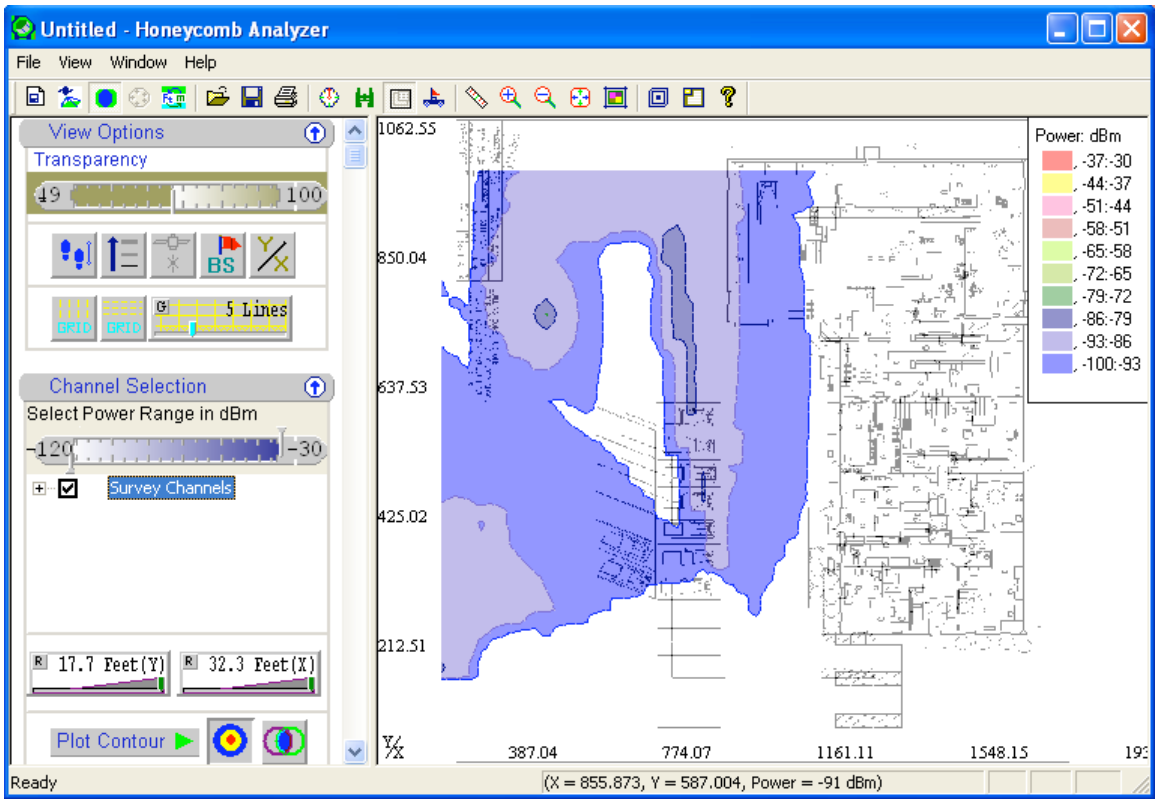
Honeycomb

Manual version 1.2



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MINIMUM HARDWARE REQUIREMENTS

PC/TABLET SOFTWARE

Operating System:	**Windows XP**
Processor Speed:	**1 GHz**
RAM:	**512 MB**
Display:	**1024x768 minimum**

IPAQ SOFTWARE

Operating System:	**Windows Mobile 5.0**

Honeycomb is a software suite for use with the Bumble Bee spectrum analyzer. The software is designed to provide a means for the Bumble Bee user to map non-802.11abg interference over a given area. The suite consists of three applications: Projector (separate CD), Collector, and Analyzer.

Projector runs on a Windows PC or Tablet UMPC. The basic idea of the Projector is to import an image of a floor plan or a map. A projection is then created to convert the pixels of the image into actual distances for meaningful site data.

Collector runs on an HP iPAQ or Tablet UMPC that is connected to the Bumble Bee hardware. A projection file is imported from the Projector. Then the Collector communicates parameters and channels to scan to the hardware. Data is then collected over the entire site for later analysis.

Analyzer processes the data collected back on the Windows PC or Tablet UMPC. Analyzer sorts out the RF information to determine if there is any interference that may interfere with 802.11 networks.

The following sections go over the various features of the three applications mentioned above.

FIGURE 1 – The Honeycomb Software Suite

NOTE: Updates for Honeycomb applications can be found in the support section of the BVS web site (www.bvsystems.com).

Honeycomb Projector

As stated previously, Projector runs on a Windows PC or Tablet. The basic idea of the Projector is to import an image of a floor plan or a map. A projection is then created to convert the pixels of the image into actual distances for meaningful site data.

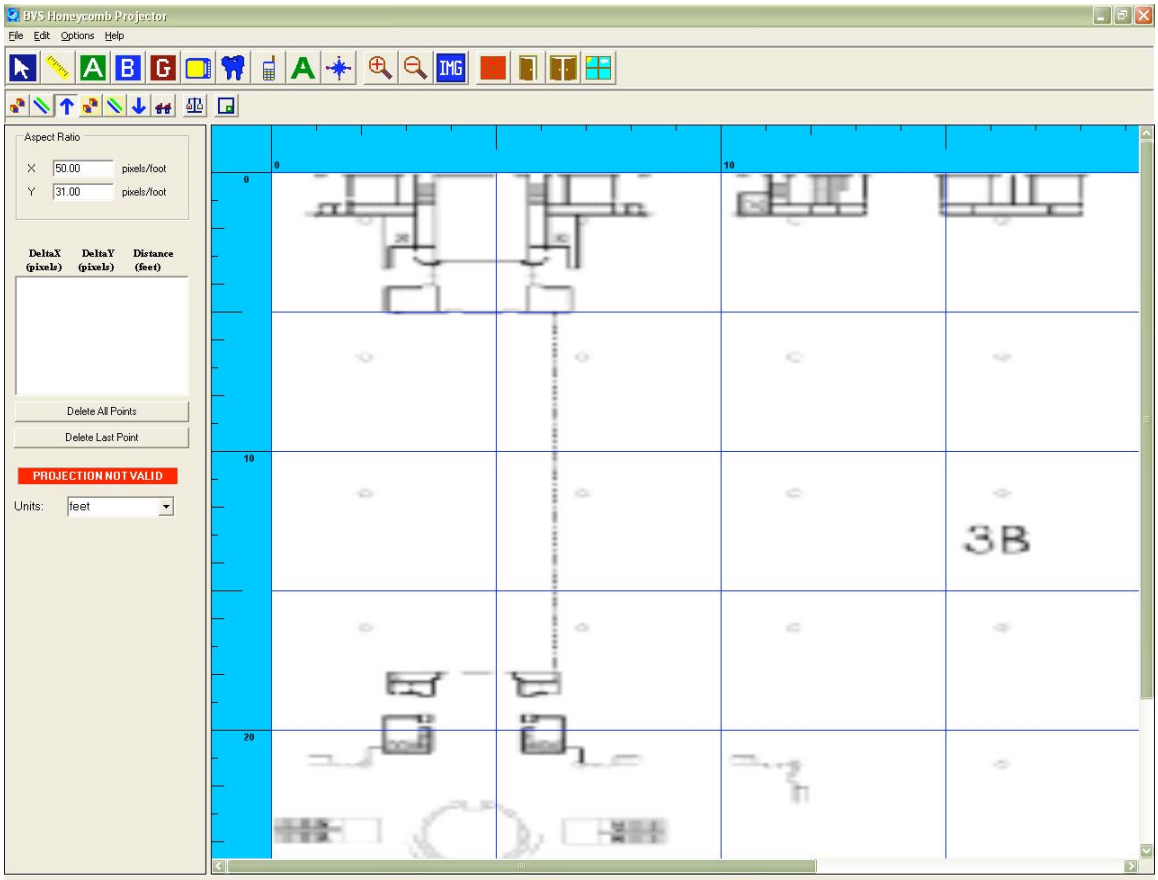


FIGURE 2 – Projector

The Projector also allows you to add 2.4 and 5 GHz objects such as access points and interferers. Text can also be added to the floor plan. The projection file is then saved for use with the Collector program to perform interference analysis.

INSTALLATION

To install the application from a CD, place the Projector CD in the drive. Choose the install button. Follow the installation instructions on the screen from this point.

QUICK START

Creating a projection file that is ready for use with the Collector requires the following steps. See the sections below for individual explanations. Projector can import any of the following file formats: Monochrome BMP, 16-bit color BMP, 256 color BMP, 24-bit BMP, GIF, ICO, TIF, JPG and PNG.

1. **CREATE A PROJECTION IMAGE**
2. **SET THE DIMENSIONS FOR THE ASPECT RATIO**
3. **ADJUST SIZE OF FLOOR PLAN IF NECESSARY**
4. **ADD STATIC OBJECTS TO FLOOR PLAN IF NECESSARY**
5. **ADD CUSTOM IMAGES AS STATIC OBJECTS**
6. **ADD WALLS, WINDOWS, AND DOORS**
7. **SAVE FILE**

CREATE A PROJECTION

Use FILE/NEW on the menu to create a new projection file. Choose a floor plan from the popup window to use as a base for your site. You may use a .bmp, .jpg, .gif etc.

SET THE DIMENSIONS FOR THE ASPECT RATIO

Click the ruler icon in the toolbox. Look for a location on the projection that you know the distance. Click on the first point of the measurement. A flag will mark the spot. Click on the second point of the measurement.

Now enter the distance and units for the measurement. Repeat steps 2 thru 4 for a second measurement. Make sure that the second measurement is in a different orientation from the first point. Keep repeating until you receive a message saying that a valid projection exists.

Points used for the projection may be deleted from the listbox on the left status bar.

ADJUST THE SIZE OF THE FLOOR PLAN

At times it may become necessary to reduce the amount of space an image takes up in memory, especially when considering the iPAQ. There are two types of image reduction available in Projector. There are multiple algorithms used to achieve the reduction.

SCALING

Scaling the image reduces the size of the image while attempting to keep all of the features of the floor plan. In effect, the image is shrunk. Scaling the image can be done in different ways. Different interpolation modes for scaling the image are listed below. These modes use different techniques

to determine how to reduce groups of pixels into one which is representative of the group.

Interpolation Modes

D is the destination image and S is the source image. Here are simple explanations of some of the interpolation modes. Trying all of the modes will give a better understanding of what changes the image will incur.
Remember, the higher-quality reduction, the slower the process. The lower the quality, the faster the reduction.

Bicubic - D takes on a color value from a source matrix (S) based on a polynomial function.

Bilinear - D takes on an average of colors from the nearest region of S (for example, a 2x2 matrix)

High Quality Bicubic - D takes on a color value from a source matrix (S) based on a polynomial function.
Higher quality Bicubic (will run slower)

High Quality Bilinear - D takes on an average of colors from the nearest region of S (higher quality than simple Bilinear)

Nearest Neighbor - D simply takes on the color value of the nearest pixel in the source.

CROPPING

Cropping the image will clip off the part of an image not specified in the new dimensions of the image.

ADD STATIC OBJECTS

A number of static objects can be permanently added to the site. Inserting each type of object is explained in the following passages.

ADD AN ACCESS POINT

Existing Access Points may be added to the floor plan to simply show their location. First, decide whether you want to represent an 802.11a, 802.11b, or 802.11g access point. Choose the icon from the toolbar with the correct letter on it (A,B,G). Now click on the part of the floor plan where you would like to represent the access point.

INSERT TEXT

1. Click on the text insertion button on the toolbox.
2. Click on the location where you wish to insert the text.
3. Enter the text.
4. Press OK.

MICROWAVE/DIRECTIONAL ANTENNA/2.4 GHz PHONE/COMPASS

Any of these objects may be placed on the floor plan. Simply click on the desired object. Then click on the floor plan where you wish the object to be placed.

ADD CUSTOM IMAGES AS STATIC OBJECTS

Any custom bitmap may be added to the floor plan. Click on the "IMG" icon on the top toolbar. Then choose an image file. Then click on the floor plan where you would like the image.

ADD WALLS, WINDOWS, AND DOORS

Additional walls, doors, and windows can be added to the floor plan.

WALLS

Click on the wall icon on the top toolbar. Then click where you would like the wall to begin. Then click on where you want the wall to end. A new wall has now been added to the floor plan.

DOORS

Click on the door on the top toolbar. Choose a single or double door using the appropriate icon. Then click on where you would like the doorway to begin. Then click on the other side of the new doorway.

NOTE: The doors will swing differently based on start and stop clicks. If the finishing click on the doorway had been the starting click, the door would then swing in the opposite direction.

WINDOWS

Similar to the procedure for doors and walls, click on the window icon on the top toolbar. Then click where you would like the window to begin. Then click on where you want the window to end. A new window has now been added to the floor plan.

SAVE THE PROJECTION

1. Choose FILE/SAVE from the menu.
2. Enter a name for your projection file.
3. You now have a projection file to put on the HP iPAQ that is part of the BumbleBee system.

STATUS BAR (Left)

On the left of the screen are different statistics. They are the pixels / foot (meter) ratio. You can also adjust whether or not the measurement units are in feet or meters.

MENUS

There are 5 submenus located in the main menu at the top of the screen.

The FILE submenu lets you open or save site files.

NEW creates a new site file.
OPEN opens an existing site file.
SAVE saves a site file under the previously saved filename.
SAVE AS saves a site file under a new filename.

The EDIT submenu has editing options.

UNDO lets you undo up to 3 previous edits to the site.

The OPTIONS submenu contains system options.

SHOW GRID overlays a grid of lines on top of the site.

The SCALE submenu contains scaling options (see "Adjust the size of the floor plan")

Bicubic
Bilinear
High
High Quality Bicubic
High Quality Bilinear
Low
Nearest Neighbor

The HELP submenu contains help options.

ABOUT pulls up the about box.

RULERS

The rulers along the vertical and horizontal planes of the projection represent a scale of the projection. These are set using the ruler toolbox option.

ZOOM MODES

There are four different modes for zooming in and out of the floor plan.

ZOOM IN

Click on the magnifying glass with the '+' sign. Then create a zoom rectangle by clicking-and-holding on an area of the floor plan. Then drag the mouse (while holding down the mouse button) to the next point.
A dashed rectangle will appear. When the zoom rectangle is the appropriate size, release the mouse button. The floor plan will now be zoomed into that rectangle.

ZOOM OUT

Clicking on the magnifying glass with the '-' sign will reduce the image resolution by a factor of 2, thereby making the image zoom out.

Honeycomb Collector

INTRODUCTION

Collector runs on an HP iPAQ or Tablet UMPC that is connected to the Bumble Bee receivert hardware. A projection file is imported from the Projector. Then the Collector communicates parameters and channels to scan to the hardware.

Data is then collected over the entire site for later analysis. Each point is collected by traversing around the site and telling the Collector where each scan point is on the imported projection file. This collection file stores information on the RF environment as it pertains to a 802.11b/a/g network.

The information is then used with the Analyzer program on the PC. You can also zoom in and out on points, delete existing points, pull up survey information on any point, and scroll throughout the entire site by use of the stylus or joystick.

INSTALLATION

Collector can be installed from a number of different sources. The application can be installed from the Honeycomb CD, from a secure digital card, and from a direct ActiveSync transfer of the executable.

Microsoft ActiveSync is an application that runs on both the iPAQ and PC and is used to communicate between the two. If your PC does not already have this application, install from the product CD. ActiveSync can also be downloaded from Microsoft.

FIGURE 3 - Collector

To install the application from a CD, place the CD in the drive. Choose the Honeycomb Collector button after verifying that you have a connection through ActiveSync has been made. The iPAQ will usually connect to the PC through the USB cradle or IR port.

To install from an SD card, place the card into the iPAQ or Tablet UMPC slot. The run the reinstall program by looking for the SD card in File Explorer. It is usually an immediate subdirectory off of the root ("My Device").

The application can also be simply copied onto the iPAQ from the PC as long as there is an ActiveSync connection. The directory where the application is to reside on the iPAQ does not matter.

REGISTRATION CODE

The first time that Collector is run, a dialog box will show up asking for the registration code. This code is located on the paperwork you received from the factory. Each unit has its own registration code that is tied to the serial number.

It is very important that the iPAQ or Tablet UMPC is connected to the BumbleBee when running the Collector. Collector asks the hardware for its serial number. If it is not talking to the hardware, the registration code will not be verified and the application disabled.

FIGURE 4 – Registration Code Screen

GETTING STARTED

Before running the Collector application, make sure that the iPAQ or Tablet UMPC is connected to the Bumble Bee receiver.

After starting the software, there are three steps that must be followed in order to start collecting data with the Collector.

They are:

- **Open a Projection File**
- **Open a Data File**
- **Adjust Scan Settings**

OPENING A PROJECTION FILE

The first step in surveying data is opening a projection file created with Projector. Tap on the leftmost icon on the bottom of the application to open an existing file. The opened filename and size are shown in the bottom information box.

OPENING A DATA FILE

A data file must be opened before beginning to scan data. The second icon on the bottom toolbar is for opening a data file. A choice needs to be made on whether to append to an existing file or to open a new file. The opened filename and size are shown in the bottom information box.

ADJUST SCAN SETTINGS

The final step is to adjust the current scan settings. Any previous settings are recovered from the system registry and will be used unless these settings are changed.

Tapping on the third icon on the toolbar will pull up the screen shown in the figure below.

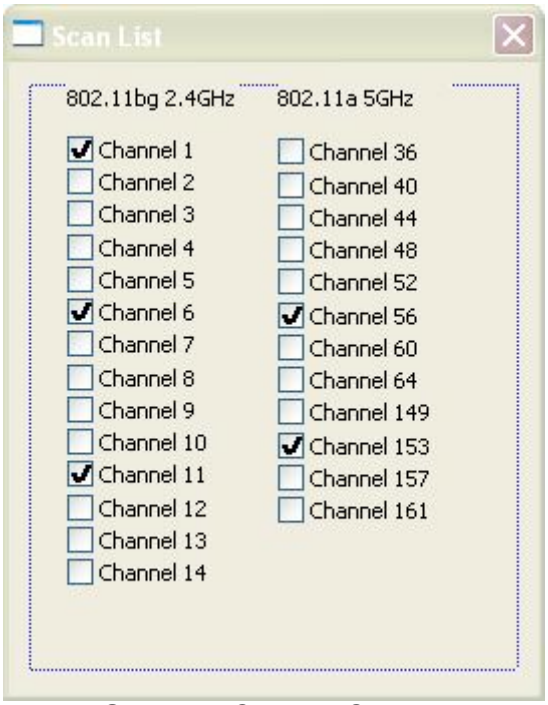


FIGURE 5 – Channel Selection

There are a series of checkboxes that show which 802.11abg channels have been selected for scanning. Check or uncheck channels to be scanned. The scan time will increase in length linearly with every channel added.

For example, if it takes 1 second to scan 1 channel, it will take 3 seconds to scan 3 channels.

Press the OK button after selecting the channels. You are now ready to begin scanning.

SCANNING

Locate a point on the projection to begin scanning. Press the stylus on the iPAQ exactly where you are standing on the projection. You will see a progress bar appear as well as information on the current channel being scanned.

After all of the channels have been scanned, a colored circle will appear on the projection. The color depends on the maximum power being reported during the scan.

Continue to make individual point scans throughout the area covered by the projection. There will be a dashed line connecting the points. This is the walk/drive path.

All information for the scans is automatically stored in the log file. The increasing size of the log file is shown in the bottom information box.

After scanning has been completed, the data file can be brought back over to the PC where it will be processed by the Analyzer application.

INFORMATION SCREEN

After a new data point has been created, information can be obtained by tapping and holding on the desired point (when using Honeycomb on the BumbleBee-TABLET, the user must press the 'i' button in the toolbar and then tap on a point to get scan information for that point). A popup list box will appear which will show information on every channel scanned for this point.

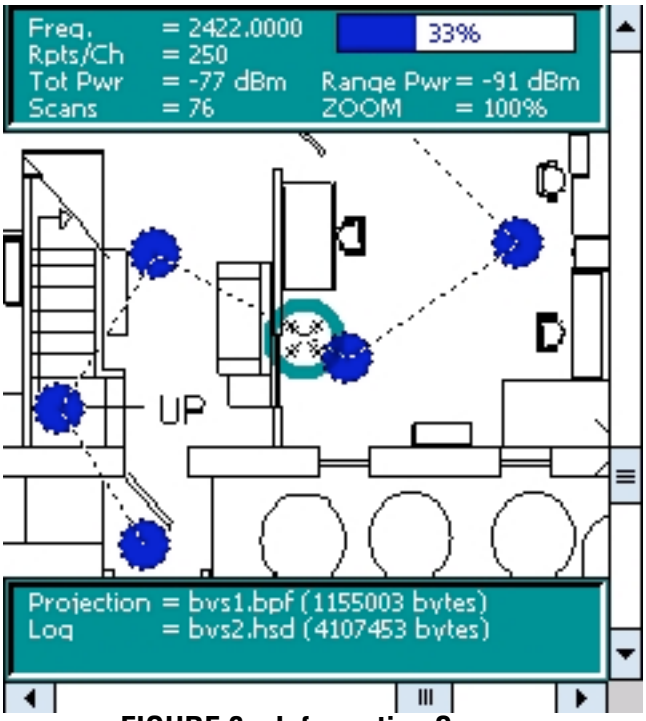


FIGURE 6 – Information Screen

DELETE A POINT

To delete a point from the survey, press and hold on the desired point. Then press the delete button on the information screen.

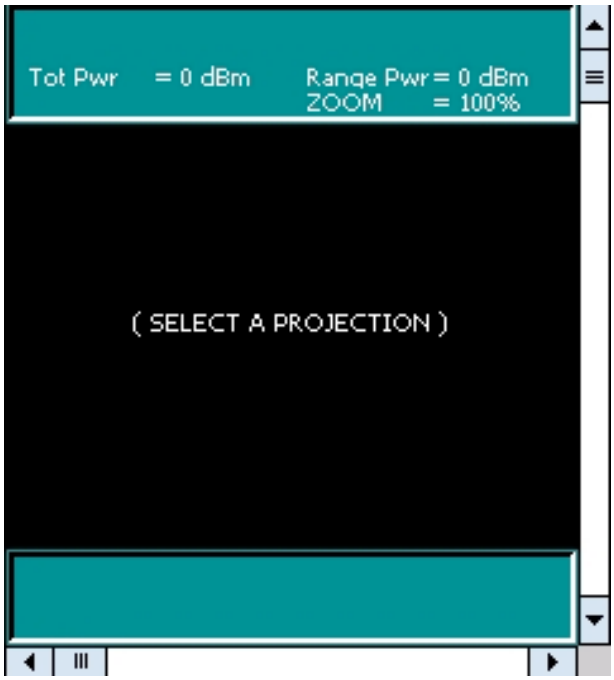
JPEG SNAPSHOT

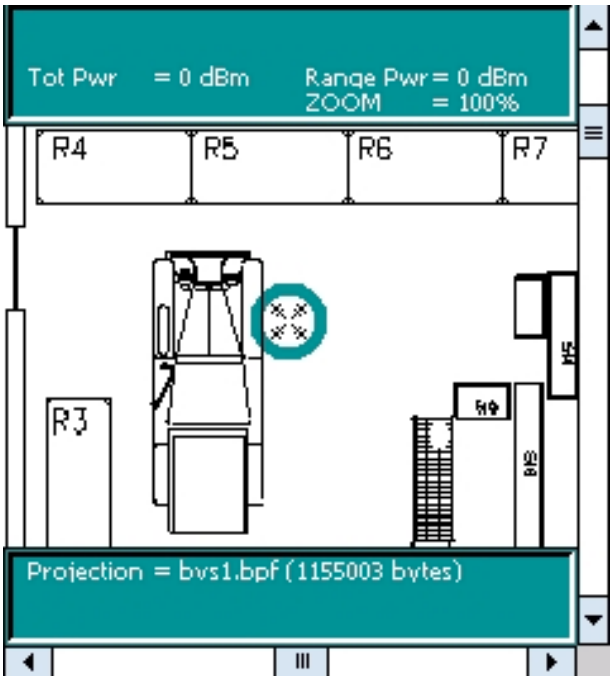
This option will take a snapshot of the current screen. You will be prompted to save the snapshot to a JPEG filename (as in digital cameras).

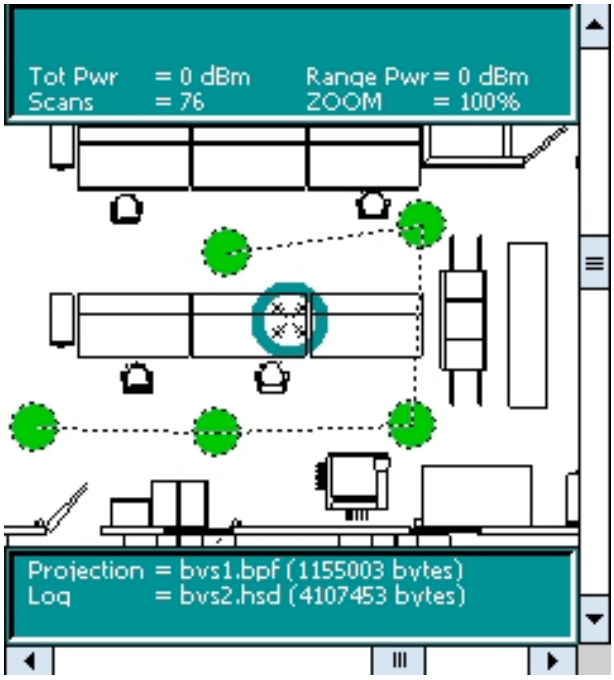
ZOOM IN

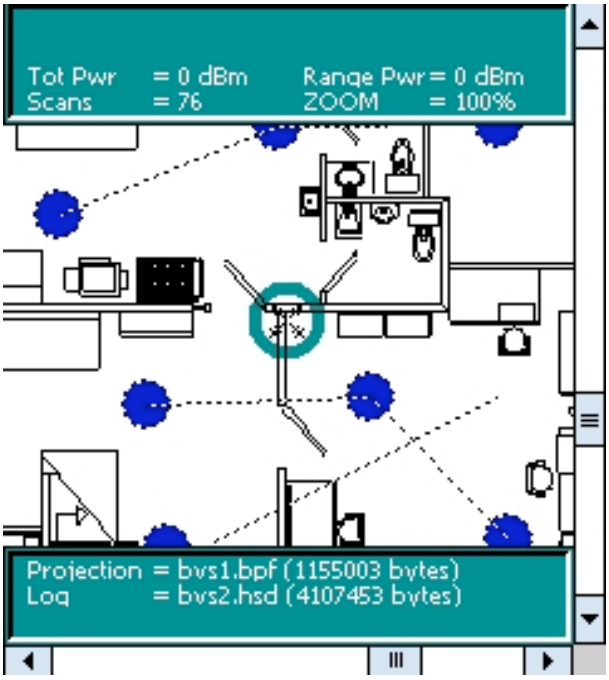
Pressing on this option will increase the magnification of the site by a factor of 2.

ZOOM OUT
Pressing on this option will reduce the magnification of the site by a factor of 2.









Honeycomb Analyzer

INTRODUCTION

The Honeycomb Collector is installed on an iPAQ PocketPC®. The Honeycomb Projector and Analyzer are installed on a laptop/desktop PC. If your BumbleBee/Honeycomb order includes an iPAQ shipped from the BVS factory, Honeycomb Collector will be installed on your iPAQ in advance. If you should need to install or re-install Honeycomb software on your iPAQ, simply use the supplied SD (Secure Digital) installation card in the SD slot of your iPAQ.

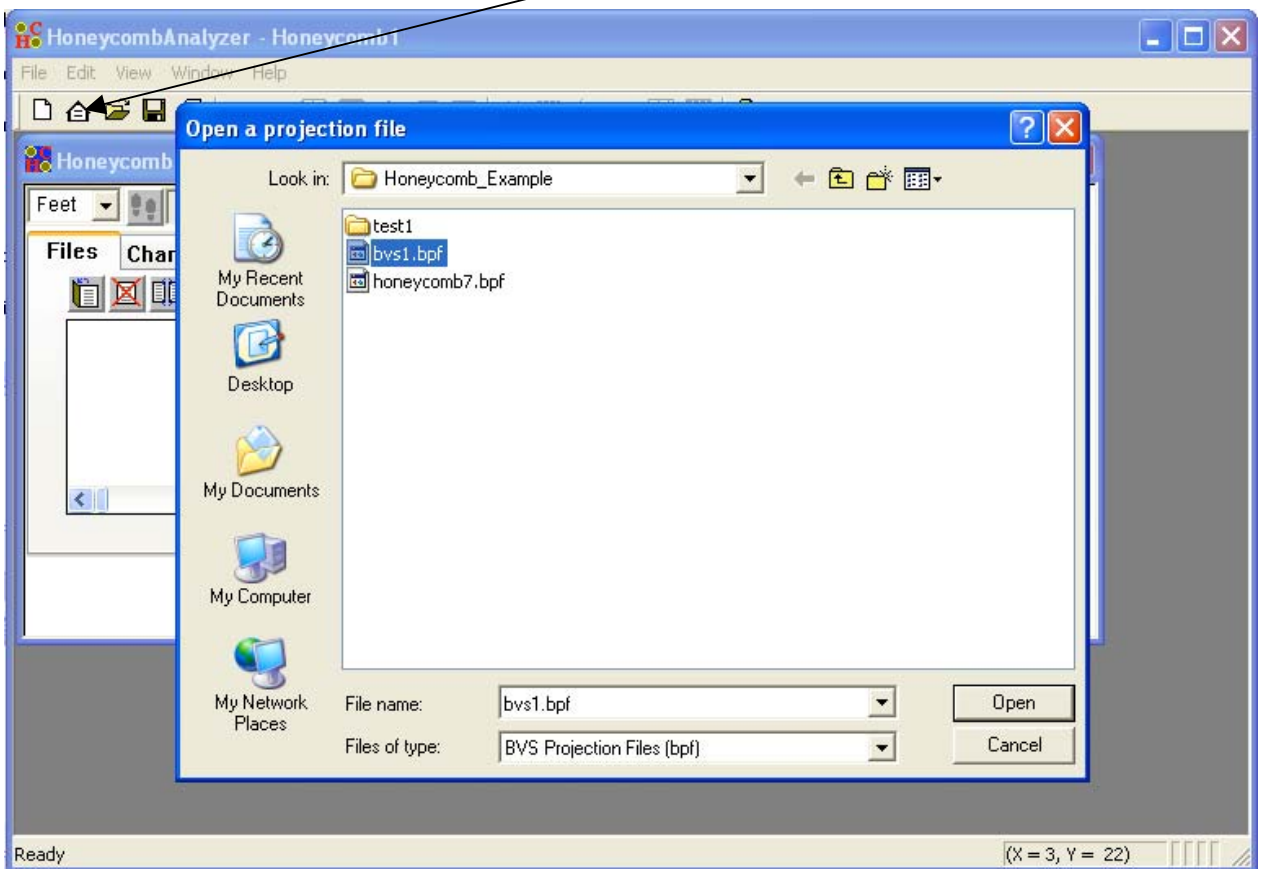
Honeycomb Collector and Analyzer PC software for your laptop or desktop is all contained on the included CD-ROM. Insert this CD-ROM into your PC and you will be prompted to install the software. Projector software may be installed using the Projector CD.

Honeycomb Analyzer is the analysis component of the BumbleBee Honeycomb software package for Wireless Local Area Networks (WLAN). It provides maximum power, occurrence rate, and combined analysis for WLAN signal, interference, and total signal (signal + interference).

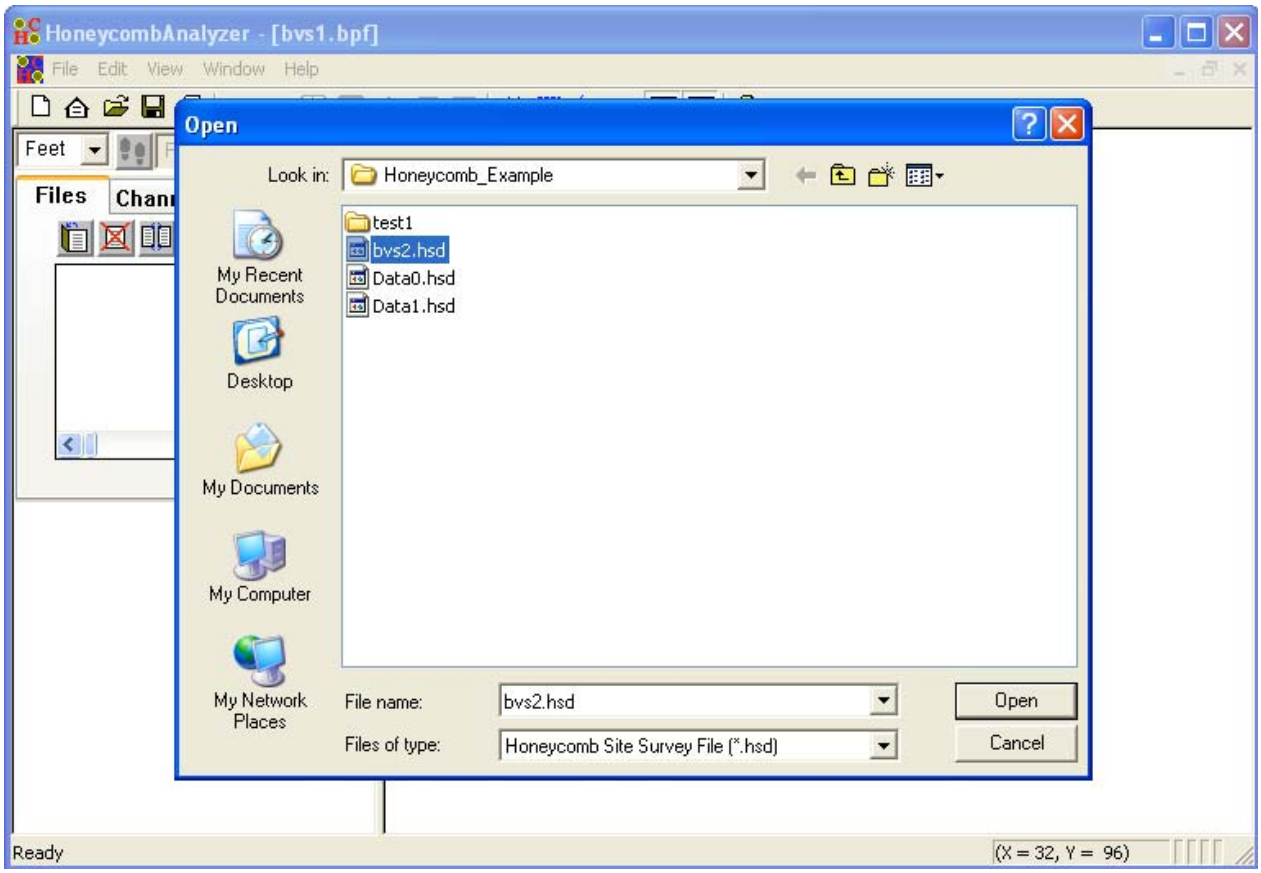
GETTING STARTED

Honeycomb Analyzer uses a projected map from the Honeycomb Projector and data recorded with the Honeycomb Collector. Honeycomb Projector generates a BVS Projection File (*.bpf) that contains the map of the survey. Honeycomb Collector produces a Honeycomb Site Survey file (*.hsd) that contains the collected data with the use of the BumbleBee.

The Honeycomb Analyzer is project based. To begin using the Honeycomb Analyzer a Honeycomb Projection file must first be loaded. Click on the hotkey located in the toolbar near the top of the screen. The Honeycomb Projection File dialog box then appears. Open the Honeycomb Projection (map) you wish to use.



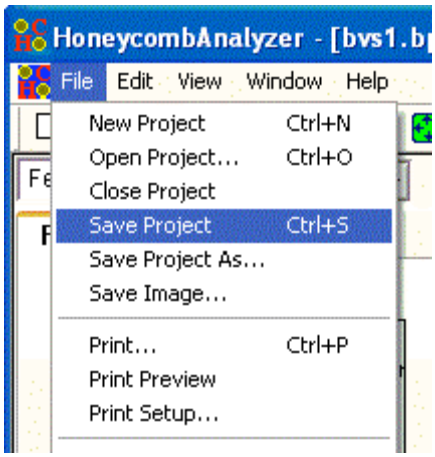
The Honeycomb Collector files must then be loaded to create a project. The Honeycomb Analyzer can process multiple survey data files jointly. To create a new project, select "File" Tab control button and click on the button. The Honeycomb Collection File dialog box then appears. Select the collection files you wish to use.



More files can be selected by clicking on the button. If you wish to use two or more files that you have saved, checking the button can merge the data in the files during the process. If a file is added in by mistake, check the box before the file, and then press the button. All the selected files will be deleted. After the collection files are selected, click the button to load and process the data.

Saving a Honeycomb Site Project File

At anytime after a project has been created, it can be saved to a file. The current settings including state of controls and graph (map, bitmap and analysis) are saved in a project file and can be recalled later. To save a project, select Save Project or Save Project As… from the File menu or the Hotkey for the Toolbar.



If the project has previously been saved, the Save option will overwrite the existing file while the Save Project As… will allow a new file name to be selected.

Opening an Existing Honeycomb Project

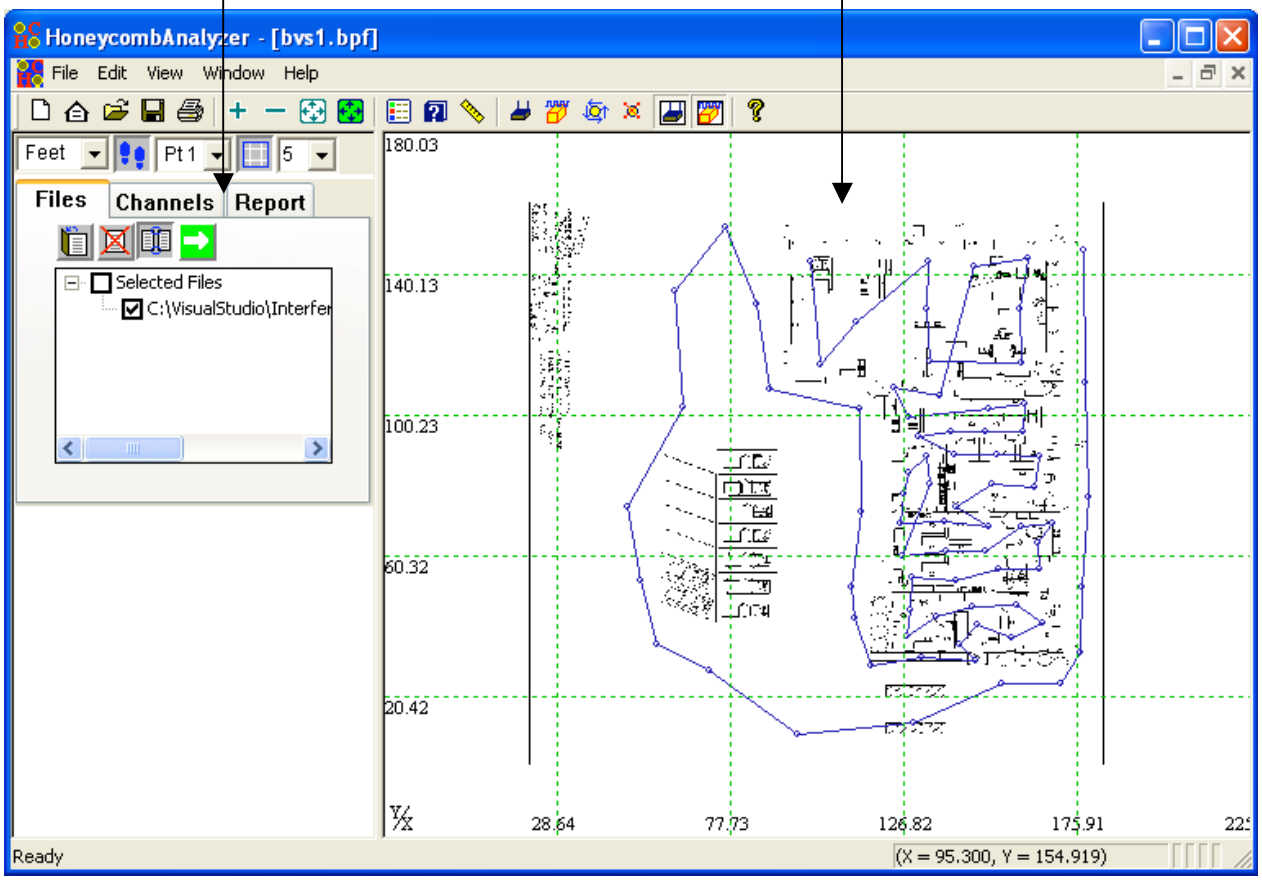
To open an existing Honeycomb Project select "Open Project" from the File menu or the Hotkey from the Toolbar. A dialog box will appear to allow the selection of the project file (*.hws).

Control Window

The Honeycomb Analyzer screen is displayed in two sections.

The left pane of the display contains the Control Window used for Files Selection, Channel Selection and Analysis, HTML Report Creation, and Point Analysis.

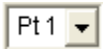
The right pane contains the map from the Honeycomb Projector.



Metric Selection

Metric information can be displayed in feet or meters. The default setting is feet. To select the metric use the **combo box located below the top toolbar.**

Survey Path

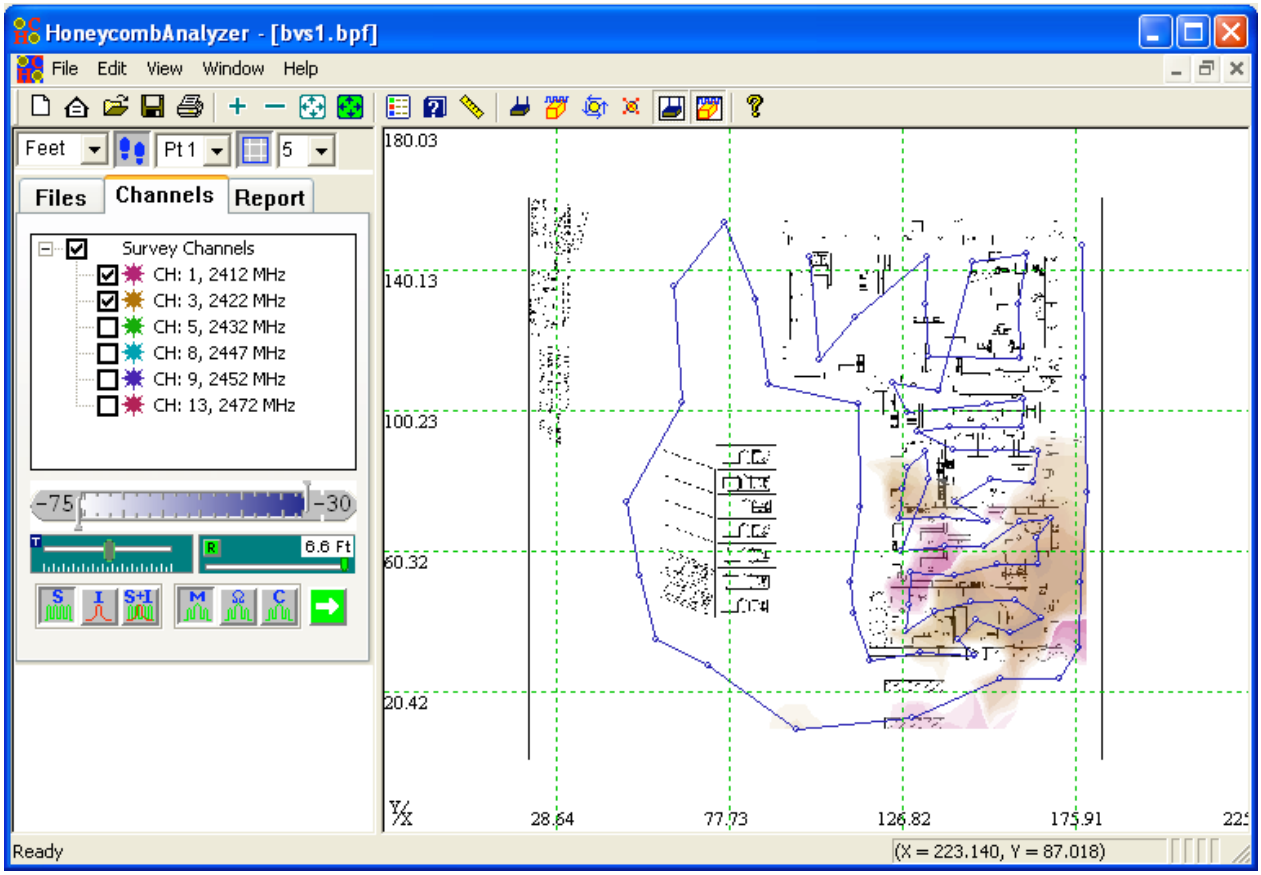
Checking the **button can show survey path. To change the line width of survey path, use the**  **combo box to choose 1 pt, 2 pt, or 3 pt line width.**

Grid Lines

Checking the **button can show grid lines. To change the number of grid lines, use the** **combo box to choose from 3 to 10 lines.**

Channel Selection

Select channels you wish to work with in the control window by clicking on the "channels" button. The channel selection tool contains a list of all channel(s) that are present in the Site Survey file. Checking the box next to the channels includes the channels in the analysis. As the channel is selected, the graph for a selected type of analysis is show in the graph view.



Channel Analysis

WLAN signal, (non-WLAN) interference, or a combination of them can be selected to analyze. The buttons to represent signal, interference, and signal plus interference are shown in the following table:

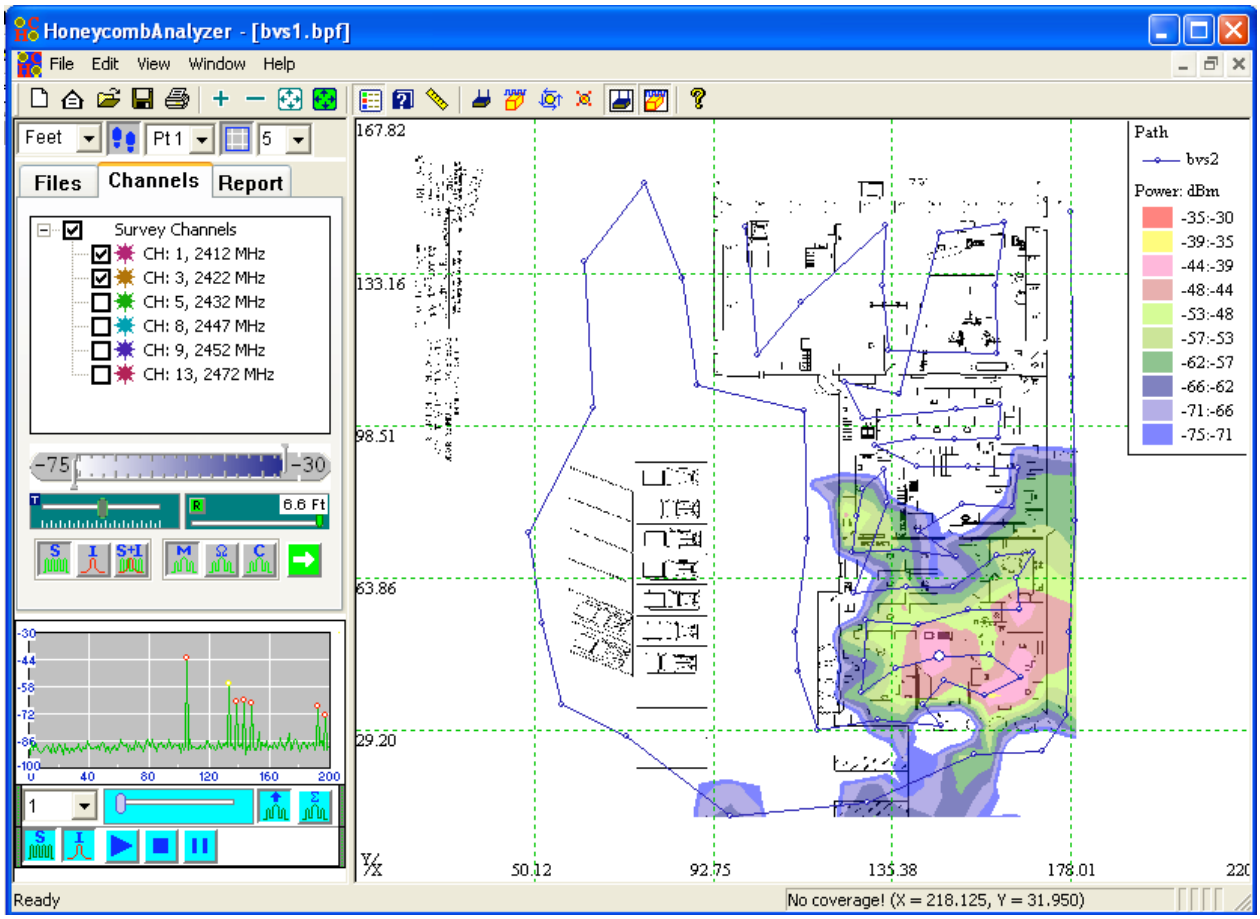
Signal	Interference	Signal+Interference

Honeycomb Analyzer implements a signal processing algorithm to separate WLAN signal and interference. Maximum power, occurrence rate, and a combined analysis can be performed. The Corresponding buttons are shown in the table below:

Maximum Power	Occurrence Rate	Combined Analysis

The analysis with the maximum value helps to locate access points or interference sources since the signal strength is inversely proportional to distance between the measurement point and the source. Plot of occurrence rate shows the percentage of WLAN channel used or the severity of the interference. The usage of WLAN channel bandwidth facilitates intrusion detection (where the occurrence rate is very high). The combined analysis uses both signal strength and occurrence rate to calculate the utility of channel. High utility means high usage of channel. The graph for a certain type of analysis is plotted when the channel is selected. The graph uses a default power range from –75 dBm to –30 dBm. To draw the graph with different power range, resolution, or different colors for one or multiple selected channels, use the button to plot the graph and the button on the Toolbar to see the legends. An example is shown below.

Graph Example (Signal with Maximum Power Analysis)



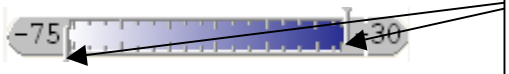
Notes that when minimum power setting is changed, the occurrence rate is changed accordingly. For example, interference occurred 4 times during 100 scans. Its power strength is –71 dBm, -60 dBm, -73 dBm, and –67 dBm individually. If the minimum setting is –75 dBm, the occurrence rate is 4%. If the minimum setting is increased to –70 dBm, since only two of them are larger than –70 dBm, the occurrence rate is 2%. The combined analysis (See Page 8) for the interference is $10\log_{10}[(10^{-60/10}+10^{-67/10})/100] = -79.2$ dBm.

Combined Analysis:

The average power (over all the scans) is used here to represent the usage of WLAN channel and the severity of the interference. For example, if both occurrence rate and signal power strength are high, the value of average power will also be high; if both occurrence rate and signal power strength are low, the value of average power will also be low.

Range Control

This feature allows the user to control how the signal strength in the channel is represented using a graph. The two sliders set the minimum and maximum values for the graphing range. The default minimum value is –75 dBm and the maximum one is –30 dBm.



Use these sliders to control min. and max. settings.

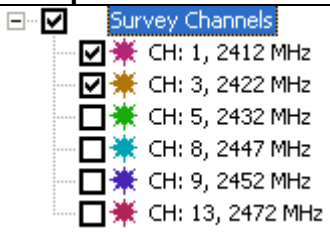
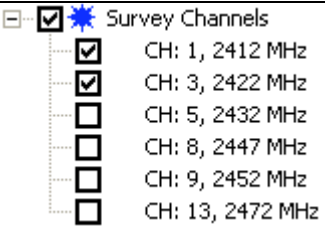
Color Selection

The color indicator between the channel and the check box has two functions:

One is to select the color used to plot the graph from that channel analysis. To change the color for a channel right click on the color indicator. A color selection dialog box will appear.

The other is to select how channels are grouped for analysis. By clicking on the space between the check box and the group label ("Surveyed Channels") the user will be able to choose how the channels are grouped. There are two conditions the user can choose from as shown in the following table:

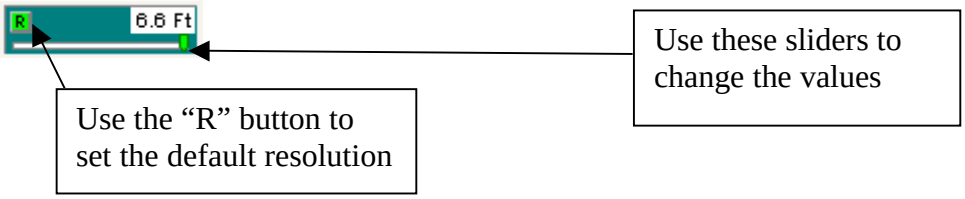
Example Grouping Description

Example	Grouping	Description
	Individual	Each selected channel is graphed in its color indicated by the color of star
	Group	The selected channels are graphed in the color.

Transparency Control

To change graph transparency, use the slider. The graph becomes opaque as the slider moves from left to right.

Resolution Control



The resolution control shows the size of the points calculated. Setting the control for low resolution will reduce the calculation time and decrease the resolution. The button R resets the control to a reasonable default setting.

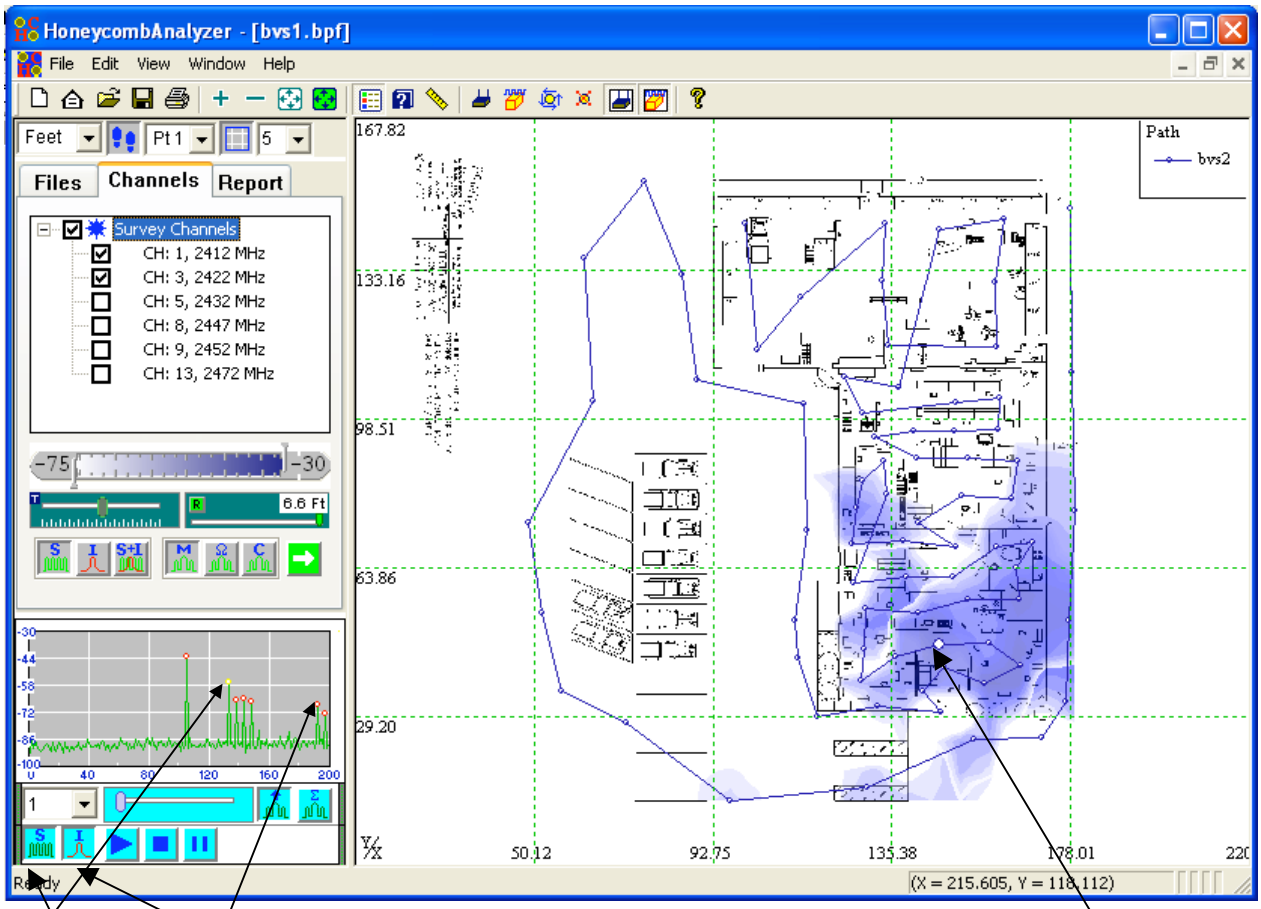
Point Analysis

When the walk path button is pressed, the measurement points are shown on the map. Double click on the point will pop up the point analysis window on the control view. The point itself will be marked by a larger circle. The scans at this point for a channel can be viewed by selecting the channel in the combo box 1. Notice that the horizontal axis is a time axis. Either peak power or total power can be shown on the screen. By clicking on the signal button, the scans with WLAN signals will be shown with yellow circles. When interference button is pressed, the scans with interference will be shown with red circles.

Buttons in Point Analysis Window:

Buttons	Descriptions
	Show Peak Power (The peak value in the spectrum for one channel during one scan)
	Show Total Power (The total power for one scan).
	Show Detected WLAN Signal (Yellow Circle)
	Show Detected Interference (Red Circle)
	Play Animated Show for Scans
	Stop Animated Show
	Pause Animated Show
1	Combo Box to Select Channels
	Slider to Control the Window

Point Analysis Example



WLAN signal

Interference

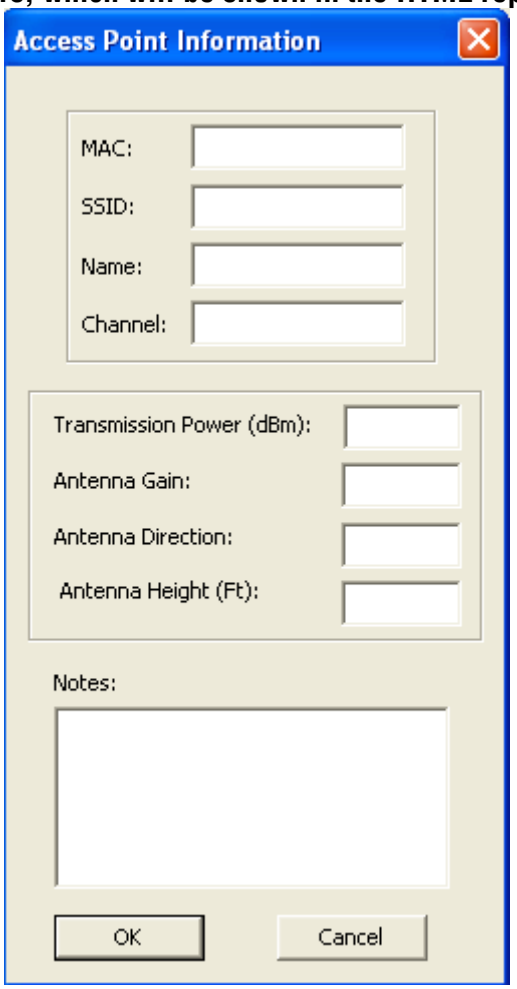
Selected Point

Buttons on The Toolbar

Button	Name	Description
	Create a New Project	Create a new project
	Open a BPF file	Open a BVS projection file (which has the map)
	Open a Project	Open an existing project
	Save a Project	Save current project as an HWS file
	Print	Print current graph
	“Zoom In” Tool	After clicking this hot button, the cursor changes to a magnifying glass.
	“Zoom Out” Tool	After clicking this hot button, the cursor changes to a zoom-out glass.
	Fit to Window	Pressing this hot key fits the image to the current size of the graph window.
	Fit to Map	Show the graph image with the whole map.
	Show Legend	Show legend for the graph
	Information Window	Show the processing data where mouse hovers
	Ruler	Measure the distance between two points on the map
	Insert an AP	Insert an access point on the map
	Insert an Interference Source	Insert an interference source on the map
	Move Source	Move an access point or interference source
	Delete Source	Delete an access point or interference source
	Show APs	Show access points on the map
	Show Interference Sources	Show interference sources on the map

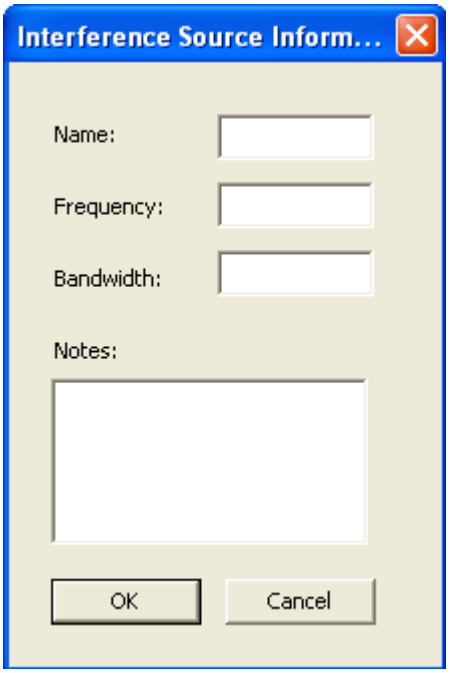
Inserting an AP

To insert an AP on the map, press on the button and the cursor will become a red flag . Clicking at any point on the map will place an AP there. A dialog for AP parameters is shown. Please type in the parameters, which will be shown in the HTML report.



Inserting an Interference Source

To insert an interference source, press on the button and the cursor will become a blue tooth icon . Clicking at any point on the map will place an interference source there. A dialog for interference source's parameters is shown. Please type in the parameters, which will be shown in the HTML report.



Show/Hide APs on the Map

Click on the button.

Show/Hide Interference Sources on the Map

Click on the button.

Moving an AP or Interference Source

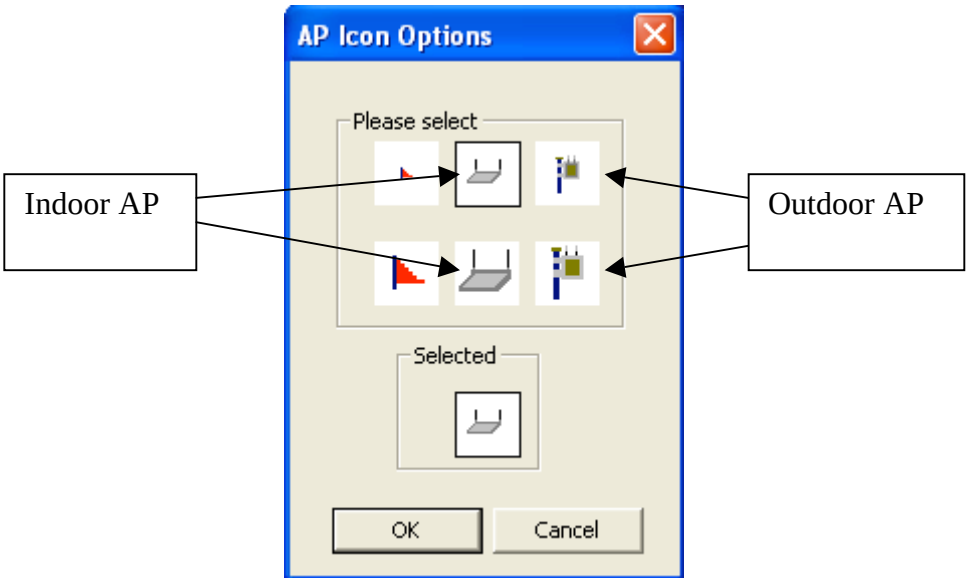
First click on the button. Then left click on the AP or interference source and hold on the mouse to move it.

Deleting an AP or Interference Source

Click on the button. Then left click on the AP or interference source. A dialog will show to ask if you really want to delete it. Click "Yes", the source is deleted; Click "No", the source is kept.

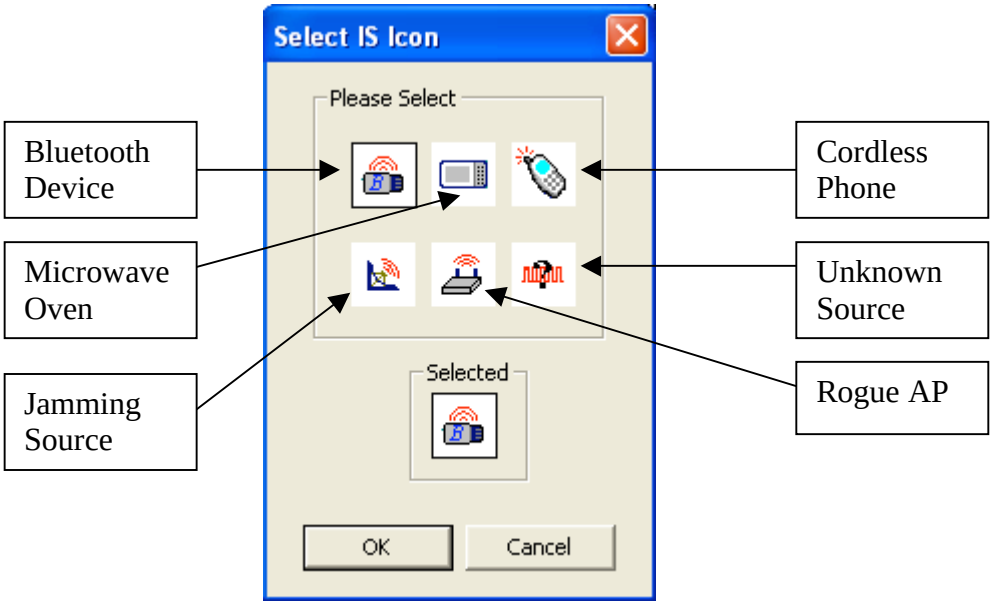
Changing AP Icons

Right click on the AP, a dialog with all icons is shown. Select the desired one and then click the "OK" button.



Changing Interference Source Icons

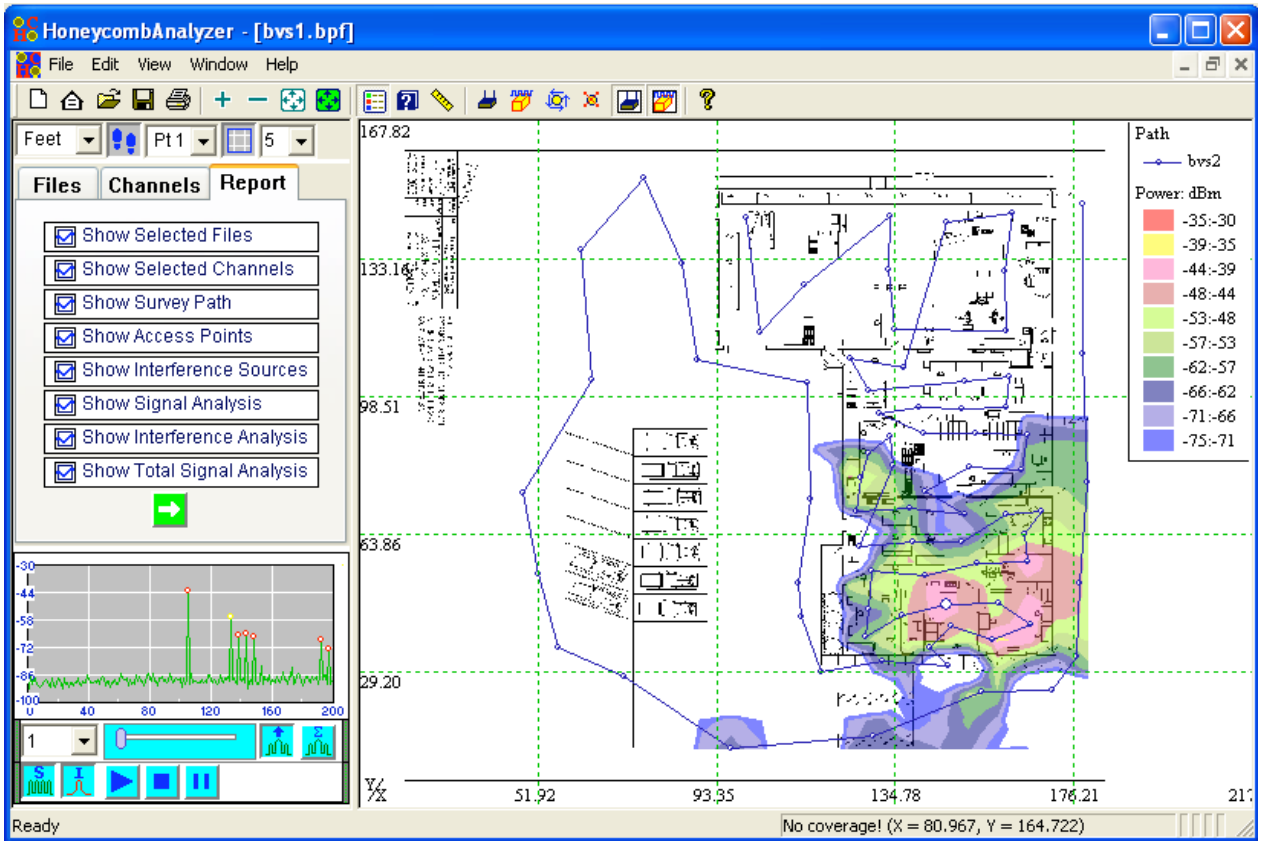
Right click on the interference source, a dialog with all icons is shown. Select the desired one and then click the "OK" button.



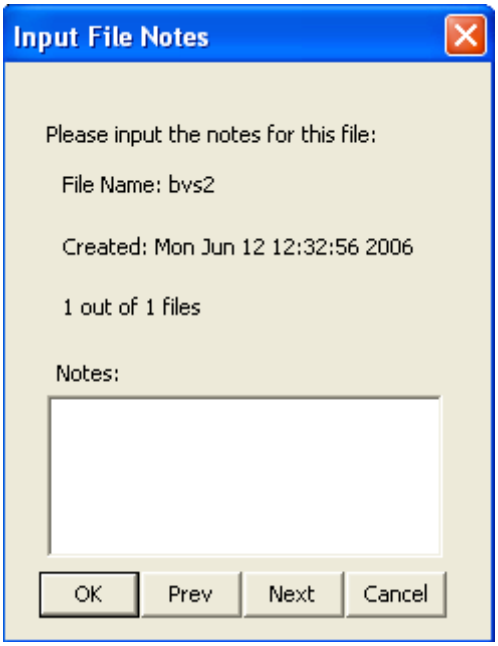
Create an HTML Report

HyperText Markup Language (HTML) files can be opened by Internet Explorer and can contain formatted text and graphics. Honeycomb Analyzer can create a HTML report that has the information about the data survey files, the inserted APs, interference sources, and the analysis of WLAN signals, interference, or a combination of them.

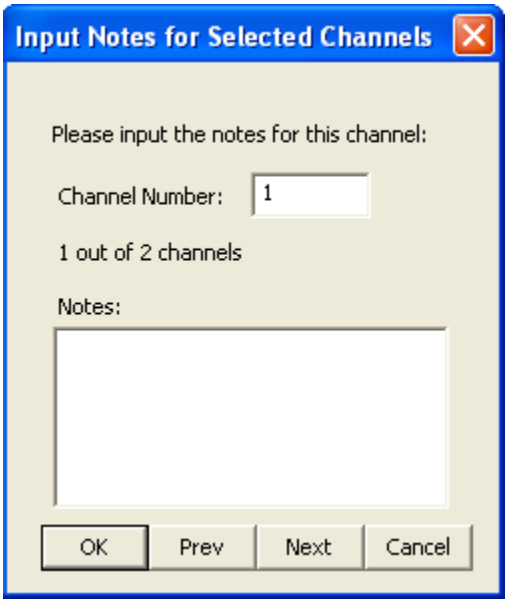
To create an Html report, click "Report" on the tab control. Select the options to be shown in the report. Then click on the button, it starts to create an Html report. Select a file name to store the file when the dialog box appears. If no channel analysis is implemented, the button "Show Signal Analysis", "Show Interference Analysis", and "Show Total Signal Analysis" will be disabled.



Then a dialog appears to allow for notes for the selected file(s). Enter the notes for the different files by clicking the "Prev" or "Next" buttons. After entering the notes for all the files then click "OK". All comments will be stored and displayed in the report.

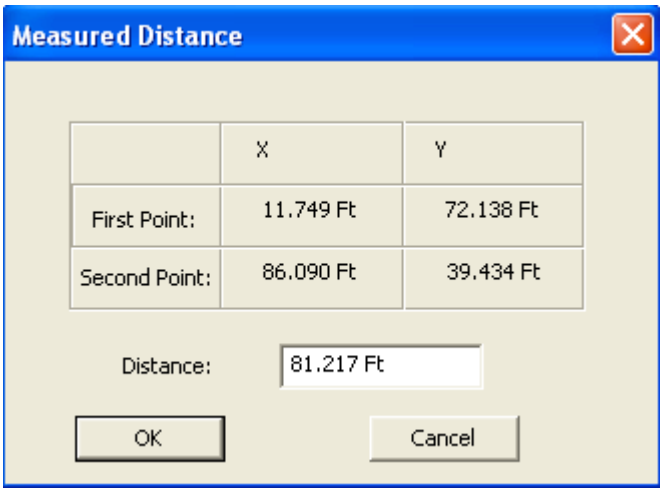


Then a dialog appears to allow for notes for the selected channel(s). Enter the notes for the different files by clicking the "Prev" or "Next" buttons. After entering the notes for all the files then click "OK". All notes will be stored and displayed in the report.



Measuring Distances

Distance measurements can be made on a graph by using the ruler tool. To measure distances use the hotkey. Left click and hold on the graph to start the measurement. The distance is shown on the below right corner of the window. By releasing the button the distance is displayed by a distance dialog box.



Saving Graph

The current coverage graph can be saved as a bitmap. Select Save Image... from the File menu.

Printing

The standard Windows printing selections Print, Print Preview and Print Setup are available from the File menu.

Appendix I: Honeycomb Site Survey Example

Here is a survey analysis for the Berkeley Varitronics Systems as investigated with Honeycomb.

1. Set Up A Projection File:

    Step 1: Obtain an image file (bmp, jpg, …) for the survey area.
    Step 2: Open Honeycomb Projector program and then open the image file.
    Step 3: Input distance between two known points. Repeat until projection has a solution.
    Step 4: Add reference points such as access points or other objects.
    Step 5: Save projection file.

2. Accumulate A Data Collection File:

    Step 1: Place projection file onto the iPAQ using ActiveSync.
    Step 2: Open the projection file in Honeycomb Collector.
    Step 3: Select channels to be scanned.
    Step 4: Start scanning by tapping your current location on the projection map.
    Step 5: When done with the survey save the file.
    Step 6: Copy collection file back to the PC for analysis using the Honeycomb Analyzer program.

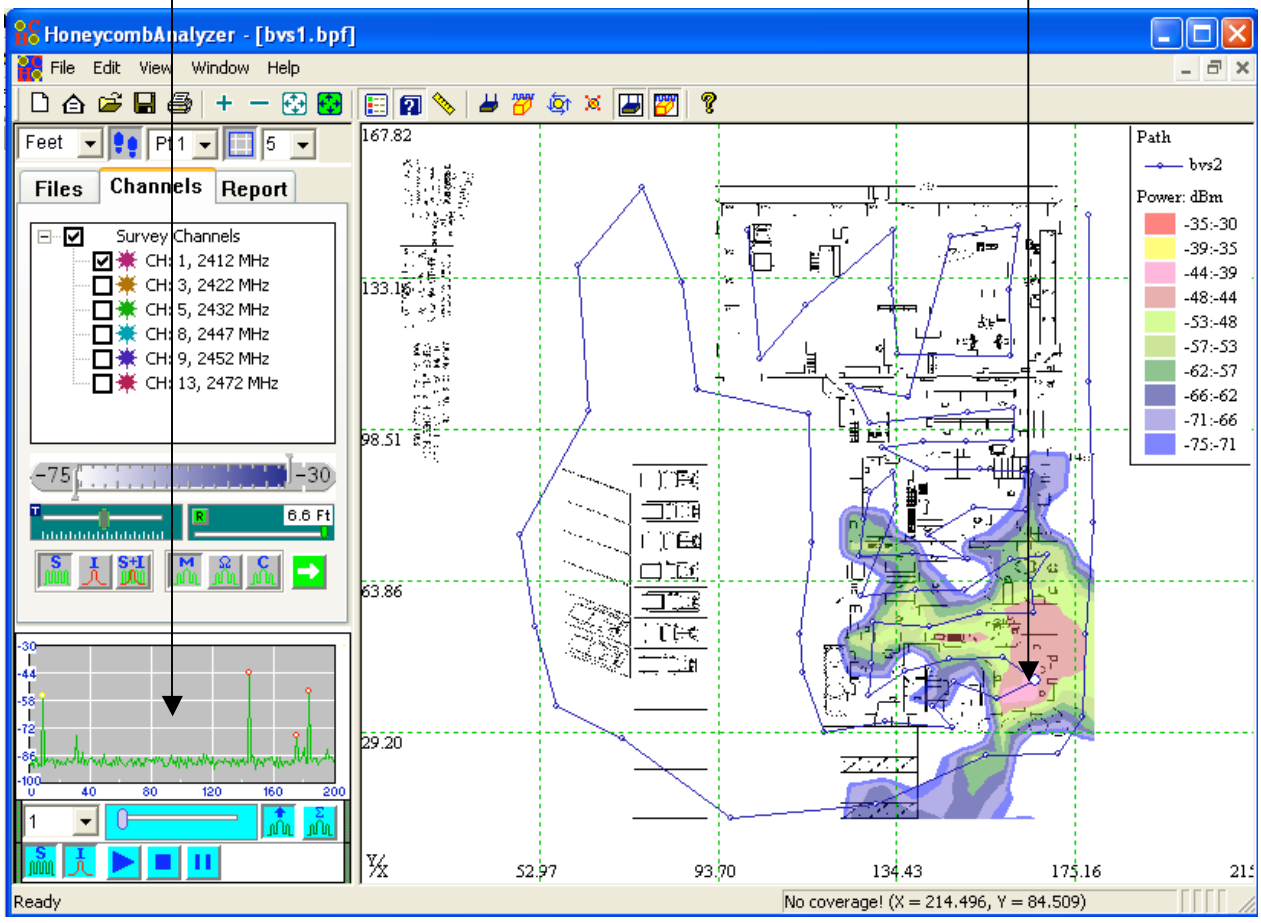
3. Analyze the Data with Honeycomb Analyzer:

Here we put one projection file "bvs1.bpf" and one data collection file "bvs2.hsd".
Step 1: Load the BPF file.

Step 2: Select the data collection file "bvs2.dsd" and then click on the button to load and process the data.
Step 3: The walk/drive paths and the measurement points are shown. To see the data for a point, double click it and the data is shown on the control window.

The analysis window for the selected point is shown here.

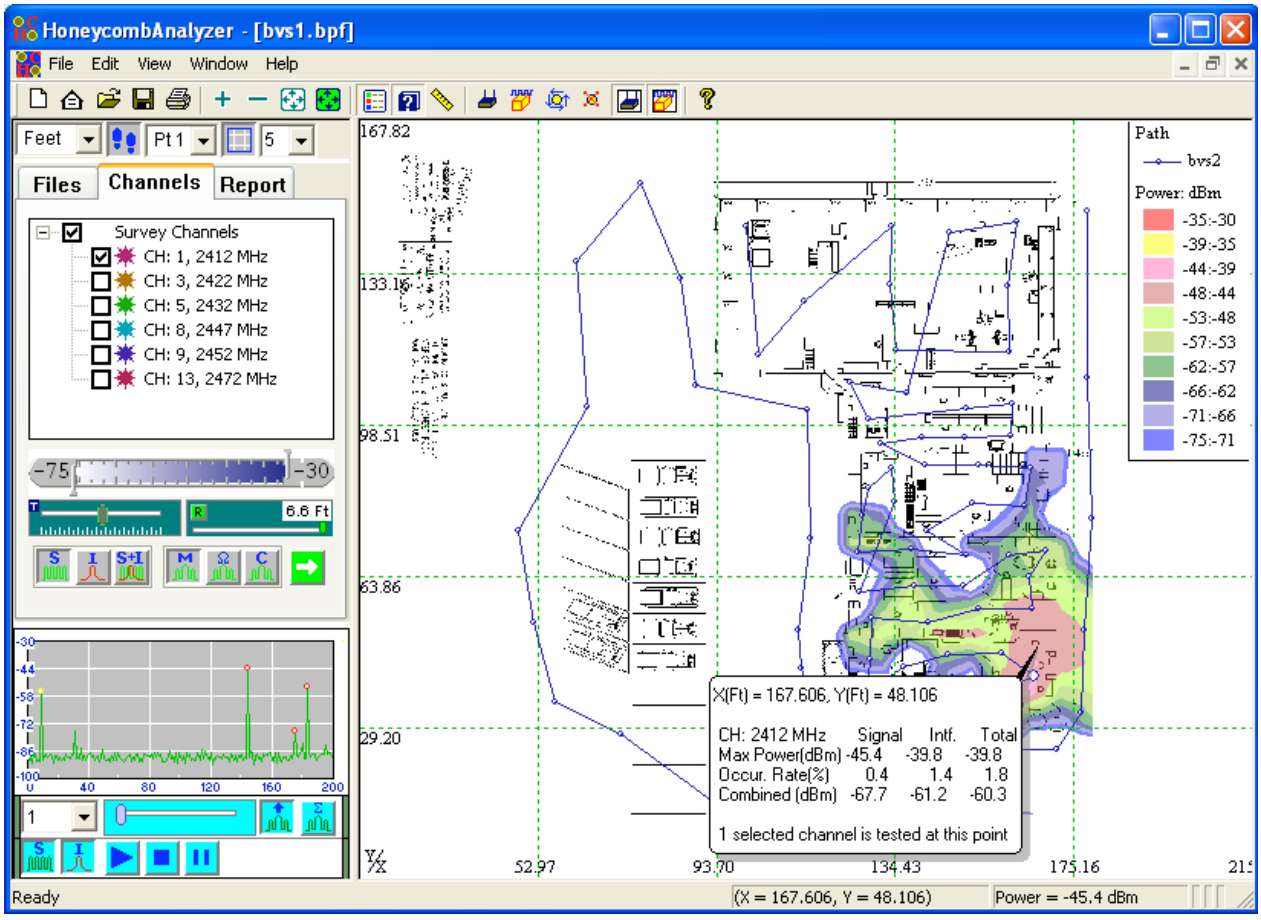
Big dot represents the selected point for analysis.



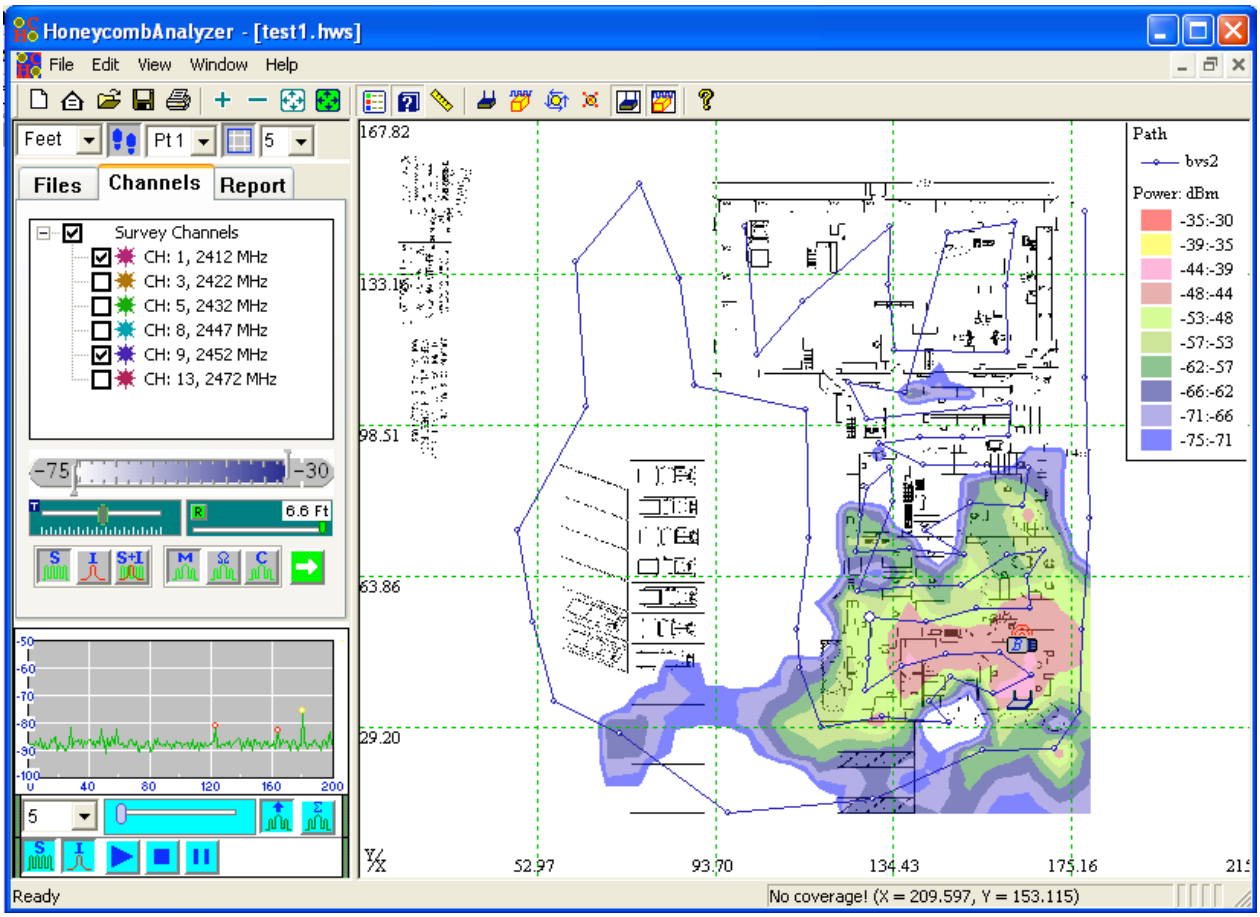
Step 4: Select the channels to analyze. Select different analysis type (Maximum power, Occurrence Rate, and combined analysis) and different signal types to see the usage and clearance of the channel.
Notice that the graph shown with the selection of the channel uses the default power setting (-75 dBm, –30 dBm) and matrix setting (20×20). It uses the its own color shown before the channel or the group color shown before "survey channels". When signal strength is weak, the color becomes brighter; when signal strength is strong, the color become darker. To show the graph with marked colors or change the powering settings and resolution, click the button to generate the graph and also use the hotkey to see the legends. This generated graph will be used in the HTML report.

Step 5: Select channel 1 and channel 9. Press the button and a graph for maximum power analysis of WLAN signal is shown here.

Step 6: By using the hotkey and all the analysis information can be seen by scrolling the mouse over the map.



Step 7: An AP's location is known. Use the hotkey to mark it on the map and also input some information for it. The location of a bluetooth device is also known. Use hotkey to mark it on the map. Right click on the access point or interference source can change their icons.



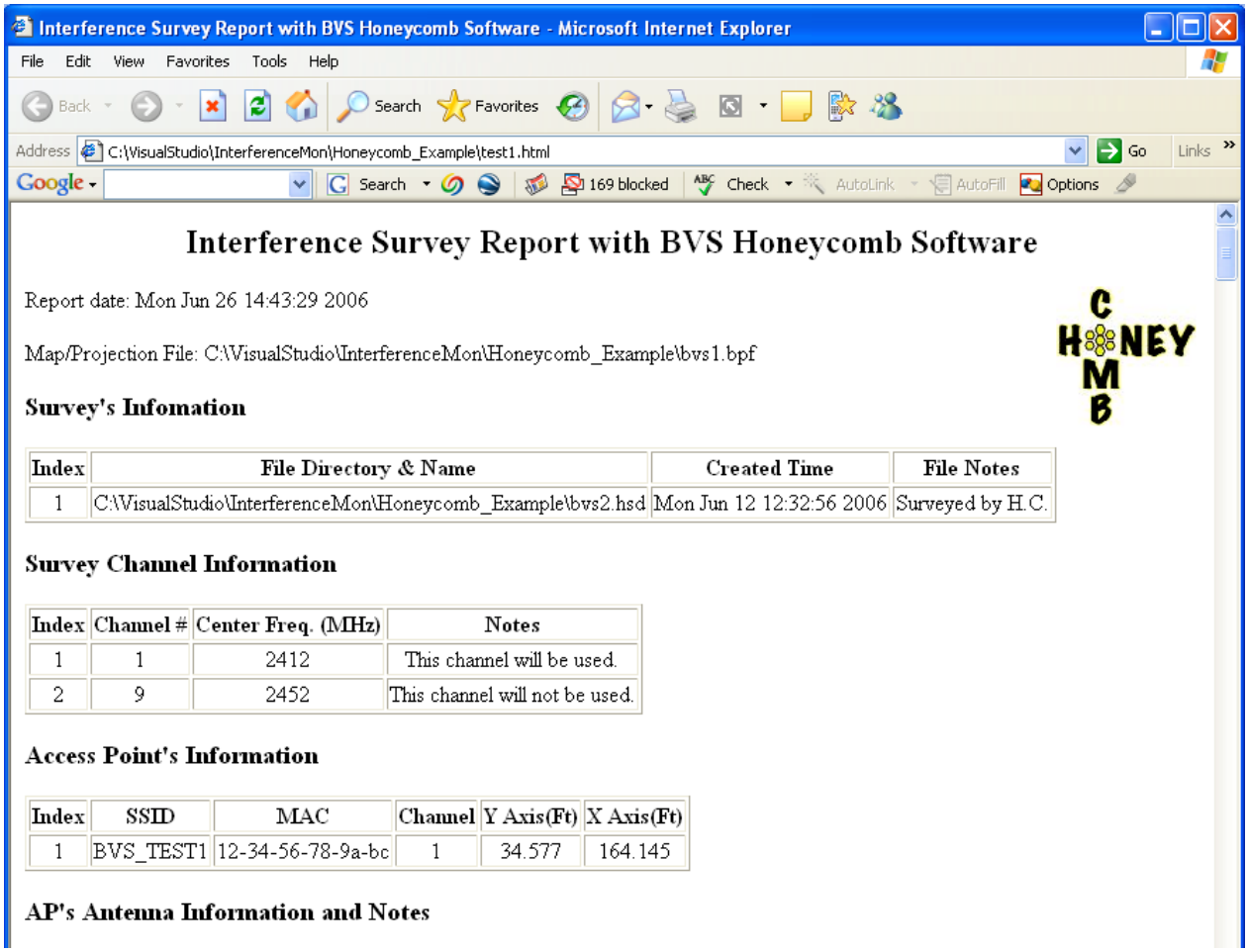
Step 8: An HTML report for this study is shown in Appendix II.

Appendix II. HTML Report

A complete HTML report consists of 8 parts:

1. **Information of Survey Files.**
2. **Information of Selected Channels.**
3. **Survey path.**
4. **Information of Access Points.**
5. **Information of Interference Sources.**
6. **Analysis graphs for WLAN signals.**
7. **Analysis graphs for interference.**
8. **Analysis graphs for total signals (signal+interference).**

An example of a HTML report (HTML_Report_Example.html) is shown in the "Example" folder. The following figures show some snapshots on the report.



(a)

Access Point's Information

Index	SSID	MAC	Channel	Y Axis(Ft)	X Axis(Ft)
1	BVS_TEST1	12-34-56-78-9a-bc	1	34.577	164.145

AP's Antenna Information and Notes

AP's Name	Trans. Power(dBm)	Antenna Gain	Height(Ft)	Direction(Deg)	Notes
Honeycomb1	20	2 dBi	3	360 (Omni)	Used for test.

Interference Source's Information

Index	Name	Frequency	Bandwidth	Y Axis(Ft)	X Axis(Ft)	Notes
1	Bluetooh Device	2.400-2.482 GHz	1 MHz	49.083	164.145	Used for Test.

Survey Path

(b)

Fig. 1. Information of (a) survey files, selected channels, (b) access points and their antennas, and interference sources.

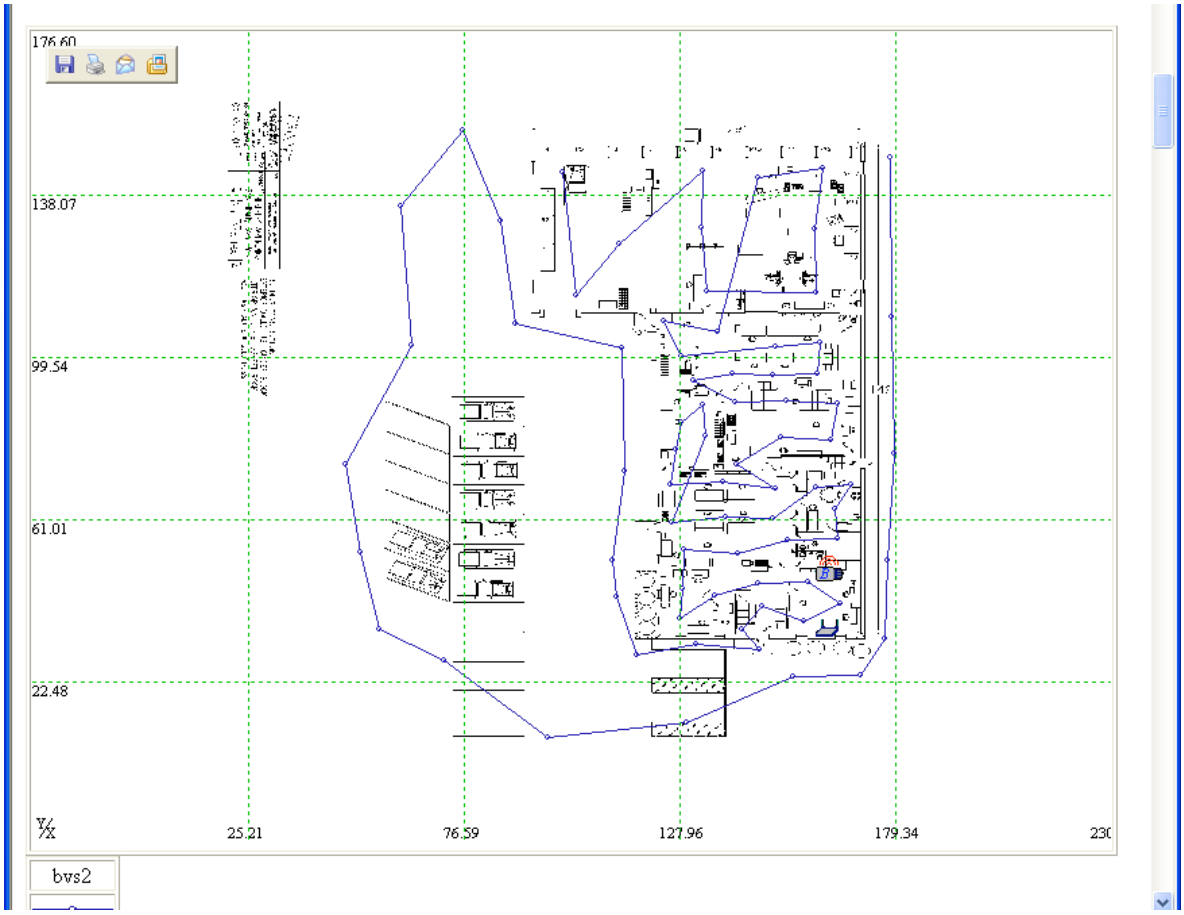
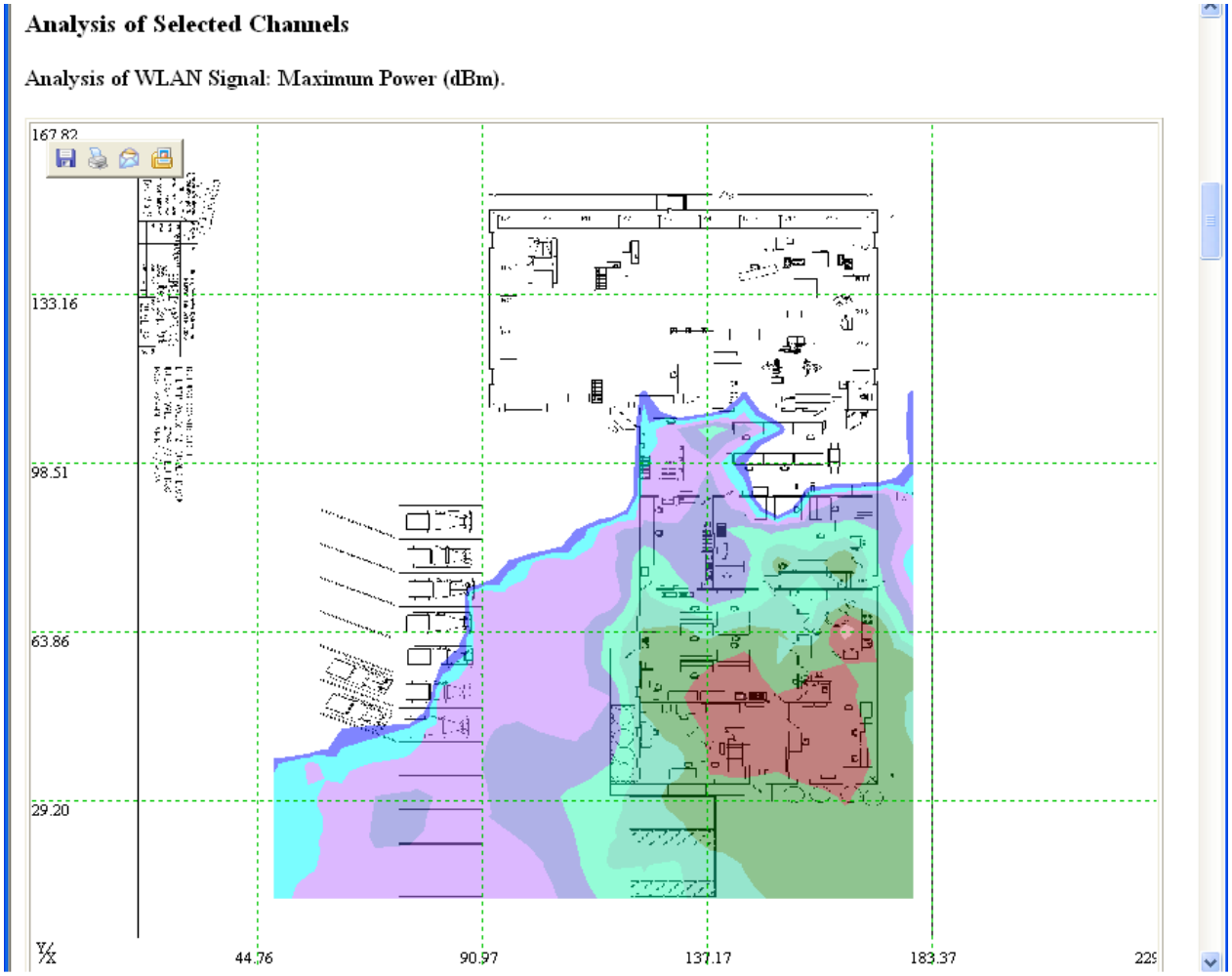


Fig. 2. Survey path.

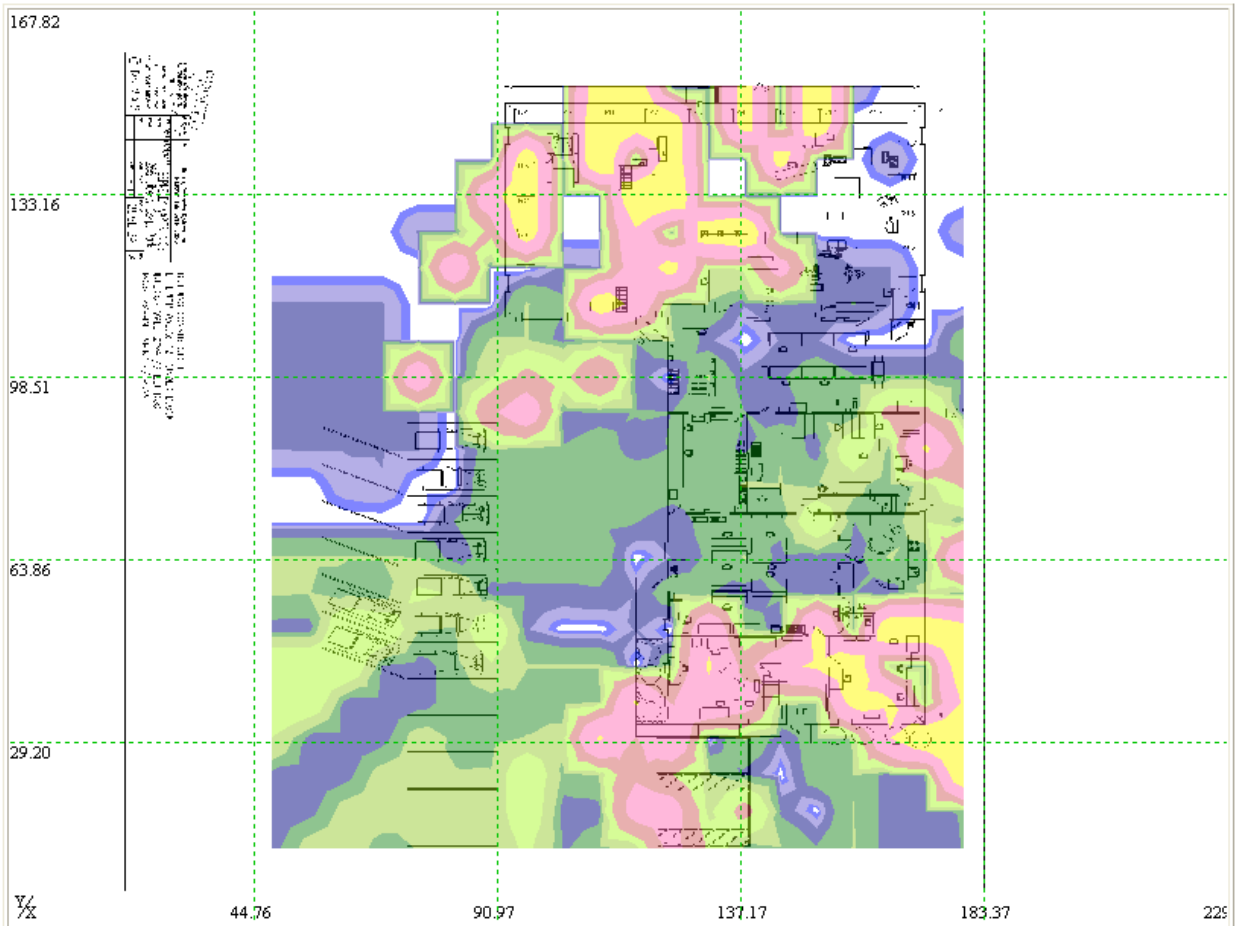


(a)

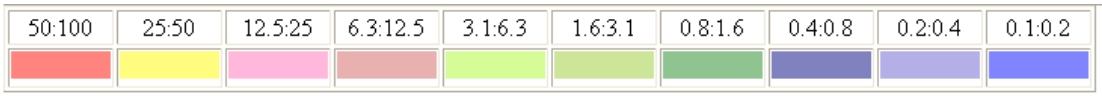
(b)

Fig. 3. (a) Graph for maximum power analysis of WLAN signal, (b) Legend for the analysis.

Analysis of Interference: Occurrence Rate (%).

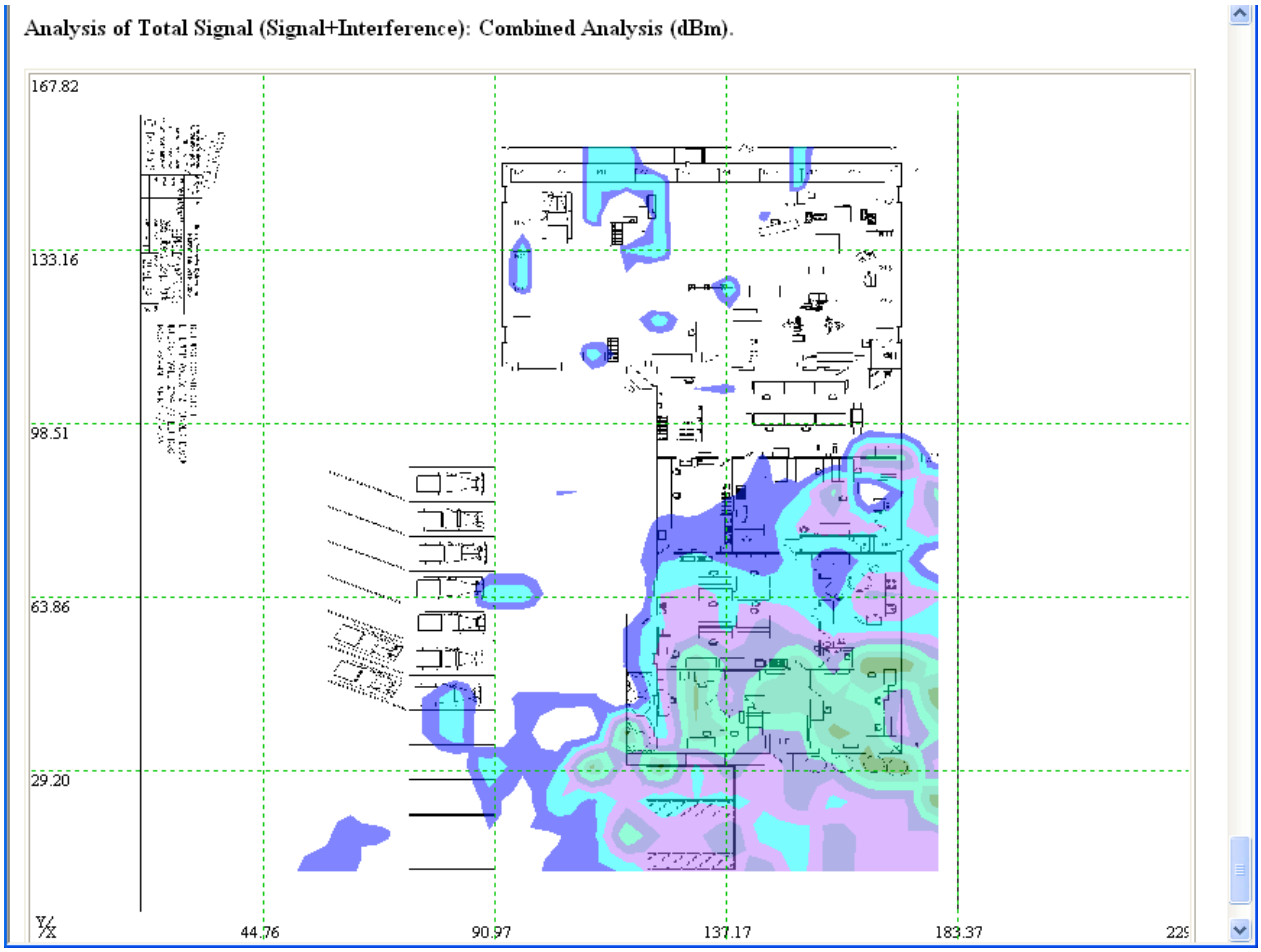


(a)

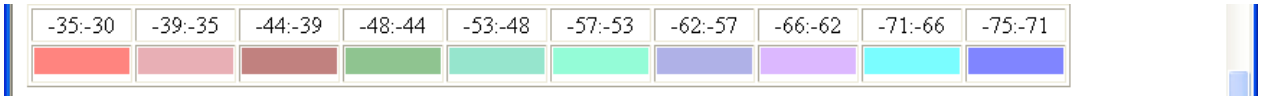


(b)

Fig. 4. (a) Graph for occurrence analysis of interference, (b) Legend for the analysis.



(a)



(b)

Fig. 5. (a) Graph for combined analysis of signal plus interference, (b) Legend for the analysis.