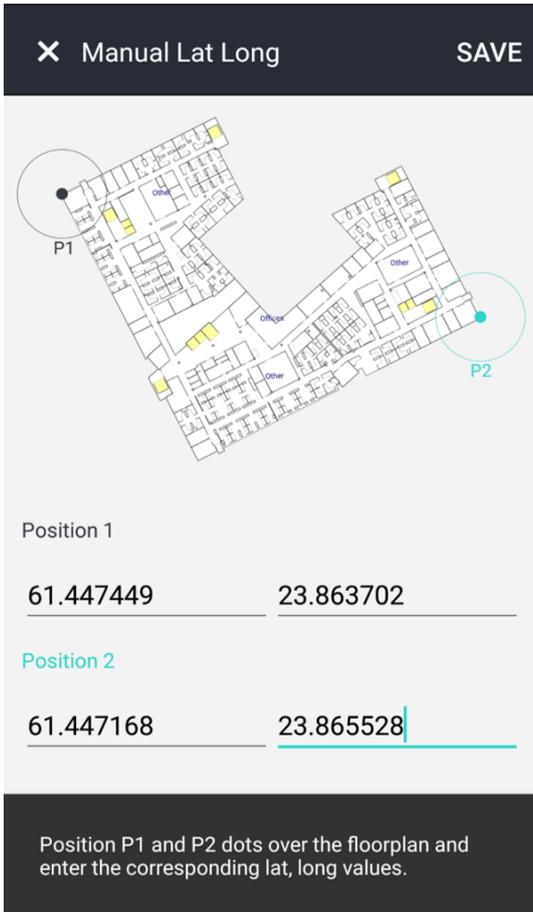
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► Custom Image-Based Venues



3. Input the Latitude and Longitude coordinates of the **second** point and tap its location on the screen (cyan marker, see below)
 4. Once both reference point coordinates have been set, tap **SAVE** in the upper left corner
- ☰ **Note:** It is convenient, if possible, to choose reference locations that are distinguishable on several floors.

Figure 6: Manual calibration



Chapter 5

Collecting Radio Data

Topics:

- [Collect Data View](#)
- [How to Collect Radio Data](#)
- [Collecting Radio Data Indo...](#)
- [Collecting Radio Data in C...](#)
- [Collecting Radio Data Outd...](#)
- [Collecting Radio Data With...](#)
- [Showing the Data Collected...](#)
- [Automated Radio Data Quali...](#)

The following section provides information on how to collect radio data by using HERE Indoor Radio Mapper.

The radio data collection is a prerequisite for indoor positioning. The collected radio data is processed in the HERE Cloud to create an understanding, a *radiomap*, of the radio environment in the venue. This radiomap is then used in the positioning phase by the HERE Mobile SDK to locate the location-aware application.

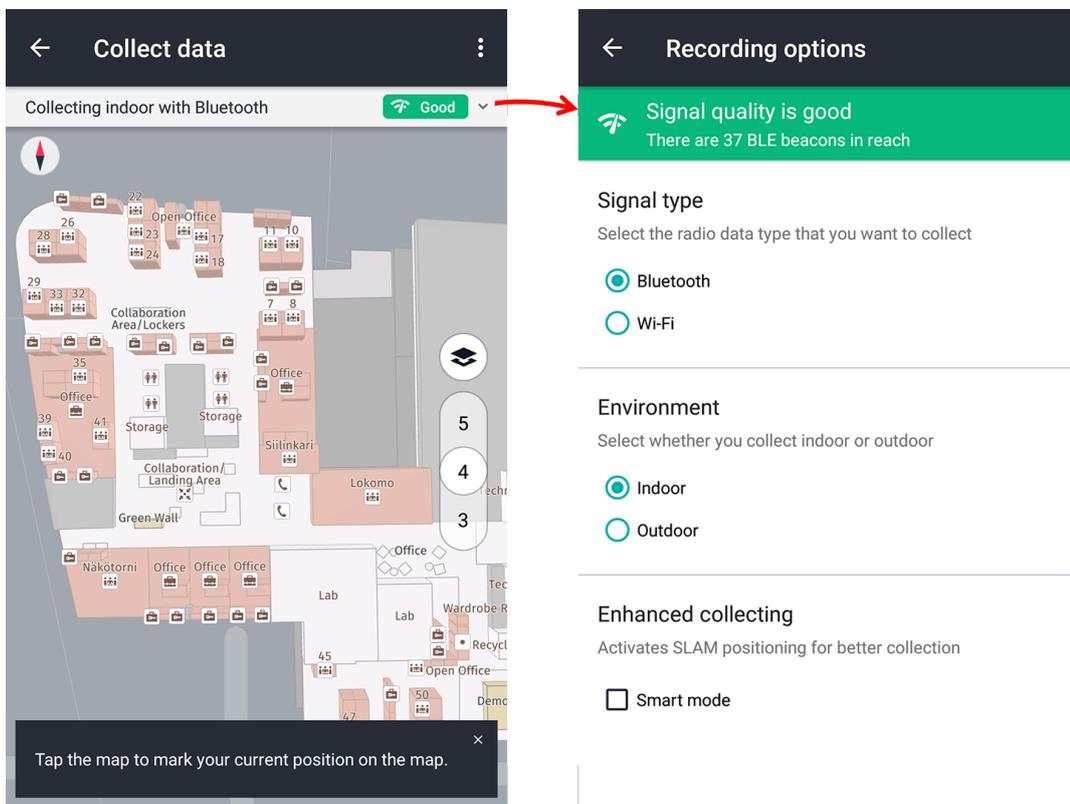
Collect Data View

The following section provides instructions on how to collect radio data in the **Collect Data** view and guidelines on how to get optimized results.

To open the **Collect Data** view, tap **Collect** in the lower bar in the **Summary** view. For more information on navigating between views, see [Basic Navigation](#) on page 14.

The following figure shows an exemplary **Collect Data** view as well as the settings menu that can be accessed by tapping the bar above the map view.

Figure 7: An exemplary Collect Data view



The basic functionality of the **Data Collect** view includes:

- To rotate the indoor map, use two fingers.
- To zoom in and out, use a two-finger pinch.
- To pan the indoor map, move one finger across the screen.
- To switch floors, use the control on the right hand side.
- To open the settings menu, tap the bar above the map view. The settings allow to switch the collection mode between **Indoor** and **Outdoor** or the radio type between **Bluetooth** and **WiFi**.
- To open the layers control, tap the **layers** icon on top of the floor switcher. For more information on the layers, please refer to [Showing the Data Collected by Others](#) on page 31 and [Automated Radio Data Quality Analysis](#) on page 32.

An important feature of the **Data Collect** view is the *real-time quality indicator* in the bar above the map view. The indicator continuously measures the radio environment (amount of access points, signal strengths) to understand, if there are enough WiFi or Bluetooth signals for high-performance indoor positioning. The result is shown as a simple-to-read meter changing color between green (high quality) and red (bad quality). Red indicator means that the radio environment lacks the characteristics to support high quality indoor positioning and more Bluetooth beacons or access points must be installed.

☰ **Note:** All the radio data need not be collected in one go. You can always collect more radio data, and the previously collected radio data gets amended with the newly collected radio data.

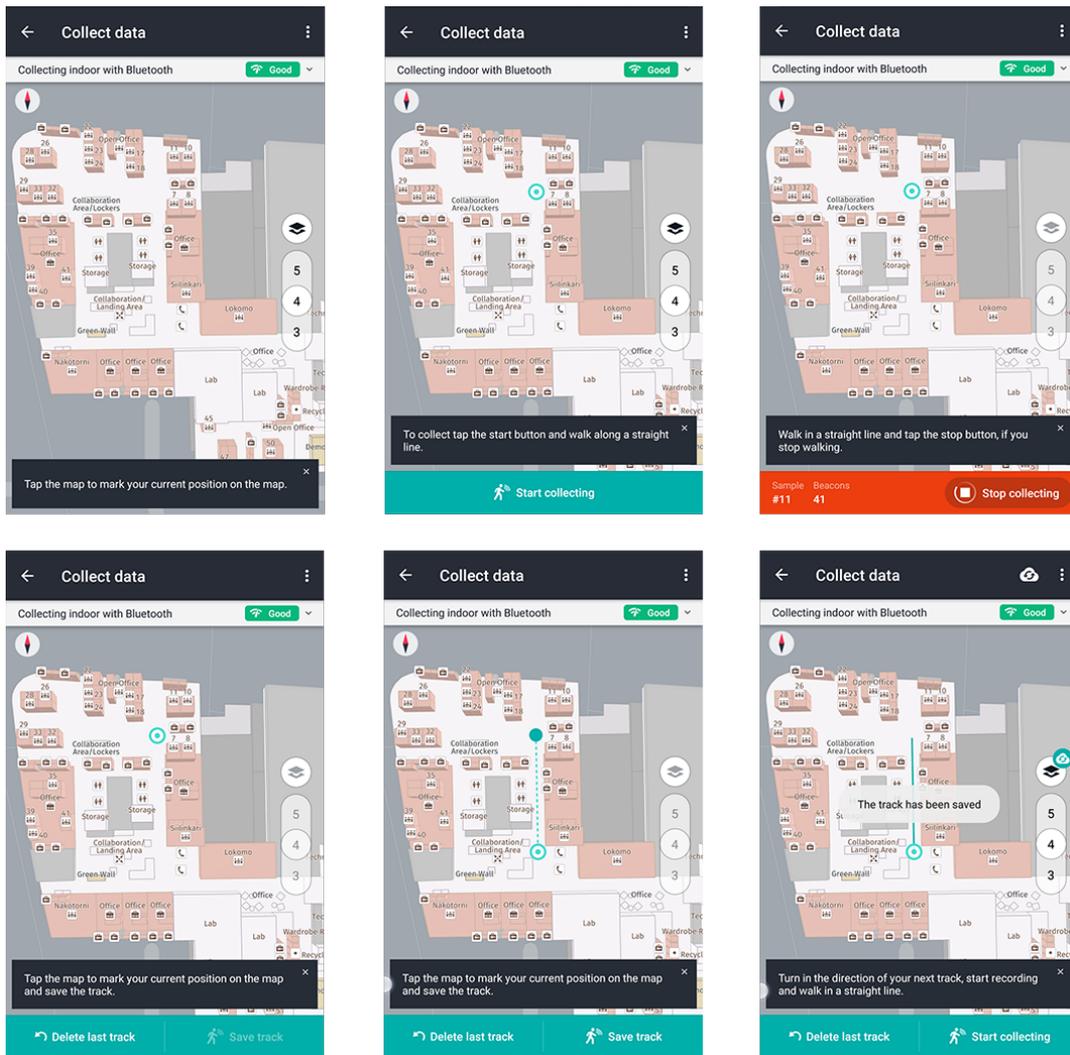
How to Collect Radio Data

The radio data is collected by walking straight lines in a sequence in the venue. This sequence is illustrated in the following set of screenshots:

1. Access the **Collect data** view
2. Tap your current location on the indoor map to set your start point. When ready, tap **Start collecting** and simultaneously start walking in a straight line with constant speed.
3. The lower bar indicates the number of radio samples collected so far and the number of Bluetooth beacons or WiFi APs at the current location.
4. When you reach your target, tap **Stop collecting** immediately.
5. Tap your current location on the indoor map to set your end point. When ready, tap **Save track**.
6. Continue collecting the next line of radio samples from the current location by tapping **Start collecting**.

Alternatively, if you made a mistake, tap **Delete last track** to delete the most recently collected line of radio data.

Figure 8: The sequence for collecting a line of radio samples



Collecting Radio Data Indoors

During the radio data collection, it is important to select the correct floor. In some buildings, such as office buildings, the floor layouts can resemble each other significantly and, as a consequence, potentially cause confusion and errors. The more thoroughly you perform the radio data collection, the better the resulting positioning performance.

To limit the effort of collecting data densely throughout the building, the following guidelines help to obtain good coverage:

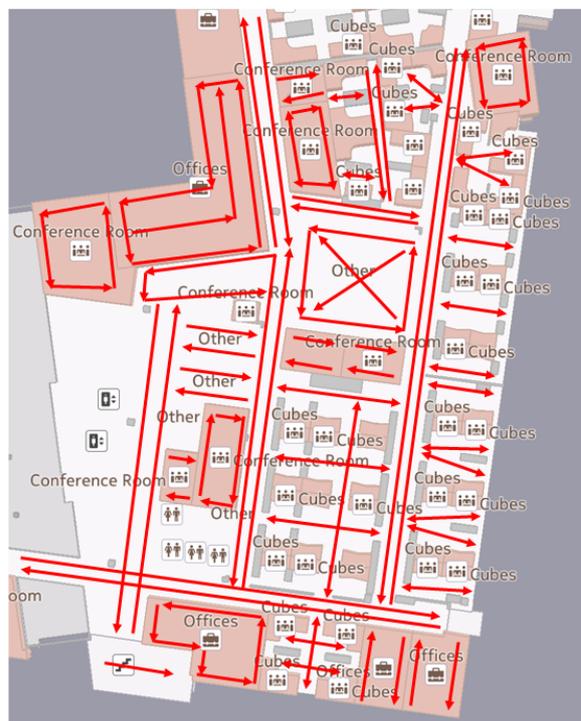
- Main areas, such as main corridors, hallways and main halls have a higher priority; map them first.
- Smaller rooms have lower priority; map them in the second phase.
- In corridors (up to three to five meter width), collect a line of radio data along the both walls. It is advisable to walk first in one direction along one wall and then in the opposite direction along the other wall so that both walking directions get covered (this reduces the impact of body shading).

- Collect radio data in small rooms along the walkable areas. For example, if the room is a small one, i.e. few meters in width, you need to collect only one line of radio data along the center line of the room. It is advisable to collect radio data twice along this line - first in one direction and then to the opposite direction, when coming back.
- In bigger rooms, collect lines of radio data along the room edges, if the width of the room is moderate (not larger than three to four meters). Again, it is advisable to collect radio data in one direction along the first edge and then to the opposite direction along the other edge.
- If the width of the location (room or hall) is larger than four meters, it is advisable to collect measurements both along the edges and in the open area. For example, if the width of the location is 10 meters, collect data along four lines: along the edges and another two lines three to four meters from both edges.

The following figure shows some of the basic principles of the radio data collection:

- In main corridors the radio data has been collected by walking in opposite directions
- Bigger rooms have been circumvented and, where possible, radio data has also been collected in the middle of the room
- In the passages to the cubicles the radio data has been collected by walking in both directions
- In smaller rooms radio data has been collected along adjacent walls in opposite directions

Figure 9: Exemplary paths for the radio data collection

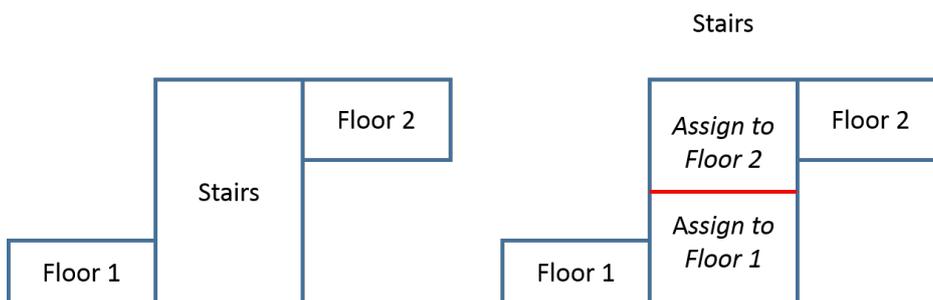


For information on how to collect radio data in connectors such as staircases and elevators, see [Collecting Radio Data in Connectors](#) on page 28.

Collecting Radio Data in Connectors

Connectors are places that connect floors, such as stairs, escalators or elevators. In order to have well-performing floor change behavior, you also need to collect radio samples in the connectors. In case of a staircase or an escalator, you can virtually divide the connector between the two connected floors roughly in the middle. The figure below shows an example:

Figure 10: Radio sample collection in connectors



When collecting radio data with HERE Indoor Radio Mapper, assign the radio data collected below the red line to the Floor 1 and the radio data collected above the red line to the Floor 2. In case of an elevator, we suggest to take a few radio samples in a stationary elevator in the floor 1 (assigned to the Floor 1) and another set of radio samples in a stationary elevator in the Floor 2 (assigned to the Floor 2). This can be achieved by keeping the elevator in the 1st floor, starting to record radio samples and then stopping recording after a few radio samples. And then moving to the 2nd floor and repeating the same.

Collecting Radio Data Outdoors

Collecting radio data outdoors is not necessary, if the positioning is to be used indoors only. However, if you wish to have smooth changes between outdoor and indoor positioning methods, it is recommend to perform some radio data collection also along the building perimeter.

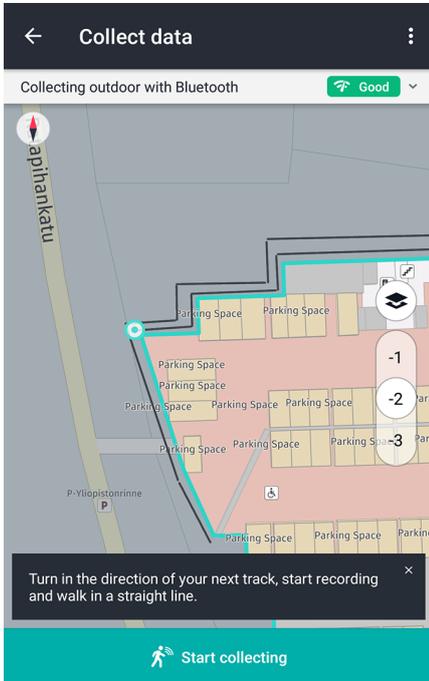
Collecting radio data outdoors is similar to collecting radio data indoors with the exception that you do not need to select a floor. You can freely choose a floor, but it does not have any impact on the end result as there is only one outdoor floor.

Make sure to observe the following guidelines for optimized results:

- Collect outdoor radio data along the building perimeter.
- Collect radio samples within a 10-meter radius around the building, each time moving between three to five meters away.
- Change the walking direction after each round.

The figure below shows radio data collected while circling the building twice. As the first round is taken just next to the building outer wall, and the second round is roughly five meters further, it is advisable to make a third round around the building, another three to four meters further away from the second round.

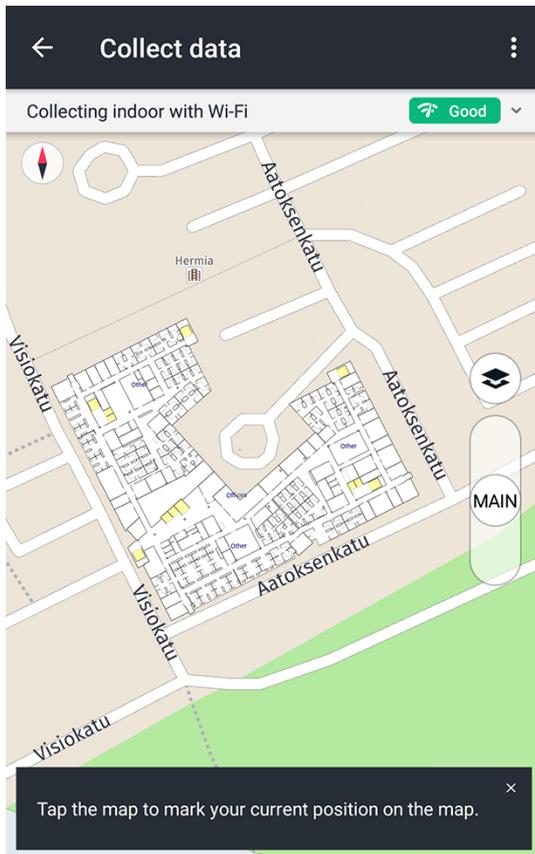
Figure 11: Collecting Radio Data Outdoors



Collecting Radio Data With Custom Indoor Maps

Collecting radio data using a custom image-based indoor map is analogous to using a HERE Venue Map.

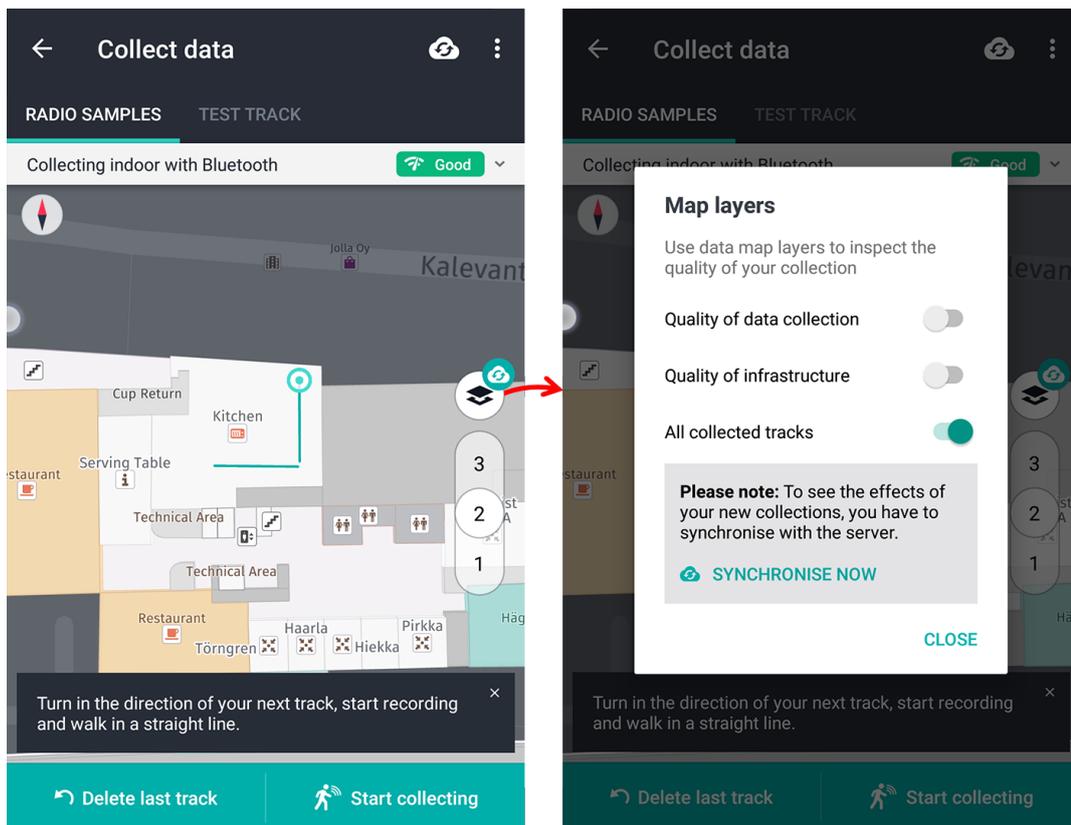
Figure 12: Radio data collection with Custom Indoor Maps



Showing the Data Collected by Others

To see the radio data collected by others using the same HERE Account, tap the **layers** icon in the **Collect Data** view. The following figure shows the **layers** menu that opens up.

Figure 13: Toggling the radio data visibility

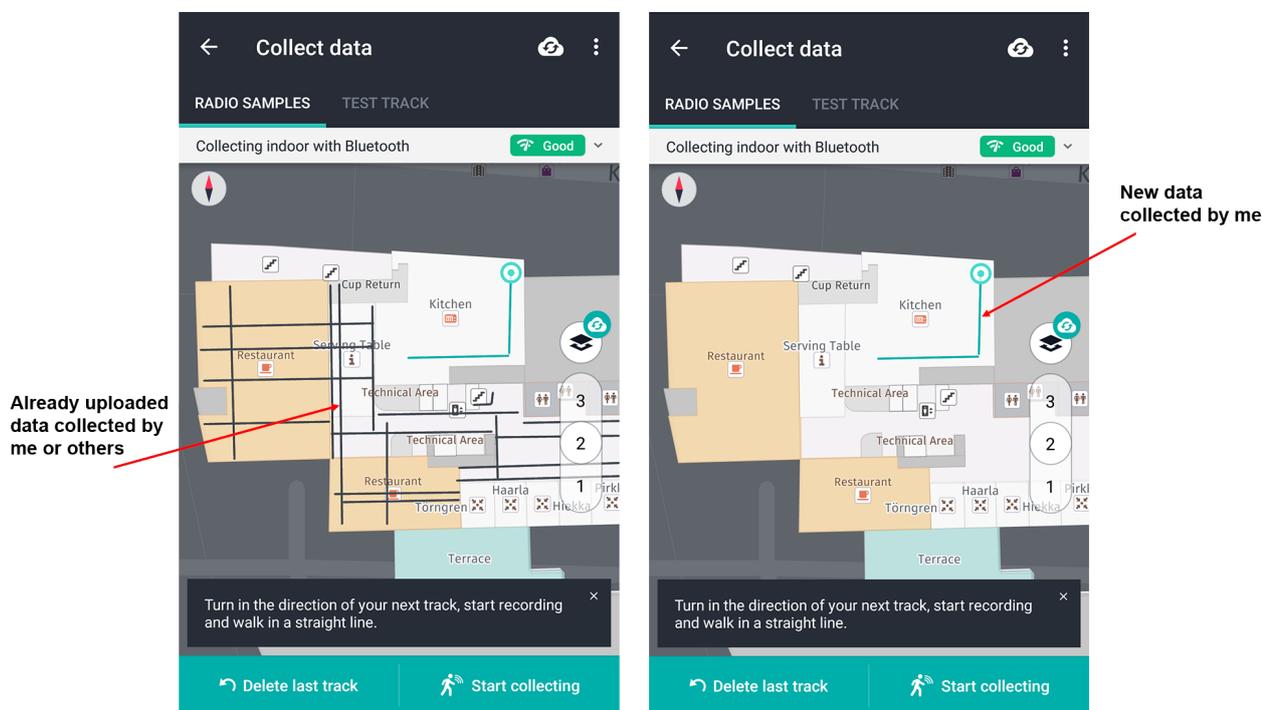


The toggle button **All collected tracks** controls the visibility of the collected radio data:

- When the toggle is off, only the radio data currently being collected is shown on the indoor map. Upon returning to the venue **Summary** view, the collected radio data is uploaded to the HERE Cloud and is no longer considered as currently collected. Thus, when returning to the **Collect data** view, the previously collected radio data can only be seen by toggling the **All collected tracks** on.
- When the toggle is on, all the radio data collected by any HERE Indoor Radio Mapper instance running with the same HERE Account will be shown on the indoor map. This is illustrated in the following screenshots. The right hand side shows an exemplary view, when the toggle is off. In this case only the radio data collected after entering the **Collect Data** view is shown. The left hand side shows the view, when the toggle is on. In this case the radio data collected earlier by the same HERE Indoor Radio

Mapper is shown together with the radio data collected by any other HERE Indoor Radio Mapper running with the same HERE Account.

Figure 14: Showing all the data



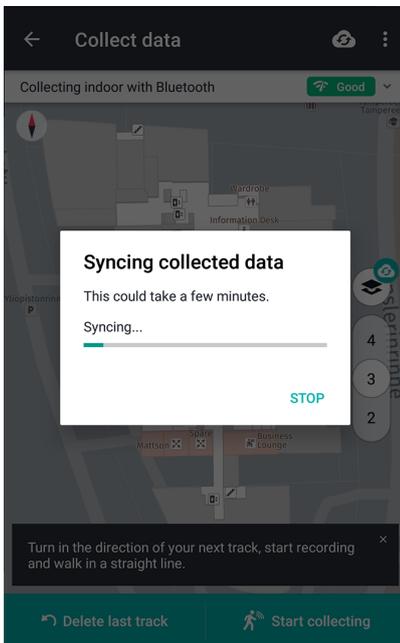
Automated Radio Data Quality Analysis

The purpose of the quality views is to provide one-glance feedback on both the quality of data collection and the radio infrastructure. The quality of data collection analyzes the density of collected tracks and indicates the locations, where further radio data collection is recommended or required. On the other hand, the quality of infrastructure analyzes the sufficiency of the WiFi Access Points or Bluetooth beacons. The quality view for infrastructure indicates the areas, where performance problems are to be expected unless further radio infrastructure gets installed.

The quality views can be toggled on and off through the **layers** menu in the **Collect Data** view. To have the most up-to-date quality views, the radio data and the quality data needs to be synchronized with the HERE Cloud. The synchronization takes place automatically, when entering the **Collect Data** view. During the radio data collection, the synchronization can be triggered manually by tapping **Synchronize now** in the **layers** menu. Note that the synchronization possibility is only available, when the collected radio data and the

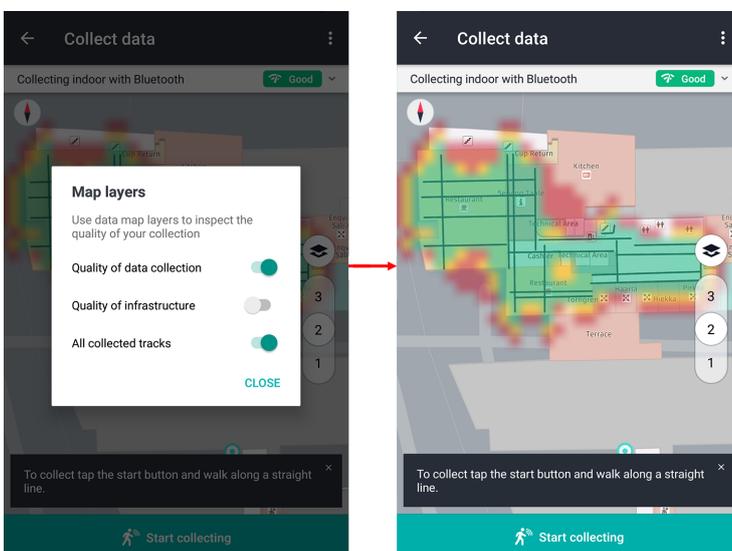
quality views are out-of-synch. The following screenshot shows the HERE Indoor Radio Mapper during the data synchronization.

Figure 15: Radio data synchronization



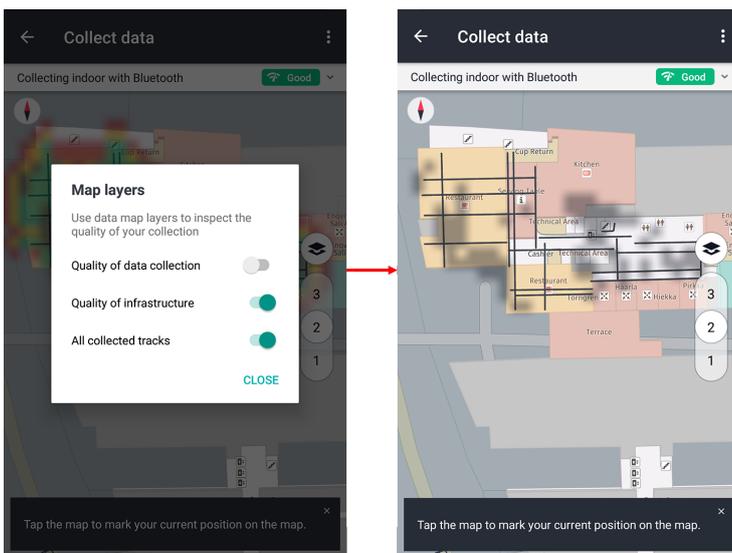
The following screenshot provides an exemplary quality view for the *data collection*. The quality of data collection is overlaid on the indoor map through the **layers** menu as a multi-color heatmap. In the exemplary view, both the collected tracks and the data collection quality have been chosen to be visible. As it can be seen, in the areas with densely collected tracks the quality heatmap indicates green. Moreover, it can also be seen that when there are bigger gaps in the data collection, the heatmap turns yellowish and even red in some places. The red color is a definite indication that further data collection is needed in the area to make HERE Indoor Positioning work optimally. Yellowish color is an indication that further data collection is strongly recommended. Of course, one can decide not to collect further radio data in those areas, but then it must be understood that the positioning performance will be sub-optimal.

Figure 16: Quality of data collection



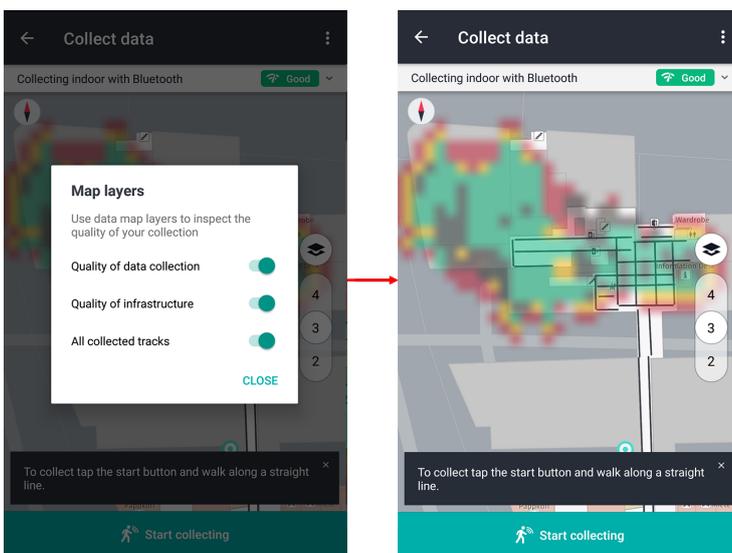
The following screenshot provides an exemplary quality view for the radio *infrastructure*. The quality of radio infrastructure is overlaid on the indoor map through the **layers** menu as a transparent layer with the worse and worse infrastructure quality being indicated with a successively blacker overlay. In the exemplary view, both the collected tracks and the infrastructure quality have been chosen to be visible. As can be seen, there are large areas that are fully transparent meaning that the infrastructure is adequate. However, especially towards the lower-right corner of the covered area, the overlay gets blacker and blacker indicating that the amount of Bluetooth beacons is not adequate for the best quality positioning. This is an indication to the installation personnel that further Bluetooth beacons (or WiFi Access Points) need to be setup in the area to achieve the best quality.

Figure 17: Quality of infrastructure



The last quality screenshot is a combined view with the collected tracks, quality of data collection and quality of infrastructure overlaid on top of each other. This view can provide a single-glance view on the progress of the work.

Figure 18: Unified quality view



- **Note:** If you have doubts regarding the sufficiency of the radio infrastructure in the venue you are mapping, you should consider first doing a very coarse radiomapping, i.e. not following the data collection guidelines rigorously, but just collecting data along e.g. the main corridors. Having done this, examine the quality of radio infrastructure to see, if the radio infra is sufficient.

Alternatively, you can walk around the venue with the **Collect Data** view open and observe the real-time infrastructure quality indicator in the bar above the map view. When the indicator is green, the radio environment is very likely sufficient for high performance indoor positioning. On the other hand, when the indicator is red, high performance indoor positioning is not possible with the current radio infrastructure.

If the radio environment seems adequate, you can proceed to do the rigorous radio data collection as instructed in [Collecting Radio Data Indoors](#) on page 26. However, if the radio infrastructure seems to be inadequate, you should consider deploying more Bluetooth beacons or WiFi Access Points in the affected areas.

Chapter 6

Managing Radio Data in Floor Detail view

Topics:

- [Floor Radio Data Managemen...](#)
- [Storing Collected Radio Da...](#)

The following section provides information on how to manage the collected radio data in the HERE Indoor Radio Mapper.

Floor Radio Data Management

The radio data management refers to managing the radio data collected for your HERE Account. The radio data management for each floor is accessed from the **Summary** view. When tapping a floor for which radio data has been collected, you will be shown the **Floor Detail** view that includes a list of the collected radio data sets.

The basic concepts of the radio data management are:

- The changes made in this view only affect the draft radiomap, which can be tested in the **Test** view. The changes are reflected to the HERE Mobile SDK only when you publish the radio data. For further information on publishing, please see [Publishing Flow](#) on page 43. Additional information on the radiomaps and data flows in general can be found in the HERE Indoor Positioning Installation Guide.
- Any changes made will be reflected to the HERE Cloud and from there to the other HERE Indoor Radio Mapper instances running on the same HERE Account. Note that the conflict resolution is simply based on the latest change winning.
- When publishing, all the enabled radio data sets end up to be used by the HERE Mobile SDK
- A new radio data set appears in the **Floor Detail** view every time you collect new radio data in the **Collect Data** view and return to the **Summary** view. This is the smallest entity of radio data that can be managed in the HERE Indoor Radio Mapper.

The basic operations that can be done in the management view are:

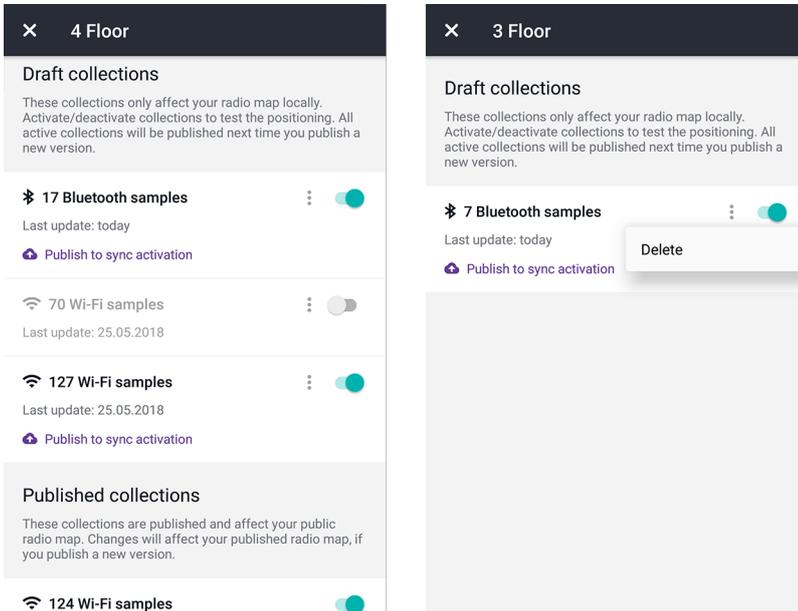
- See which radio data sets have been published for use by the HERE Mobile SDK, and which are still unpublished
- Disable radio data sets from use (only the draft radiomap is affected)
- Enable radio data sets back into use (only the draft radiomap is affected)
- Delete radio data sets (only un-published ones can be deleted)

The following figure shows exemplary **Floor Detail** views for two floors. The following remarks can be made:

- For the 4th floor
 - 17 Bluetooth radio samples are only in the draft radiomap, not usable by the HERE Mobile SDK
 - 70 WiFi radio samples have been disabled from the use totally
 - 127 WiFi radio samples are only in the draft radiomap, not usable by the HERE Mobile SDK
 - 124 WiFi radio samples are both in the draft radiomap and also published for the HERE Mobile SDK
- For the 3rd floor

- 7 Bluetooth radio samples have not been published. The **delete** menu has been exposed by pressing the three vertical dots. Pressing **delete** will delete this radio data set (7 Bluetooth radio samples).

Figure 19: Exemplary Floor Detail views



Storing Collected Radio Data

HERE Indoor Radio Mapper stores all the collected radio data in the HERE Cloud given that the device has Internet connectivity. If the radio data cannot be uploaded immediately, the radio data is stored in the internal database. The radio data remains in the database, even if:

- the application is closed,
- the device is switched off, or
- the device runs out of battery.

The radio data gets uploaded automatically to the HERE Cloud as soon as the connection is re-established.

Chapter 7

Testing Positioning Performance

Topics:

- [Testing Positioning Real-T...](#)

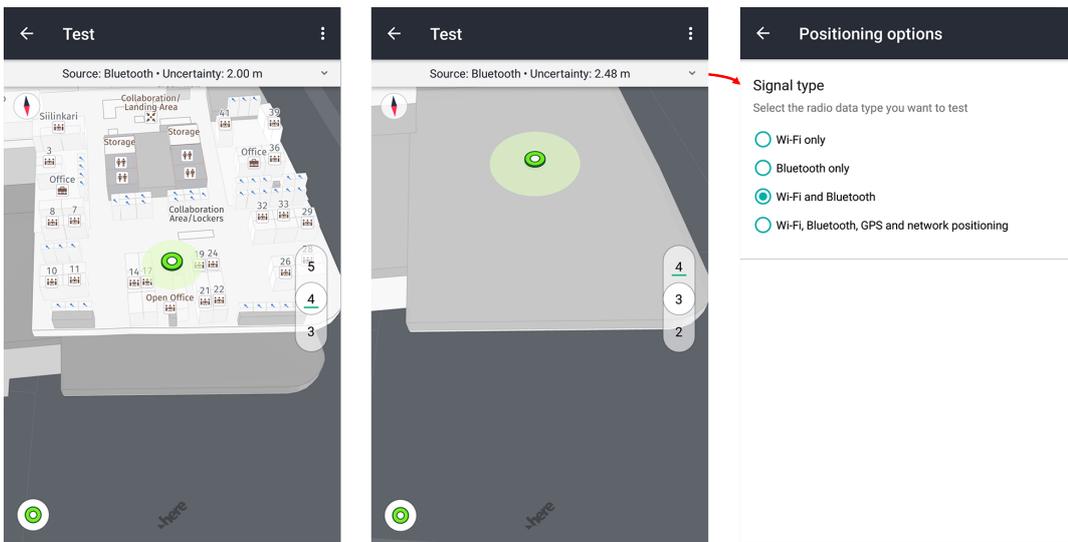
The following section provides information on how to conduct performance testing with HERE Indoor Radio Mapper.

Testing Positioning Real-Time

The prerequisite for testing is collecting radio data at the venue. After the radio data upload the HERE Cloud, it takes some minutes before the generated radiomap is available for testing. To open the **Test** view with the latest positioning data (radiomap) from the HERE Cloud, tap **Test** in the lower bar of the **Summary** view. For more information on navigating between views, see [Basic Navigation](#) on page 14.

The following screenshots show the **Test** view in action and the positioning technology selection menu.

Figure 20: Exemplary real-time positioning view and positioning technology selection



The **Test** view provides the following controls:

- The bar above the map view provides the access to the positioning method selection:
 - Activate **Wi-Fi only** to use WiFi-based indoor positioning exclusively
 - Activate **Bluetooth only** to use Bluetooth-based indoor positioning exclusively
 - Activate **Wi-Fi and Bluetooth** to use both Wi-Fi- and Bluetooth -based indoor positioning methods. In this case the algorithm utilizes the best one of the technologies, one technology at a time.
 - Activate **Wi-Fi, Bluetooth, GPS and network positioning** if you want to use all HERE positioning technologies (HERE Indoor Positioning, HERE WiFi/Cell -based Network Positioning and satellite-based methods). In this case HERE Indoor Radio Mapper will select the best positioning method automatically.
- **Centering** icon

The **centering** icon is located in the lower left corner. When you tap the **centering** icon, the screen is centered to the current location and floor. Moreover, the screen is kept centered to the current location and floor as you move. This *tracking mode* is indicated by having the **centering** icon in sight.

Note: The location icon can be seen through the floors. This is illustrated in the midmost screenshot. The floor indicator indicates that the 3rd floor Venue Map is being shown. The true location is in the 4th floor (as indicated by the green indicator for the 4th floor in the

floor switcher). However, the **centering** icon at the lower left corner in the midmost screenshot indicates that the location is not being tracked. When you again want to get back to the actual current floor, press the **centering** icon.

The **Test** view provides the following information:

- **Source**

Indicates the technology used for the location determination, and is one of *Bluetooth*, *Wi-Fi*, *Wi-Fi outdoor*, *Cellular* or *GPS*.

- **Uncertainty**

Indicates the estimated location uncertainty in meters. Note that *uncertainty* is different from *error* or *accuracy*. *Uncertainty* is a statistical quantity expressing, how well the measurements and the radiomap match at the current location. The better the match, the lower the *uncertainty* - and vice versa.

Chapter 8

Publishing Radio Data

Topics:

- [Publishing Flow](#)

The following section provides details on publishing the radio data for use by the HERE Mobile SDK. The radio data needs to be published before it can be used by the HERE Mobile SDK.

Note that publishing to the HERE Mobile SDK requires that you have registered for the HERE Mobile SDK evaluation or have a commercial license. The registration to the evaluation is done at the [HERE Developer Portal](#).

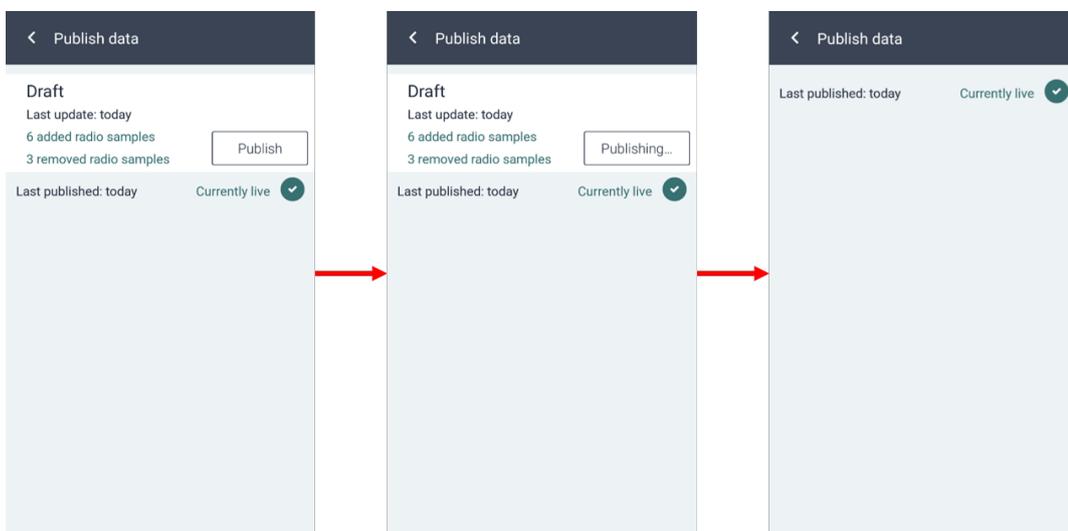
Publishing Flow

Whenever radio data is being collected or a radio data set state is changed between enabled and disabled in the **Floor Detail** view (see [Floor Radio Data Management](#) on page 37), the operations affect only the draft radiomap. The basic idea is that radio data can be modified and tested freely in HERE Indoor Radio Mapper and the changes are not reflected to the production before the radio data is published. Note that when you test positioning with HERE Indoor Radio Mapper, you are always testing the positioning performance using the draft radiomap. Thus, before HERE Mobile SDK sees the same radio data as you test in HERE Indoor Radio Mapper, you need to publish the radio data.

Publishing means synchronizing the draft radiomap to the production. Any radio data sets, published or unpublished, that are *enabled* in the per-floor **Floor Detail** view are published, when the publish is commenced in the **Publish** view. Vice versa, any *disabled* radio data sets, published or unpublished, are removed from the production upon publish. Please refer to HERE Indoor Positioning Installation Guide for detailed explanation on the draft and published (production) radiomaps.

The following figure shows the publishing sequence. When entering the **Publish** view you will see the latest publishing time as well as the latest draft radiomap update time. Moreover, you will be shown the difference between the draft and the currently published radiomap (number of added and removed radio samples).

Figure 21: Publishing flow



If you decide to publish the current draft radiomap, tap the **Publish** button and it changes to indicate *Publishing*. Once the publishing process is complete, the only indication left will be the latest publishing time. Note that the Bluetooth and WiFi radio data are published at the same time.

Chapter 9

Advanced features

Topics:

- [Collecting Test Tracks](#)
- [Running a Test Track](#)
- [SLAM Mode for Radio Data C...](#)

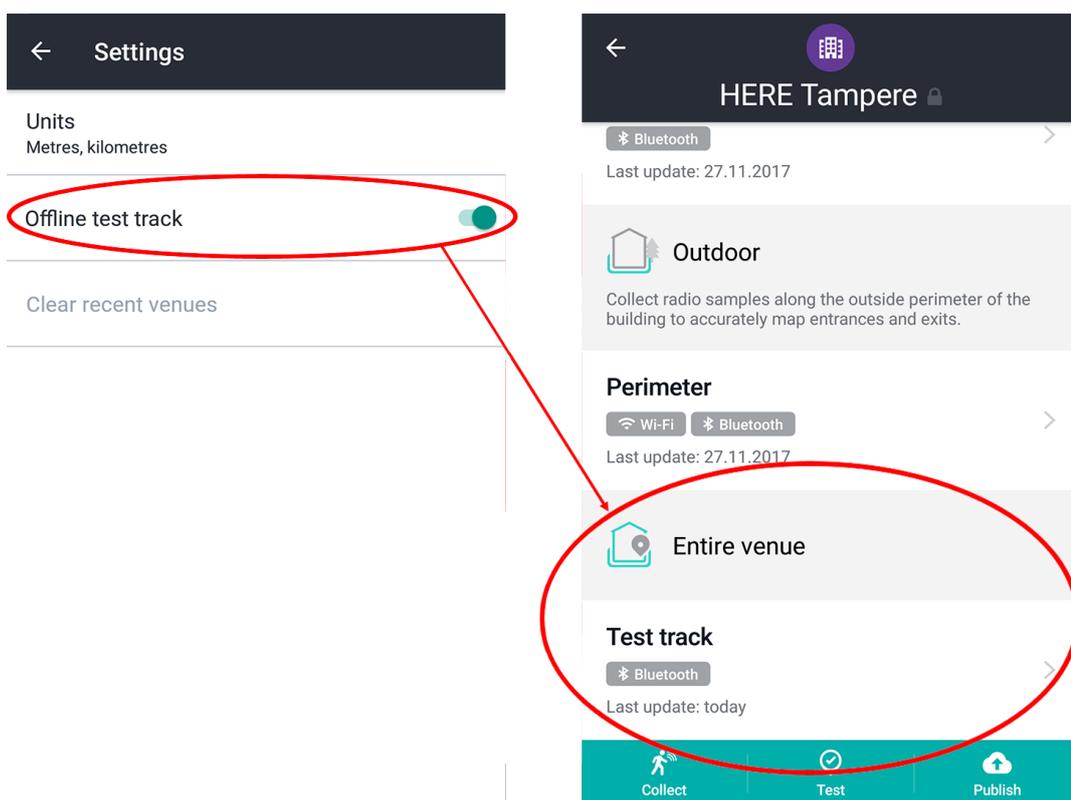
The following section provides information on the HERE Indoor Radio Mapper advanced features.

Collecting Test Tracks

Collecting an offline test track provides you with quantitative feedback on the positioning accuracy and floor detection rate. Conceptually, during the test track collection, the HERE Indoor Radio Mapper user walks through some path of interest in the venue in a similar manner as during the regular radio data collection. Then, during the test track execution, the collected radio samples are located using the previously collected radio data. As the test track also contains the ground truth locations, HERE Indoor Radio Mapper will be able to compare the true and estimated locations and provide quantitative information on the system performance.

The test track functionality is an advanced feature and thus needs to be enabled separately. Enabling is done through the **Settings** menu that can be accessed through the main **menu** from the **Landing** view. The following screenshot shows how the test track functionality can be enabled (left). After enabling the functionality, a new section *Entire Venue* appears in each venue's **Summary** view (right).

Figure 22: Enabling the test track functionality



To collect a test track, select the **TEST TRACK** tab in the **Collect Data** view (this tab only appears after enabling the feature from the **Settings** menu).

Collecting a test track is similar to collecting radio data, with the following guidelines:

- Select the technology (Bluetooth or WiFi) from the settings (tap the bar above the map view to access).
- Visit all the floors from which you have collected the radio data.
- Comprehensively visit the areas from which you have collected the radio data.
- Visit also outdoor areas, in case you have collected outdoor radio data.

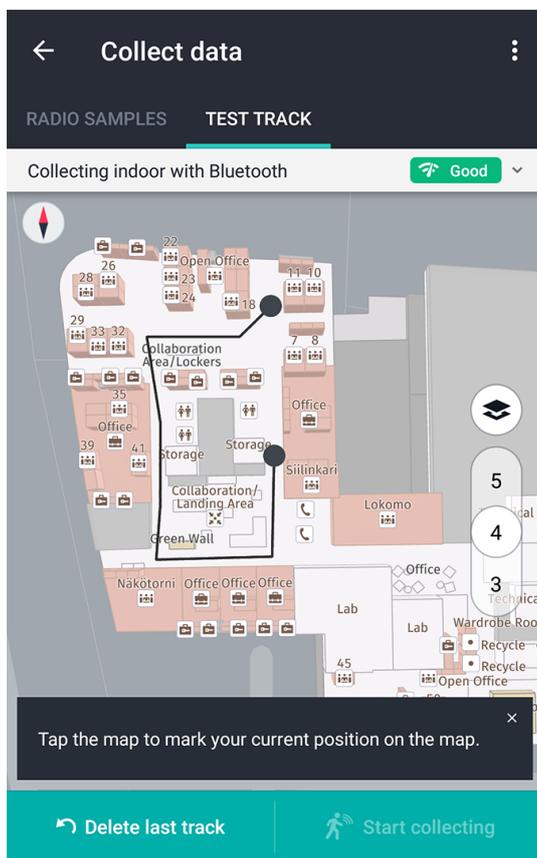
- As the test track needs to be continuous, you need to continue the track always from the end point of the previous segment.
- When changing from indoors to outdoors, or vice versa, remember to change to indoor/outdoor mode from the settings (tap the bar above the map view to access).
- Test track can be finished at any point once you have covered all the applicable areas.

You can only collect one test track per building for each technology, i.e. you can have one test track for Bluetooth and the other one for Wi-Fi. You can delete a test track by tapping the **Test Track** in the **Summary** view.

You can collect a test track with less density than radio samples. For example, when collecting a test track in a corridor, instead of collecting a line of radio data along the opposite walls (as you should do when collecting radio samples), you can collect a test track simply along the center line. The same applies to rooms and other areas.

For information on running the test track to obtain quantitative information on the HERE Indoor Positioning performance at your venue, please see [Running a Test Track](#) on page 46.

Figure 23: Exemplary Test track in the Collect Data view



Running a Test Track

Before running a test track, you need to collect a test track. You can collect a test track at any point during the deployment: either before, during or after the radio data collection. For information on how to collect a

test track, see [Collecting Test Tracks](#) on page 45. However, you can only run the test track after the radio data collection.

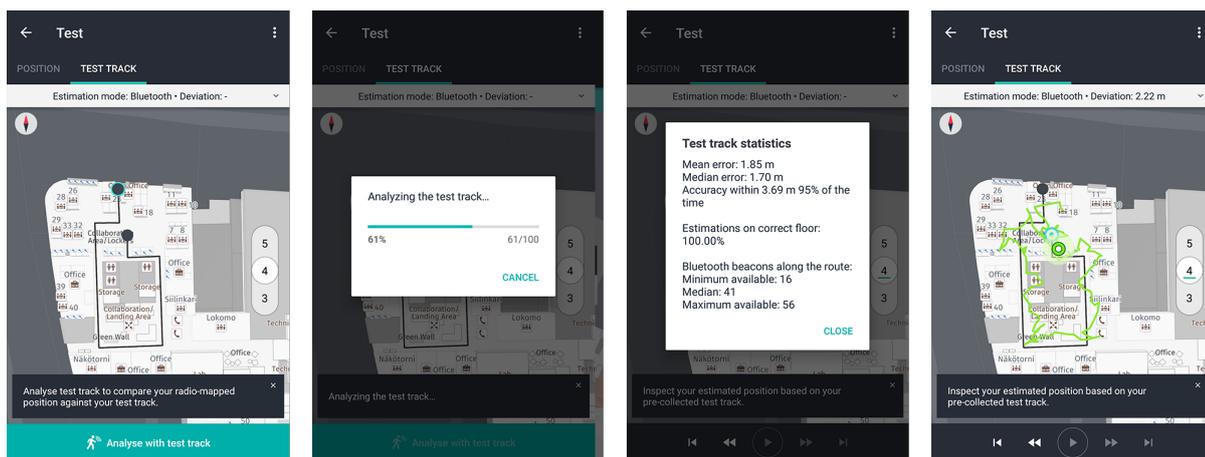
To analyze and run the test track, select the **TEST TRACK** tab in the **Test** view. Tapping the **play** icon analyzes the test track and provides the following information:

- **Mean, median and 95% error** - average and median error over the whole track in meters, and additionally the 95% error indicating that the error is less than the value 95% of the time.
- **Floor detection** - rate of detecting the correct floor in percentage; 100% means perfect floor detection.
- **Minimum, median and maximum available Wi-Fi access points** (or Bluetooth beacons) - Statistics regarding the number of Wi-Fi access points or Bluetooth beacons over the test track.

After the analysis, you can proceed to playback the test track. The **play, fast forward and backward** buttons are found at the bottom of the view. When playing, you will see both the estimated location and the true location moving along the test track. The top bar provides you the following information:

- **Estimation mode** indicates whether you collected the test track for *Bluetooth* or *Wi-Fi*.
- **Deviation** indicates the distance in meters between the test track position (true location) and the current estimated position.

Figure 24: Exemplary Test Track view



SLAM Mode for Radio Data Collection (beta)

SLAM, or *Simultaneous Localization And Mapping*, is an experimental feature that speeds up radio data collection. SLAM utilizes in-device sensors to show the user current location while walking. This is different from the classic data collection, where the user location is not shown in real-time. In the SLAM-based collection you will still need to walk in straight lines, but seeing your real-time location during the radio data collection helps and speeds up the process significantly.

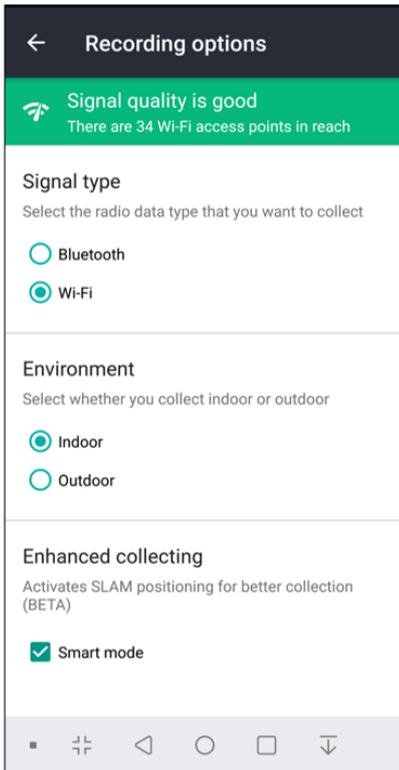
Using SLAM consists of the following steps:

1. Enabling SLAM functionality in **Recording options**
2. Calibration to calibrate the direction sensing and your step length
3. Collect data in a continuous mode, tapping **Save** at each turn

1. Enabling SLAM

SLAM is enabled by checking **Smart mode** on in **Recording options** (tap the bar above the map).

Figure 25: Enabling Smart Mode (SLAM collection)



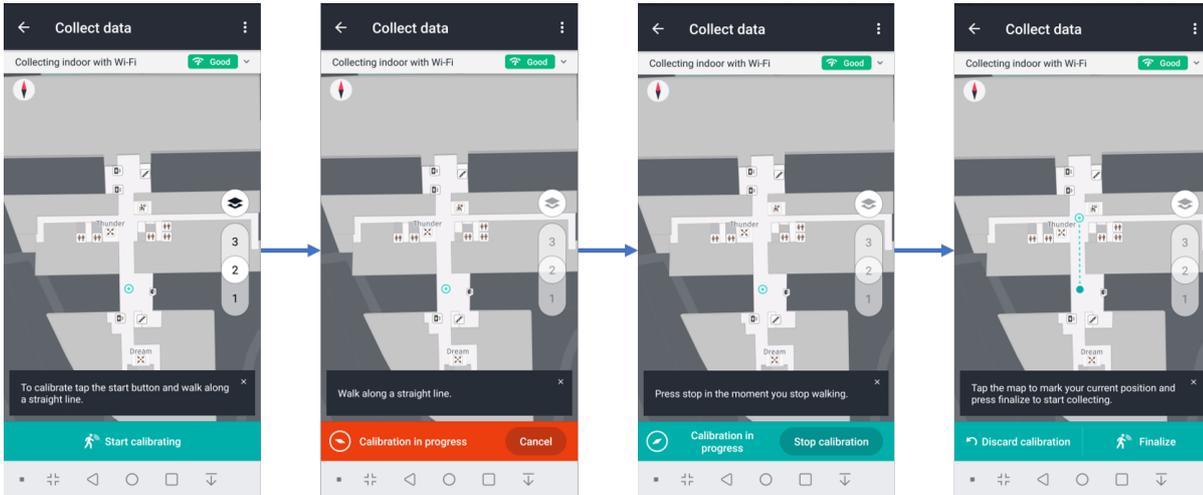
2. Calibration

SLAM needs to be calibrated before use. During this phase, the device direction sensing and your step length get calibrated. The following figure shows the SLAM calibration steps:

1. Indicate your current location on the indoor map
2. Initiate calibration by tapping **Start Calibrating**. The bar under the map turns red.
3. Walk along a straight line at constant speed. During this phase we capture your device direction and steps.
4. The bar below the map turns green, when enough steps have been taken
5. When you want to stop calibration, tap **Stop Calibration**
6. Indicate your current location on the indoor map and tap **Finalize**

7. SLAM-based radio data collection commences immediately (see the next section)

Figure 26: SLAM Calibration

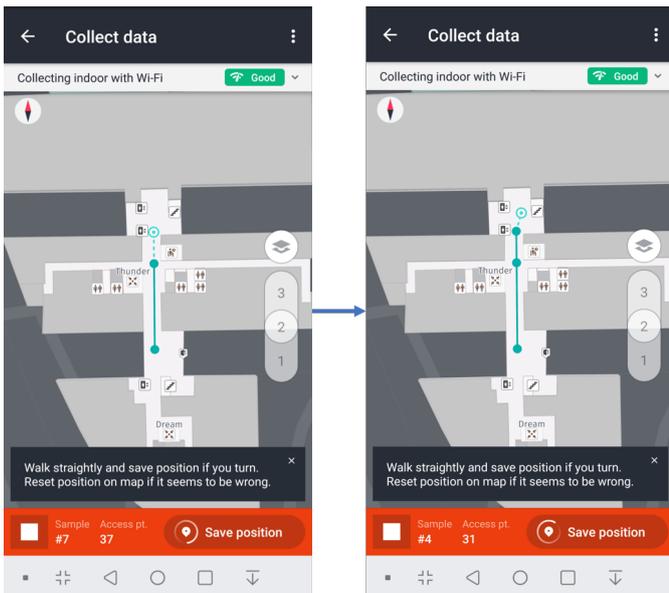


3. Using SLAM

SLAM-based radio data collection commences immediately once you tap **Finalize** in the SLAM Calibration. The actual data collection is performed as follows:

1. As you walk, in **straight lines**, you see a dot (your estimated location) moving on the indoor map
2. If, at any point, you see the dot moving away from your current path, you need to correct the current location to the correct place by tapping your current location on the indoor map
3. Before turning, tap **Save position**, and make a turn
4. When you have completed the whole path, or you switch a floor, tap **stop** button in the lower left corner

Figure 27: Collecting Radio Data With SLAM



Chapter 10

FAQ

Topics:

- [Why do I have to walk in s...](#)
- [Why do I need to align my ...](#)
- [Are there any device setti...](#)

The following section lists frequently asked questions and provides useful answers.

Why do I have to walk in straight lines at constant speed?

HERE Indoor Radio Mapper interpolates the collected radio samples between the start and end points you indicate on the floor plan. Because HERE Indoor Radio Mapper does not know about your walking speed or any turns that you make, the tool assumes that you walked in a straight line from the start to the end at constant speed. This assumption allows the HERE Indoor Radio Mapper to divide the radio samples evenly along that line.

Why do I need to align my own custom indoor maps to Latitude and Longitude coordinates?

Alignment serves two purposes:

1. To understand the dimensions of the building, in meters. This is important for HERE Indoor Positioning to function correctly.
2. When we switch from indoor positioning to outdoor positioning, having both indoor and outdoor maps in the same coordinate system is the only way to ensure smooth transition.

Are there any device settings that I should be aware of?

The latest Android devices have an advanced option that allows measuring the WiFi and Bluetooth radio signals even when the radios are turned off. HERE Indoor Radio Mapper benefits from enabling this option.

In Samsung devices these settings can be found through **Settings** -> **Location** -> **Improve accuracy**. The menu has the setting separately for WiFi and Bluetooth. HERE Indoor Radio Mapper queries these settings to be enabled, if not already enabled.

When this setting is enabled for WiFi, HERE Indoor Radio Mapper switches the WiFi connectivity off, when collecting WiFi radio data to ensure the best measurement quality. Similarly, when this setting is enabled for Bluetooth, HERE Indoor Radio Mapper switches the Bluetooth connectivity off, when collecting Bluetooth radio data to ensure the best measurement quality.