Wave Navigator

User's Manual

silex technology

WA107530XB

Index

1. Introduction

Thank you for purchasing the Wave Navigator.
This manual explains how to install, operate and configure Wave Navigator. It also describes what to do when an abnormality occurs.
Make sure to read this manual prior to use.

This manual is intended for the following audience. The work described in this manual must be performed only by individuals described below.
- Those who are qualified to do the work described herein according to customer company rules.
- Those who have general knowledge of wireless communication.

TIP

- The following conditions are requirements for using Wave Navigator.
  - Wireless devices and wireless survey devices are installed on the required locations such as the floor.
  - Wireless survey devices are connected to Wave Navigator.
  - Wave Navigator, InfluxDB (a time series database), and Grafana (a tool used to visualize and analyze data) are installed. This set of application software can be installed using the provided Wave Navigator installer.

1-1. Introduction

1-1-1. About the Notation

This manual provides information on how to configure and use Wave Navigator.
Please read the Safety Instructions carefully before using Wave Navigator.


TIP

: This symbol indicates important information that needs to be observed when operating Wave Navigator. Make sure to read this information for safe and proper use.


Note

: This symbol indicates information that is useful when using Wave Navigator. If you experience difficulties operating Wave Navigator, please refer to this information first.

1-1-2. Disclaimers

- The unauthorized transfer or copying of the content of this manual, in whole or in part, without prior written consent is expressly prohibited by law.
- The content of this manual is subject to change without notice.
- This manual was prepared to accurately match the content of each OS, but the actual information shown on the computer monitor may differ from the content of this manual due to future OS version upgrades, modifications, and other changes.
- Although every effort was made to prepare this manual with the utmost accuracy, Silex Technology will not be held liable for any damages as a result of errors, setting examples, or other content.

1-1-3. Trademarks

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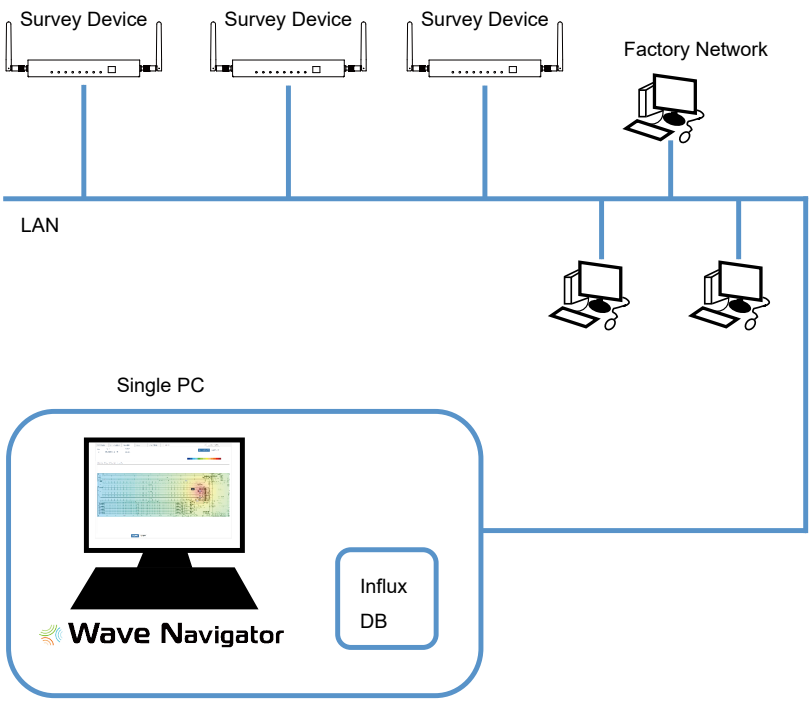
1-2. Product Overview

Wave Navigator is a tool used to monitor and visualize the wireless environment on each floor, based on data collected from industrial wireless survey devices installed in a location such as a factory or warehouse.

Measurement values such as the noise, radio wave status, and radio wave intensity that are collected from wireless survey devices can be analyzed and visualized with a heat map.
It is also possible to measure the wireless environment before or after installing wireless devices to determine their locations or settings based on the measurement result.
Furthermore, if an anomaly occurs with a wireless device, its cause can be estimated or identified.

These functions help reduce on-site issues related to wireless communication.



Note

- An application software called "Grafana" is used to visualize and analyze data. (https://grafana.com/)

1-2-1. Troubleshooting Wireless Device Issues

When something is wrong with a wireless device, the floor wireless conditions and communication status of the wireless device can be checked to identify the cause.

Note

- The following situations do not apply to every issue. An issue may occur as a result of multiple causes.

Check item					Possible cause
Wireless device status	Bandwidth rate	Radio wave intensity status	Other wireless device status	Noise status	
No target device	-	-	-	-	The device not being powered ON
Connected	High	High	Radio wave intensity of other devices: Strong	-	Adversely effected by other devices
Connected	Normal	Also weak for surrounding devices	Normal	-	Radio blocking objects
Connected	Normal	Weak only for the device	Normal	-	Antenna failure
Connected	High	High	Many devices	-	Too many wireless devices
Connected	Normal	High	Normal	High	Noise sources

Use the following procedures to check the above check items.

Item	Step	See page
Wireless device status	**Data Display** > **Floor Wireless Conditions**	**4-1. Floor Wireless Conditions**
	Data Display > **Floor List** > **Measurement data analysis** > **Survey**	**Checking the Survey Data** in **4-2-1. Checking the Measurement Data Analysis Result**
	Data Display > **Floor List** > **Wireless monitoring** > **Survey**	**Checking the Survey Data on Floor Map** in **4-2-2. Checking the Wireless Monitoring Result**
Bandwidth rate	**Data Display** > **Wireless anomaly · resolution information** in **Floor Wireless Conditions**	**4-1. Floor Wireless Conditions**
	Data Display > **Floor List** > **Measurement data analysis** > **Survey**	**Checking the Survey Data** in **4-2-1. Checking the Measurement Data Analysis Result**
	Data Display > **Floor List** > **Wireless monitoring** > **Survey**	**Checking the Survey Data on Floor Map** in **4-2-2. Checking the Wireless Monitoring Result**
Radio wave intensity status	**Data Display** > **Floor List** > **Measurement data analysis** > **Radio wave intensity**	**Checking the Radio Wave Intensity** in **4-2-1. Checking the Measurement Data Analysis Result**
	Data Display > **Floor List** > **Wireless monitoring** > **Radio wave intensity**	**Checking the Radio Wave Intensity of Wireless Devices** in **4-2-2. Checking the Wireless Monitoring Result**
Other wireless device status	**Data Display** > **Floor List** > **Wireless monitoring** > **Survey** > **Survey information** for the survey device near the point to be checked on the map > **Details** > **Device information** in **Survey**	**Checking the Survey Data on Floor Map** in **4-2-2. Checking the Wireless Monitoring Result**
Noise status	**Data Display** > **Floor List** > **Measurement data analysis** > **Spectrum information**	**Checking the Spectrum Information** in **4-2-1. Checking the Measurement Data Analysis Result**
	Data Display > **Floor List** > **Wireless monitoring** > **Spectrum information**	**Checking the Spectrum Information** in **4-2-2. Checking the Wireless Monitoring Result**

1-3. Export Control Regulations

Wave Navigator may include goods, technology and/or software that are covered by export control regulations in Japan and the United States. Observe the export control regulations of both countries and other countries that are applied to goods, technology and/or software.

1-4. Terminology

This page lists terms you will need to understand when using Wave Navigator.

Term	Description
area	Targets such as factories and warehouses that are monitored or analyzed by Wave Navigator, grouped in a desired unit. An area contains floors, which are units to be monitored or analyzed.
floor	A location in a building in an area such as a factory or warehouse.
floor map	A map of a floor in a factory, warehouse, etc. It indicates a block where the wireless environment is monitored or analyzed by Wave Navigator.
frame	A wireless communication packet.
Grafana	An open-source dashboard tool used to analyze time series data. Used to display the analysis result in a time series graph, for example.
heat map	A means of displaying data analysis results by color. The strength/weakness of numerical data (in matrix format) is shown with colors.
InfluxDB	A time series database used by Wave Navigator. InfluxDB is in the computer where Wave Navigator is installed and manages the data collected from survey devices.
pre-survey	A method that measures the wireless LAN environment on a floor by using survey devices. Performed before or right after installing wireless devices in order to determine their installation location and setting values.
propagation coefficient	The way that radio waves propagate depending on the location, represented as a coefficient. The value of the coefficient indicates how radio waves propagate in a location as follows: - 2.0 : Ideal space with no radio blocking objects - 2.0 or less : Space where radio waves reflect as they propagate - 2.0 or more : Space where radio waves are absorbed by blocking objects and attenuate as they propagate
radio wave intensity	Indicates the strength of the radio waves used for wireless communication.
spectrum	Complex information or signal decomposed and arranged into its components.
spectrum analysis	In Wave Navigator, a method that decomposes and analyzes radio waves used for wireless communication in terms of the radio wave intensity, frequency, or time series.
survey	A method that measures the wireless LAN environment for industrial wireless communication, which is used in factories and warehouses, etc.
survey device	A device that measures the wireless LAN environment for industrial wireless communication, which is used in factories and warehouses, etc.
wireless band	A radio wave bandwidth used for wireless communication. There are 2.4GHz band and 5GHz W52/W53/W56/W58 bands. Usable bands depend on the country.

2. Installing Wave Navigator

The following programs are required for using Wave Navigator on a computer.
Run **Setup.exe** to install the programs.
- Silex Navigators
- Wave Navigator

Note

- Silex Navigators is the base application software required to use Wave Navigator.

Refer to **A-1. Main Specifications** for specifications required for the computer on which to install the software.

2-1. Installing Wave Navigator

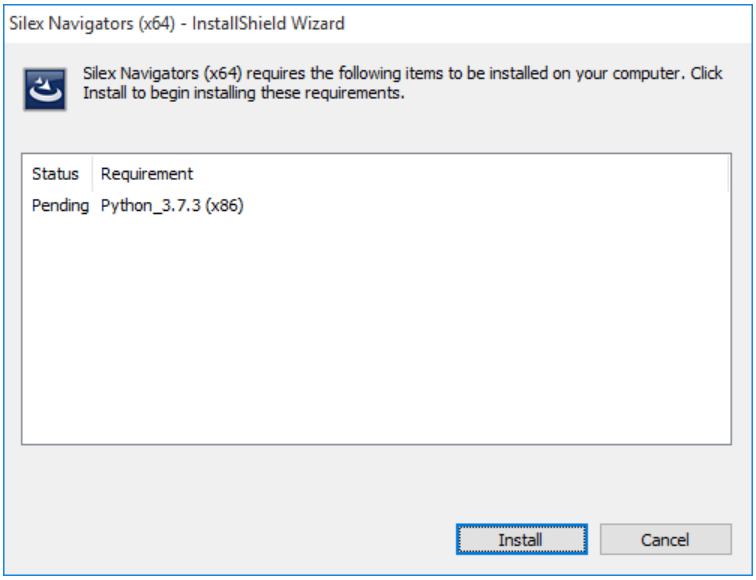
TIP

- If an error occurs during installation, the programs may need to be uninstalled respectively. (See **2-2. Uninstalling Wave Navigator**)
- To install, first log on as a computer administrator or another user assigned to the Administrators group.

1. Run **Setup.exe** from an installation data folder.

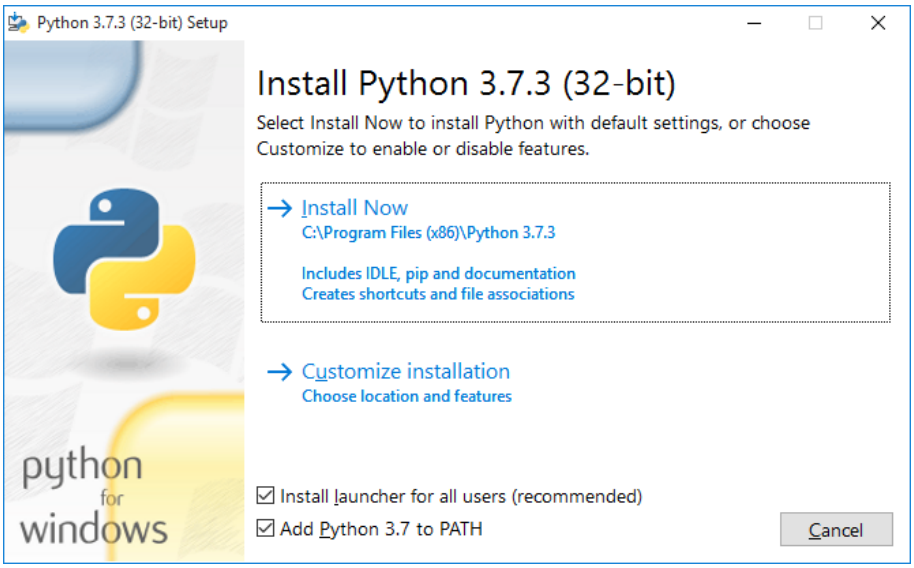
2. If the **User Account Control** screen is displayed, click **Yes**.

3. If Python is not installed on the computer, Python will be installed. Click **Install**.



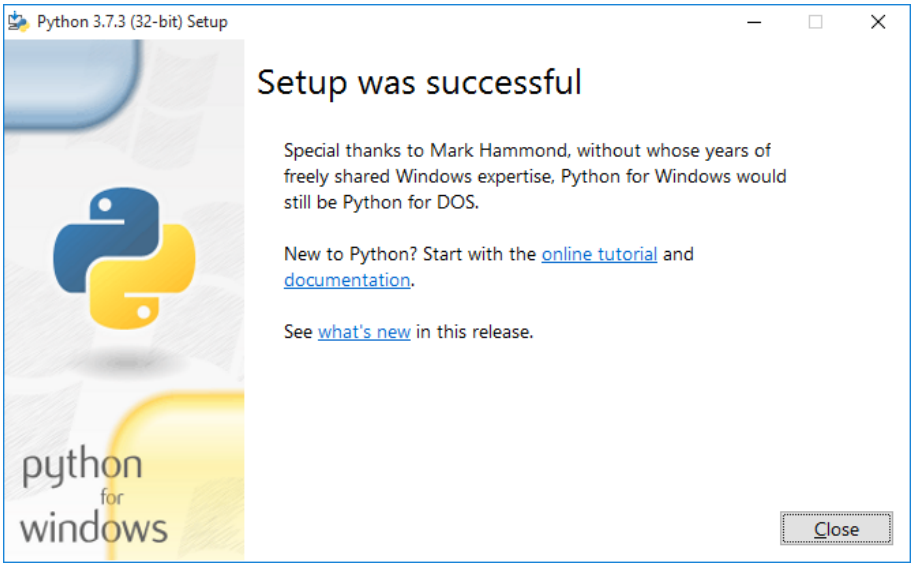
If Python is already installed, proceed to step 6.

4. The Python installation screen is displayed. Click **Install Now.**

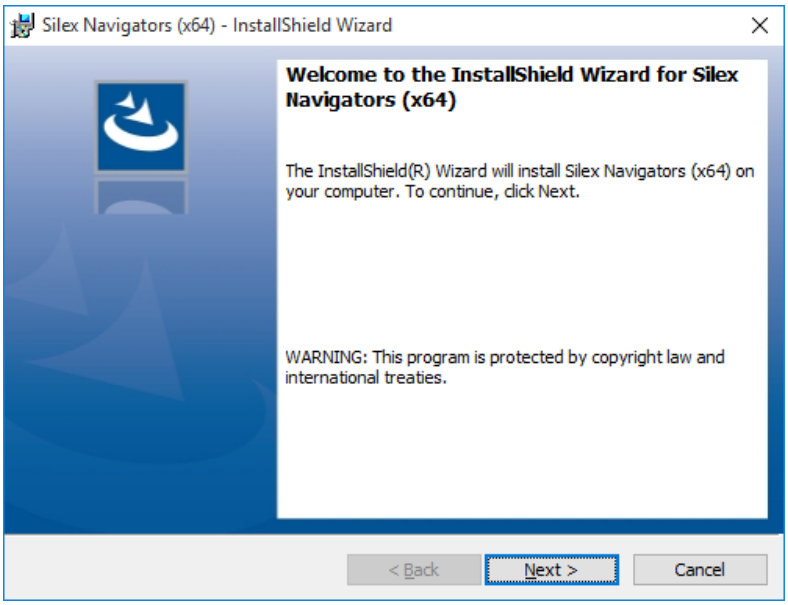


Installation will begin.

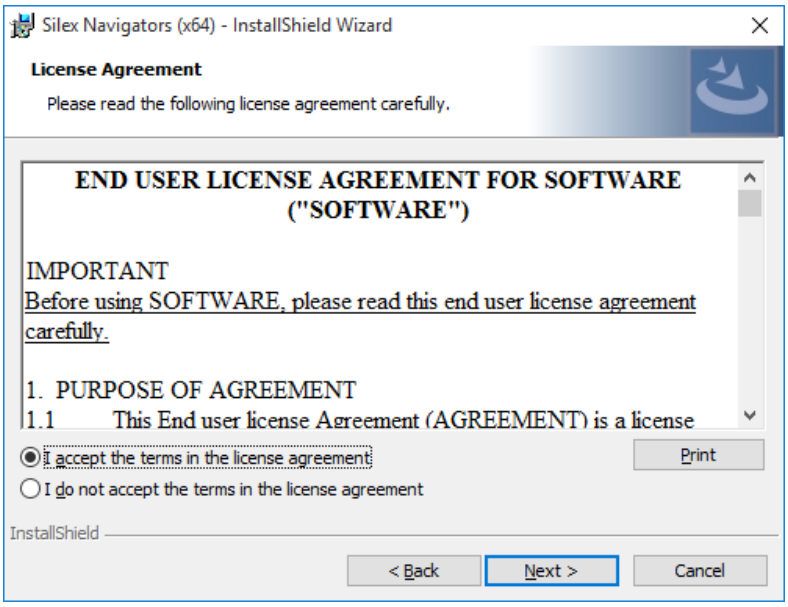
5. When the installation is completed, the installation complete screen is displayed. Click **Close**.



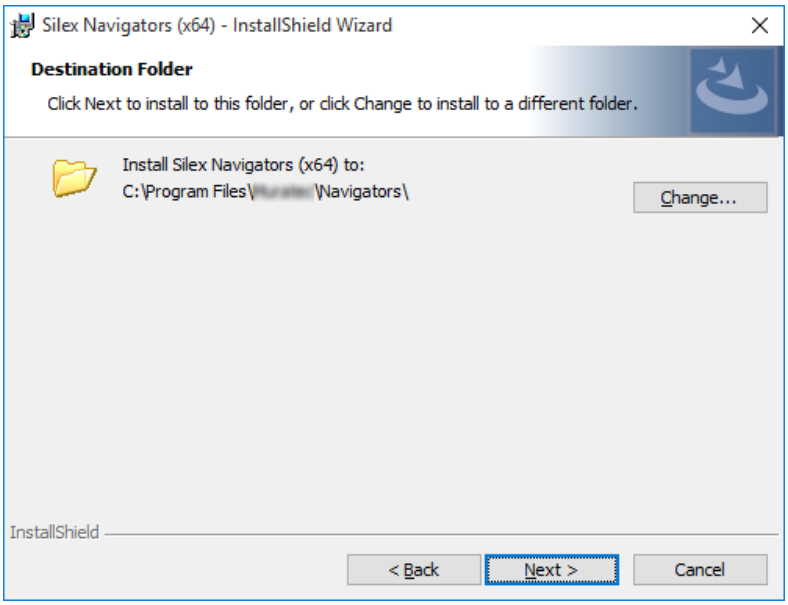
6. The Silex Navigators installation wizard screen is displayed. Click **Next**.



7. The end user license agreement is displayed. Read the content carefully. If you agree, select **I accept the terms in the license agreement** and then click **Next**.

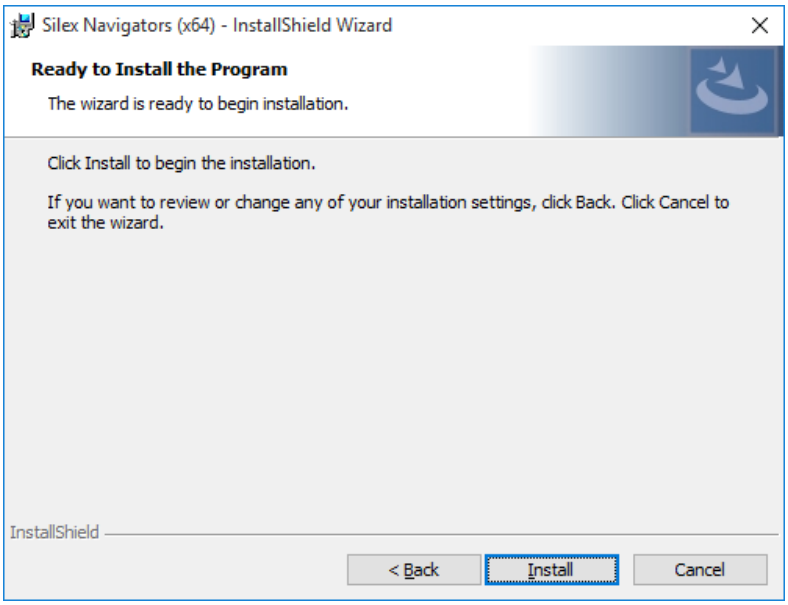


8. Confirm the installation folder and then click **Next**.



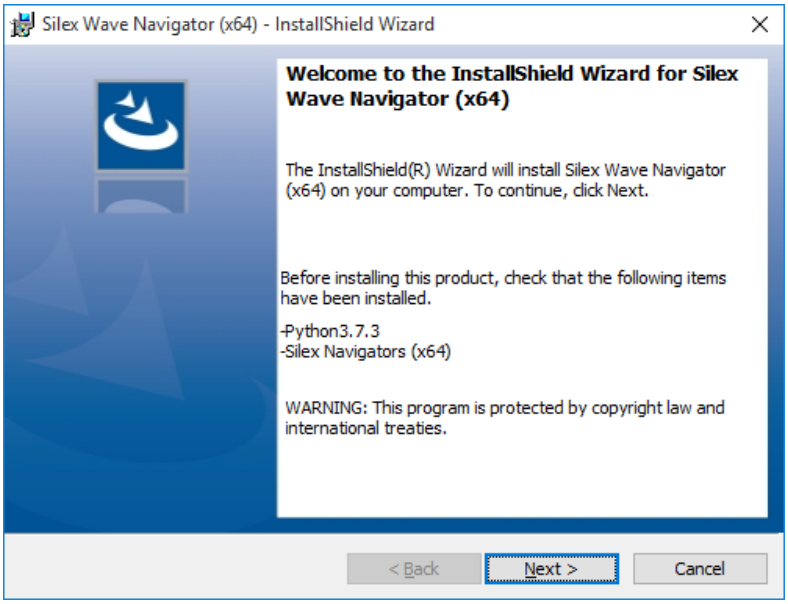
Click **Change** to change the installation folder.

9. Click **Install**.



10. When the installation is completed, the installation complete screen is displayed. Click **Finish**.

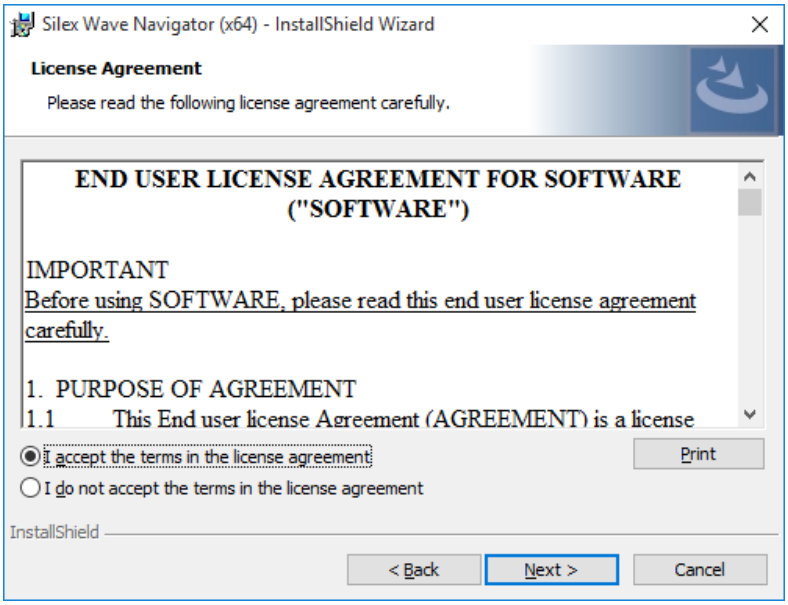
11. The Wave Navigator installation wizard screen is displayed. Click **Next**.



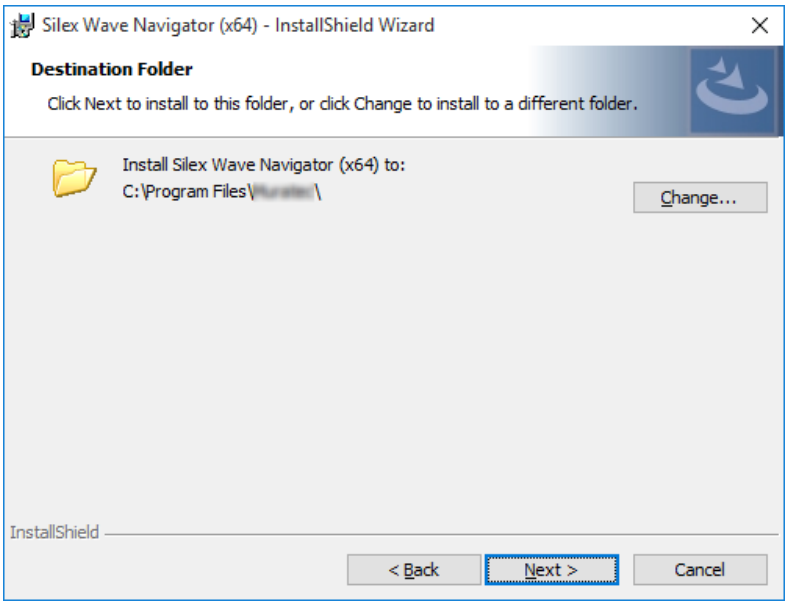
TIP

- If the installation is cancelled after this step and you want to reinstall it, go to the **Files** folder of an installation data folder, open the **WaveNavigator_x.x.x_installer_x.x.x.x** folder (x.x.x and x.x.x.x consist of alphanumerics) and run **setup.exe**. Do not run **Setup.exe** of the step1 then, since it causes an error.

12. The end user license agreement is displayed. Read the content carefully. If you agree, select **I accept the terms in the license agreement** and then click **Next**.

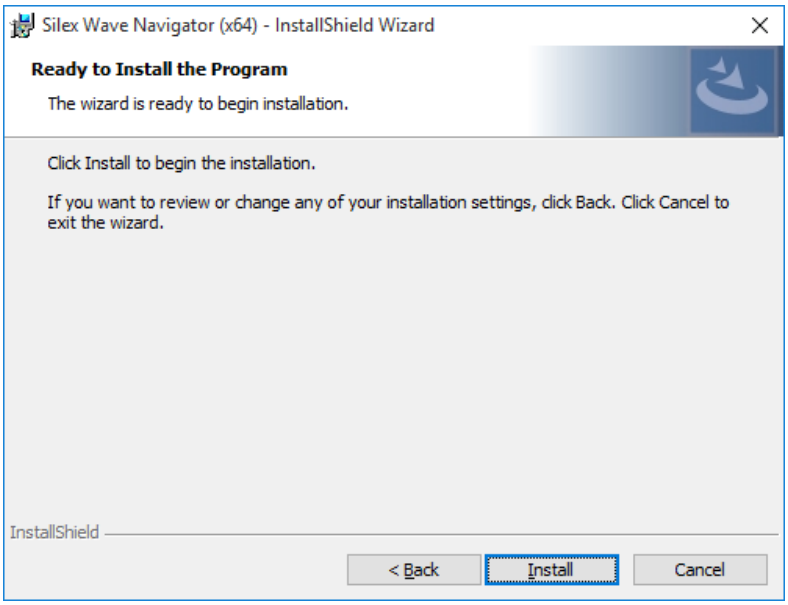


13. Confirm the installation folder and then click **Next**.

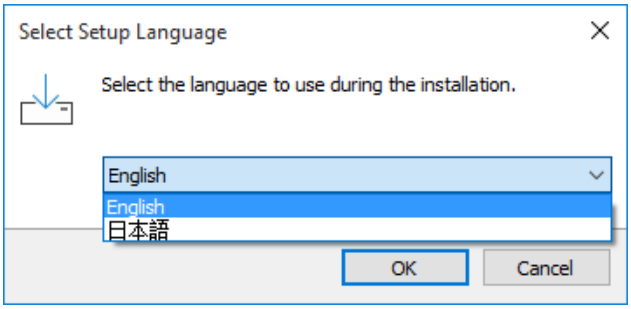


Click **Change** to change the installation folder.

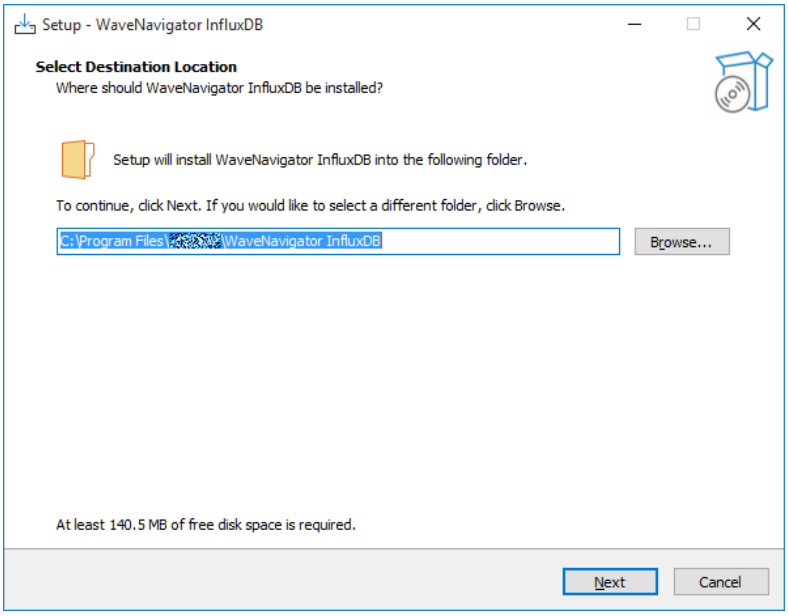
14. Click **Install**.



15. Select the language to use during installation and click **OK**.

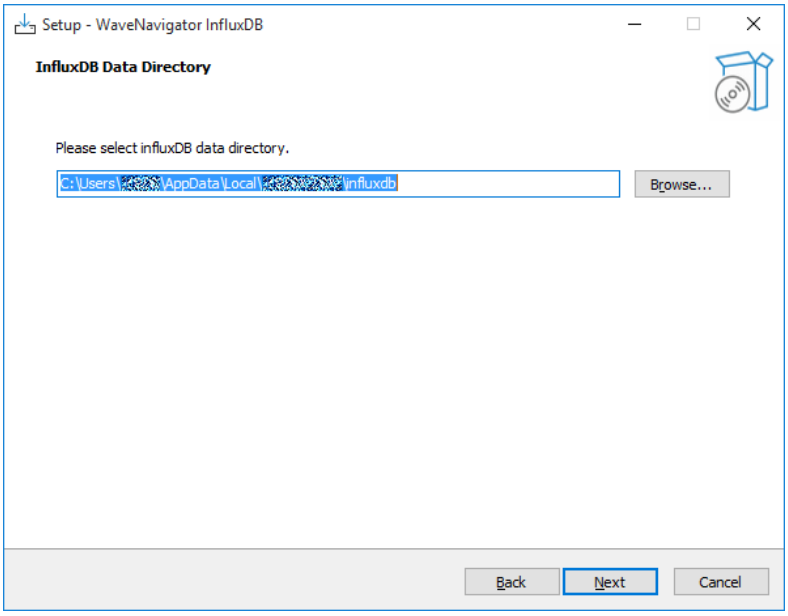


16. Confirm the installation folder and then click **Next**.



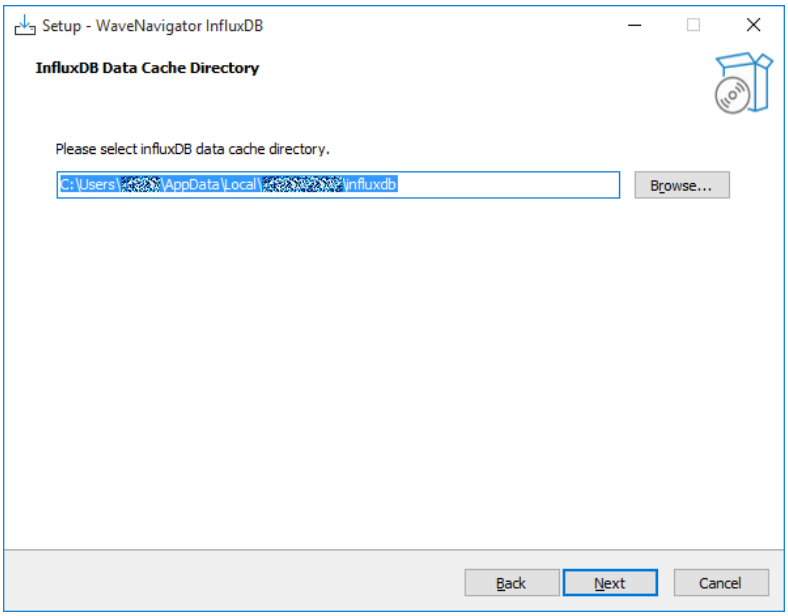
Click **Browse** to change the folder.

17. Confirm the time series DB data folder and then click **Next**.



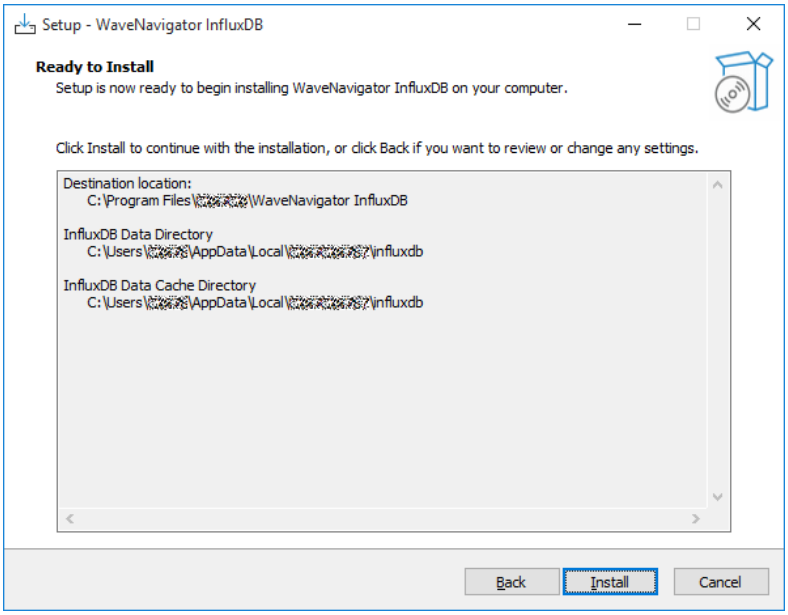
Click **Browse** to change the folder.

18. Confirm the time series DB data cache folder and then click **Next**.

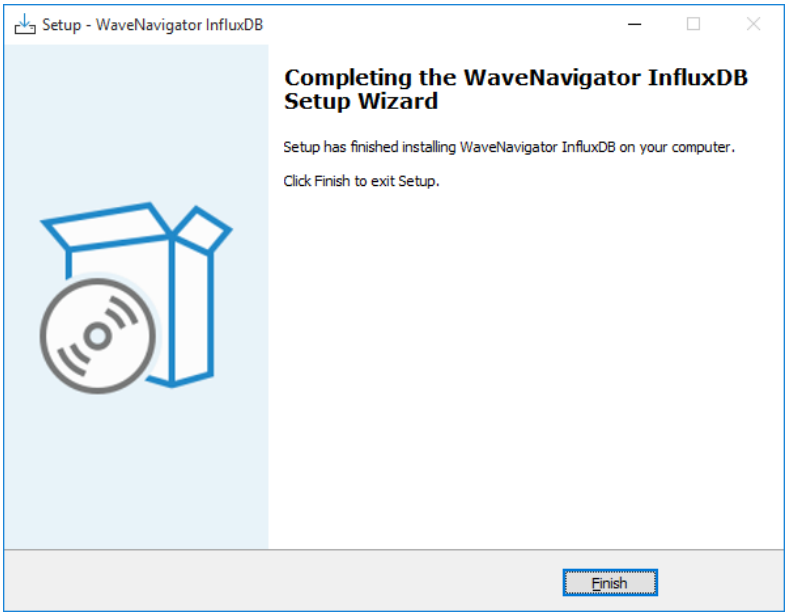


Click **Browse** to change the folder.

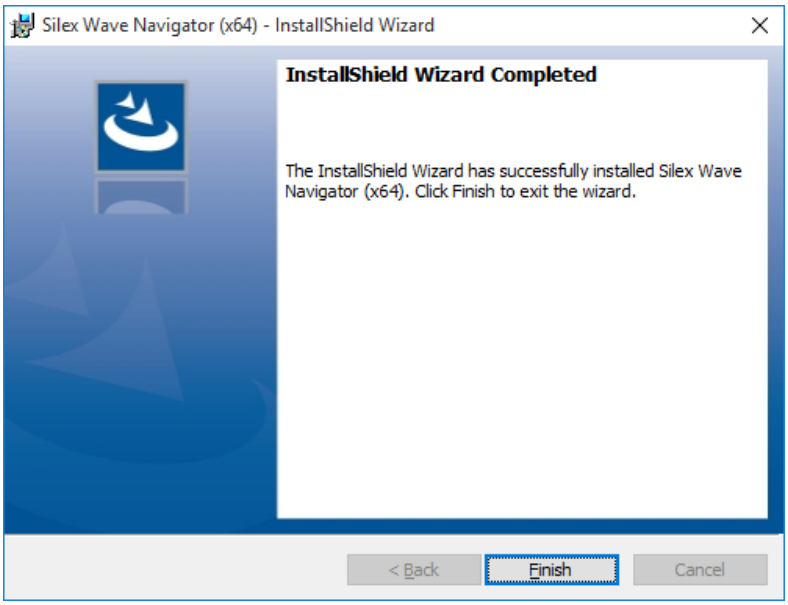
19. Click **Install**.



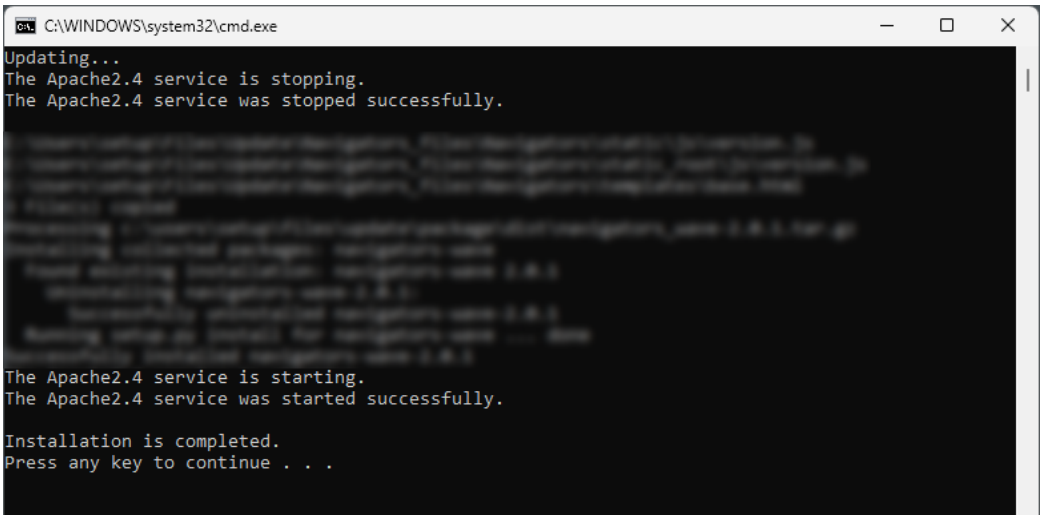
20. Click **Finish**.



21. When the installation is completed, the installation complete screen is displayed. Click **Finish**.



22. The Command Prompt screen is displayed.
When the message "**Press any key to continue...**" appears, press any key.



23. Once the Command Prompt screen closes, the installation is finished.

Note

- If the installation fails due to an error, please contact Silex Technology.

2-2. Updating the Wave Navigator

Update the installed Wave Navigator.

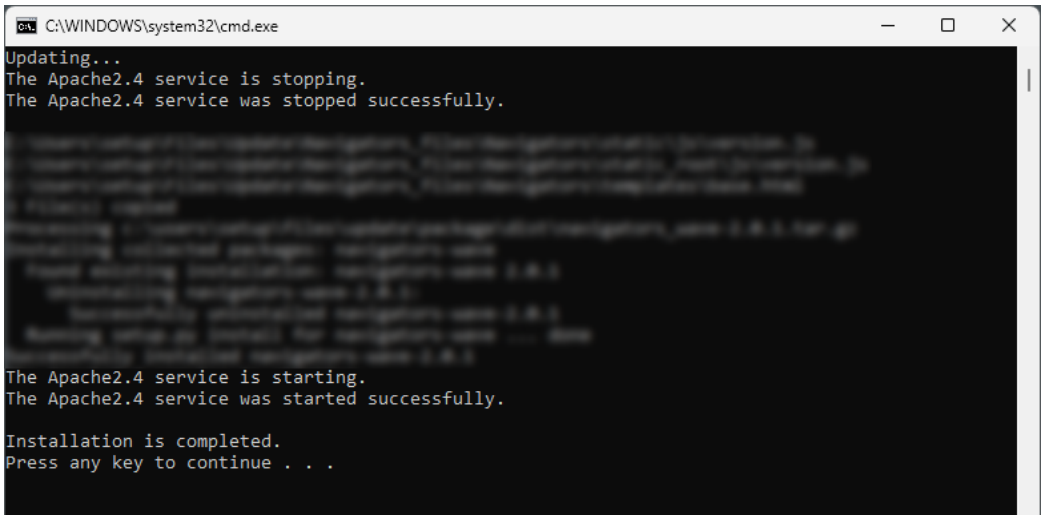
TIP

- To update, first log on as a computer administrator or another user assigned to the Administrators group.

1. Run **Setup.exe** from an installation data folder.

2. If the **User Account Control** screen is displayed, click **Yes**.

3. The Command Prompt screen is displayed.
When the message "**Press any key to continue...**" appears, press any key.



4. Once the Command Prompt screen closes, the update is finished.

Note

- If the update fails due to an error, please contact Silex Technology.

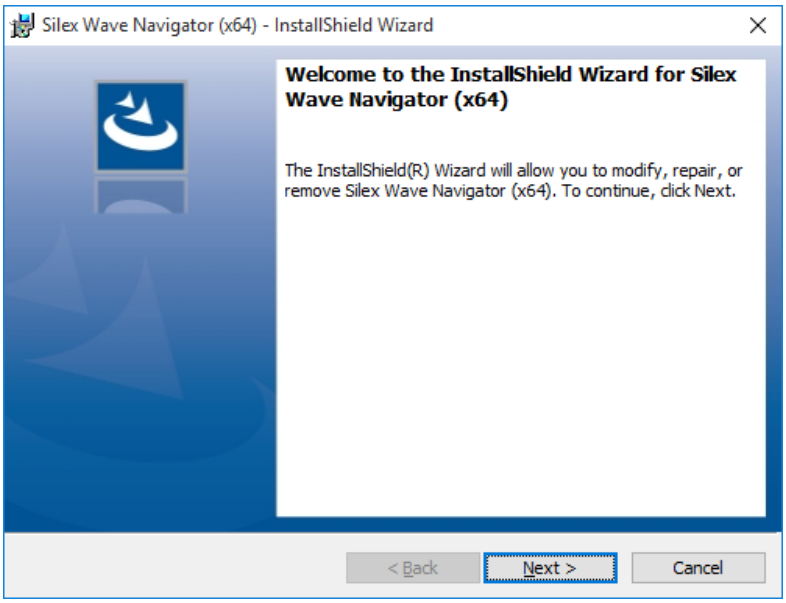
2-3. Uninstalling Wave Navigator

TIP

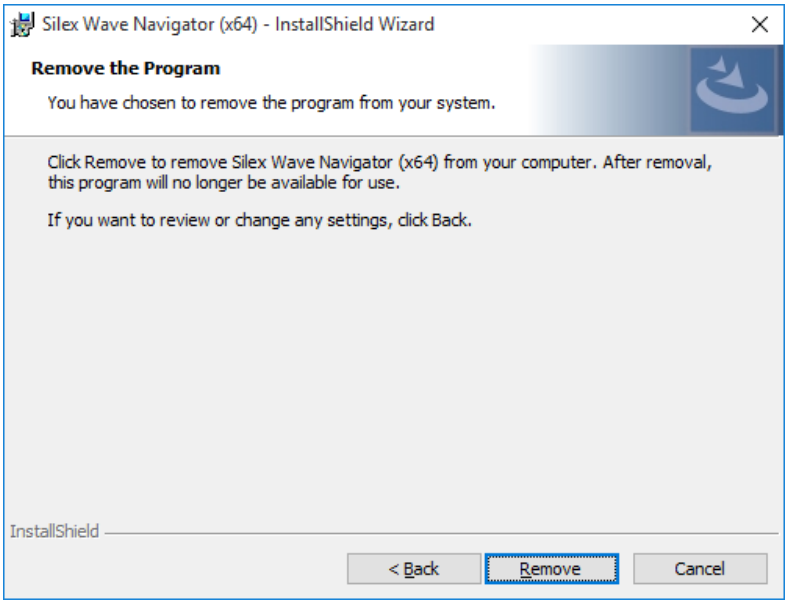
- Uninstall Wave Navigator first, and then uninstall Silex Navigators. If uninstallation is done in a wrong order, the programs may not work correctly after they are reinstalled.
- The uninstallation cannot be executed from **Programs and Features** of **Control Panel**. Follow these steps to uninstall.
- To uninstall, first log on as a computer administrator or another user assigned to the Administrators group.
- Even if Wave Navigator is uninstalled, the following programs are not removed.
  - Apache2.4
  - NGINX
  - InfluxDB

2-3-1. Uninstalling Wave Navigator

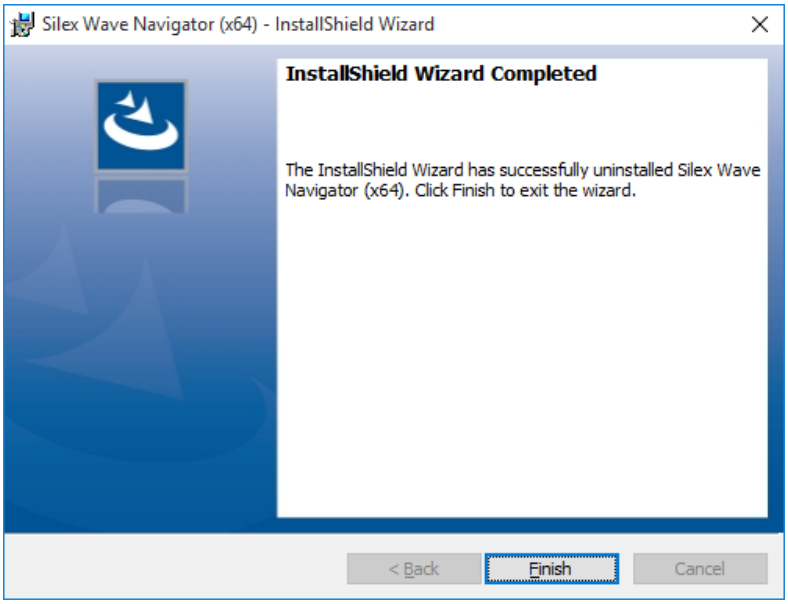
1. Open the **Files** folder from an installation data folder.
2. Run **setup.exe** found in the **WaveNavigator_x.x.x_installer_x.x.x.x** folder. x.x.x and x.x.x.x consist of alphanumerics.
3. If the **User Account Control** screen is displayed, click **Yes**.
4. The Wave Navigator installation wizard screen is displayed. Click **Next**.



5. Click **Remove**.

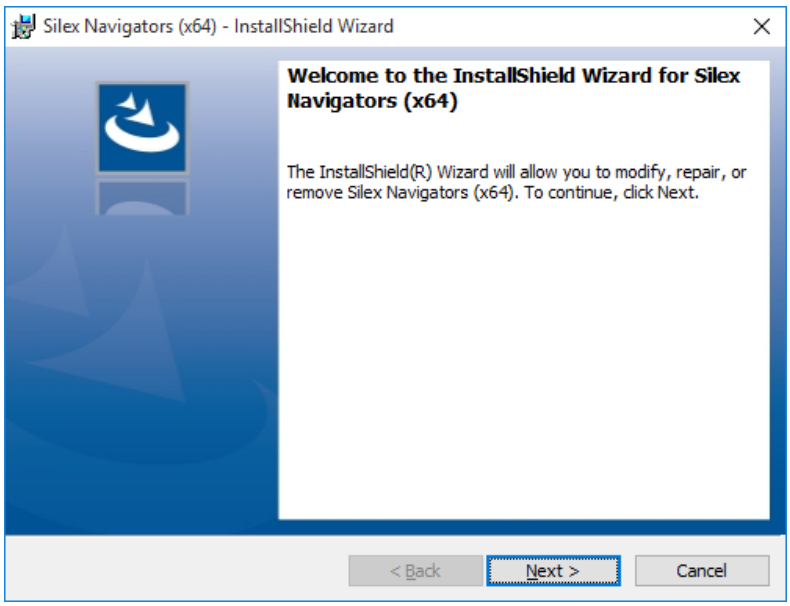


6. When the uninstallation is completed, the installation complete screen is displayed. Click **Finish**.

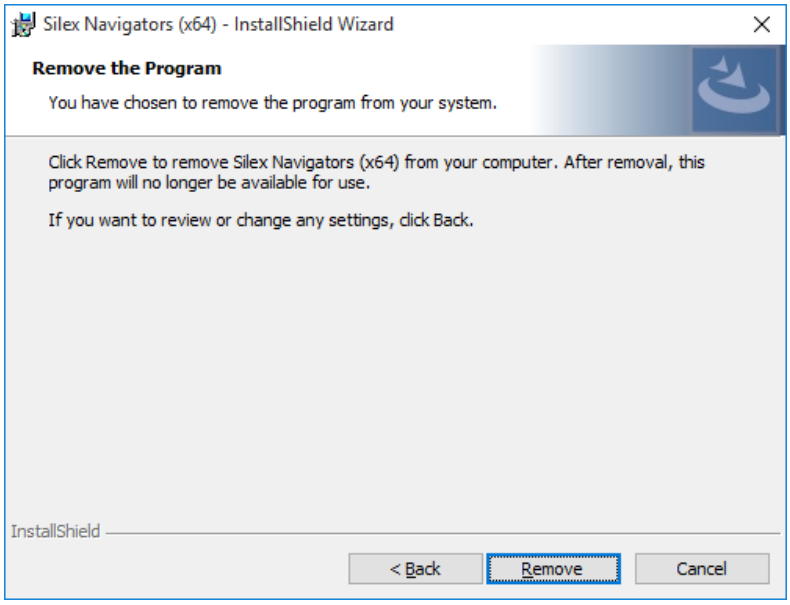


2-3-2. Uninstalling Silex Navigators

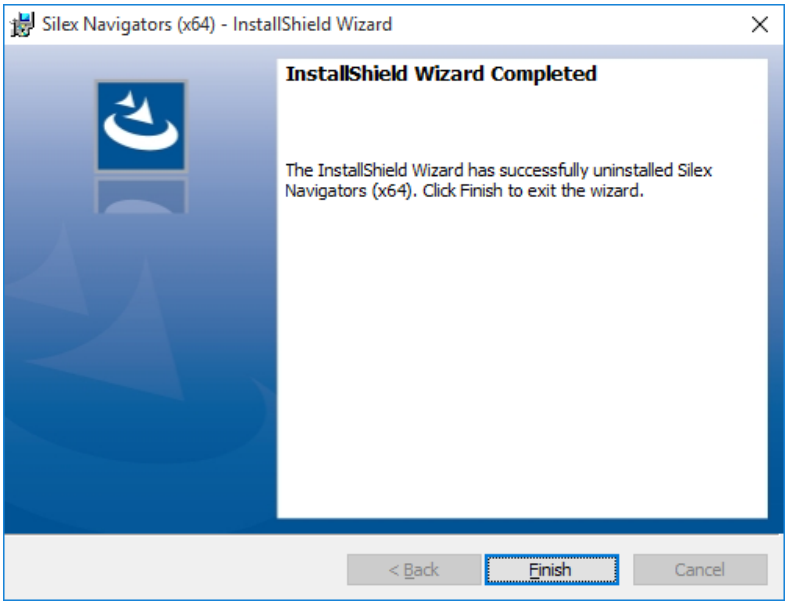
1. Open the **Files** folder from an installation data folder.
2. Run **setup.exe** found in the **Navigators_x.x.x_installer_x.x.x.x** folder.
   x.x.x and x.x.x.x consist of alphanumerics.
3. If the **User Account Control** screen is displayed, click **Yes**.
4. The Silex Navigators installation wizard screen is displayed. Click **Next**.



5. Click **Remove**.



6. When the uninstallation is completed, the installation complete screen is displayed. Click **Finish**.



3. Logging in/out of Wave Navigator

3-1. Logging in

Start the Web browser and access the application software.

TIP

- Only the Google Chrome (hereinafter referred to as "Chrome") Web browser may be used.

1. Start Chrome.

2. Enter the following in the Chrome "address bar".

Enter the IP address of the computer on which Wave Navigator is installed, followed by **:8080**.
(Enter the IP address of the computer on which Wave Navigator is installed in place of "xxx.xxx.xxx.xxx" above.)

3. Press **Enter** on the keyboard.
The activate screen is displayed.

Note

- If the activate screen is not displayed due to an error, please contact Silex Technology.

4. Enter the Activate Key issued by Silex Technology and click **ACTIVATE**.

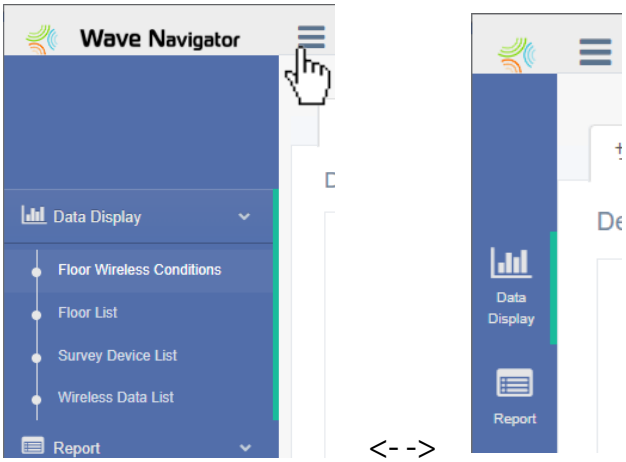
Note

- When the activate key has already been set, the activate screen is not displayed.

5. The login screen is displayed.
Enter your user ID and password, and then click **LOGIN**.

- The user ID and password must be registered ahead of time. (See **7-4. User Management**)
- Characters will be shown as "·" as you enter the password.
- The following users are registered by default. Login as an "admin user" to login with administrator privileges.
  General user: User ID "user" and password "user"
  Admin user: User ID "root" and password "root"

6. The Wave Navigator screen is displayed.



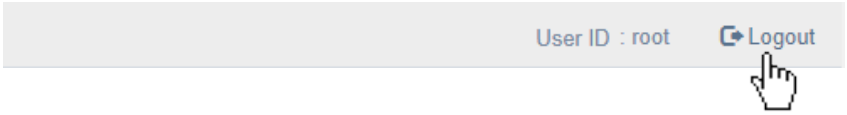
Note

- Click the area next to **Wave Navigator** on the computer screen to hide the side menu. Click again to display it.
- The side menu is not displayed if the Web browser screen is too small (such as when using a tablet). Click the area next to **Wave Navigator** to display it.

3-2. Logging out

This will end access to the application software.

1. Click **Logout** on the upper right of the screen.



2. A confirmation screen is displayed. Click **Yes**.
   You will be returned to the screen prior to logging in.

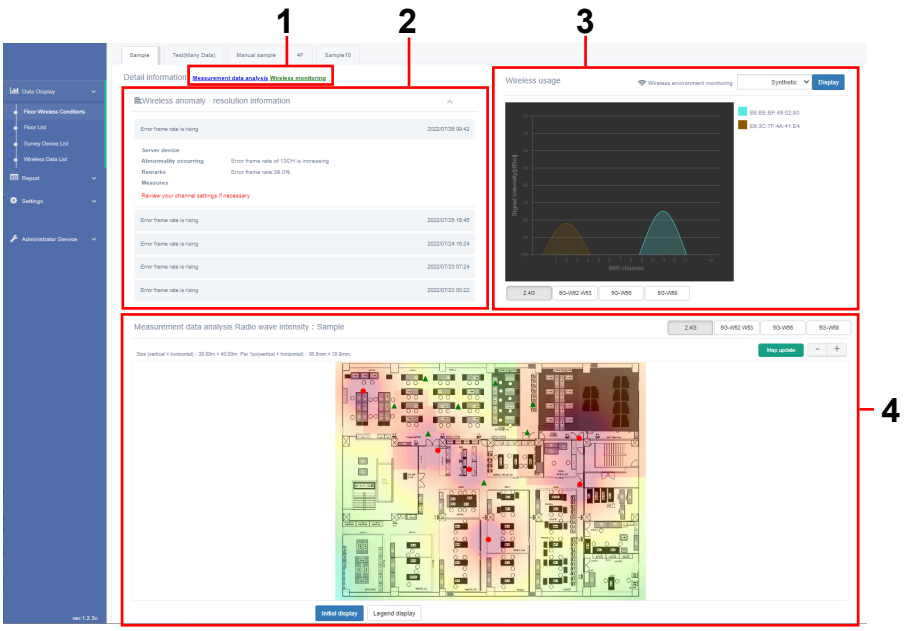
4. Data Display

The wireless data is displayed based on the floor information registered in the analysis settings in advance and the data measured by the survey device.
This section explains how to use the following screens.

- Floor Wireless Conditions
- Floor List
- Survey Device List
- Wireless Data List

4-1. Floor Wireless Conditions

You can check the wireless usage and warning display when an anomaly is detected for each floor. This provides insight into the wireless communication status and the overview of the wireless environment for each floor. The data is refreshed every five minutes.



No.	Item	Description	Default
1	Measurement data analysis Wireless monitoring	**Measurement data analysis** Click to display the measurement data analysis screen. (See **4-2-1. Checking the Measurement Data Analysis Result**) You cannot click if the survey measurement data is not registered in **Wireless device register** in **Settings**. (See **Survey measurement** in **6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**) **Wireless monitoring** Click to display the wireless communication analysis screen for the floor. (See **4-2-2. Checking the Wireless Monitoring Result**) You cannot click if the survey device is not registered in **Wireless device register** in **Settings**. (See **Wireless device register** in **6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**)	-

No.	Item	Description	Default
2	Wireless anomaly· resolution information	Displays warnings if anomalies are detected in the wireless conditions. Up to five warnings are displayed starting with the most recent. Click a warning description to display the details and measures in collapsible accordion format. The warning display is refreshed during regular analysis of survey data. The shortest interval is 5 minutes. The displayed warning details can be set in **Wireless anomaly · resolution information** in **Settings**. (See **6-3. Wireless Anomaly · Resolution Information Settings**)	-
3	Wireless usage	Graph Displays the radio wave intensity for each bandwidth in the graph, for the wireless device on the floor registered in **Settings**. Click a button for each bandwidth under the graph to display the result for the clicked bandwidth.	2.4G
		Survey device Enables you to filter the display of the survey devices for which the wireless conditions are measured. Select **Synthetic** to synthesize and display the data measured for all the survey devices.	Synthetic
		Wireless device list Lists the SSID or MAC address of the wireless devices to the right of the graph. If the device name is registered in **Wireless device register** in **Settings**, the device name is displayed. (See **Wireless device** in **6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**) Click an SSID, MAC address, or device names to display only the data for the clicked wireless device in the graph.	-

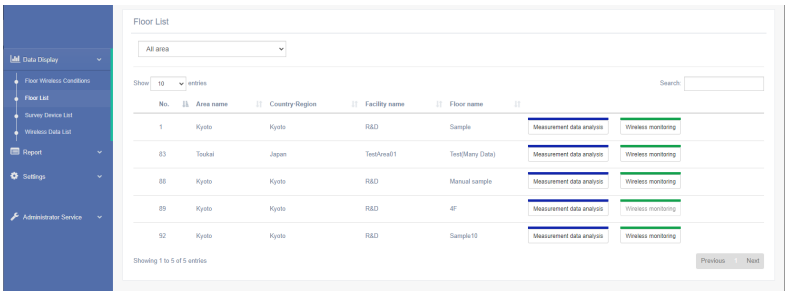
No.	Item	Description	Default
4	Map	Displays data on the floor map for **Floor information** / **Radio wave intensity in Wireless monitoring** or for **Radio wave intensity** in **Measurement data analysis**. The type of data to display can be set in **Floor Register** in **Settings**. (See **Floor wireless conditions display** in **6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**) If the data is for **Radio wave intensity**, wireless band buttons are displayed. Click the button for the wireless band that you want to check. Drag the cursor on the map to move the map. **Map update** Reflects the configured settings on the map. **+ / -** Zooms in/out the map. **Initial display** Resets the map that was moved, zoomed in, or zoomed out to the initial display. **Legend display** Opens a screen that describes the icons displayed on the map.	-

1. Click **Data Display** > **Floor Wireless Conditions**.

2. Select the tab of a floor name you want to display.
   - The wireless conditions of the selected floor are displayed.
   - The displayed floor name tabs depend on the user.
   - Check **Wireless anomaly · resolution information**, wireless communication conditions, or wireless environment as needed.

4-2. Floor List

You can check the list of floors already registered in the analysis settings.
Click **Data Display** > **Floor List**. The list of registered floors is displayed.

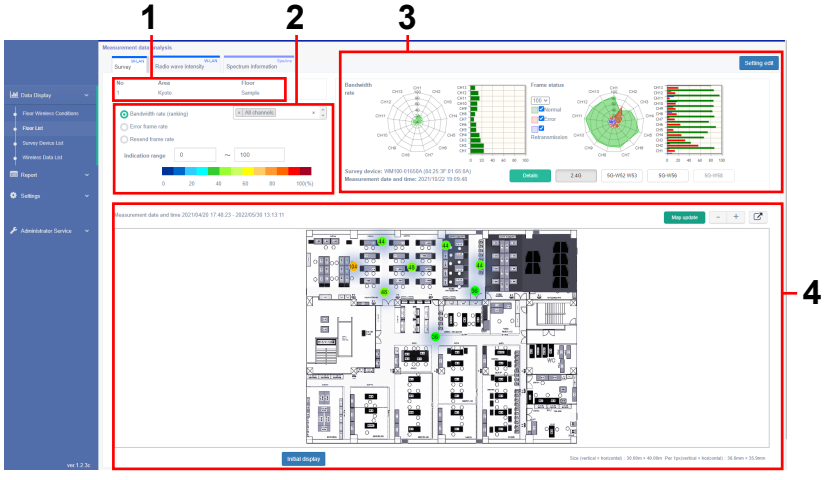


The following items are displayed here. Click ⇅ to change how these items are sorted. ⇅ is displayed for items currently used for the ascending order and ⇅ is displayed for items used for the descending order.

- No. (floor number)
- Area name
- Country·Region
- Facility name
- Floor name
- Measurement data analysis result
  (Click **Measurement data analysis** to display. You cannot click this button if the survey data is not registered in **Wireless device register** in **Settings**.)
- Wireless monitoring result
  (Click **Wireless monitoring** to display. You cannot click this button if the survey device is not registered in **Wireless device register** in **Settings**.)

4-2-1. Checking the Measurement Data Analysis Result

You can check the analysis result of the data measured by survey devices. This allows you to check the wireless communication conditions and wireless environment for each category.



No.	Item	Description
1	Floor name	Displays the floor number, area name, and floor name.
2	Map settings	Display the menu items for setting the map type, indication range, etc. The displayed content depends on the category.
3	Machine information graph	Displays the list of devices registered for the floor, the graph for wireless data, etc. The displayed content depends on the category. **Setting edit** Opens the **Survey measurement** screen in **Settings**. (See **Survey measurement** in **6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**) This button is only displayed when you are logged in as the admin user.
4	Map	Displays the information for the wireless devices and survey devices on the map. The measurement date and time range is displayed on the upper left of the map. The latest and oldest measurement dates and times are displayed. If there is no valid measurement data, the measurement date and time field shows **No valid measurement data**. The size and scale are displayed on the lower right of the map. Drag the cursor on the map to move the map. **Map update** Reflects the configured settings on the map. **+ / -** Zooms in/out the map.  Click this button to open only the map in another tab. This enables you to check the map image on a larger screen. This button is displayed on the **Survey**, **Radio wave intensity,** and **Spectrum analysis** tabs. **Initial display** Resets the map that was moved, zoomed in, or zoomed out to the initial display.

1. Click **Data Display** > **Floor List**.

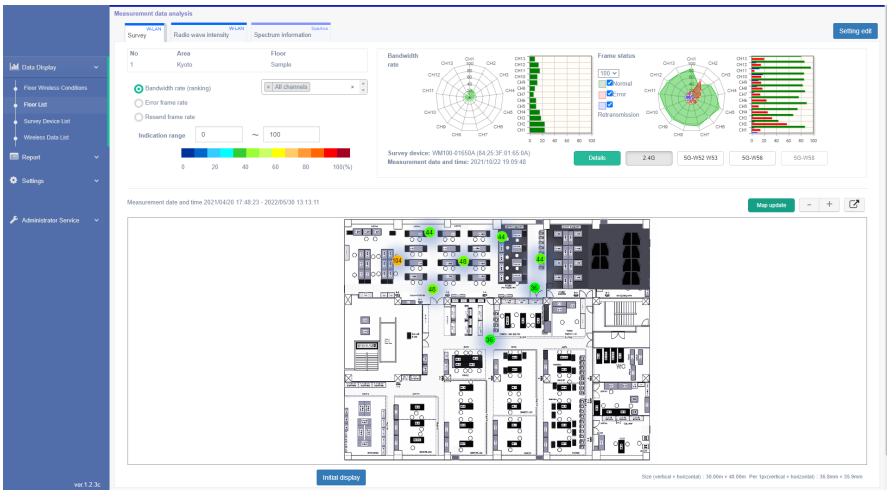
2. Select an area you want to display from the area list.
   - The list of floors registered in the selected area is displayed.
   - The area names displayed in the area list depend on the user.
   - Selecting **All area** displays the list of floors registered in all the areas that the user can view.

3. Click **Measurement data analysis** for the floor you want to check.
   The measurement data analysis screen is displayed.

Checking the Survey Data

From the measurement data analysis result, you can check the bandwidth rate (ranking), error frame rate, or resend frame rate for the specified channel in a heat map. For the map for the error frame rate or resend frame rate, you can also display a graph that shows the bandwidth rate and frame status for the data measured by the survey device in the location.

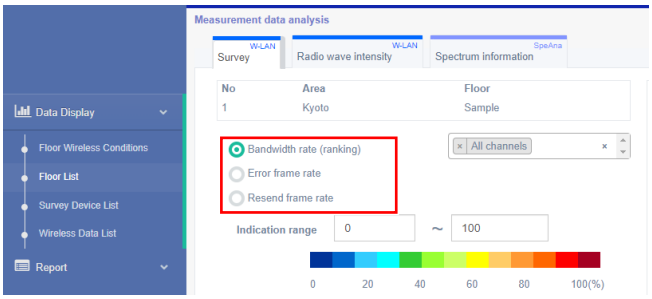
- Bandwidth rate (ranking):
  Displays the channel with the lowest bandwidth rate among the specified channels by using colors. Also, the number of the channel with the lowest bandwidth rate is displayed on the icon. The icon color is different for each channel. The three channels with the lowest usage and their usage rates can also be checked for each measurement point.
- Error frame rate:
  Displays the channel with the highest error frame rate among the specified channels for each measurement point by using colors.
- Resend frame rate:
  Displays the channel with the highest resend frame rate among the specified channels for each measurement point by using colors.



1. Display the measurement data analysis screen for the floor you want to check. (See **4-2-1. Checking the Measurement Data Analysis Result**)

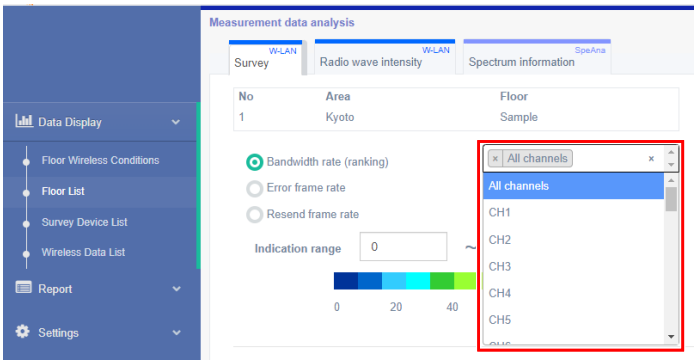
2. Click the **Survey** tab.

3. Click **Bandwidth rate (ranking)**, **Error frame rate**, or **Resend frame rate**.



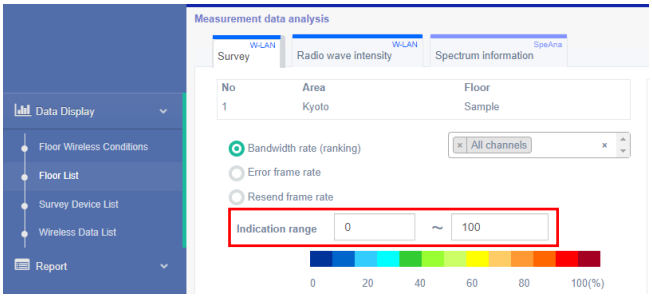
Bandwidth rate (ranking) is selected by default.

4. Select the channels you want to check.



- You can select multiple channels. For the range of channels that can be selected for each bandwidth, refer to **Channels** in **4-4-2. Checking the Survey Data (Device Information)**. (Default: All channels)
- Click "x" to clear the selected channels.

5. For **Indication range**, set the range to be displayed in the heat map.

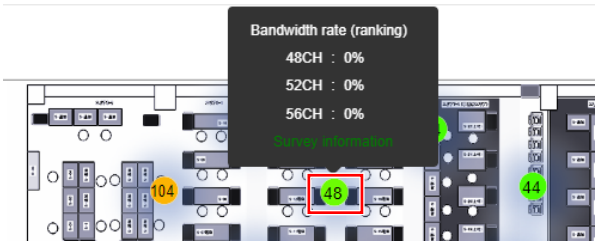


Set the indication range between 0 and 100%. (Default: 0-100%)

6. Click **Map update**.

- The heat map is displayed with the configured settings.
- If you selected **Bandwidth rate (ranking)** in step 3, proceed to step 7.
- If you selected **Error frame rate** or **Resend frame rate** in step 3, proceed to step 8.

7. Move the cursor over the icon for the measurement point you want to check on the floor map, and check the details.



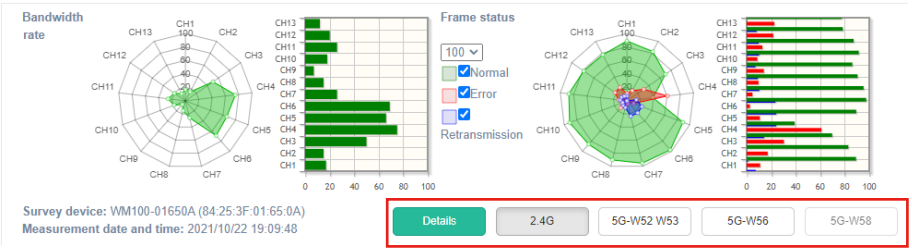
- The three channels with the lowest usage among the data measured by the survey device at the point and their usage rates are displayed.
- If there is no measurement data for the set channels, the lowest bandwidth rate ranking is not displayed.
- If there is measurement data, **Survey information** is displayed. Click **Survey information** to display the bandwidth rate and frame status for the data measured by the survey device at the point in a graph. If you clicked **Survey information**, proceed to step 9. If there is no measurement data, **Survey information** is not displayed. If there is no measurement data, there are no further steps.

8. Move the cursor over the icon for the survey device you want to check on the floor map and click **Survey information**.

The bandwidth rate and frame status for the data measured by the selected survey device at the point are displayed in a graph.

- Move the cursor over an icon on the floor map to display the measurement ID and the date and time when the data was measured for the ID.
- If there is no measurement data, **Survey information** is not displayed.

9. Click the button for the wireless band you want to check, and view the result.



- You can select the wireless band from **2.4G**, **5G-W52 W53**, **5G-W56**, and **5G-W58**.
- Click **Details** to display the survey result details screen. (See **4-4-1. Checking the Survey Data (Bandwidth Information)**)
- Change the number under **Frame status** to change the graph scale.
- Uncheck **Normal**, **Error**, or **Retransmission** to display only the checked frame statuses. For details on the frame status, refer to **Frame status** in **4-4-1. Checking the Survey Data (Bandwidth Information)**.

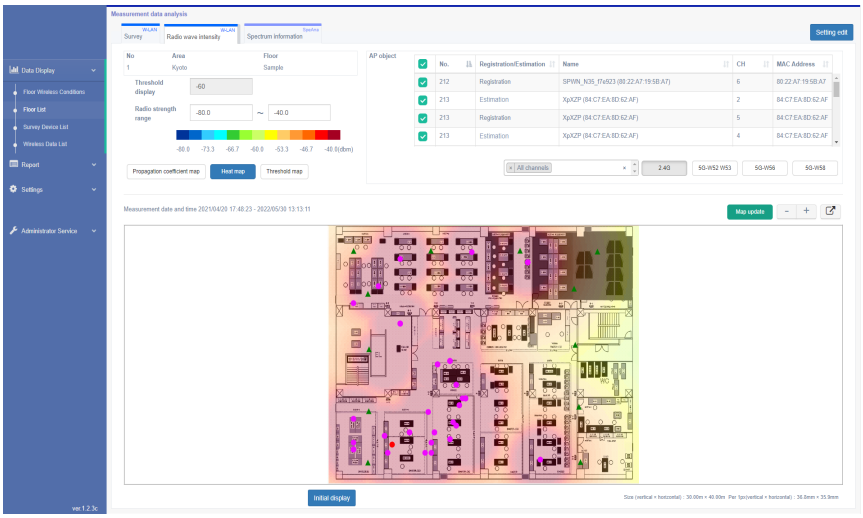
Checking the Radio Wave Intensity

From the measurement data analysis result, you can check the wireless coverage of wireless devices for each channel in the heat map or threshold map for the radio wave intensity. You can also check how well radio waves propagate in the space on the propagation coefficient map.

- Propagation coefficient map:
  Displays the space propagation coefficients with colors.
- Heat map:
  Displays the radio wave intensity of the target wireless device with colors. You can set the radio wave intensity range you want to display. Set the radio wave intensity between -120.0 and -40.0 dbm. (Default: -80.0 to -40.0 dbm)
- Threshold map:
  Displays only the data with a radio wave intensity equal to or higher than the one that is set in Threshold display. Set the threshold between -120 and -40 dbm. (Default: -60 dbm)

In the list of AP objects on the upper right of the screen, you can also check the information about the wireless devices registered to the floor as well as the wireless devices whose existence and location were estimated based on the measurement data analysis result.
To display the estimated wireless devices, the following three conditions must be met.

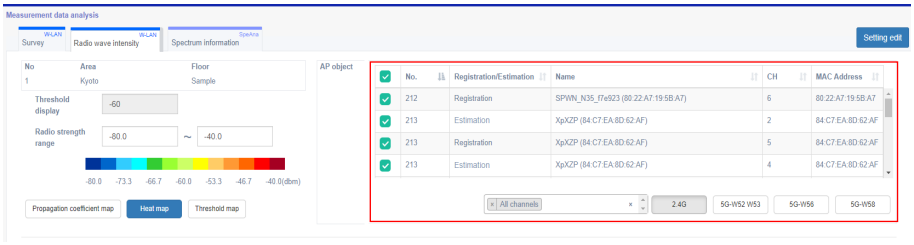
- Three or more locations have been pre-surveyed on the floor.
- One or more wireless devices are registered to the floor.
- Estimated wireless devices are placed inside the measurement location for pre-survey.



1. Display the measurement data analysis screen for the floor you want to check. (See **4-2-1. Checking the Measurement Data Analysis Result**)

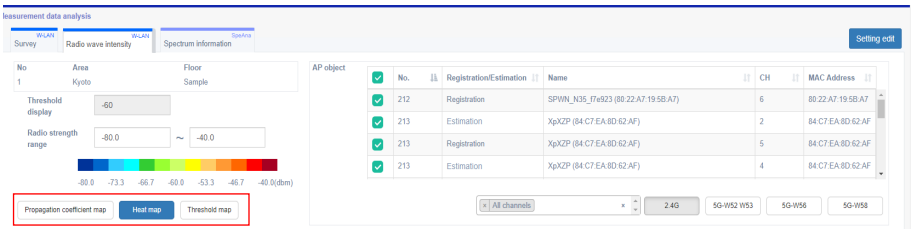
2. Click the **Radio wave intensity** tab.

3. Click the button for the wireless band you want to check, and check the devices you want to check.



- You can select the wireless band from **2.4G**, **5G-W52 W53**, **5G-W56**, and **5G-W58**.
- Uncheck the checkbox to the left of **No.** unchecks all devices.
- You can also select all the devices that communicate at specified channels by selecting the channels you want to check in the channel specification box under the AP object list. For how to select channels in the channel specification box, refer to step 3 in **Checking the Spectrum Information**.
- Click ▯ to change how these items are sorted. ▯ is displayed for items currently used for the ascending order and ▯ is displayed for items used for the descending order.

4. Click **Propagation coefficient map**, **Heat map**, or **Threshold map**.



If you selected **Propagation coefficient map**, proceed to step 6.

5. Set the threshold display and radio strength range.
If you selected **Heat map** in step 4, set only the radio strength range.

6. Click **Map update**.

- The propagation coefficient map, heat map, or threshold map is displayed with the configured settings.
- If you checked multiple devices in step 3, the result with the strongest radio wave intensity is displayed.
- Move the cursor over ● on the floor map to display the MAC address of the wireless device registered in **Wireless device** (**6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**). If the SSID was detected with the survey, the SSID information is also displayed. If there are wireless devices estimated based on the measurement data analysis result, move the cursor over ● to display the MAC address of the estimated wireless device. If the SSID was detected with the survey, the SSID information is also displayed. Move the cursor over ▲ to display the name of the survey device registered in **Survey measurement** (**6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**) and the measurement date and time of the measurement data.
- Move the cursor over a location other than icons on the floor map to display the radio wave intensity at that location.

Checking the Spectrum Information

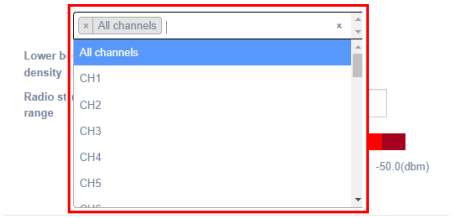
From the measurement data analysis result, you can check the spectral density data of wireless devices for each channel on the floor map. This allows you to check for noise sources that may affect the wireless communication. On the map display, the highest radio wave intensity value that is higher than the set **Lower bound density** is displayed with colors. You can also display the spectral density graph for a survey device specified on the floor map. You cannot click this tab if no wireless survey devices are registered in **Settings** or if there is no data for analysis.

- Lower bound density:
  The lower bound of the spectral density you want to display on the map. Set the lower bound density between 0 and 30%. (Default: 10%)
- Radio strength range:
  The wave intensity range you want to display on the map. Set the radio wave intensity between -120.0 and -40.0 dbm. (Default: -90.0 to -50.0 dbm)

1. Display the measurement data analysis screen for the floor you want to check. (See **4-2-1. Checking the Measurement Data Analysis Result**)

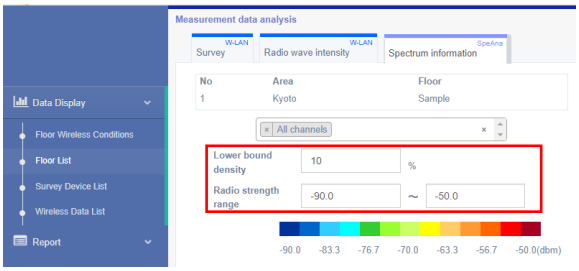
2. Click the **Spectrum information** tab.

3. Select the channels you want to check.



  - You can select multiple channels. For the range of channels that can be selected for each bandwidth, refer to **Channels** in **4-4-2. Checking the Survey Data (Device Information)**. (Default: All channels)
  - Click "×" to clear the selected channels.

4. Set **Lower bound density** and **Radio strength range**.

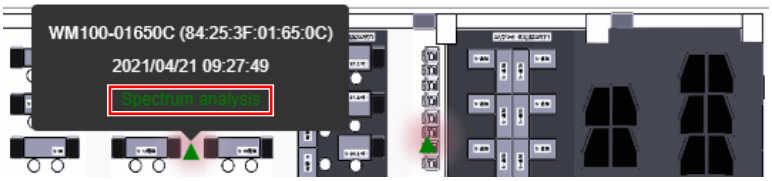


5. Click **Map update**.

The spectral density strength for the selected channel is displayed with colors on the floor map.

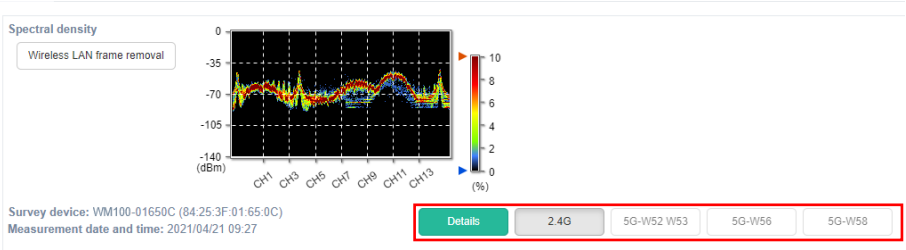
6. Move the cursor over the icon for the survey device you want to check on the floor map and click **Spectrum analysis**.

The spectral density for the selected survey device is displayed on the graph.



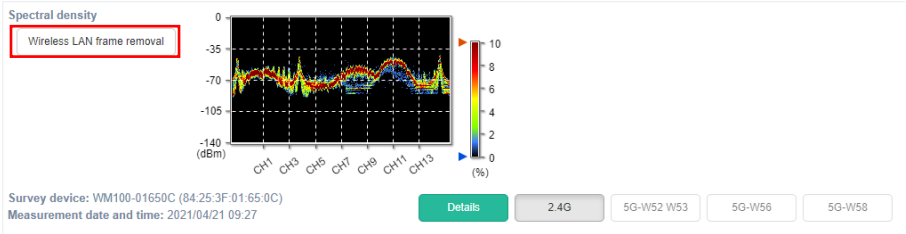
- Move the cursor over an icon on the floor map to display the name of the survey device registered in **Survey measurement** (**6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**) and the measurement date and time of the measurement data.
- If there is no measurement data, **Spectrum analysis** is not displayed.

7. Click the button for the band you want to check.



- Double-click on the graph to display or hide the scale marks.
- Operate the side bar right to the graph to filter the display by density.
- You can select the wireless band from **2.4G**, **5G-W52 W53**, **5G-W56**, and **5G-W58**.
- Click **Details** to display the spectrum result details screen. (See **4-4-3. Checking the Spectrum Data (Spectrum)**)

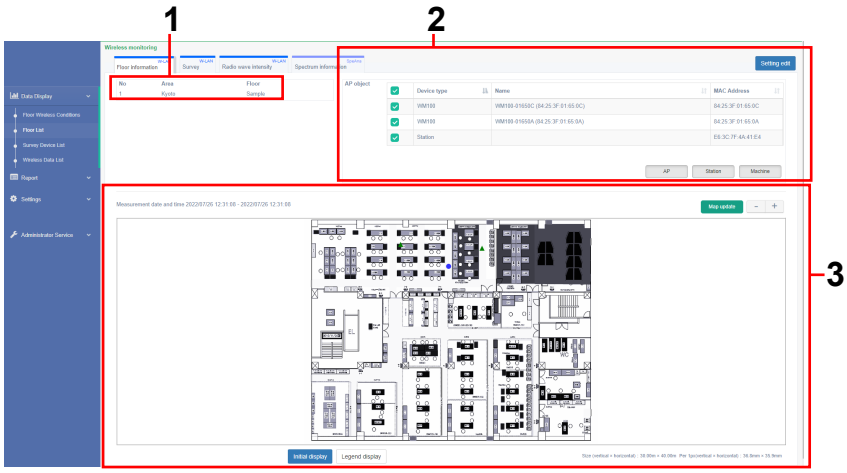
8. Click **Wireless LAN frame removal** to remove wireless LAN frames.



- If you click **Wireless LAN frame removal**, the graph shows the result after removing wireless LAN frames. Click this button to check for noise sources that may affect the wireless communication.
- The result changes each time you click **Wireless LAN frame removal**.
- If there is no survey data measured at the same time as the spectrum data by the survey device, you cannot remove wireless LAN frames.

4-2-2. Checking the Wireless Monitoring Result

You can check the analysis result of the data measured by survey devices on a regular basis. You can check the wireless communication conditions and wireless environment for each category, which provides more details than **Floor Wireless Conditions**.



No.	Item	Description
1	Floor name	Displays the floor number, area name, and floor name.
2	Machine information graph	Displays the list of devices registered for the floor and the graph for wireless data. The displayed content depends on the category. **Setting edit** Opens the **Wireless device** screen in **Settings**. (See **6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**) This button is only displayed when you are logged in as the admin user.

No.	Item	Description
3	Map	Displays the information for the wireless devices and survey devices on the map. The measurement date and time range is displayed on the upper left of the map. The latest and oldest measurement dates and times are displayed. The time difference is within an hour. If there is no valid measurement data, the measurement date and time field shows **No valid measurement data**. The size and scale are displayed on the lower right of the map. Drag the cursor on the map to move the map. **Map update** Reflects the configured settings on the map. **+ / -** Zooms in/out the map.  Click this button to open only the map in another tab. This enables you to check the map image on a larger screen. This button is displayed on the **Survey**, **Radio wave intensity,** and **Spectrum analysis** tabs. **Initial display** Resets the map that was moved, zoomed in, or zoomed out to the initial display. **Legend display** Opens a screen that describes the icons displayed on the map. This is displayed on the map in the **Floor information** tab.

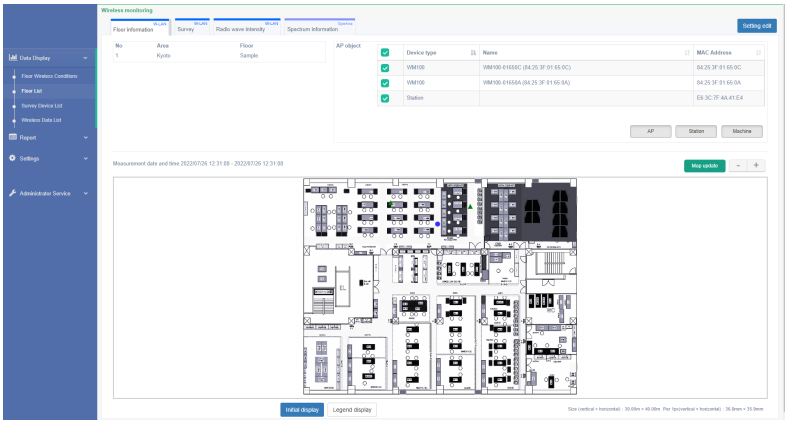
1. Click **Data Display** > **Floor List**.

2. Select an area you want to display from the area list.
   - The list of floors registered in the selected area is displayed.
   - The area names displayed in the area list depend on the user.
   - Selecting **All area** displays the list of floors registered in all the areas that the user can view.

3. Click **Wireless monitoring** for the floor you want to check.
   The floor details screen is displayed.

Checking the Floor Information

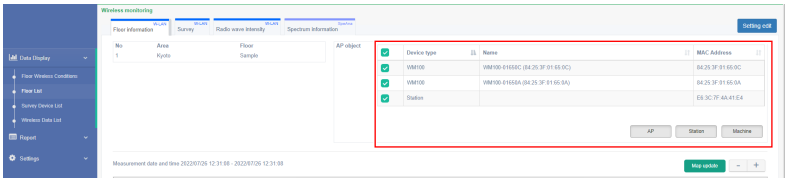
You can check the communication status and placement status of wireless devices on the floor map.



1. Display the wireless monitoring screen for the floor you want to check. (See **4-2-2. Checking the Wireless Monitoring Result**)

2. Click the **Floor information** tab.

3. Select the devices you want to check from the AP object list.



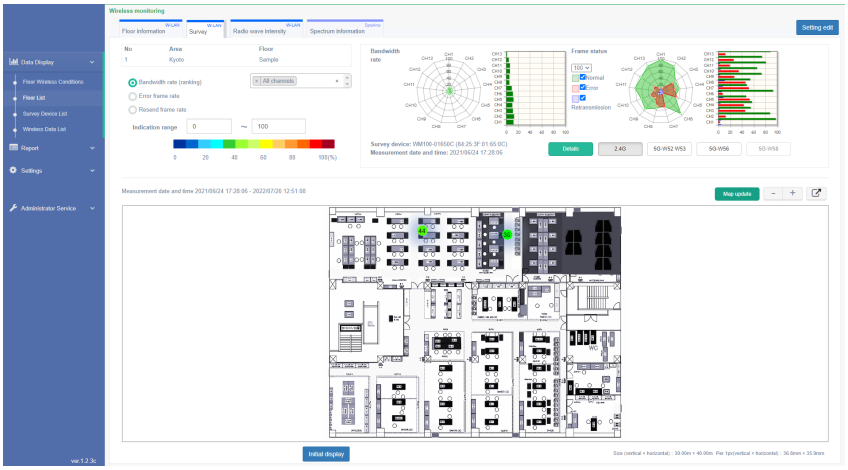
- Uncheck the checkbox to the left of **Device type** to uncheck all devices.
- Click to change how these items are sorted. is displayed for items currently used for the ascending order and is displayed for items used for the descending order.
- Each time you press **AP**, **Station**, or **Machine**, the clicked devices are displayed or hidden.

4. Click **Map update**.
   - The information about the selected devices is displayed on the floor map.
   - Move the cursor over an icon on the floor map to display the MAC address of the target device and the MAC address of the device with which it is communicating. If the SSID was detected with the survey, the SSID information is also displayed. The circumference of the icon for the device with which the device under the cursor is communicating blinks.

Checking the Survey Data on Floor Map

You can check the bandwidth rate (ranking), error frame rate, or resend frame rate for the specified channel on the floor map. For the map for the error frame rate or resend frame rate, you can also display a graph that shows the latest bandwidth rate or frame status measured by the survey device. You cannot click this tab if no survey devices are registered in **Settings** or if there is no data for analysis.

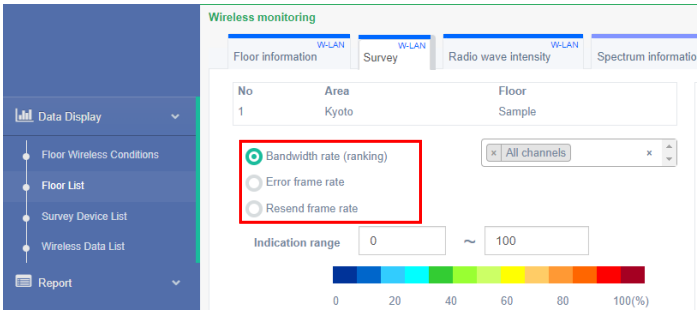
- Bandwidth rate (ranking):
  Displays the channel with the lowest bandwidth rate among the specified channels by using colors. Also, the number of the channel with the lowest bandwidth rate is displayed on the icon. The icon color is different for each channel. The three channels with the lowest usage and their usage rates can also be checked for each measurement point.
- Error frame rate:
  Displays the channel with the highest error frame rate among the specified channels for each measurement point by using colors.
- Resend frame rate:
  Displays the channel with the highest resend frame rate among the specified channels for each measurement point by using colors.



1. Display the wireless monitoring screen for the floor you want to check. (See **4-2-2. Checking the Wireless Monitoring Result**)

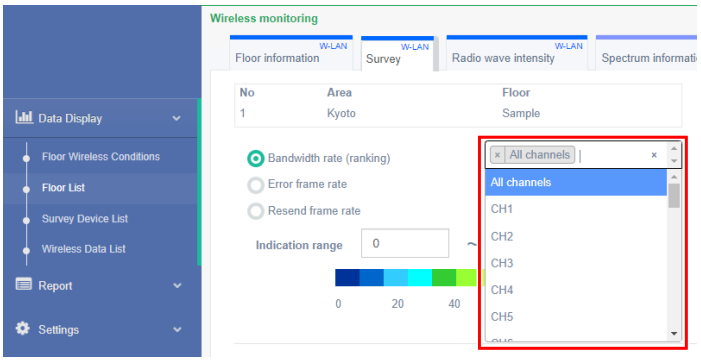
2. Click the **Survey** tab.

3. Click **Bandwidth rate (ranking)**, **Error frame rate**, or **Resend frame rate**.



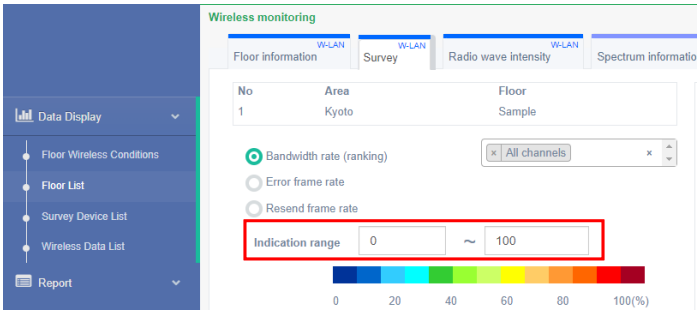
Bandwidth rate (ranking) is selected by default.

4. Select the channels you want to check.



- You can select multiple channels. For the range of channels that can be selected for each bandwidth, refer to **Channels** in **4-4-2. Checking the Survey Data (Device Information)**. (Default: All channels)
- Click "×" to clear the selected channels.

5. For **Indication range**, set the range to be displayed in the heat map.

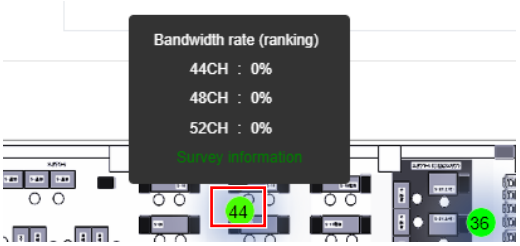


Set the indication range between 0 and 100%. (Default: 0-100%)

6. Click **Map update**.

- The heat map is displayed with the configured settings.
- If you selected **Bandwidth rate (ranking)** in step 3, proceed to step 7.
- If you selected **Error frame rate** or **Resend frame rate** in step 3, proceed to step 8.

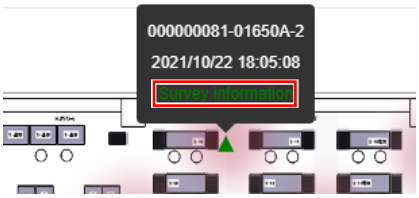
7. Move the cursor over the icon for the measurement point you want to check on the floor map, and check the details.



- The three channels with the lowest usage among the latest data measured at the selected point and their usage rates are displayed.
- If there is no measurement data for the set channels, the lowest bandwidth rate ranking is not displayed.
- If there is measurement data, **Survey information** is displayed. Click **Survey information** to display the bandwidth rate and frame status for the data measured by the survey device at the point in a graph. If you clicked **Survey information**, proceed to step 9. If there is no measurement data, **Survey information** is not displayed. If there is no measurement data, there are no further steps.

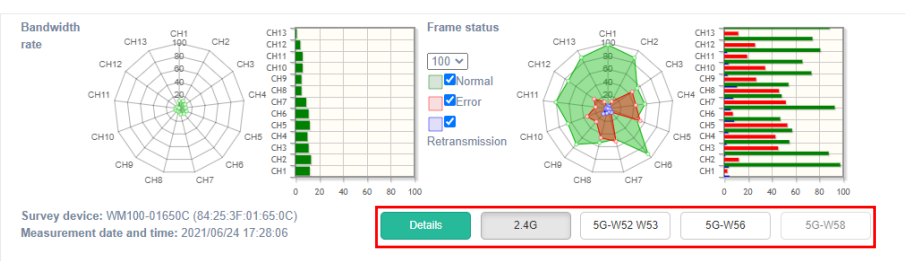
8. Move the cursor over the icon for the survey device you want to check on the floor map and click **Survey information**.

The bandwidth rate and frame status for the latest data measured by the selected survey device are displayed in a graph.



- Move the cursor over an icon on the floor map to display the name of the survey device registered in **Wireless device** (**6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**) and the latest measurement date and time.
- If there is no measurement data, **Survey information** is not displayed.

9. Click the button for the wireless band you want to check, and view the result.



- You can select the wireless band from **2.4G**, **5G-W52 W53**, **5G-W56**, and **5G-W58**.
- Click **Details** to display the survey result details screen. (See **4-4-1. Checking the Survey Data (Bandwidth Information)**)
- Change the number under **Frame status** to change the graph scale.
- Uncheck **Normal**, **Error**, or **Retransmission** to display only the checked frame statuses. For details on the frame status, refer to **Frame status** in **4-4-1. Checking the Survey Data (Bandwidth Information)**.

Checking the Radio Wave Intensity of Wireless Devices

You can check the wireless coverage of wireless devices placed on the floor for each channel in the heat map or threshold map for the radio wave intensity. You cannot click this tab if no wireless survey devices are registered in **Settings** or if there is no data for analysis.

- Heat map:
  Displays the radio wave intensity of the target wireless device with colors. You can set the radio wave intensity range you want to display. Set the radio wave intensity between -120.0 and -40.0 dbm. (Default: -80.0 to -40.0 dbm)
- Threshold map:
  Displays only the data with a radio wave intensity equal to or higher than the one that is set in **Threshold display**. Set the threshold between -120 and -40 dbm. (Default: -60 dbm)

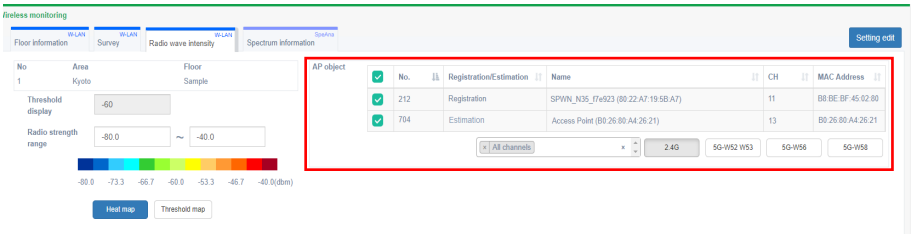
In the list of AP objects on the upper right of the screen, you can also check the information about the wireless devices registered to the floor as well as the wireless devices whose existence and location were estimated based on the measurement data analysis result.
To display the estimated wireless devices, the following three conditions must be met.

- Three or more locations have been pre-surveyed on the floor.
- One or more wireless devices are registered to the floor.
- Estimated wireless devices are placed inside the measurement location for pre-survey.

1. Display the wireless monitoring screen for the floor you want to check. (See **4-2-2. Checking the Wireless Monitoring Result**)

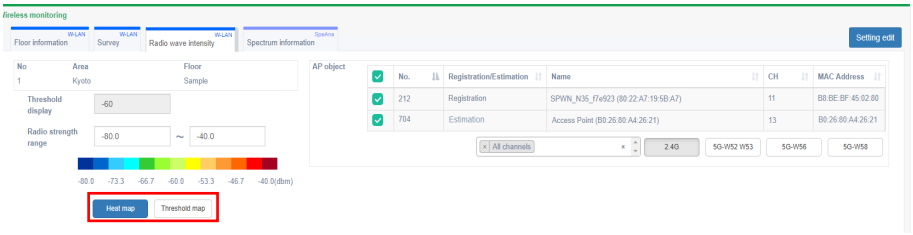
2. Click the **Radio wave intensity** tab.

3. Click the button for the wireless band you want to check, and check the devices you want to check from the list of displayed devices.



- You can select the wireless band from **2.4G**, **5G-W52 W53**, **5G-W56**, and **5G-W58**.
- Uncheck the checkbox to the left of **No.** unchecks all devices.
- You can also select all the devices that communicate at specified channels by selecting the channels you want to check in the channel specification box under the AP object list. For how to select channels in the channel specification box, refer to step 3 in **Checking the Spectrum Information**.
- Click ▯ to change how these items are sorted. ▯ is displayed for items currently used for the ascending order and ▯ is displayed for items used for the descending order.

4. Click **Heat map** or **Threshold map**.



5. Set the threshold display and radio strength range.
If you selected **Heat map** in step 4, set only the radio strength range.

6. Click **Map update**.

- The heat map or threshold map is displayed with the configured settings.
- Move the cursor over ● on the floor map to display the MAC address of the wireless device registered in **Wireless device** (**6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**). If the SSID was detected with the survey, the SSID information is also displayed. If there are wireless devices estimated based on the measurement data analysis result, move the cursor over to ● display the MAC address of the estimated wireless device. If the SSID was detected with the survey, the SSID information is also displayed. Move the cursor over ▲ to display the name of the survey device registered in **Wireless device** (**6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**) and the latest measurement date and time.
- Move the cursor over a location other than icons on the floor map to display the radio wave intensity at that location.

Checking the Spectrum Information

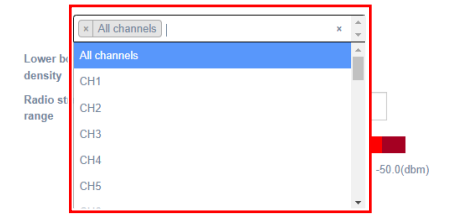
You can check the spectral density data of wireless devices for each channel on the floor map. This allows you to check for noise sources that may affect the wireless communication. On the map display, the highest radio wave intensity value that is higher than the set **Lower bound density** is displayed with colors. You can also display the spectral density graph for a survey device specified on the floor map. You cannot click this tab if no wireless survey devices are registered in **Settings** or if there is no data for analysis.

- Lower bound density:
  The lower bound of the spectral density you want to display on the map. Set the lower bound density between 0 and 30%. (Default: 10%)
- Radio strength range:
  The wave intensity range you want to display on the map. Set the radio wave intensity between -120.0 and -40.0 dbm. (Default: -90.0 to -50.0 dbm)

1. Display the wireless monitoring screen for the floor you want to check. (See **4-2-2. Checking the Wireless Monitoring Result**)

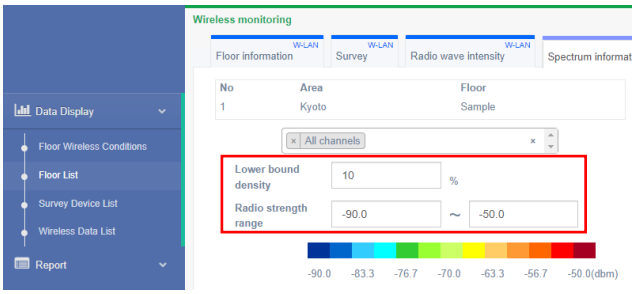
2. Click the **Spectrum information** tab.

3. Select the channels you want to check.



- You can select multiple channels. For the range of channels that can be selected for each bandwidth, refer to **Channels** in **4-4-2. Checking the Survey Data (Device Information)**. (Default: All channels)
- Click "×" to clear the selected channels.

4. Set **Lower bound density** and **Radio strength range**.

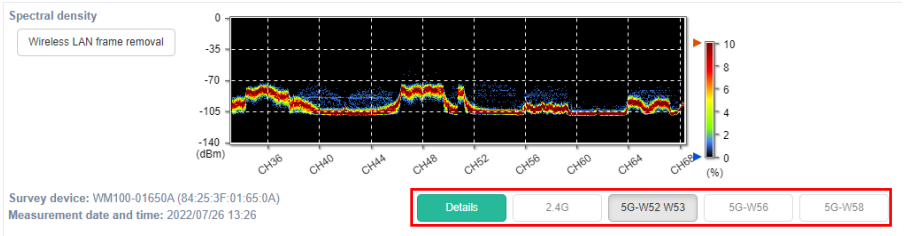


5. Click **Map update**.
The spectral density strength for the selected channel is displayed with colors on the floor map.

6. Move the cursor over the icon for the survey device you want to check on the floor map and click **Spectrum analysis**.
The spectral density for the selected survey device is displayed on the graph.

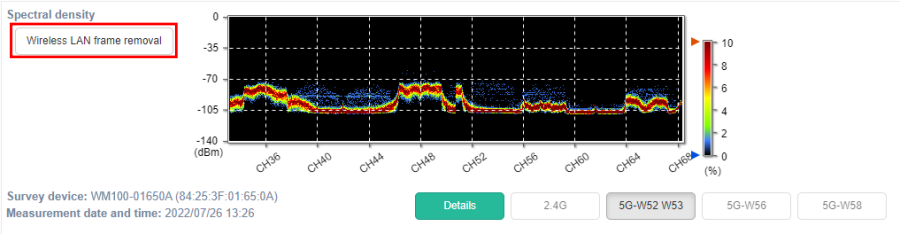
- Move the cursor over an icon on the floor map to display the name of the survey device registered in **Wireless device** (**6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices**) and the latest measurement date and time.
- If there is no measurement data, **Spectrum analysis** is not displayed.

7. Click the button for the band you want to check.



- Double-click on the graph to display or hide the scale marks.
- Operate the side bar right to the graph to filter the display by density.
- You can select the wireless band from **2.4G**, **5G-W52 W53**, **5G-W56**, and **5G-W58**.
- Click **Details** to display the spectrum result details screen. (See **4-4-3. Checking the Spectrum Data (Spectrum)**)

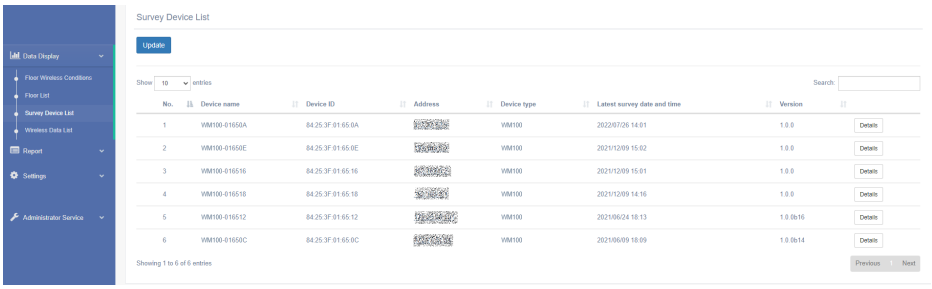
8. Click **Wireless LAN frame removal** to remove wireless LAN frames.



- If you click **Wireless LAN frame removal**, the graph shows the result after removing wireless LAN frames. Click this button to check for noise sources that may affect the wireless communication.
- The result changes each time you click **Wireless LAN frame removal**.
- If there is no survey data measured at the same time as the spectrum data by the survey device, you cannot remove wireless LAN frames.

4-3. Survey Device List

You can check the information about survey devices registered in InfluxDB and check the data measured by survey devices.



The following items are displayed here. Click ⇅ to change how these items are sorted. ⇊ is displayed for items currently used for the ascending order and ⇈ is displayed for items used for the descending order.

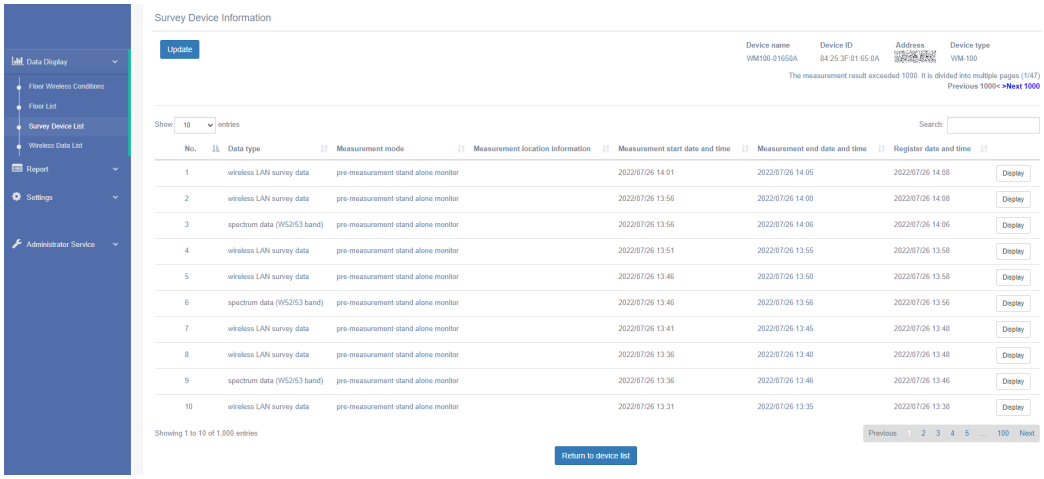
Item	Description
No.	Displays the survey device number.
Device name	Displays the survey device name.
Device ID	Displays the survey device ID.
Address	Displays the survey device IP address. Click to display the survey device setting screen. This field is empty if the IP address is not registered.
Device type	Displays the survey device type.
Latest survey date and time	Displays the latest date and time the data is measured by the survey device.
Version	Displays the survey device version.
Details button	Click this button to display the survey device details screen. (See **4-3-1. Checking the Survey Device Information**)

Entering a partial device name, etc. in the search box displays the matching data.

1. Click **Data Display** > **Survey Device List**.
   The list of the latest survey devices registered in InfluxDB is displayed.
2. To obtain the latest data again, click **Update**.

4-3-1. Checking the Survey Device Information

You can display the list of the measured wireless data for each survey device.



The following items are displayed here. Click ⬚ to change how these items are sorted. ⬚ is displayed for items currently used for the ascending order and ⬚ is displayed for items used for the descending order.

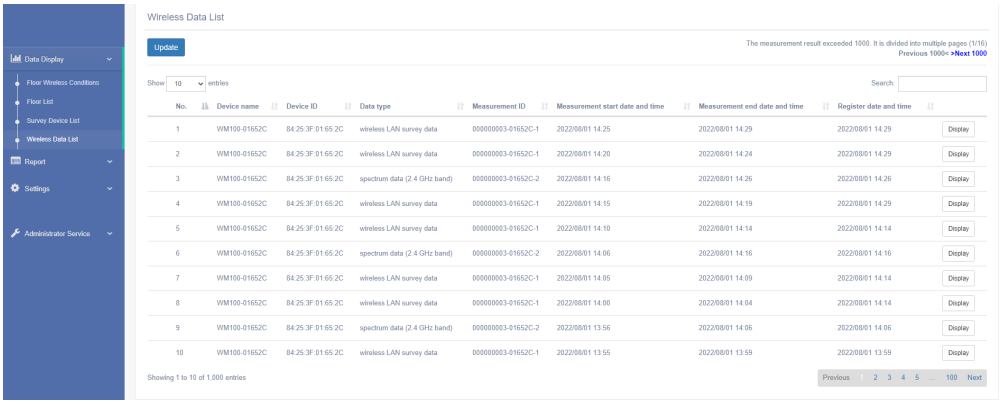
Item	Description
No.	Displays the number that was set when the data was measured by the survey device. This is numbered sequentially in the order of measurement.
Data type	Displays the type of the wireless data measured by the survey device.
Measurement mode	Displays the measurement mode of the survey device when the wireless data was measured.
Measurement location information	Displays the location where the wireless data was measured.
Measurement start date and time	Displays the date and time when the wireless data measurement started.
Measurement end date and time	Displays the date and time when the wireless data measurement ended.
Register date and time	Displays the date and time when the wireless data was registered in InfluxDB.
Display button	Click this button to display the wireless data details screen. This is displayed if the data type is any of the following: - **wireless LAN survey data** (See **4-4-1. Checking the Survey Data (Bandwidth Information)**) - **spectrum data (xx)** (See **4-4-3. Checking the Spectrum Data (Spectrum)**) (xx) represents the bandwidth information.
Download button	Click this button to download the captured wireless data. (See **4-4-5. Downloading Capture Data**) This is displayed if the data type is **wireless capture data**.

Entering a partial data type, etc. in the search box displays the matching data.

1. Click **Data Display** > **Survey Device List**.
   The list of the latest survey devices registered in InfluxDB is displayed.
2. To obtain the latest data again, click **Update**.
3. Click **Details** for the survey device you want to check.
   - The survey device information is displayed.
   - The device name, device ID, address, and device type of the selected survey device are displayed on the upper right of the screen.
   - Click **Return to device list** to return to the **Survey Device List** screen.

4-4. Wireless Data List

You can display the list of the wireless data measured by survey devices. Up to 1,000 latest records of data are displayed. If the data exceeds 1,000 records, click **Previous 1000** or **Next 1000** to display the previous/next 1,000 records of data. If you click **Display** for the wireless data you want to check, the wireless data details are displayed.

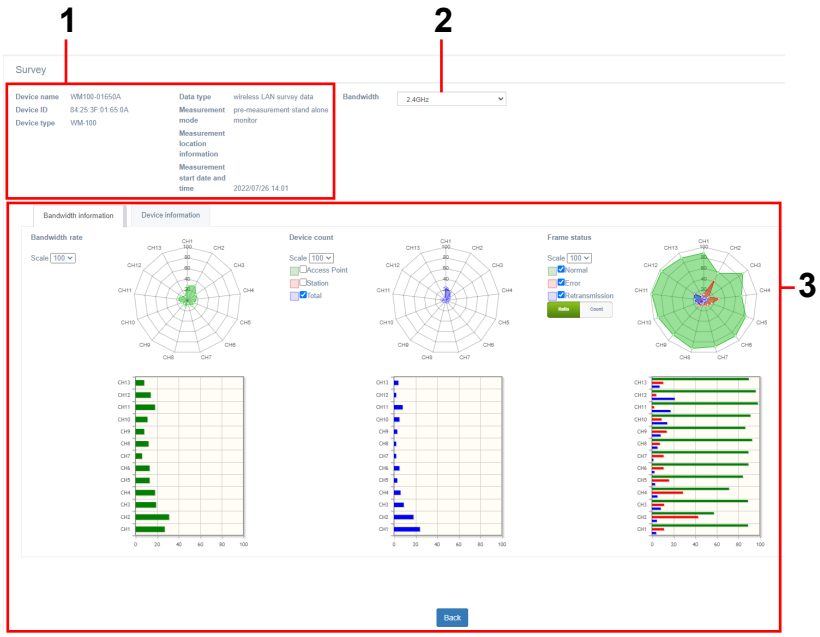


The following items are displayed here. Click ⇅ to change how these items are sorted. ⇊ is displayed for items currently used for the ascending order and ⇈ is displayed for items used for the descending order.

Item	Description
No.	The number that was set when the data was measured by the survey device. This is numbered sequentially in the order of measurement.
Device name	The survey device name.
Device ID	The survey device ID.
Data type	The type of the wireless data measured by the survey device.
Measurement ID	The measurement ID of the wireless data.
Measurement start date and time	The date and time when the wireless data measurement started.
Measurement end date and time	The date and time when the wireless data measurement ended.
Register date and time	The date and time when the wireless data was registered in InfluxDB.
Display button	Click this button to display the wireless data details screen. This is displayed if the data type is any of the following: - **wireless LAN survey data** (See **4-4-1. Checking the Survey Data (Bandwidth Information)**) - **spectrum data (xx)** (See **4-4-3. Checking the Spectrum Data (Spectrum)**) (xx) represents the bandwidth information.
Download button	Click this button to download the captured wireless data. (See **4-4-5. Downloading Capture Data**) This is displayed if the data type is **wireless capture data**.

Entering a partial data type, etc. in the search box displays the matching data.

1. Click **Data display** > **Wireless Data List**.
   The list of the latest wireless data registered in InfluxDB is displayed.
2. To obtain the latest data again, click **Update**.
3. Click **Display** for the data you want to check.
   The wireless data details screen is displayed. For how to check the data for each data type, refer to the following pages.



No.	Item	Description
1	Survey device	Displays the following details: - Device name - Device ID - Device type - Data type - Measurement mode - Measurement location information - Measurement start date and time
2	Bandwidth	This selects the wireless bandwidth. This is displayed if the data type is **wireless LAN survey data**. You can select from the following wireless bandwidths. - 2.4GHz - 5GHzW52-W53 - 5GHzW56 - 5GHzW58
3	Wireless data	Displays the wireless data details. The displayed content depends on the wireless type. **Back** Returns to the Wireless Data List screen.

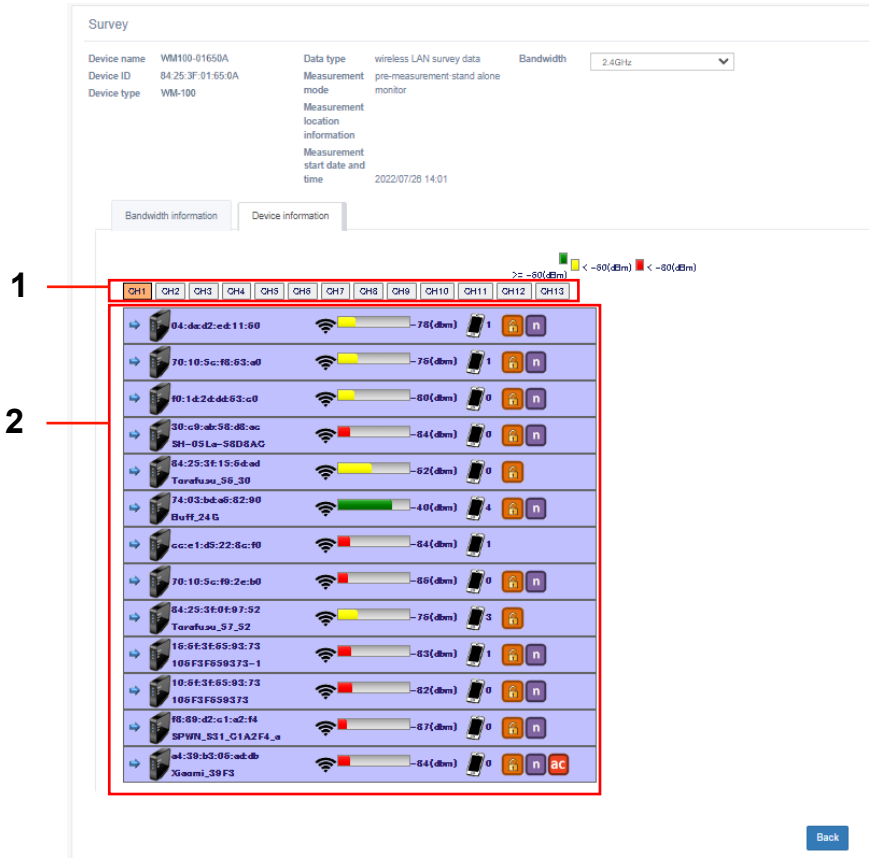
4-4-1. Checking the Survey Data (Bandwidth Information)

This screen is displayed if **Data type** is **wireless LAN survey data** in **Survey Device Information** or **Wireless Data List**.
You can check the bandwidth rate, device count, and frame status for each channel in a graph. You can change the number for **Scale** next to each graph to change the graph scale.

No.	Item	Description
1	Bandwidth rate	Displays the bandwidth rate in a graph.
2	Device count	Displays the number of access points and stations in a graph. Check **Access Point**, **Station**, or **Total** to display the result for the checked devices.
3	Frame status	The frame status groups the communication frames into the **Normal**, **Error,** and **Retransmission** types to show them in a graph. The frame status ratio or count for each channel is displayed in a graph. Check **Normal**, **Error**, or **Retransmission** to display the result for the checked statuses. Click **Ratio** or **Count** to change the graph. **Ratio** shows the calculation results to two decimal places, which may cause the total not to be 100%.

4-4-2. Checking the Survey Data (Device Information)

This screen is displayed if **Data type** is **wireless LAN survey data** in **Survey Device Information** or **Wireless Data List**.
From the survey data, you can check the information about the connected access points and stations for each channel.



No.	Item	Description
1	Channels	Select the channels you want to check. You can select the following range of channels for each bandwidth. 2.4GHz : CH1 to CH13 5GHzW52-W53: CH36, CH40, CH44, CH48, CH52, CH56, CH60, CH64 5GHzW56 : CH100, CH104, CH108, CH112, CH116, CH120, CH124, CH128, CH132, CH136, CH140 5GHzW58 : CH149, CH153, CH157, CH161, CH165
2	Wireless device information	Displays the MAC address, ESSID (SSID), and radio wave intensity of the registered access points for each channel. A green, yellow, or red bar is displayed depending on the radio wave intensity. If stations are connected to an access point, clicking the access point displays the MAC address of the stations. Displays the number of connected stations. This is displayed if the access point is encrypted. Displays the IEEE802.11 standard type. This is not displayed if only the legacy modes (a, b, g) are supported.

4-4-3. Checking the Spectrum Data (Spectrum)

This screen is displayed if **Data type** is **Spectrum data (xx)** in **Survey Device Information or Wireless Data List**. (xx represents the bandwidth information.)
You can check the spectrum information measured by survey devices in a graph. You can inspect noises emitted from devices other than wireless devices to check for radio interference.

No.	Item	Description
1	Spectrum program graph	Displays the radio wave status for each frequency band in a three-dimensional graph that consists of x: frequency, y: time, z: signal strength. Operate the side bar on the right to filter the display by strength.
2	Spectral density graph	Displays the density (%) of the radio wave intensity for each frequency band in a three-dimensional graph that consists of x: frequency, y: signal strength, z: density (occurrence ratio). Operate the side bar on the right to filter the display by density.

Note

- Double-click on the graph to display or hide the scale marks.

4-4-4. Checking the Spectrum Information (Frame Removal)

This screen is displayed if **Data type** is **Spectrum data (xx)** in **Survey Device Information or Wireless Data List**. (xx represents the bandwidth information.)
You can check the spectrum information measured by survey devices in a graph. Click **Wireless LAN frame removal** to display the spectrum information measured by the survey device after removing the wireless LAN frames in the graph.
The result changes each time you click **Wireless LAN frame removal**. If there is no survey data measured at the same time as the spectrum data by the survey device, you cannot click this tab.

No.	Item	Description
1	Wireless LAN frame removal button	The graph result changes each time you click this button. This button is clicked by default.
2	Spectrum program graph	Displays the radio wave status for each frequency band in a three-dimensional graph that consists of, x: frequency, y: time, z: signal strength. Operate the side bar on the right to filter the display by strength.
3	Spectral density graph	Displays the density (%) of the radio wave intensity for each frequency band in a three-dimensional graph that consists of x: frequency, y: signal strength, z: density (occurrence ratio). Operate the side bar on the right to filter the display by density.

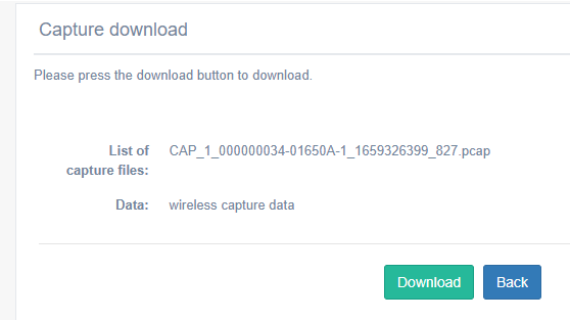
Note

- Double-click on the graph to display or hide the scale marks.

4-4-5. Downloading Capture Data

You can download the wireless capture data measured by the survey device.

1. Click **Data display** > **Wireless Data List**.
   The list of the latest wireless data registered in InfluxDB is displayed.
2. To obtain the latest data again, click **Update**.
3. Click **Download** for the wireless capture data you want to download.
4. Click **Download**.



- The downloaded data is saved under the following folder with Chrome default settings: the Downloads folder (C:\Users\"user_name"\Downloads).
- The capture data is downloaded as a compressed zip file. The file name is **capture_Year/Month/Day/Hour/Minute/Second_.zip**. The date and time shown for the file name is the date and time the download file began being created.
- The extracted capture data has the ".pcap" extension. To view the data, an application that can open this type of files is required.

5. Report

You can specify the date and time and create a wireless warning history, bandwidth information, or radio wave intensity report for each floor.

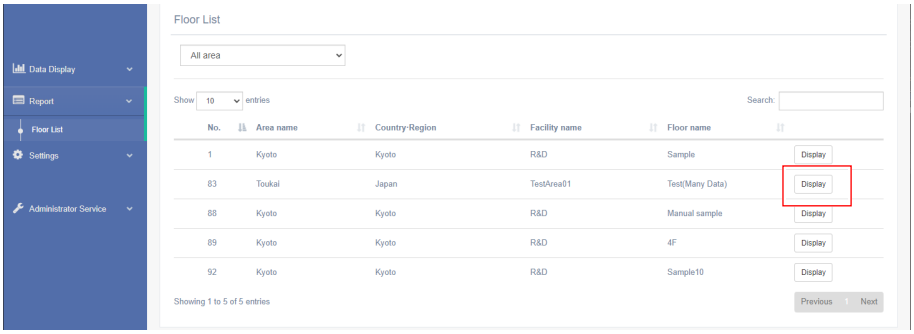
5-1. Floor List

You can check the list of floors already registered in the analysis settings.

1. Click **Report** > **Floor List**.

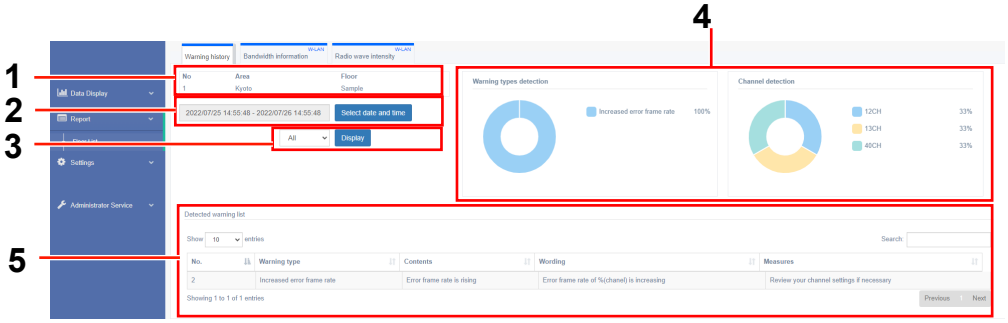
2. Select an area you want to display from the area list.
   - The list of floors registered in the selected area is displayed.
   - The area names displayed in the area list depend on the user.
   - Selecting **All area** displays the list of floors registered in all the areas that the user can view.

3. Click **Display** for the floor you want to check.
   The report screen for the selected floor is displayed.



5-2. Floor List: Warning History

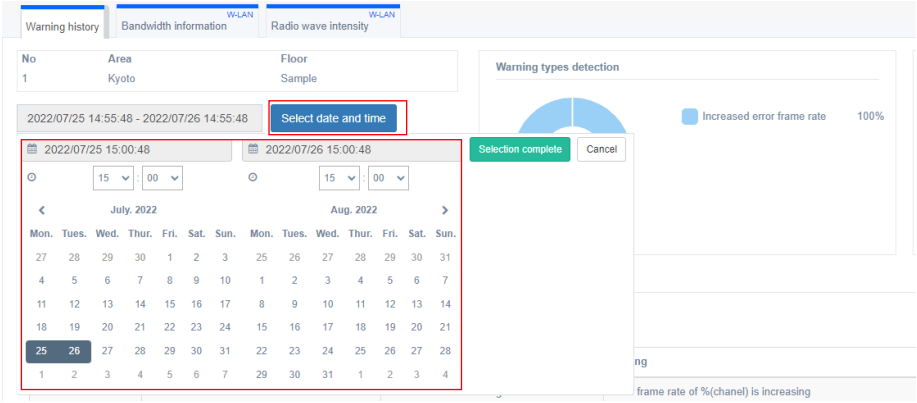
You can display the list of warnings detected on the specified date and time. In addition, the top five ratios for the detected warning types and channels are displayed in graphs.



No.	Item	Description	Default
1	Floor name	Displays the floor number, area name, and floor name.	-
2	Select date and time	This selects the date and time for creating the report.	Last 24 hours
3	Channel	This allows you to filter the channels to be displayed. Selectable channels differ for each bandwidth.	ALL
4	Graphs	The top five ratios for the detected warning types and channels are displayed in graphs.	-
5	Warning list	The list of detected warnings is displayed. Click to change how these items are sorted. is displayed for items currently used for the ascending order and is displayed for items used for the descending order. Entering a partial warning type, etc. in the search box displays the matching warnings.	-

1. Display the report screen for the floor you want to check. (See **5-1. Floor List**)
2. Click the **Warning history** tab.

3. Click **Select date and time** and select the date and time you want to check.



- The last 24 hours are selected by default.
- Click a date on the calendar to set the period. You can also set the time by entering the time using the time entry boxes at the top of the calendar.

4. Click **Selection complete**.

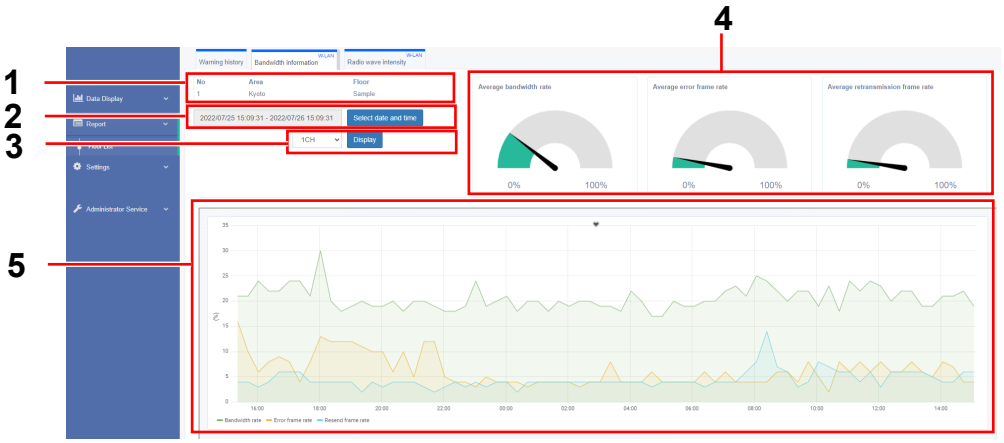
5. Select the channels you want to check and click **Display**.

5-3. Floor List: Bandwidth Information

You can display the time series graph and averages for the bandwidth rate, error frame rate, and resend frame rate for a floor.

TIP

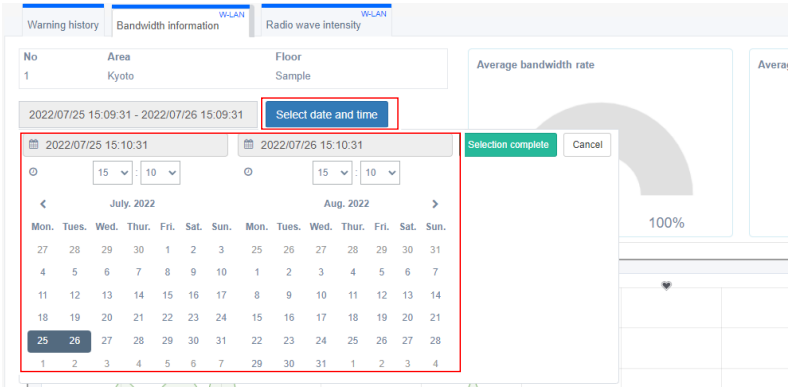
- Though graphs may display 💙, Grafana menus, vertical lines that show the change in data, etc., do not click these menus or use the keyboard to operate them. Unknown screens may be displayed. (See **8-3. The Report does not Show Graphs**)



No.	Item	Description	Default
1	Floor name	Displays the floor number, area name, and floor name.	-
2	Select date and time	This selects the date and time for creating the report.	Last 24 hours
3	Channel	This allows you to filter the channels to be displayed. Selectable channels differ for each bandwidth.	1CH
4	Average graphs	These graphs display the average of the bandwidth rate, error frame rate, and resend frame rate.	-
5	Time series graph	This time series graph uses Grafana to display the bandwidth rate, error frame rate, and resend frame rate.	-

1. Display the report screen for the floor you want to check. (See **5-1. Floor List**)
2. Click the **Bandwidth information** tab.

3. Click **Select date and time** and select the date and time you want to check.



- The last 24 hours are selected by default.
- Click a date on the calendar to set the period. You can also set the time by entering the time using the time entry boxes at the top of the calendar.
- You can also drag the time series graph to select the period you want to check.

4. Click **Selection complete**.

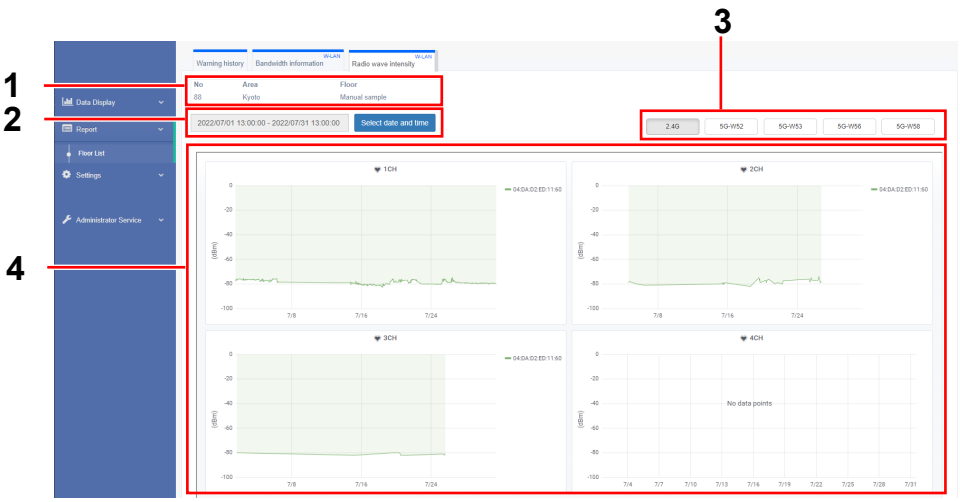
5. Select the channels you want to check and click **Display**.

5-4. Floor List: Radio Wave Intensity

You can display the transition of the radio wave intensity of wireless devices for each bandwidth in a time series graph.

TIP

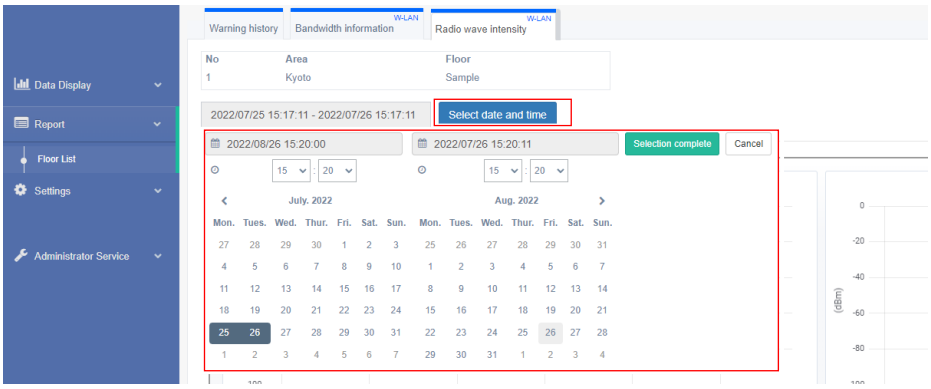
- Though graphs may display 💙, Grafana menus, vertical lines that show the change in data, etc., do not click these menus or use the keyboard to operate them. Unknown screens may be displayed. (See **8-3. The Report does not Show Graphs**)



No.	Item	Description	Default
1	Floor name	Displays the floor number, area name, and floor name.	-
2	Select date and time	This selects the date and time for creating the report.	Last 24 hours
3	Bandwidth	You can select the bandwidth for creating the report. The following bandwidths are available. - 2.4G - 5G-W52 - 5G-W53 - 5G-W56 - 5G-W58	2.4G
4	Graph	This time series graph uses Grafana to display the transition of the radio wave intensity for each channel over time.	-

1. Display the report screen for the floor you want to check. (See **5-1. Floor List**)
2. Click the **Radio wave intensity** tab.

3. Click **Select date and time** and select the date and time you want to check.



- The last 24 hours are selected by default.
- Click a date on the calendar to set the period. You can also set the time by entering the time using the time entry boxes at the top of the calendar.
- You can also drag the graph to select the period you want to check.

4. Click **Selection complete**.

5. Click the button for the band you want to check.

6. Settings

This section explains how to use the following screens.

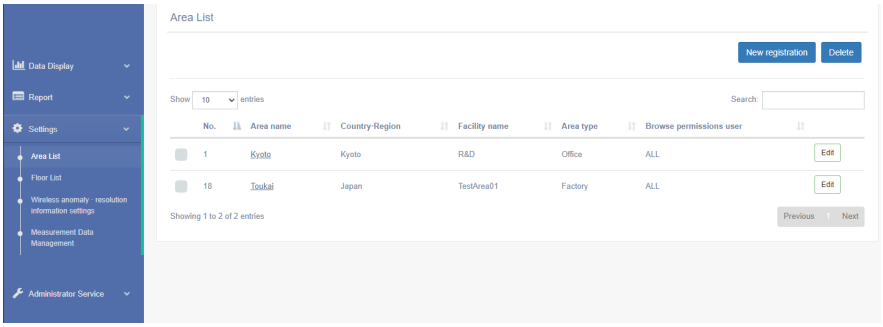
- Area List
- Floor List
- Wireless Anomaly · Resolution Information Settings
- Measurement Data Management

TIP

- Log in as a user with the Administrator authority to display the Settings menu.

6-1. Area List

This screen allows you to manage areas that control floors.
Click **Settings** > **Area List**. The list of registered areas is displayed.



The following items are displayed here. Click ⇅ to change how these items are sorted. ⇊ is displayed for items currently used for the ascending order and ⇈ is displayed for items used for the descending order.

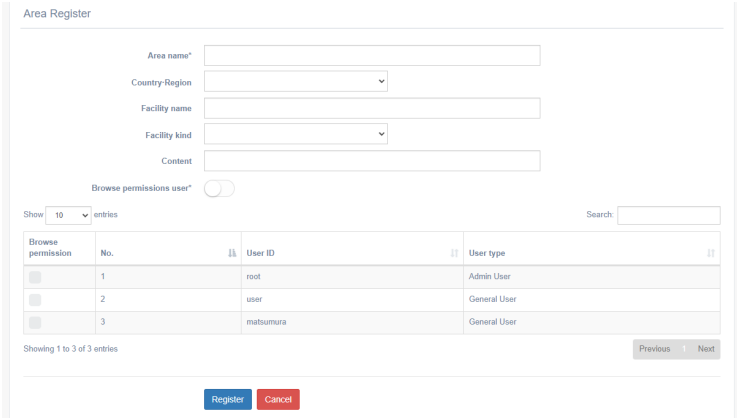
- No. (area number)
- Area name
- Country·Region
- Facility name
- Area type
- Browse permissions user

6-1-1. Registering Areas

New areas can be registered. Enter the following items.

Item	Description
Area Name	The area name. This item is required. This must be entered within 100 characters. Area names that are already registered cannot be registered again.
Country·Region	The country and region name that controls the area. This must be entered within 10 characters. You can click ⌄ to select a country and region name if it was registered before.
Facility name	The facility name. This must be entered within 100 characters.
Facility kind	The facility kind. This must be entered within 10 characters. You can click ⌄ to select a facility kind if it was registered before.
Content	Register this when you want to enter the description or remarks on the area. This must be entered within 100 characters.
Browse permissions user	Sets the users who can browse the area. This item is required. Slide the button to the left to turn **OFF**, resulting in all the users being able to browse it. Slide the button to the right to turn **ON**, resulting in only the selected users being able to browse it. Select the users who can browse it from the user list below.

1. Click **Settings** > **Area List**.
2. Click **New registration**.
3. Enter each of the items.



4. Click **Register**.

6-1-2. Modifying Areas

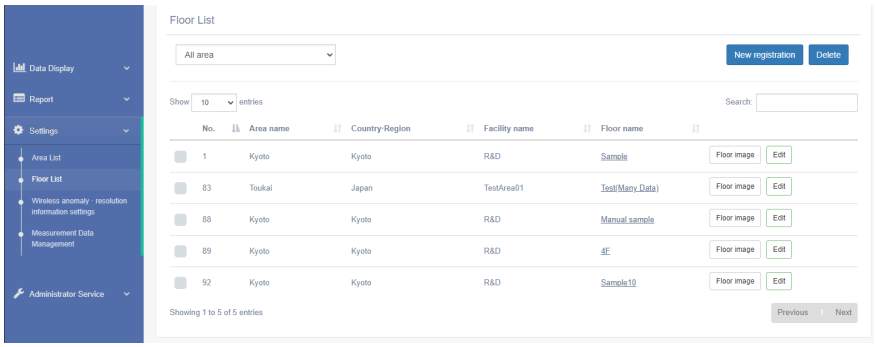
1. Click **Settings** > **Area List**.
2. Click **Edit** for the area you want to modify.
   - You can also click the area name in **Area List** to edit.
   - Entering a partial area name, etc. in the search box will display matching areas.
3. The registered content is displayed for modification.
4. Click **Register**.

6-1-3. Deleting Areas

1. Click **Settings** > **Area List**.
2. Select the area to delete.
   Entering a partial area name, etc. in the search box will display matching areas.
3. Click **Delete**.
4. A confirmation screen is displayed. Click **Confirm**.

6-2. Floor List

This screen allows you to manage floors that an area controls.
Click **Settings** > **Floor List**. The list of registered floors is displayed.



The following items are displayed here. Click ⇅ to change how these items are sorted. ⇅ is displayed for items currently used for the ascending order and ⇅ is displayed for items used for the descending order.

- No. (floor number)
- Area name
- Country·Region
- Facility name
- Floor name
- Floor map (click **Floor image** to display)

6-2-1. Registering Floors, Pre-survey Data, and Wireless Devices

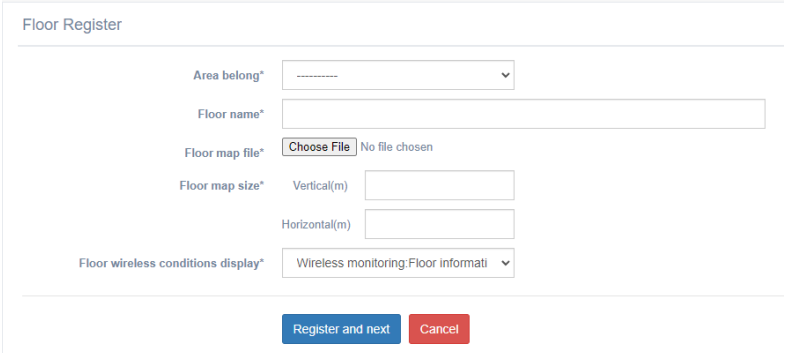
You can register new floors. Be sure to enter items in **Floor Register**. In this screen, you also register the survey data measured for the floor in advance as well as wireless devices. Items in **Wireless device register** are optional. There are two methods for registering the survey data measured in advance: specifying the survey device and measurement ID to register data one by one and importing data all at once.
Enter the following items.

Item		Description
Floor Register		
	Area belong	This item is required. Select an area name registered in **Area List**.
	Floor name	The floor name. This item is required. This must be entered within 100 characters. Floor names that are already registered cannot be registered again.
	Floor map file	This item is required. Import a floor information file into Wave Navigator. Click **Choose File** and then select an image file.
	Floor map size	This item is required. Register the vertical and horizontal sizes of the floor map. You can enter a number between 0.01 and 999.99 (m) in steps of 0.01.
	Floor wireless conditions display	This item is required. Select the map type to be displayed in **Data Display** > **Floor Wireless Conditions**. Select the map from **Wireless monitoring: Floor information**, **Wireless monitoring: Signal strength**, or **Measurement data analysis: Signal strength**. (Default: Wireless monitoring: Floor information)

Item	Description
Wireless device register	
Survey measurement	
Name	Select a survey device. Click to display the list of survey device names. Click to display the list of survey device names, MAC addresses, and IP addresses.
MAC address	Displays the MAC address of the survey device selected in **Name**.
IP address	Displays the IP address of the survey device selected in **Name**.
Measurement ID	Select survey data. Click to display the list of measurement IDs for the survey data of the survey device selected in **Name**. Click to display the list of survey device names, measurement IDs, and measurement dates and times. Checking **The measurement mode displays only the measurement data of the pre-survey** under the **Survey measurement** tab displays only the survey data registered as pre-measurement data on the survey device in advance.
Measurement date and time	Displays the date and time the survey data selected in **Measurement ID** was measured.
X coordinate (m)	Enter the X coordinate of the survey device. The origin point is on the lower left of the floor map. You can enter a number between 0.00 and 999.99 (m) in steps of 0.01. You can also click directly the location where you want to place it on the floor map.
Y coordinate (m)	Enter the Y coordinate of the survey device. The origin point is on the lower left of the floor map. You can enter a number between 0.00 and 999.99 (m) in steps of 0.01. You can also click directly the location where you want to place it on the floor map.

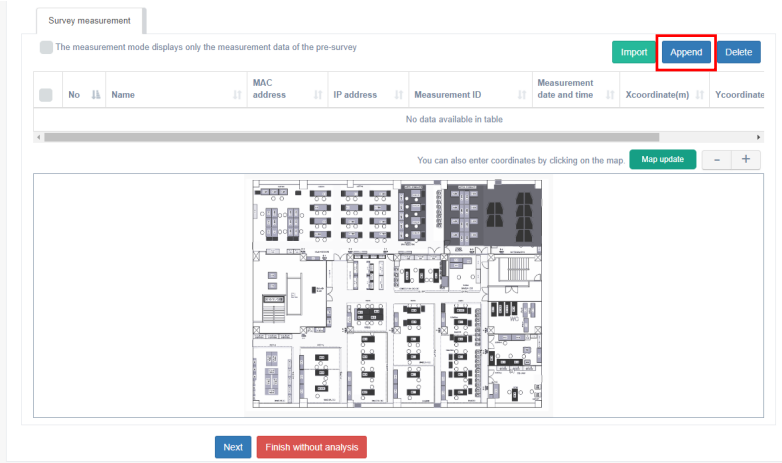
Item	Description
Wireless device register	
Wireless device	
Wireless device kind	Select the wireless device kind. You can select the wireless device type from WM-100, Access Point, or Station.
Device ID	Enter the device ID. Checking **Display the list of devices detected at pre-survey** under the **Wireless device** allows you to select from the list of device IDs detected by pre-survey. To enter this directly, enter the MAC address of the wireless device as 12-character alphanumerics.
MAC address	Displays the MAC address of the wireless device selected or entered in **Device ID**.
IP address	Displays the IP address of the wireless device selected or entered in **Device ID** if it was detected. If it was not detected, nothing is displayed.
X coordinate (m)	Enter the X coordinate of the wireless device. The origin point is on the lower left of the floor map. You can enter a number between 0.00 and 999.99 (m) in steps of 0.01. You can also click directly the location where you want to place it on the floor map.
Y coordinate (m)	Enter the Y coordinate of the wireless device. The origin point is on the lower left of the floor map. You can enter a number between 0.00 and 999.99 (m) in steps of 0.01. You can also click directly the location where you want to place it on the floor map.
Name	The wireless device name. This must be entered within 100 characters.

1. Click **Settings** > **Floor List**.
2. Click **New registration**.
3. Enter each item in **Floor Register**.

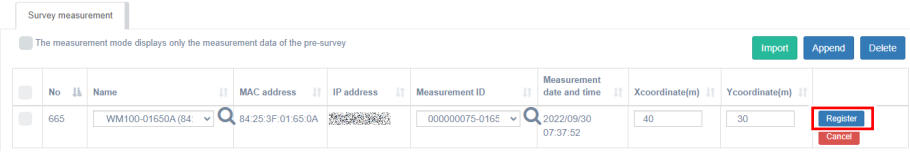


4. Click **Register and next**.

5. Click **Append** in **Survey measurement** to enter each item.



6. Click **Register**.

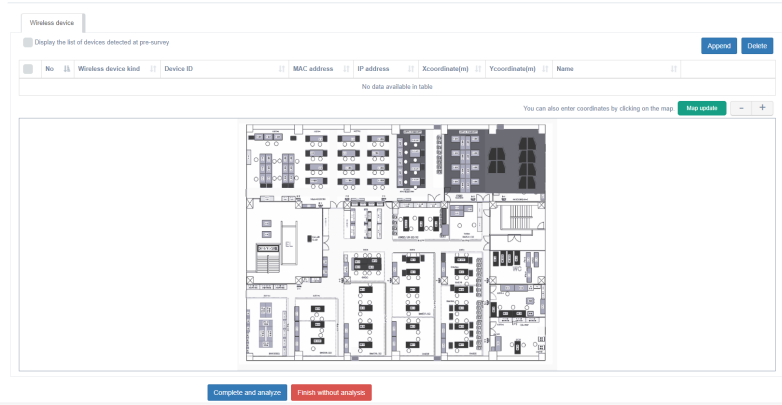


- To continue to register another survey measurement data, repeat the procedure from step 5 to register all data.
- To delete a registered survey data, check the data you want to delete and click **Delete** and **Confirm**.

7. To register a wireless device, click **Next**.

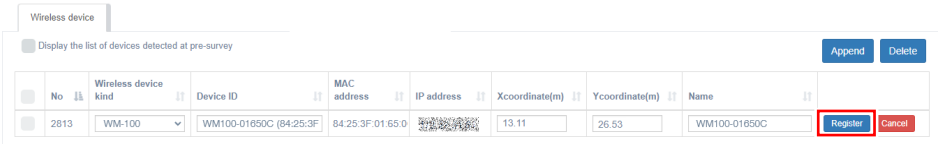
- If you do not want to register **Wireless device**, click **Finish without analysis** to finish the procedure.

8. **Wireless device** screen is displayed.



9. Click **Append** to enter each item.

10. Click **Register**.



- To continue to register another wireless device, repeat the procedure from step 9 to register all devices.
- To delete a registered wireless device, check the wireless device you want to delete and click **Delete** and **Confirm**.

11. Click **Complete and analyze**.
- When the measurement data analysis starts, **Analysis in progress** is displayed in the measurement data analysis screen for the floor. Click this button to display the measurement data analysis screen. There are no more steps if you clicked **Complete and analyze**.
- Clicking **Finish without analysis** finishes the registration without the wireless analysis.

6-2-2. Modifying Floors, Survey Measurements, and Wireless Devices

1. Click **Settings** > **Floor List**.

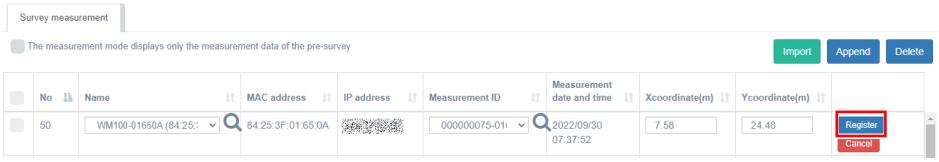
2. Click **Edit** for the floor you want to modify.
   - You can also click the floor name to edit.
   - Entering a partial floor name, etc. in the search box displays the matching floors.

3. The content registered in **Floor Register** is displayed for modification.

4. Click **Register and next**.

5. The content registered in **Survey measurement** is displayed for modification. Click **Edit** for the survey data you want to modify and modify the content.

6. Click **Register**.



   - If you want to continue to edit other data, repeat the procedure from step 5.

7. To modify the content of wireless devices, click **Next**.

   If you do not want to modify the content of wireless devices, click **Finish without analysis**.

8. The content registered on each tab in **Wireless device register** is displayed for modification.
   To modify the content in the **Wireless device** tab, click **Edit** for the wireless device you want to modify, modify the content, and click **Register**.

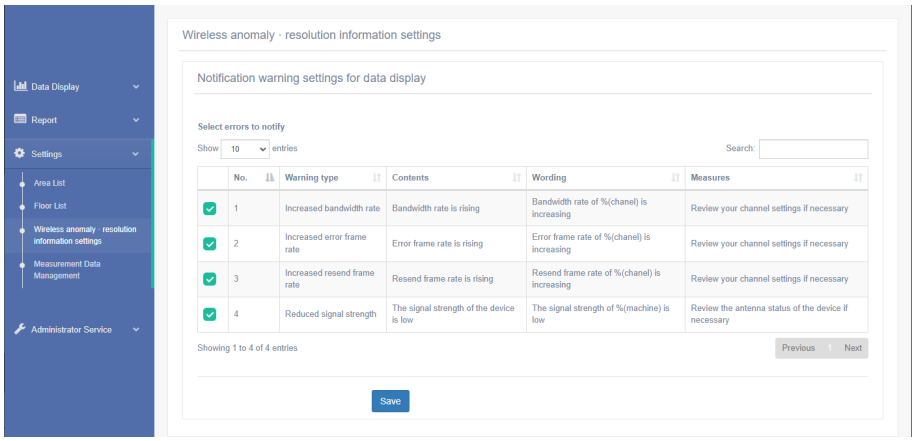
9. To perform the wireless analysis with the modified content, click **Complete and analyze** in the **Wireless device** tab.
   Clicking **Finish without analysis** in the **Wireless device** tab finishes the registration without performing the wireless analysis.

6-2-3. Deleting Floors

1. Click **Settings** > **Floor List**.
2. Select the floor to delete.
   Entering a partial floor name, etc. in the search box displays the matching floors.
3. Click **Delete**.
4. A confirmation screen is displayed. Click **Confirm**.

6-3. Wireless Anomaly · Resolution Information Settings

You can change the warning details to be displayed for **Wireless anomaly · resolution information** in **Data Display** > **Floor Wireless Conditions**.



1. Click **Settings** > **Wireless anomaly · resolution information settings**.

2. Uncheck the checkbox at the beginning of an item to hide it. The relevant item is no longer displayed in **Wireless anomaly · resolution information**.
   - Entering a partial warning type, etc. in the search box displays the matching warnings.
   - Click ⇅ to change how these items are sorted. ↑ is displayed for items currently used for the ascending order and ↓ is displayed for items used for the descending order.

3. Click **Save**.

4. Click **OK**.

6-4. Measurement Data Management

You can back up/restore the data measured by survey devices and check the automatic delete history.

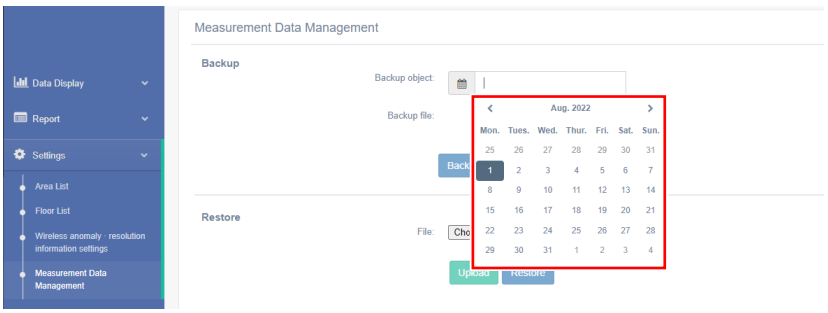
6-4-1. Backing Up the Measurement Data

You can back up the data measured by survey devices for each date.

TIP

- Do not use Wave Navigator while backing up data. Other operations may not be performed successfully while backup data is being created.

1. Click **Settings** > **Measurement Data Management**.
2. Click the box to the right of **Backup object** in **Backup** to select the date for backup.



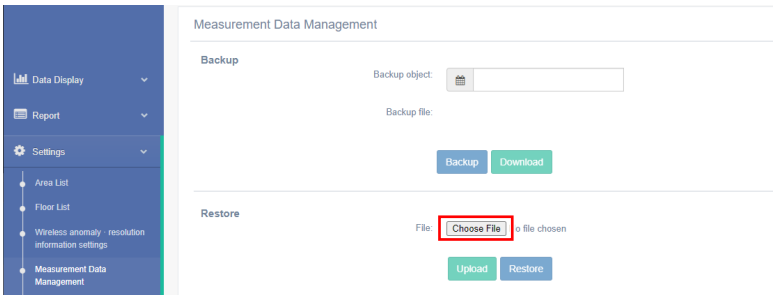
Click a date in the calendar to select the date.

3. Click **Backup**.
Backup data is created. The file name of the created backup data is **influx_backup_Year/Month/Day_Hour/Minute/Second.zip**. The date and time shown for the file name is the date and time the backup data began being created.
4. Click **Download**.
Backup data is saved in the folder as specified in the Web browser settings.

6-4-2. Restoring the Measurement Data

You can restore the measurement data backed up in **Backing up the measurement data**. (See **6-4-1. Backing Up the Measurement Data**) Provide the data you want to restore beforehand.

1. Click **Settings** > **Measurement Data Management**.
2. Click **Choose File** in **Restore**.



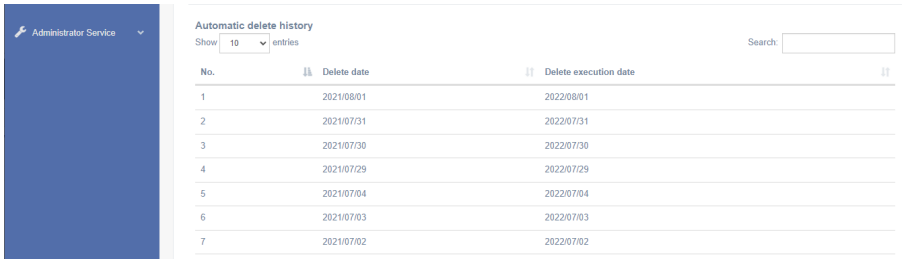
3. Select the file you want to restore and click **Open**.
4. Click **Upload**.
5. Click **Restore**.
6. Click **OK**.

6-4-3. Checking the Automatic Delete History

The data collected by survey devices and data measurement history, which are managed by InfluxDB, are deleted automatically after the retention period. You can check the history of the delete date and delete execution date for deleted data.

Note

- The retention period of the data and data measurement history is 364 days. After the retention period, entries for the oldest date are deleted.
- If the remaining HDD capacity falls below 1 GB, entries for the oldest date are deleted even within the retention period. However, the data collected on the current day is not deleted.



The following items are displayed here. Click ⇅ to change how these items are sorted. ↓↑ is displayed for items currently used for the ascending order and ↑↓ is displayed for items used for the descending order.
Entering a delete date, etc. in the search box will display matching automatic delete history entries.

- No.
- Delete date
- Delete execution date

1. Click **Settings** > **Measurement Data Management**.
2. Check the automatic delete history.

7. Administrator Service

This section explains how to use the following menus.

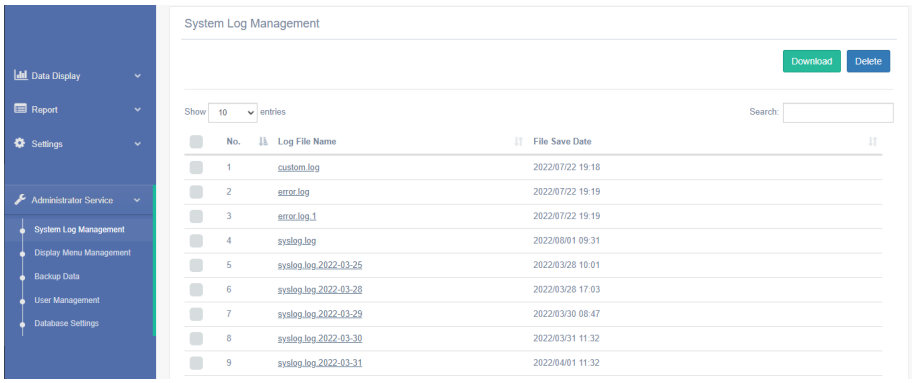
- System Log Management
- Display Menu Management
- Backup Data
- User Management
- Database Settings

TIP

- Login as a user with administrator privileges to display the administrator service menu.

7-1. System Log Management

This screen allows you to display, download and delete system logs for the system being used.



The following items are displayed here. Click to change how these items are sorted. is displayed for items currently used for the ascending order and is displayed for items used for the descending order.
Entering a partial log file name, etc. in the search box will display matching log files.

- No.
- Log File Name
- File Save Date

7-1-1. Displaying System Logs

1. Click **Administrator Service** > **System Log Management**.

2. Click a log file name to display that system log.
   - Click **Back** to close the system log screen.
   - Click **Download** to download content.

7-1-2. Downloading System Logs

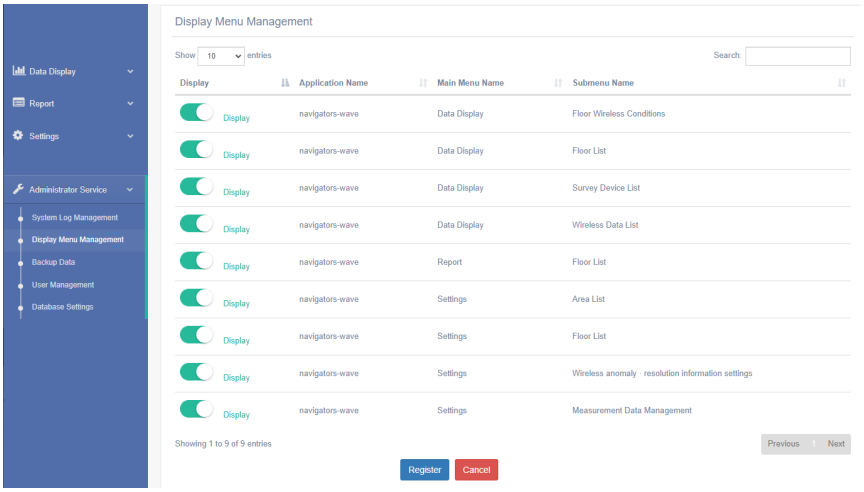
1. Click **Administrator Service** > **System Log Management**.
2. Select the log file name to download.
   You can also select the checkbox in the item names row to select all system logs.
3. Click **Download**.
4. A confirmation screen is displayed. Click **Confirm**.
   - The file is saved in the folder as specified in the Web browser settings.
   - System logs are downloaded as compressed zip files. The file name will be **syslog_Year/Month/Day/Hour/Minute/Second.zip**. The time and date shown for the file name is the time and date the download file began being created.

7-1-3. Deleting System Logs

1. Click **Administrator Service** > **System Log Management**.
2. Select the log file name to delete.
   You can also select the checkbox in the item names row to select all system logs.
3. Click **Delete**.
4. A confirmation screen is displayed. Click **Confirm**.

7-2. Display Menu Management

The items displayed in each menu can be changed.



1. Click **Administrator Service** > **Display Menu Management**.

2. Sliding the button located at the head of the item to the left will **Hide** the item from being displayed in the menu.
   - Hiding all sub-menus related to a single main menu will also hide the main menu.
   - To display an item again, slide the button to the right.

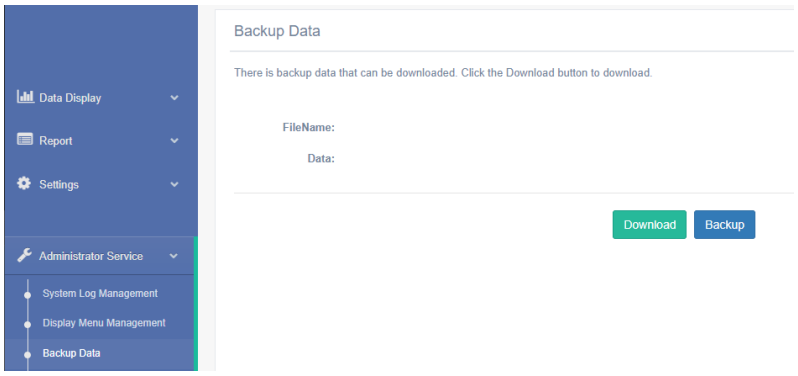
3. Click **Register**.

7-3. Backup Data

The following data can be backed up.

- Data related to settings registered in Wave Navigator, such as analysis settings
- Data uploaded to Wave Navigator, such as maps

To back up the data measured by survey devices, refer to **6-4-1. Backing Up the Measurement Data**.



TIP

- Do not use Wave Navigator while backing up data. Other operations may not be performed successfully while backup data is being created.

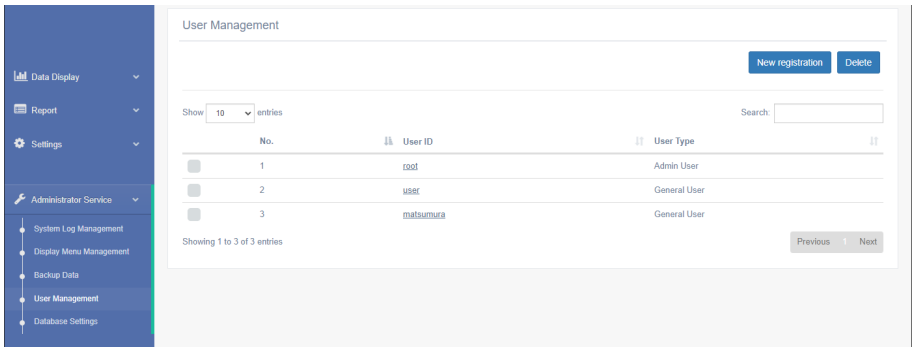
1. Click **Administrator Service** > **Backup Data**.
2. Click **Backup**.
3. A confirmation screen is displayed. Click **Confirm**.
   - Backup data is created. Once it has been created, **There is backup data that can be downloaded. Click the Download button to download.** is displayed.
   - The file name of the backup data will be **backup_Year/Month/Day/_Hour/Minute/Second.zip**. The date and time shown for the file name is the date and time the back-up data began being created.
4. Click **Download**.
   Backup data is saved in the folder as specified in the Web browser settings.

Note

- Extract the backup data to find a file named **restore.bat**. This file can be run under the Navigators installation folder on the applicable computer to restore the data that was backed up.
- Restoring must be run with a user who has administrator privileges.

7-4. User Management

This screen allows you to register, modify and delete users that can login to Wave Navigator or the installed application software.
Entering a partial user ID, etc. in the search box displays matching users.



The following items are displayed here. Click ⇅ to change how these items are sorted. ⇊ is displayed for items currently used for the ascending order and ⇈ is displayed for items used for the descending order.

- No. (registration ID)
- User ID
- User Type (General User/Admin User)

7-4-1. Registering Users

Up to 50 users can be registered, including the default **user** and **root** accounts. Enter the following items.

Item	Description
User ID	Register the user ID. This item is required. Enter up to 30 characters. This may include letters, numbers and the underscore ("_") character.
Password	Register the password. This item is required. Enter up to 10 characters. This may include letters, numbers and the underscore ("_") character. Characters are displayed as "·" on the screen when entered.
Show Password	Select this checkbox to display characters as they are typed when entering the password.
Account Type	Select whether to register the user as a general user or admin user. General user: These users are allowed to operate the screens for the installed application software. In Wave Navigator, they can use the **Data Display** and **Report** menus. Admin user: In addition to the same operations allowed for general users, these users can also use administrator menus. In Wave Navigator, they can use the **Data Display**, **Report**, **Settings**, and **Administrator Service** menus.

1. Click **Administrator Service** > **User Management**.
2. Click **New registration**.
3. Enter each of the items.
4. Click **Register**.

7-4-2. Modifying Users

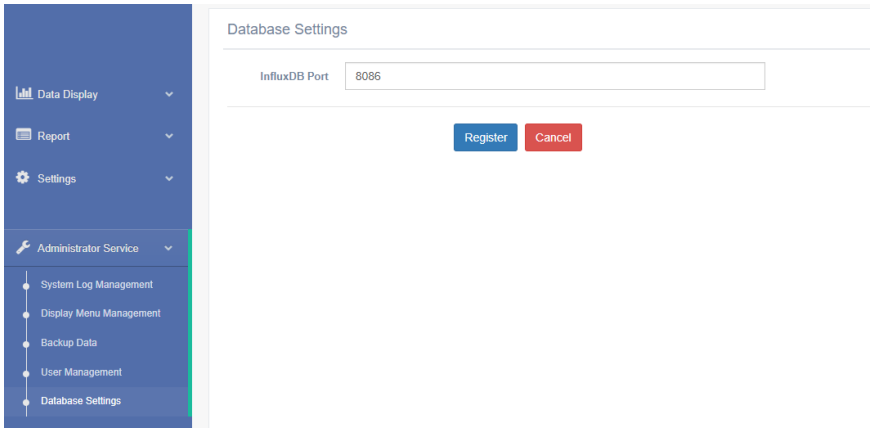
1. Click **Administrator Service** > **User Management**.
2. Click the user ID to modify.
   Entering a partial user ID, etc. in the search box will display matching users.
3. The registered content is displayed for modification.
   Make sure to set the password again.
4. Click **Register**.

7-4-3. Deleting Users

1. Click **Administrator Service** > **User Management**.
2. Select the user ID to delete.
   Entering a partial user ID, etc. in the search box will display matching users.
3. Click **Delete**.
4. A confirmation screen is displayed. Click **Confirm**.

7-5. Database Settings

You can enter the port number used to connect to InfluxDB.



1. Click **Administrator Service** > **Database Settings**.
2. Enter the port number for InfluxDB and click **Register**.
   The default value is 8086.
3. A confirmation screen is displayed. Click **Confirm**.

8. Troubleshooting

Read this section if something is not working as intended.

8-1. The Login Screen Is not Displayed

Item to check	Check
Is everything connected properly?	Confirm that the computer on which Wave Navigator is installed is powered on. Confirm that the network settings of the computer being used are correct, and confirm the status of the network (are the LAN cables for both computers connected?). If you are proficient in operating a computer, use the **command prompt** on the computer being used to ping the computer on which Wave Navigator is installed.
Is the IP address wrong?	Make sure that the IP address configured on the computer on which Wave Navigator is installed is entered correctly.
Is there a device with the same IP address on the same network?	Two or more devices with the same IP address cannot be connected on the same network. Set unique IP addresses for each individual device and computer on the network.
Was the device previously used on a different network?	If the device was used on a different network, the network settings that were set may be preventing communication with the computer being used. Check the network settings for the computer on which Wave Navigator is installed.
Does access to the device fail even after checking the items above?	Reinstall Wave Navigator. Once it has been reinstalled, try accessing Wave Navigator again. If the problem still persists, contact Silex Technology.

8-2. Data Collected by the Survey Device does not Show Up

Item to check	Check
Is the survey device operating normally?	Various kinds of wireless data are measured by the survey device and collected by the computer where Wave Navigator is installed. Check the survey device state and communication status to confirm that the measurement data is uploaded from the survey device to Wave Navigator properly.
Are the port settings correct?	Confirm that the InfluxDB port settings are correct in **Administrator Service** > **Database Settings**.
Is the HDD space enough?	If the remaining HDD space is extremely small on the computer where Wave Navigator is installed, new wireless data cannot be collected. Delete unnecessary files, etc. on the computer where Wave Navigator is installed.

8-3. The Report does not Show Graphs

Item to check	Check
Has the Grafana dashboard been deleted?	The time series graph shows screens registered in Grafana[*1]. The time series graph cannot be displayed if the settings on Grafana were changed, or if the registered graph was deleted. Check the settings for Grafana.
Did you click or use the keyboard on the bandwidth information or radio wave intensity graph?	The time series graph shows screens registered in Grafana[*1]. Operations performed on the graph are processed as a Grafana function. If an unknown screen, etc. is displayed, press **F5** on the keyboard or click the refresh button on the Web browser to return to the original screen.

*1 Grafana is a dashboard tool used to visualize and analyze data.
(https://grafana.com/)

A. Appendix

A-1. Main Specifications

Product specifications are subject to change without notice in the interest of product improvement. Thank you for your understanding.

Item		Specification
Product name		Wave Navigator
Compatible browser		Google Chrome
Applicable language		English/Japanese
Communication		HTTP
Port number		3000, 8080, 8086, 8090
Server		
	Supported OS	Windows Server 2016 (64bit) Windows 10 Pro (64bit) Windows 11
	CPU	Intel Core i5 or above
	Memory	At least 4 GB
	HDD	At least 1 TB of free storage

TIP

- If the following programs have already been installed by another application, the installation of Wave Navigator may fail or Wave Navigator may not work properly. In that case, please contact Silex Technology.
  - Apache2.4
  - NGINX
  - Grafana
  - InfluxDB

A-2. Product Information and Customer Services

A-2-1. Product Information

The services below are available from the Silex Technology website. For details, please visit the Silex Technology website.

URL
https://www.silextechnology.com/

- Support information (FAQ)

A-2-2. Customer Support Center

Customer Support is available for any problems that you may encounter.
If you cannot find the relevant problem in this manual or on our website, or if the corrective procedure does not resolve the problem, please contact Silex Technology Customer Support.

Contact Information
support@silexamerica.com

Note

- Visit the Silex Technology website (https://www.silextechnology.com/) for the latest FAQ and product information.