www.wireless-planning.com
e-mail: admin@mlinkplanner.com

Indoor RadioPlanner 1.0

Planning tool for Wi-Fi and other indoor wireless networks

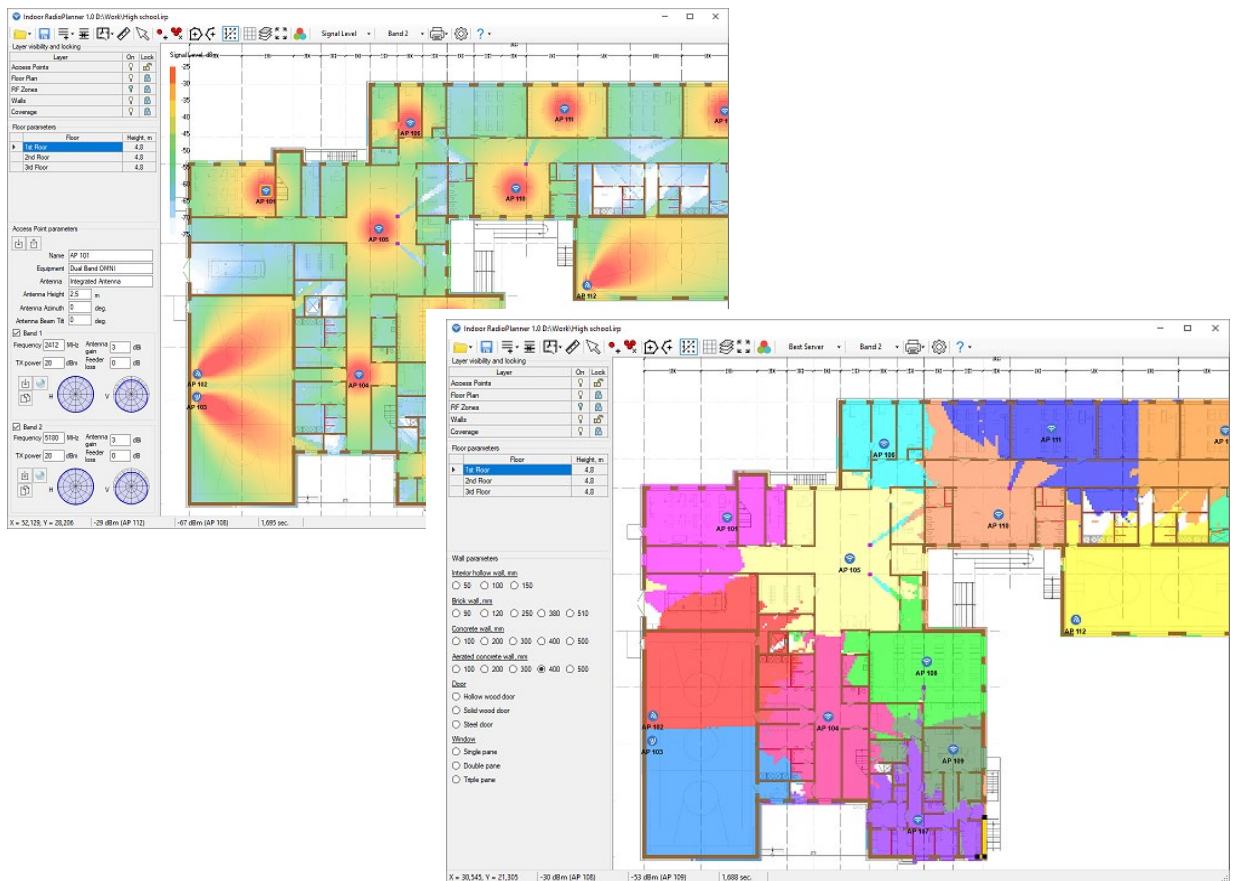## User Manual

Table of Contents

About

Indoor RadioPlanner is designed for planning indoor wireless networks. Release 1.0 is mainly intended for planning Wi-Fi networks in the 2.4 GHz, 5 GHz, and 6 GHz bands, but it can also be used for planning indoor 5G (NR) / LTE / DECT / GSM / IoT / P25 / DMR / TETRA networks in the frequency range of 150 MHz – 7.5 GHz.

Main Features

1. Coverage prediction according to the ITU-R P.1238-11 propagation model "Propagation data and prediction methods for the planning of indoor radiocommunication systems and radio local area networks in the frequency range of 300 MHz to 450 GHz".

2. Floor plans:

   - CAD files in DWG / DXF formats

   - Raster images in popular formats: PNG, JPG, BMP

3. A simple built-in editor that allows you to quickly create a structural model of a building using various types of walls and RF Zones.

4. The ability to customize attenuation for different types of walls

5. Support for loading multi-story buildings into the project

6. Fast access point configuration

7. Prediction types:

   - Signal Level

   - Best Server

   - Number of APs

8. Increased detail and high speed of calculations due to algorithm optimization and parallel computations across multiple processor threads.

9. Planning for two Wi-Fi frequency bands

10. Reports available as PDF documents or images

Installation and Activation

Indoor RadioPlanner runs only on 64-bit Windows 7, 8, 8.1, or 10. The minimum computer configuration required is a Core i3 CPU, 4GB RAM, 200GB HDD, a video card, and a monitor with support for a resolution of at least 1366x768.

To install Indoor RadioPlanner, run the Setup_Indoor_RadioPlanner.exe file. Select your language and click Install to launch the installation process. Click Next to continue. To proceed with the installation, read and accept the License Agreement by checking the box next to "I accept the terms in the License Agreement" and clicking Next.

After installing Indoor RadioPlanner, you will see a new entry in the Start menu and a shortcut on your desktop.

During the 7-day trial period, you can try all of the program's features without activation (except for the option to save project files).

After the trial period has expired, you must purchase a license and activate the software to continue using it.

Note: The activation process requires an internet connection.

To purchase Indoor RadioPlanner, click Help - Purchase in the program menu. This will open the purchase page in your web browser. After completing your purchase, you will receive an activation ID code via email. To activate your software, click Help - Enter Activation ID Code in the program menu, enter your code, and click ACTIVATE.

Software Update

We periodically release free updates that improve the functionality and stability of Indoor RadioPlanner.

The program supports both manual and automatic update checks. It will check for available updates each time it starts up. To check for updates manually, click Help - Check for Updates in the program menu. If an update is available, a window will open displaying information about the current and available versions of Indoor RadioPlanner. You can download the update from the provided link and install it manually (make sure to close Indoor RadioPlanner before installing an update).

## RF Predictive Modeling in Indoor RadioPlanner

User Interface

The program window includes the following elements:

- The **main menu and toolbar**, located at the top of the window.
- The **central work area**, which displays the floor plan with access points, RF zones, walls, and coverage prediction results.
- The **layers control panel**, located on the left side of the window. This panel allows you to enable or disable editing of layers, as well as control their visibility.
- The **floor selection panel**, located below the layers control panel.
- The **selected element parameters panel**, located at the bottom left of the window. This panel displays options for the selected access point, RF zone, or wall.
- The **status bar**, located at the bottom of the window, provides information about coordinates and power levels for the two access points with the strongest levels for two bands.

To zoom in and out, roll the mouse wheel. To move the floor plan, click on the mouse wheel and drag it.
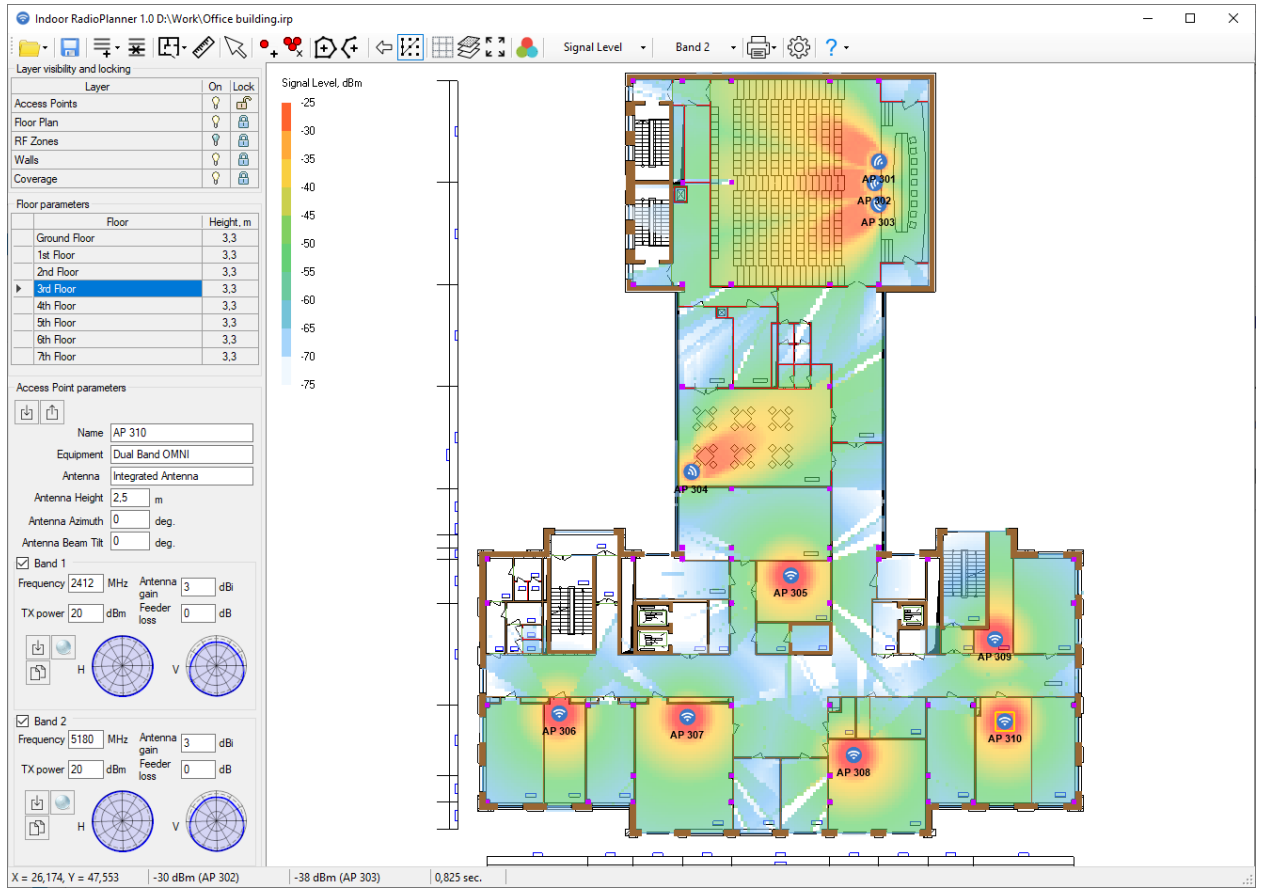
Standard tools for working with files:
- New
- Open
- Save
- Save as...

Save

Add floor

Delete selected floor

Import floor plan:
- Import a CAD DWG/DXF file
- Import a image

Ruler/Floor plan scaling

Object selection

Add Access Point

Delete all APs on the floor

Add RF Zones

Add Walls

Undo. Undo is possible only for the following objects: APs, RF zones, walls. After changing the floor or deleting all APs using the "Delete all APs on the floor" button, undo is impossible.

Snap to nodes

Display grid (1m grid space)

Setting the view of floor plans imported from a DWG / DXF file

Fit to screen

Calculate Coverage:

- Signal Level
- Best Server
- Number of APs

Band:
- Band 1
- Band 2
- Band 1 & Band 2

Report to PDF or to printer/ Save Coverage as a picture/ AP parameters list

Settings

Help

More information about each tool can be found in the relevant sections of the manual.

The trial package includes two sample Wi-Fi network projects for multi-story buildings. The first project, "High School," uses a picture as a floor plan, while the second project, "Office Building," uses drawings in CAD format. Both projects are fully prepared for coverage prediction; simply open the project and press "Calculate Coverage."

Layers

The layers panel is located on the left side of the screen. Using this panel, you can control the visibility of layers on the map by enabling or disabling them. You can also lock or unlock layers to enable or disable editing.

Layers:

Access Points
Floor Plan
RF Zones

Walls
Coverage

Controlling the visibility and locking of a layer is done by clicking on the icons opposite the corresponding layer. To edit the elements of a layer, you need to make the layer visible and unlock it by setting the icons to [icons].

Floor Plans

The program allows you to load floor plans for an entire building into your project. The floor selection panel is located below the layers panel. You can add or remove floors from your project, import floor plans, and scale them using the following tools on the main toolbar:

Add empty floor/ Create a floor with this floor plan / Create a floor with this floor plan and RF zones / Create a floor with this floor plan, RF zones, and APs

Delete selected floor

Import the plan of the selected floor as a DWG / DXF CAD file or an image in PNG, JPG, or BMP formats

Ruler / Floor plan scaling

To add a floor plan to your project, follow these steps:

1. Add a new empty floor using the "Add Floor" tool.
2. Load a floor plan from a DWG/DXF CAD file or a PNG, JPG, or BMP image.
3. Use the ruler to scale the floor plan. Click on the "Ruler" tool, then mark a known distance on the plan with a line, specify the line length, and click "Apply Scaling."

If the CAD drawing is made at a 1:1 scale, it does not need to be scaled.

Floors are aligned with each other using a coordinate grid. Turn on the display of the coordinate grid and align the floors at point X=0, Y=0 (thick lines indicate zero axes).

Creating a Building RF Environment Model

Create a model of the building's RF environment that will be used for coverage predictions based on the floor plans.

The basic propagation model ITU-R P.1238-11 takes into account two parameters related to the propagation environment:

$$L_{total} = L(d_o) + N \log_{10} \frac{d}{d_o} + L_f(n) \qquad \text{dB}$$

N: The distance power loss coefficient (a parameter of RF propagation) indicates how much the signal level drops in dB when the distance from the signal source changes by a factor of 10. In practice, the RF Environment coefficient N/10 is usually used, which ranges from 2.5 to 4.5.

Lf, dB: The floor or wall penetration loss factor (in dB) for floors or walls located between the access point and the subscriber terminal.

Please note that in release 1.0, calculations only consider access points located on the same floor.

RF Environment (RF Zones)

To create a building RF environment model, you need to draw different RF Zones and walls with corresponding loss parameters.

You can draw the following RF environment types on the floor plan:

Open Space (large open space with almost no obstacles) - 2.5 dB
Light RF Environment (cubicle office area, low warehouse stock) - 3.0 dB
Medium RF Environment (closed office area, medium warehouse stock) - 3.5 dB
Dense RF Environment (many rooms with light material, high warehouse stock) - 4.0 dB
High-Density RF Environment (many rooms with heavy material, elevator shaft) - 4.5 dB
Atrium (large opening in the floor (hole), excluded from prediction calculations)

To add an RF environment to the floor plan, click on the appropriate tool in the toolbar. Then use the mouse to draw a polygon for the RF environment (right-click to finish drawing the polygon). Select the RF environment coefficient from the list that appears. To complete the entry, press Esc or click on the Select tool on the panel.

You can perform the following operations on RF environment polygons (to do this, you must unlock the layer):

-    Edit the shape of polygons by dragging their nodes with the mouse.
-    Drag and drop entire polygons.
-    Delete polygons by selecting them and pressing Delete.

Walls

You can draw the following wall types on the floor plan:

Type	Thickness	Color	900 MHz loss (dB) **custom band**	2.4 GHz loss (dB)	5 GHz loss (dB)
Interior hollow wall	50 mm	(red)	1	1	2
	100 mm		2	3	5
	150 mm		3	4	9
Brick wall	90 mm	(orange)	5	6	10
	120 mm		6	8	13
	250 mm		8	10	25
	380 mm		13	15	30
	510 mm		15	20	37
Concrete wall	100 mm	(magenta)	4	6	10
	200 mm		8	10	13
	300 mm		12	14	22

	400 mm		15	18	30
	500 mm		20	25	37
Aerated concrete wall	100 mm		3	4	7
	200 mm		5	7	9
	300 mm		8	10	15
	400 mm		10	13	21
	500 mm		14	18	26
Door	hollow wood		3	4	7
	solid wood		4	6	10
	steel		9	13	25
Window	single pane		2	3	6
	double pane		4	7	13
	triple pane		6	13	20

To add a wall to the floor plan, click on the appropriate tool on the toolbar. Next, draw the wall with the mouse (press the left mouse button to finish drawing the wall). Then select the wall type from the list that appears. To complete the entry, press Esc or click on the Selection tool in the toolbar.

You can perform the following operations on walls (to do this, you must unlock the layer):

- Edit the shape of walls by dragging their nodes with the mouse
- Drag and drop entire walls
- Delete the wall (select it and press Delete)

Since the same materials have different attenuation values for different frequencies, the table shows the attenuation for the standard 2.4 GHz and 5 GHz bands, as well as for the custom band (in this case it's 900 MHz, but you can set any in the frequency range 150 MHz – 7.5 GHz). Attenuation values can be edited in the Settings menu.

If the calculation uses a frequency range other than the one mentioned above, interpolation or extrapolation will determine the attenuation value.

Access Points

To add an access point to the floor plan, select the Add Access Point tool and click on the desired location on the floor plan. If you need to install the same access point in a different place - click on this place and so on. To exit access point setting mode, press Escape or select the Select Objects tool. You can change the type of access point by loading an appropriate template.

Access point parameters
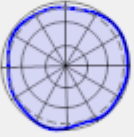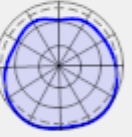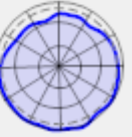
		Load AP parameters from the template
	⎣↥⎦	
	⎣↥⎦	Save the AP as a template
Name		AP name, the text field
Equipment		AP equipment model, text field
Antenna Type		Antenna model, text field. Automatically filled with the antenna pattern file name when selecting a pattern.
Antenna Height, m		Height of the antenna radiation center relative to the floor level, m
Antenna Azimuth, degree		Antenna azimuth in degrees
Antenna Beam Tilt, degree		Tilt the antenna in degrees. Down is negative; up is positive.
Frequency, MHz		Frequency, MHz
TX Power, dBm		Transmitter power, dBm
Antenna gain, dBi		Antenna gain relative to isotropic radiator, dBi
Feeder loss, dB		Cable and connectors loss, dB
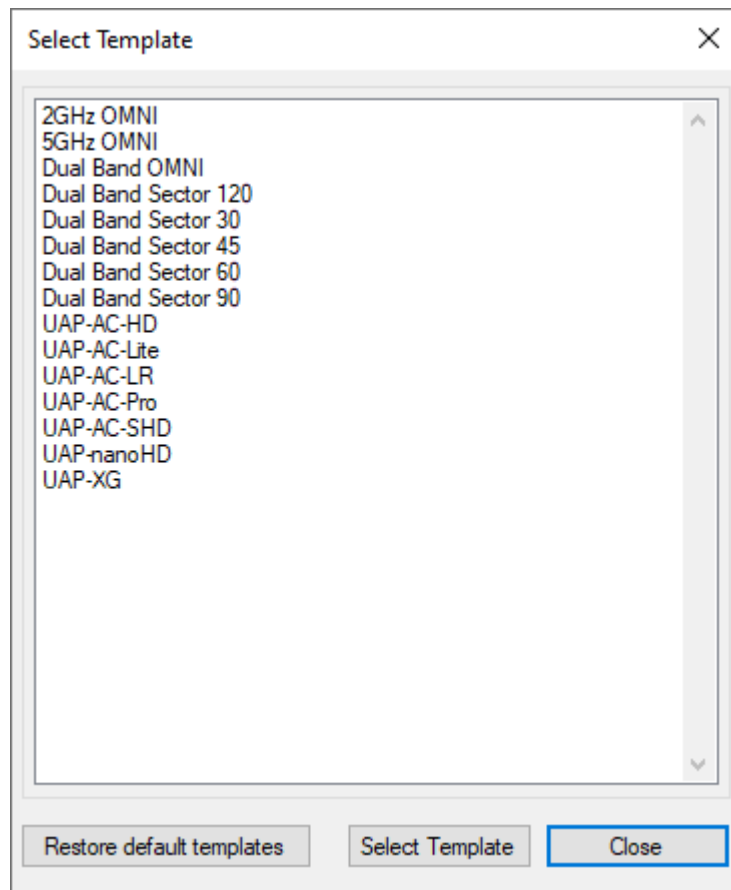
Creating a new AP using a template

You can change the antenna azimuth for an access point directly on the floor plan. To do this, double-click on the corresponding access point and rotate the circle that appears in the desired direction. The antenna icon will show the direction of maximum antenna radiation.

Prediction Types

Indoor RadioPlanner 1.0 version supports the following types of prediction:

- Signal Level
- Best Server
- Number of APs

Indoor RadioPlanner can perform visualizations for one frequency band or two at once.

Please note that release 1.0 does not support calculations related to frequency planning, interference, or number of wireless clients.

Signal Level

This visualization shows a signal strength map (also called a coverage map or heatmap) measured in dBm. Signal strength is one of the most important factors influencing WLAN performance, as areas with low signal cannot establish a reliable and high-throughput link between an AP and client devices. The signal level is shown for an AP that has the strongest signal in a given map area.

A signal level above -60 dBm is considered excellent. Levels between -60 and -85 dBm are mediocre, and levels below -85 dBm provide only marginal connectivity. Signal strength is affected by distance from an AP, AP output power, type and direction of an antenna, and most importantly, physical obstructions such as walls, doors, windows, and their material.

You can change color schemes in Settings menu.
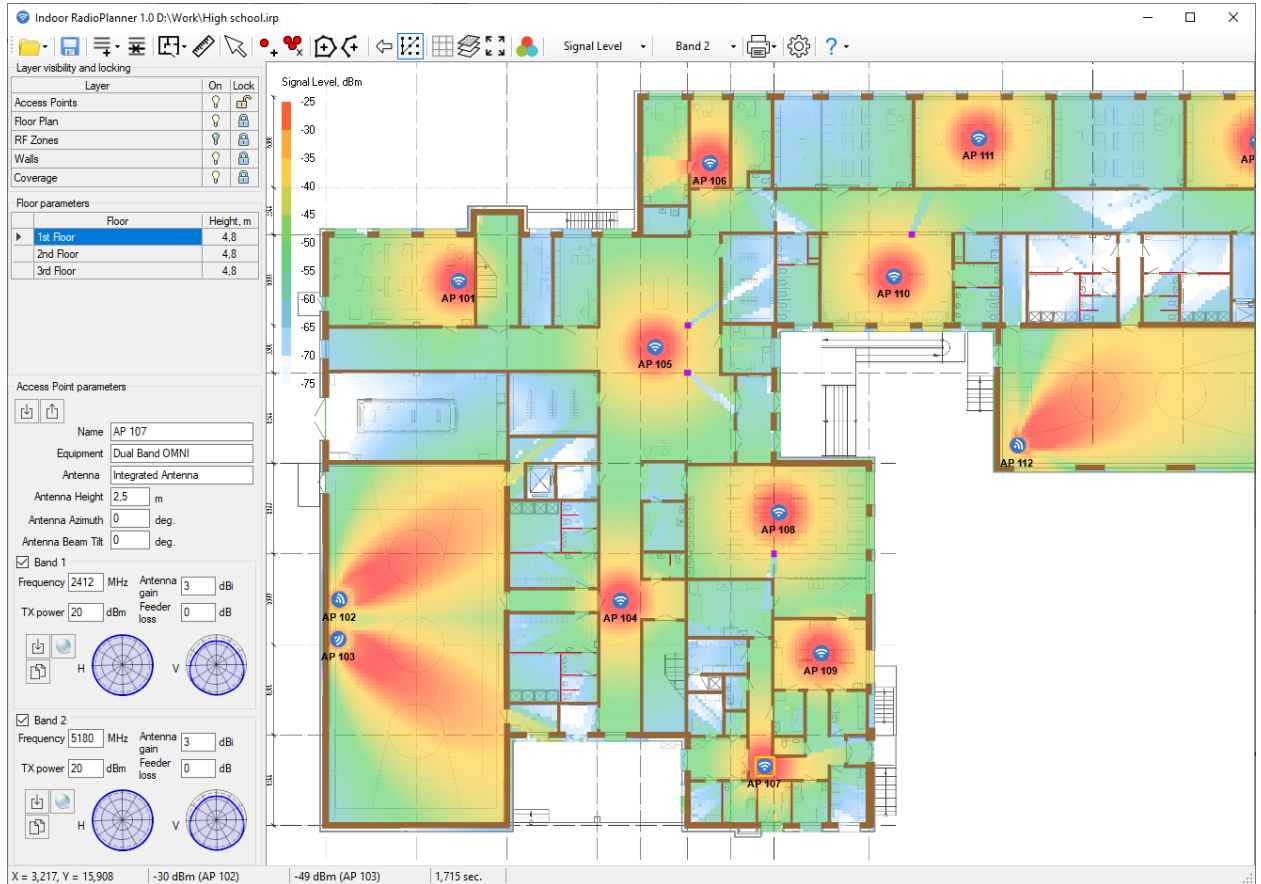
Signal Level

Best Server

The Best Server map shows the identity of the AP supplying the strongest received signal at a location. The colors that indicate coverage from various access points are assigned automatically from a standard set.

Only levels above the RSSI level set in the Settings menu are taken into account.
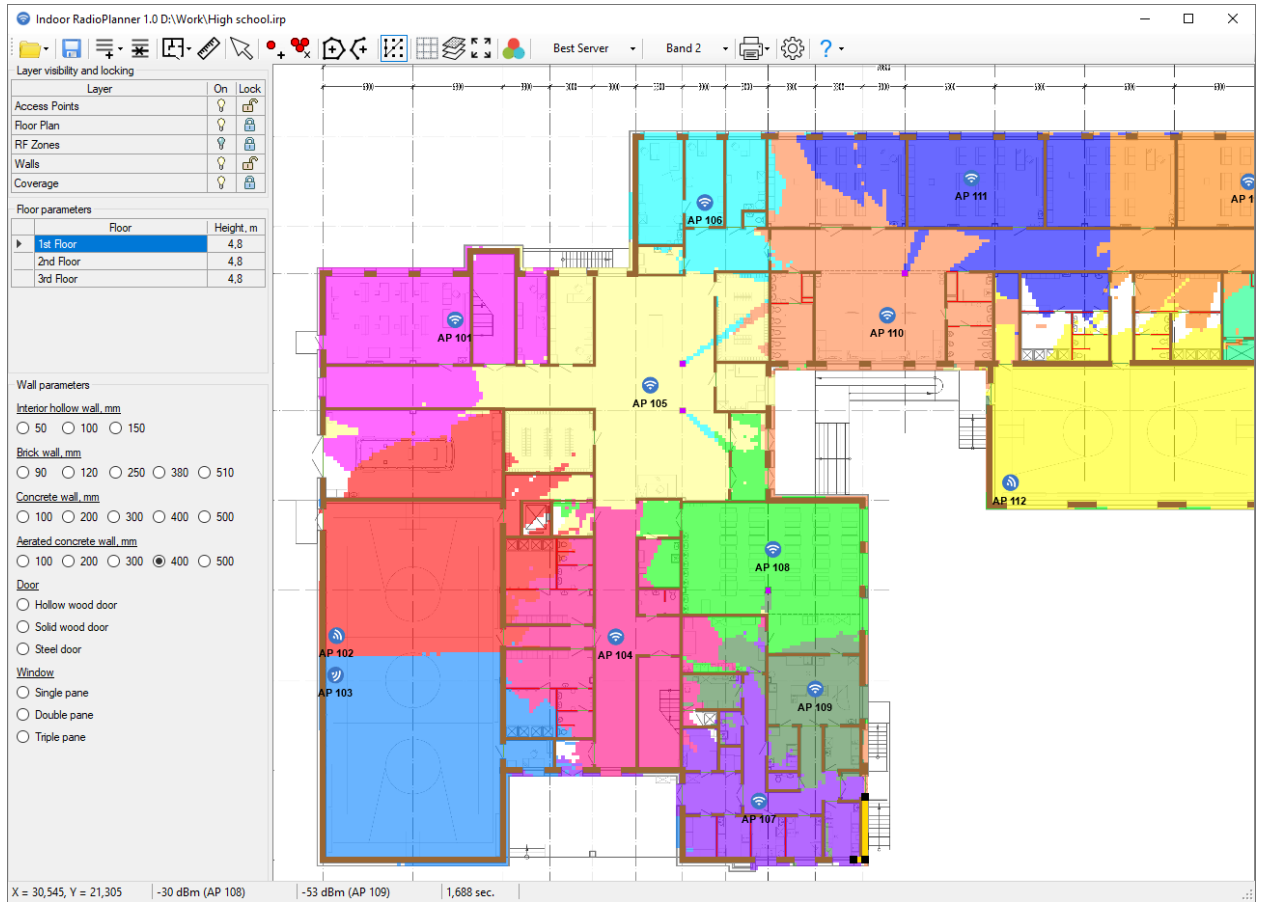
Best Server

Number of APs

This visualization shows how many APs cover a given area. Only levels above the RSSI level set in the Settings menu are taken into account.
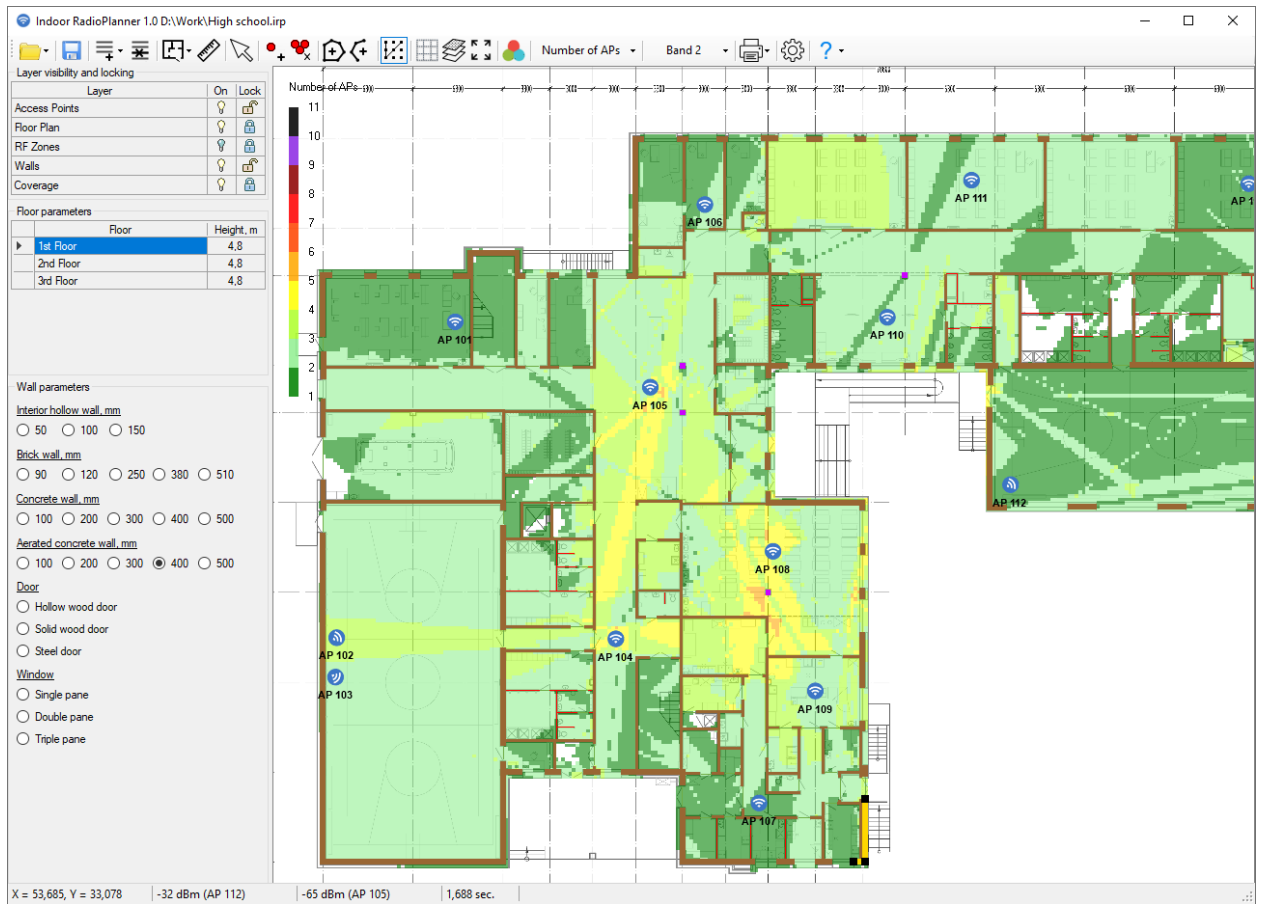
Number of APs

Report

Save Coverage as a picture	Save coverage for this floor as a picture
Coverage report to PDF or printer	Get the coverage report for each floor of the building. The coverage report can be printed or saved in PDF format using the standard Microsoft print to the PDF printer.
Access point parameter list	Save AP parameter list as CSV file
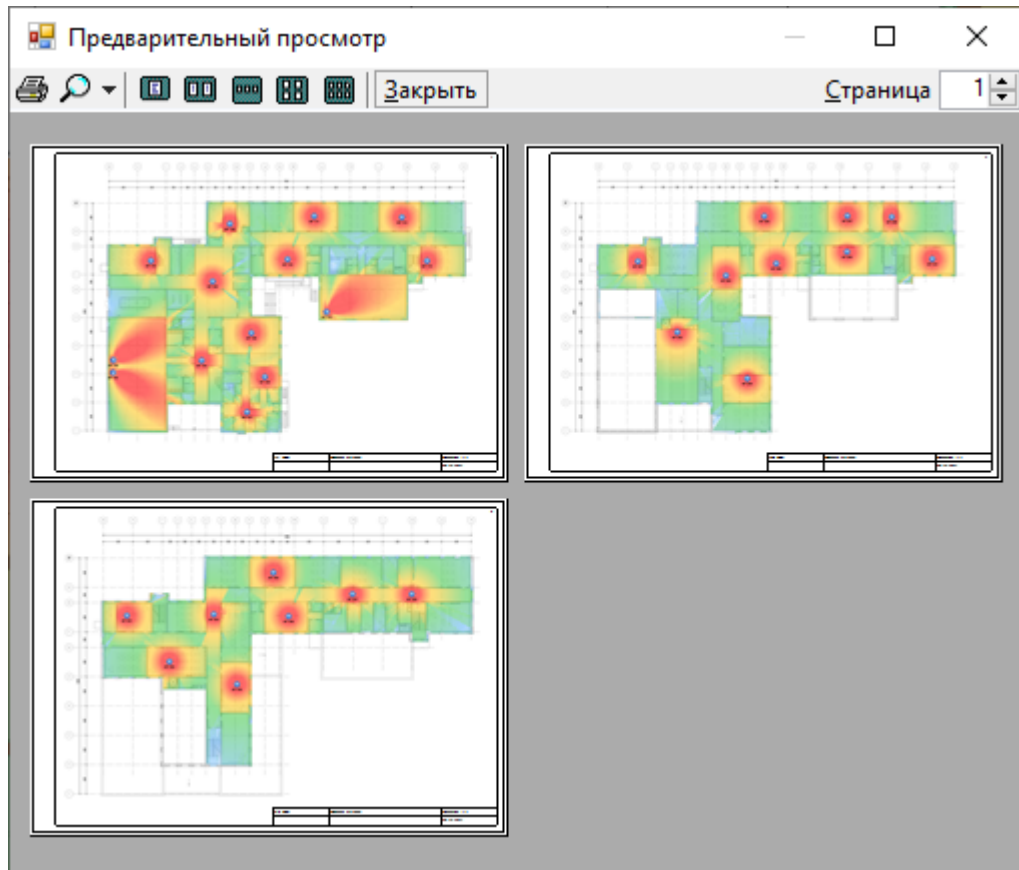
Saving a report to a PDF file

Settings

In this menu, you can customize the color scheme for the Signal Level heatmap, set image resolution in the report, customize wall penetration loss, and set client terminal parameters.

Settings				✕

Signal level, dBm

Minimum `-75`   Maximum `-25`   Min RSSI `-75`

Client terminal parameters

Antenna height `1.5` m   Antenna gain `0` dBi

Language

◉ English
○ Русский
○ Español

Close and open the app after changing the language
If you need your own language here, let us know

Picture Resolution for Report

min   max

Custom frequency for wall parameters

Frequency `900` MHz

Wall parameters

Type	Loss, dB 2400 MHz	Loss, dB 5000 MHz	Loss, dB Custom freq.
Interior hollow wall 50mm (2")	1	2	1
Interior hollow wall 100 mm (4")	3	5	2
Interior hollow wall 150 mm (6")	4	9	3
Brick wall 90 mm (3.5")	6	10	5
Brick wall 120 mm (5")	8	13	6
Brick wall 250 mm (10")	10	25	8
Brick wall 380 mm (15")	15	30	13
Brick wall 510 mm (20")	20	37	15
Concrete wall 100 mm (4")	6	10	4
Concrete wall 200 mm (8")	10	13	8
Concrete wall 300 mm (12")	14	22	12
Concrete wall 400 mm (16")	18	30	15
Concrete wall 500 mm (20")	25	37	20
Aerated concrete wall 100 mm (...	4	7	3
Aerated concrete wall 200 mm (...	7	9	5
Aerated concrete wall 300 mm (...	10	15	8
Aerated concrete wall 400 mm (...	13	21	10
Aerated concrete wall 500 mm (...	18	26	14
Hollow wood door	4	7	3
Solid wood door	6	10	4
Steel door	13	25	10
Window single pane	3	6	2
Window double pane	7	13	5
Window triple pane	13	20	10

Cancel   OK

Help

In this menu, you will find information about the developer, a link to the user manual, and an option to check for updates. The trial version will also have links to the purchase page and activation menu. After activating the program, these menu items will disappear.