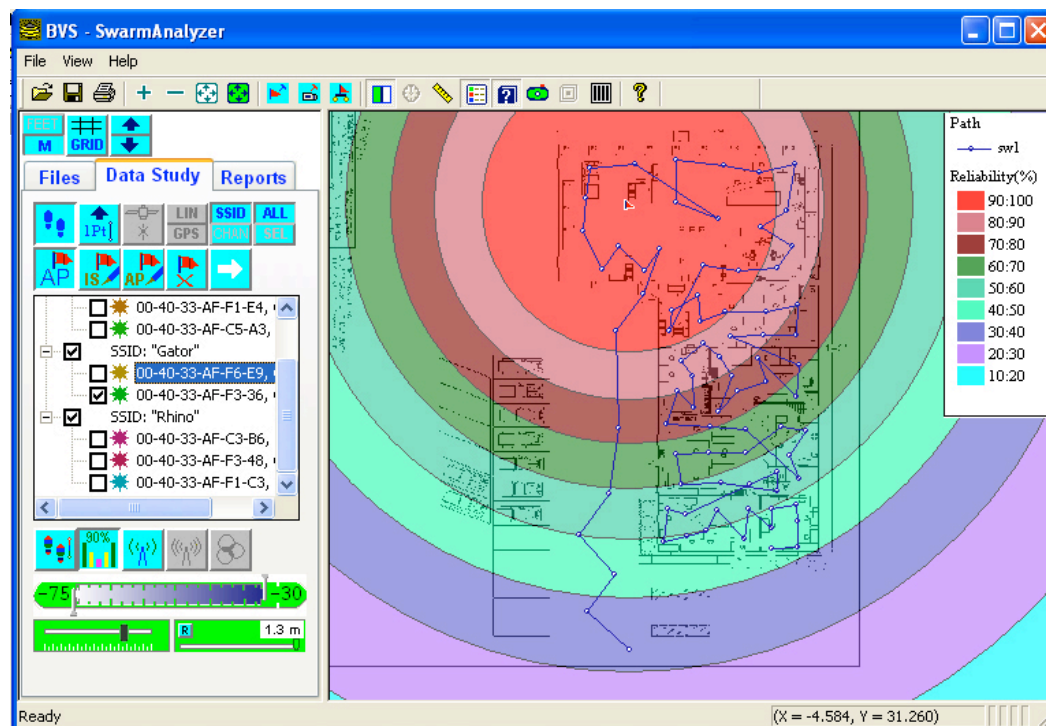


SWARM

Manual version 1.7



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Swarm Projector

Projector runs on a Windows PC or Tablet PC (Yellowjacket model dependent). 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.

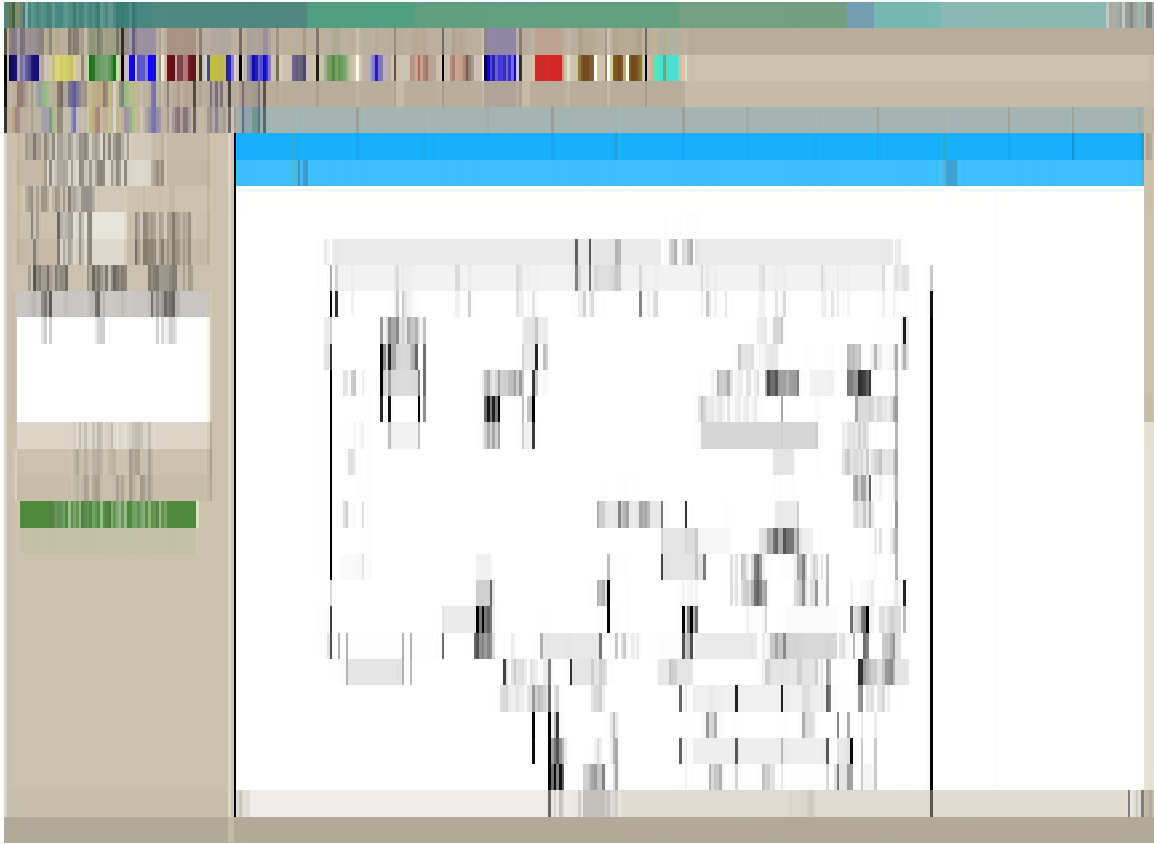


Figure 1 – Linear Projector

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 or SD card (model dependent), place the Projector CD or SD card in the drive. Choose the Linear Projector 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

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 for use with the Collector.

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.

GETTING A QUICK PROJECTION

Steps:

1. Clear all the pairs.
2. Measure a horizontal distance.
3. Measure a distance where the line is at least 45 degrees off-parallel from the first distance. Less than 90 degrees. Using different directions helps to validate the projection quicker.

Make sure the distances are fairly accurate. You should be able to get a projection within a small number of points.

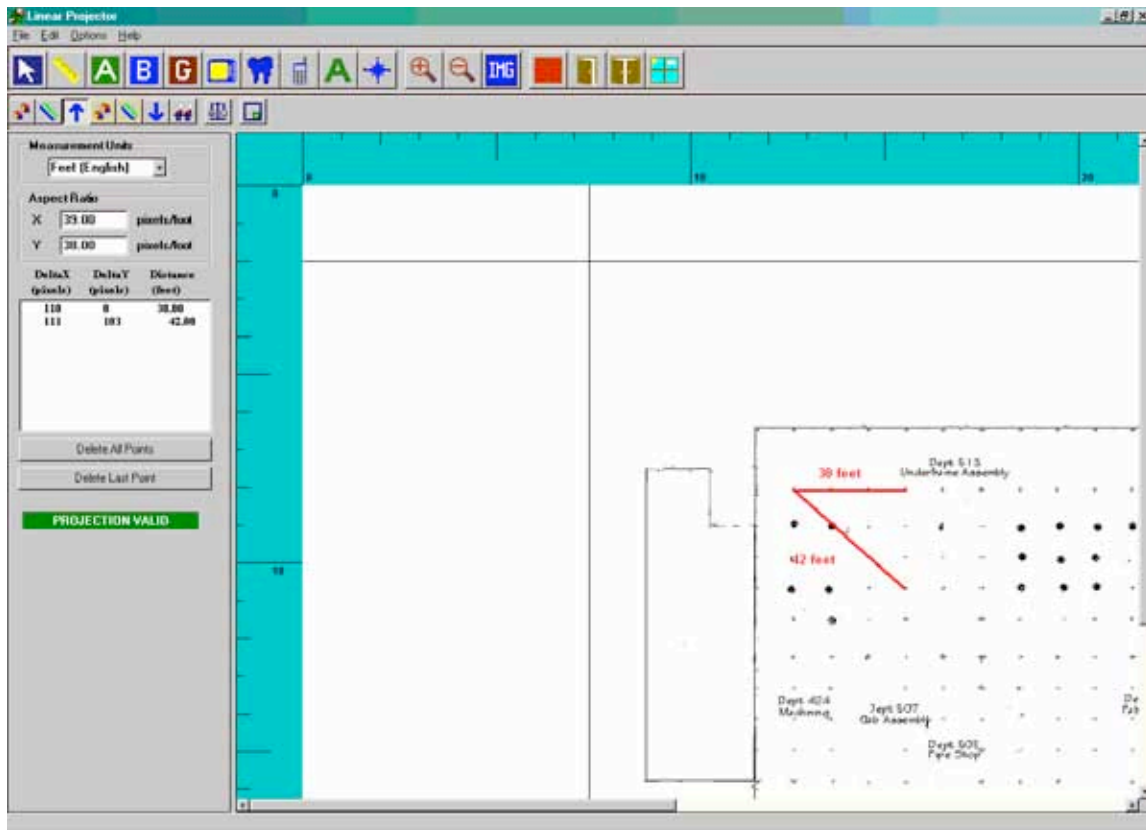


Figure 2 – Quick Projection

Procedure for creating a BVS GPS Projection File

1. Find the area of interest on GoogleEarth.
 2. Select Alt-Print Screen to copy the current screen to the clipboard.
 - 2a. Do not close GoogleEarth, you will need it later.
 3. Open MS Paint.
 4. Choose Edit/Paste. The screen shot is now in Paint.
 5. Use the crop tool (dashed rectangle) to select only the satellite image portion of the screenshot.
 6. Choose Edit/Copy.
 7. Choose File/New. Do not save the current image.
 8. Choose Edit/Paste. The satellite portion of the original is now in the new image.
 9. Save this image as a bitmap.
 10. Open up BVS GPS Projector.
 11. Choose File/New and select the bitmap. You will see a red circle in the upper-right hand corner, this tells you the file is not geo-coded as of yet.
 12. Choose "Input Options" from the iconic toolbar under the main menu. Set the resulting popup box to "degree:minute:second".
 - 12a. Leave BVS GPS Projector running.
 13. Go back to GoogleEarth. You will need the positions of at least 6 points on the map to create a valid projection in BVS Projector.
 14. Choose the pushpin icon "Add Placemark".
 15. Move the resulting pushpin to your first location. Write down the latitude and longitude of the location.
- NOTE: North is positive and South is negative. East is positive and West is negative. This is important when entering degrees in BVS Projector.**
16. Go to BVS Projector and click on the 'set points' icon.
 17. Click on the same location as you did on GoogleEarth.
 18. Enter the latitude and longitude that you wrote down, keeping in mind to put a negative sign in front of the degrees when needed.
 19. The point will be numerically marked.
 20. If a popup box stating that the projection is now valid appears, proceed to step 21. A green circle would now appear in the upper right corner. If not, repeat steps 14-20 until a valid projection is obtained.

21. Save the resulting projection in BVS GPS Projector as a GEO-coded map.

Swarm Collector (iPAQ handheld) User Manual

NOTE: When surveying, make sure that access points do not have beaconing turned off. This will affect survey results.

INTRODUCTION

The Swarm Collector runs on the HP iPAQ Pocket PC that is connected to a BVS YellowJacket B/A/G (YBAG) system. The Collector allows you to import a projection file that was created using indoor or outdoor Projector software. You then use this file to walk/drive around a survey site and collect survey points. These points create a data file of information on your WiFi network.

The information is then saved back to a collection file for use with the Swarm 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.



REGISTRATION CODE

The first time that Swarm 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 unique to the serial number.

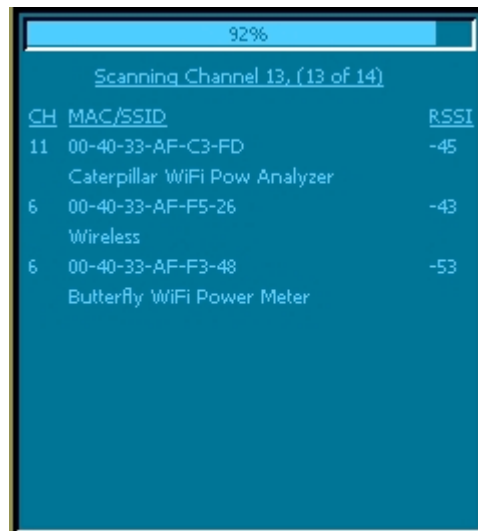
It is very important that the iPAQ is connected to the YBAG when running the Swarm application. Swarm asks the hardware for its serial number. If it is not talking to the hardware, the registration code will not be verified and the application disabled.

SCANNING

Scanning for packets may be accomplished using two methods. The first is by automatic scanning. This is discussed below and is used when there is GPS position data available.

The second method is manual scanning. This is done when there is no GPS position data available or when using a linear projection file. In this method, the user will tap on his or her current location on the map/floorplan to initiate a single scan.

This scan will be performed over the channels selected. During this type of scan, a window will appear that shows MAC addresses found and their RSSI values. Channel number and SSID are also displayed.



CH	MAC/SSID	RSSI
11	00-40-33-AF-C3-FD Caterpillar WiFi Pow Analyzer	-45
6	00-40-33-AF-F5-26 Wireless	-43
6	00-40-33-AF-F3-48 Butterfly WiFi Power Meter	-53

Manual Scanning

When the scan has been completed, a new data point shows up at the point tapped and the packet information is stored.

Continue to tap on points while walking/driving through the survey area.

NOTE: Each channel will typically be scanned for 2 seconds. Therefore, if for example you have all 14 802.11bg channels selected, it will take approximately 30 seconds to complete

a scan.

“THE TOOLBAR”



The toolbar runs along the bottom of the display and performs the following functions (from left to right):

2. Opening a projection file (linear or GPS)
3. Opening a collection file
4. Starting an automatic scan
5. Stopping an automatic scan
6. Choosing channels for a channel list
7. Zoom in on the survey area
8. Zoom out of the survey area
9. Take a snapshot of the display
10. Display the “About Box” information.

OPENING A PROJECTION FILE

The first step in surveying data is opening a projection file created with either the indoor or outdoor Projector application. Tap on the leftmost icon on the bottom of the application to open an existing projection file.

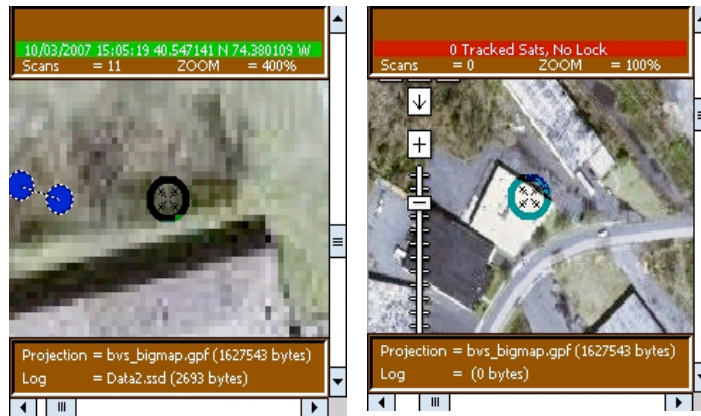
If the survey you are performing will be using GPS information (even if there will be any areas where GPS reception cannot be received), a GPF needs to be loaded. If GPS information will not be used and scanning will be done manually, a LPF (linear projection file) needs to be used.

OPENING A COLLECTION FILE

The user will be prompted to choose a previously saved collection file (with previously recorded data) or to start a new collection file. This is the second icon from the left. If CANCEL is chosen instead of a file, data collection will not be allowed.

STARTING AN AUTOMATIC SCAN

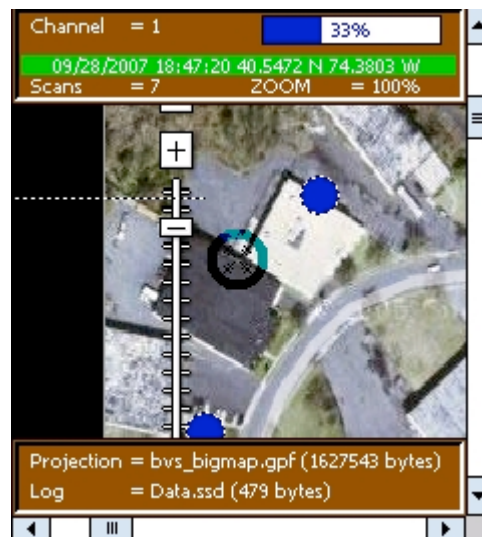
If a GPS projection file has been selected and the GPS receiver has a position fix (green bar in the upper information box), the user may choose to start an automatic scan.



GPS Locked and GPS not locked

An automatic scan will set the receiver to all of the channels in the channel list (at a 2 second interval). The current GPS position will be used as the location of the scan. After all of the channels have been scanned, the packets collected will be stored in a single data point.

After the first point has been saved, the automatic scanning mechanism will start the next data point at the latest GPS coordinates.



GPS Scanning

If GPS lock is lost (red or yellow bar), the current scan will be completed and then scanning will stop. The automatic scanning can be manually started again when GPS lock has been reacquired.

UPPER INFORMATION BOX – The upper information box shown displays current channel, progress of current scan, GPS information, number of scans, and zoom level of the survey area.

LOWER INFORMATION BOX – The lower information box displays the names of the projection

and collection file and their current size. When a log file is chosen, it's name and size will not show up until after the first data point is scanned.

STOPPING AN AUTOMATIC SCAN

Pressing this button will stop an automatic scan if one has been started. The current data point will be completed. A “STOP SCAN PENDING” message will appear in the lower information box until that data point has been completed.

CHOOSING CHANNELS

By default, all 14 channels in the 2.4GHz band are selected for surveying. To change the channels to scan, choose the fourth icon from the left on the toolbar. A window will show checkboxes for all selectable channels. 802.11a, 802.11b, and 802.11h channels are available for selection.

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.

SNAPSHOT

In pressing this button, the user will be prompted to save the snapshot of the current display to a JPEG filename (as in digital cameras).

ABOUT

Standard application about box with version and copyright information.

WALK/DRIVE PATH

A dashed line will show up between points on the survey. This dashed line represents the walk/drive path for the survey.

COMPLETE SURVEY

When you have covered the entire site with survey points, you can transfer the file back to the PC for use with Swarm Analyzer. Points are saved as they are taken. No final save of the file is needed.

Transfer the projection and collection files back to the PC for analysis.

INFORMATION SCREEN

Press and hold on any point in the survey with the stylus. This will pull up an information screen for that survey point. This screen shows all of the MAC addresses that were seen during the scan of this point. Information such as channel number, SSID, and RSSI are displayed.

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.

SCROLL BARS

The scroll bars aid in navigating throughout the site.

SURVEYING TIPS

In order for the Swarm Analyzer to be effective, enough points must be taken so that a clear picture of site coverage is given. Obviously, the more points, the better the reporting will be in Analyzer.

Swarm Collector (Tablet PC) User Manual

NOTE: When surveying, make sure that access points do not have beaconing turned off. This will affect survey results.

INTRODUCTION

The Swarm Collector runs on a Tablet PC that is connected to a BVS YellowJacket B/A/G/N (YBAGN) system via USB. The Collector allows you to import a projection file that was created using the Linear or GPS Projector software. You then use this file to walk/drive around a survey site and collect survey points. These points create a data file of information on your WiFi network.

The information is then saved back to a collection file for use with the Swarm Analyzer program on the Tablet 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.



Swarm Collector

TOOLBAR

The options in the tool bar are as follows (from left to right):

Open a Projection File – Open a position-coded projection file created in either Linear or GPS Projector.

Open a Collection File – Open a data collection file. Either an existing or new collection file can be chosen.

Start Scan – Start automatically scanning the frequency list and link the resulting data to the correct position on the map. Automatically starts a new scan after the previous one completes.

Stop Scan – Stops the current automatic scan upon completion of the current sweep.

Frequency List – Set or edit the list of frequencies to scan.

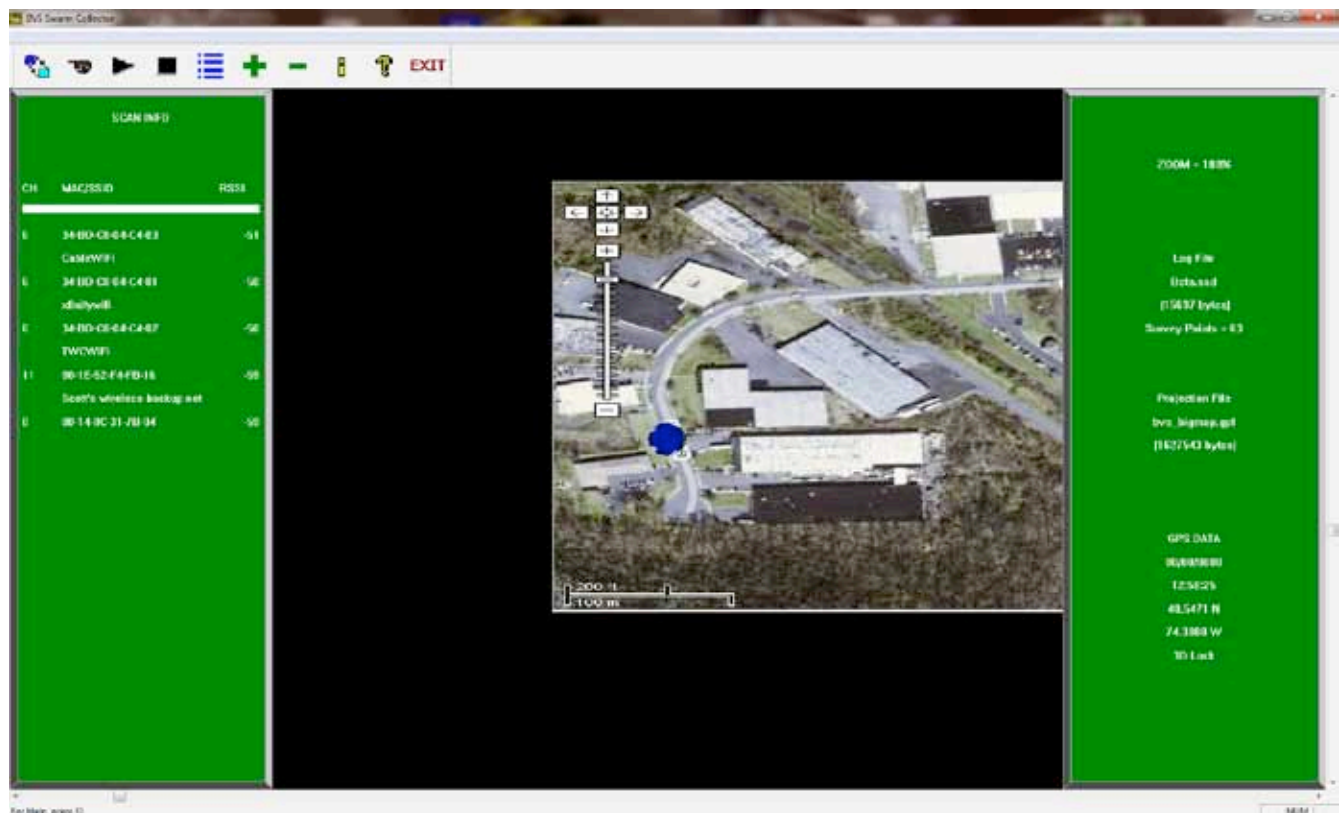
Zoom In – Zoom in to a portion of the map.

Zoom Out – Zoom out from a portion of the map.

Information – After clicking on the information button, a successive click on a circle on the map will show the packet information for that point.

About – Show version information for the application.

Exit – Exits the application.



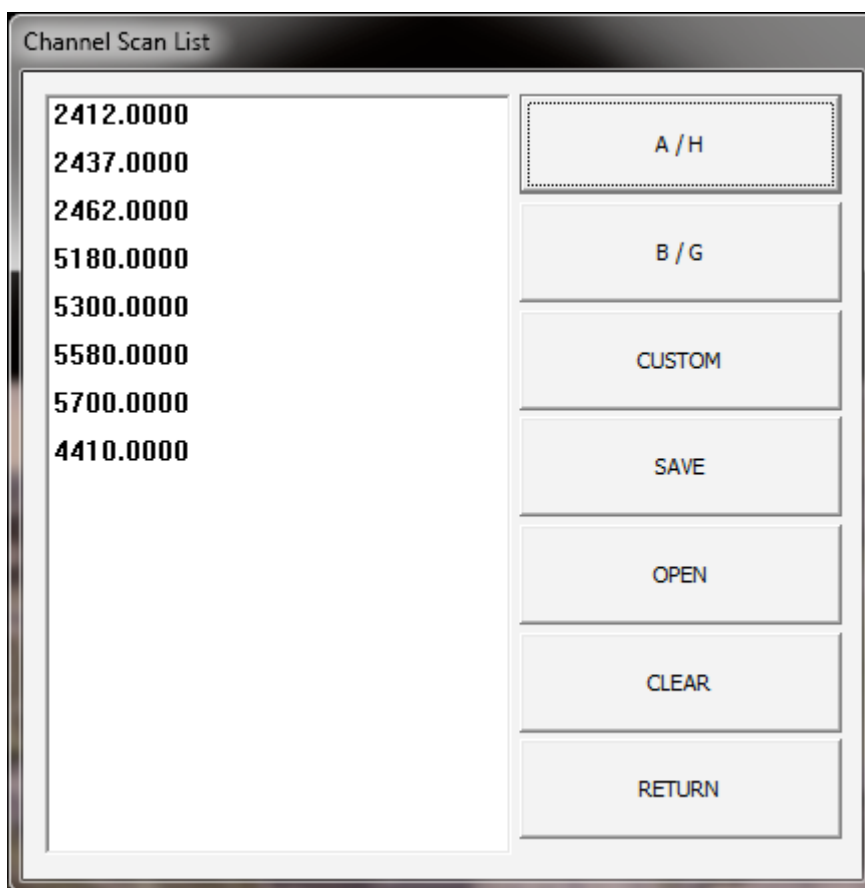
FREQUENCY SCAN LIST

To set or change the frequencies to be scanned, press the blue icon on the tool bar with the 5 lines.

The resulting dialog shows the current list of frequencies to be scanned. The current frequency list can be saved by choosing the save option. Any saved lists can be restored using the open option.

There are three types of frequencies which may be selected. 802.11ah channels, 802.11bg channels, or custom frequencies. Choose on the respective buttons to add or edit any of these channels/frequencies.

The current list may also be cleared by pressing the clear button.



802.11A/H CHANNELS

Choose the 802.11a or 802.11h channels to be put in the master frequency list. Individual channels may be selected by checking the appropriate box. Sections of channels may also be selected by pressing the respective buttons.

These sections include all 802.11a, all 802.11h, UNII-Low channels, UNII-Mid channels, or UNII-High channels. All 802.11a and 802.11h channels may also be cleared with the press of a button.

When the editing of these channels is complete, press OK.

802.11 A/H Channels

<input checked="" type="checkbox"/> 36	<input type="checkbox"/> 40	<input type="checkbox"/> 44	<input type="checkbox"/> 48	<input type="checkbox"/> 52
<input type="checkbox"/> 56	<input checked="" type="checkbox"/> 60	<input type="checkbox"/> 64	<input type="checkbox"/> 100	<input type="checkbox"/> 104
<input type="checkbox"/> 108	<input type="checkbox"/> 112	<input checked="" type="checkbox"/> 116	<input type="checkbox"/> 120	<input type="checkbox"/> 124
<input type="checkbox"/> 128	<input type="checkbox"/> 132	<input type="checkbox"/> 136	<input checked="" type="checkbox"/> 140	<input type="checkbox"/> 149
<input type="checkbox"/> 153	<input type="checkbox"/> 157	<input type="checkbox"/> 161	<input type="checkbox"/> 165	

All A	All H	UNII-L	UNII-M	UNII-H
-------	-------	--------	--------	--------

Clear All AH

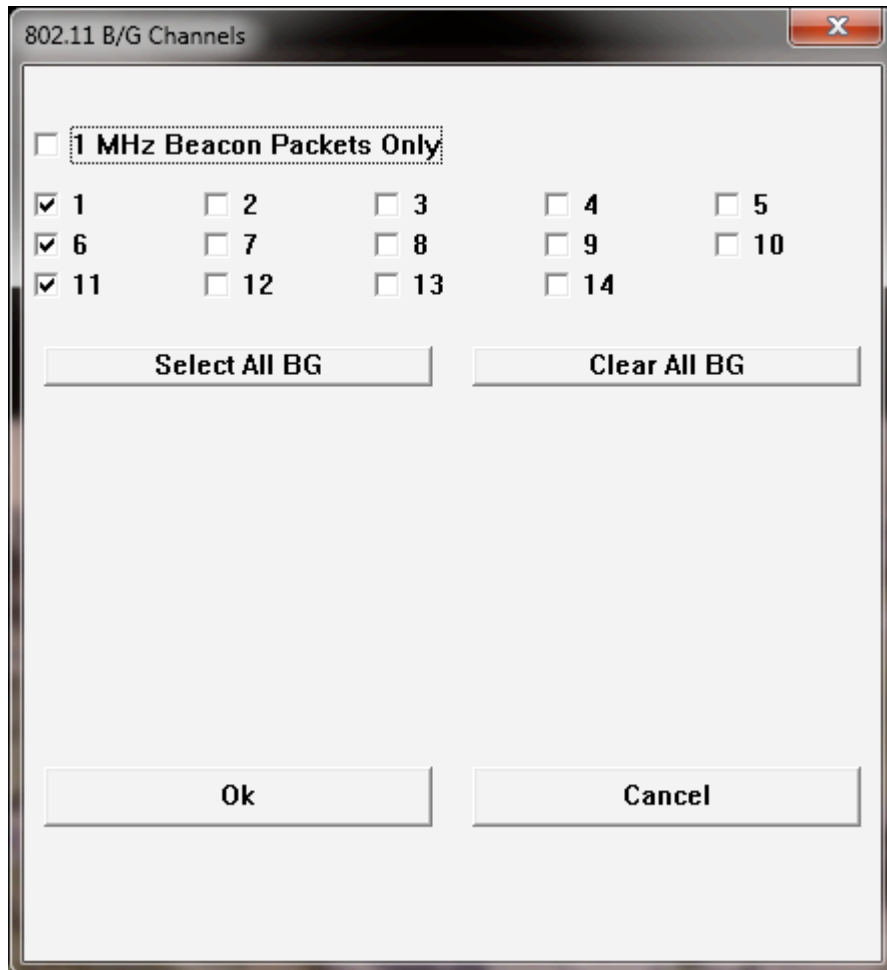
Ok Cancel

802.11 B/G CHANNELS

Choose the 802.11 b/g channels to be put in the master frequency list. Individual channels may be selected by checking the appropriate box.

All 802.11 b/g channels may be selected by pressing the select all button. All 802.11 b/g channels may also be cleared with the press of a button.

When the editing of these channels is complete, press OK.

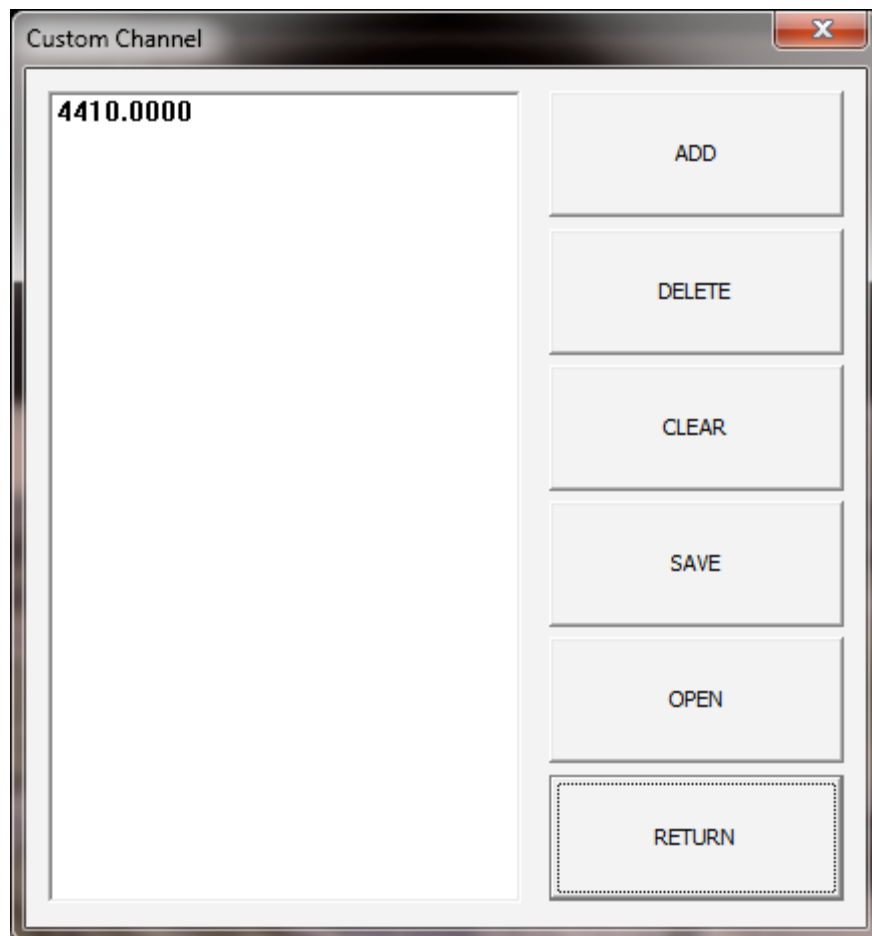


The image shows a Windows-style dialog box titled "802.11 B/G Channels". It has a standard title bar with a close button (X) in the top right corner. The main area of the dialog contains a checkbox labeled "1 MHz Beacon Packets Only" which is currently unchecked. Below this, there is a grid of 14 checkboxes, each followed by a number from 1 to 14. Checkboxes 1, 6, and 11 are checked, while the others are unchecked. The checkboxes are arranged in three rows: the first row has 1, 2, 3, 4, 5; the second row has 6, 7, 8, 9, 10; and the third row has 11, 12, 13, 14. Below the grid, there are two buttons: "Select All BG" on the left and "Clear All BG" on the right. At the bottom of the dialog, there are two more buttons: "Ok" on the left and "Cancel" on the right.

Channel	Selected
1	✓
2	
3	
4	
5	
6	✓
7	
8	
9	
10	
11	✓
12	
13	
14	

CUSTOM FREQUENCIES

Custom frequencies which do not fall under the standard 802.11 a/b/g/h numbering scheme may added or edited from the custom frequency dialog.



The resulting dialog shows the current list of custom frequencies to be scanned. The current frequency list can be saved by choosing the save option. Any saved lists can be restored using the open option.

Frequencies may be added by pressing the add button. A number dialog will appear. Press the appropriate number pad keys to create a frequency. Then press GHz, MHz, or kHz to add the frequency to the list.

Enter Frequency and then Choose Units

4410.00

7	8	9	GHz
4	5	6	MHz
1	2	3	kHz
.	0	EXIT	CLEAR

Frequencies in the list may be deleted by selecting the frequency, then pressing the delete button.

The current list may also be cleared by pressing the clear button. Press return when done editing the list.

Introduction

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


Swarm 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 also be prompted to install the Projector and Collector.

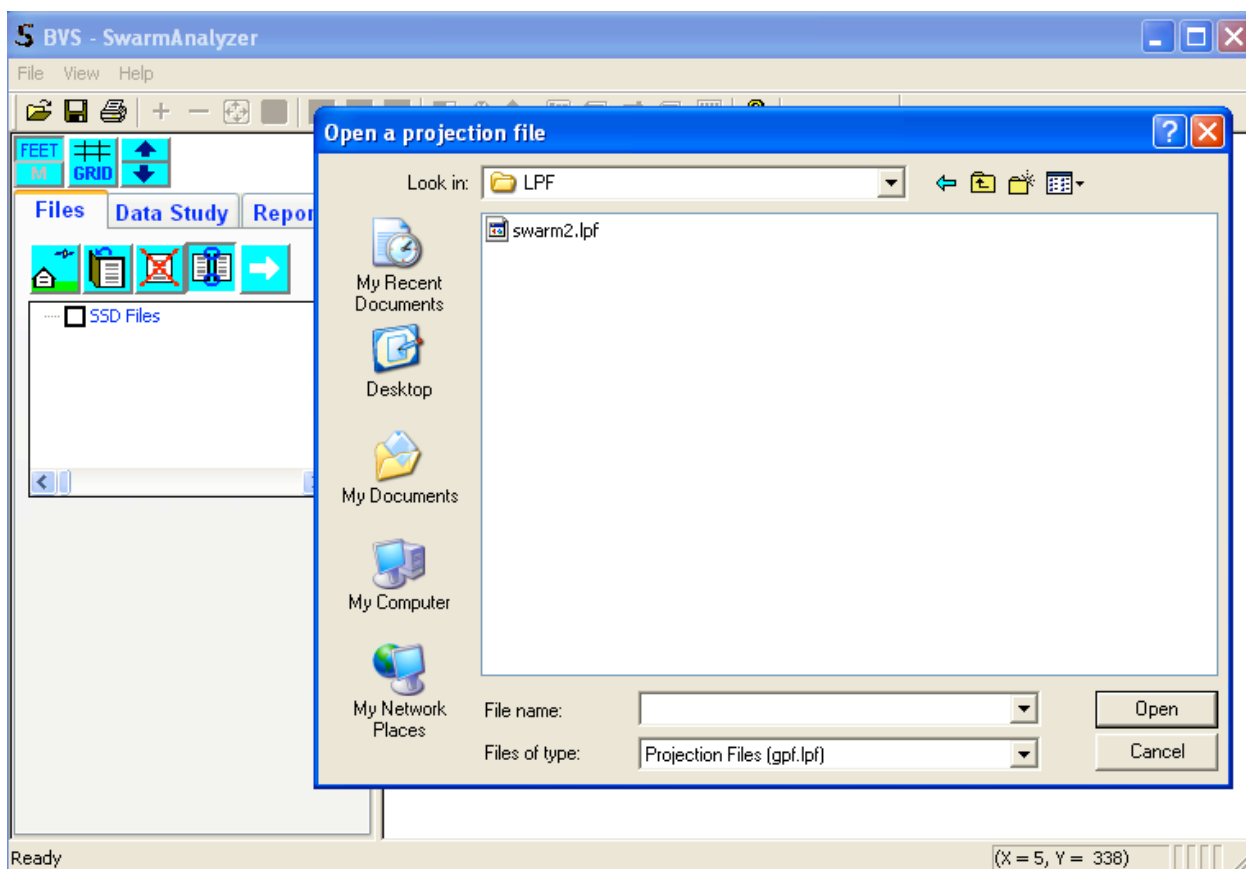
Swarm Analyzer User Manual




Swarm Analyzer is the analysis component of the Yellow Jacket Swarm software package for Wireless Local Area Networks (WLAN). It provides analysis of coverage, interference, reliability, channel reuse and more.

Getting Started with Swarm Analyzer

Swarm Analyzer uses a linear-projected map or a geo-projected map from BVS linear and GPS Projector and the data recorded with the Swarm Collector. BVS Linear or GPS Projector generates a Linear Projection File (*.lpf) or Geo Projection File (*.gpf) that contains the map of the survey. Swarm Collector produces a Swarm Site Survey data file (*.ssd) that contains the collected data with the use of the YellowJacket BANG.

The Swarm Analyzer is project based. To begin using the Swarm Analyzer a Swarm Projection file should first be generated. Click on the  hotkey located in the toolbar near the top of the screen. The projection file dialog box then appears. Open the projection file you wish to use.




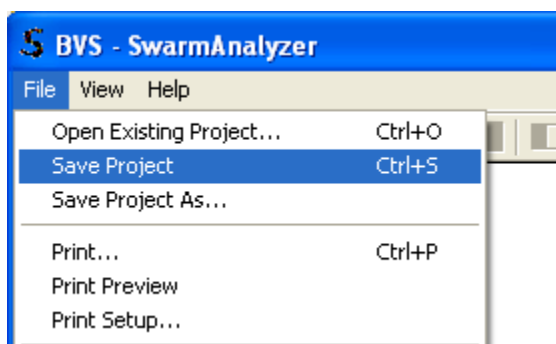
The Swarm Collector files must then be loaded to create a project. The Swarm Analyzer can process multiple survey data files. Click on the  button to add the SSD files into the processing list. If you wish to use two or more files that you have saved, you can merge the file by clicking on the  button. If a file is added in by mistake, check the box before the file and uncheck all other files and then press the  button to remove the file from the list.

When all the SSD files are selected, press the  button to load and process the files. Swarm Software will automatically switch to the **Data Study** section.

Note that the “Merge File” means merging the data in the files to process them together. It does not mean that you are merging the multiple files into one file.

Saving a Swarm 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 or Save as... from the File menu or click on the  button.



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

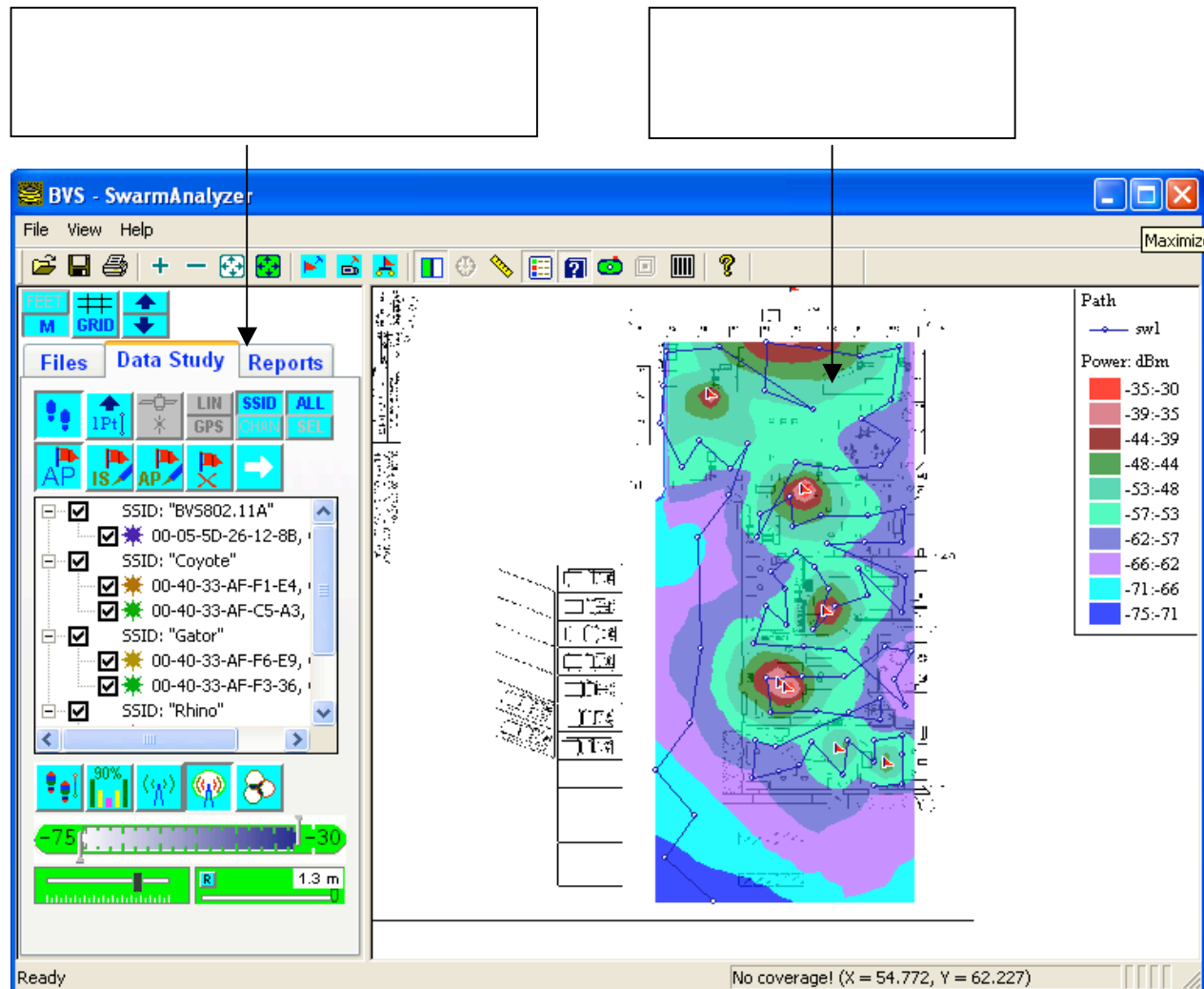
The left pane of the display contains the Control Window used for files, data study, and report generation.

The right pane contains the map from the Linear Projector.

Opening an Existing Swarm Site Project

To open an existing Swarm Site Project select Open Existing Project from the File menu. A dialog box will appear to allow the selection of the project file (*.sws).

The Swarm Analyzer screen is displayed in two sections.



Metric Selection

Metric information can be displayed in feet or meters. The default setting is feet. Click on the **FEET** button located on the top of control window will toggle the settings.

Plotting Grid

Grid can be plotted by clicking on the **GRID** button. The number of lines can be changed by clicking on the **GRID** button.

AP Sorting & Selection for Graphing

Select the Access Points or group of Access Points you wish to work with in the section of **Data Study** in the control window. The AP Selection tool contains a list of all AP(s) that are present in the Site Survey file. Checking the box next to the MAC address includes the AP(s) in the analysis. The AP(s) can be sorted and grouped by SSID or by Channel using the **SSID** **CHAN** button at the top of the window. The **ALL** **SEL** button can be used to show selected APs only or all APs.

Color Selection


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

One is to select the color used to graph signal strength from that AP(s). To change the color for a selected AP(s) right click on the color indicator. A color selection dialog box will appear.

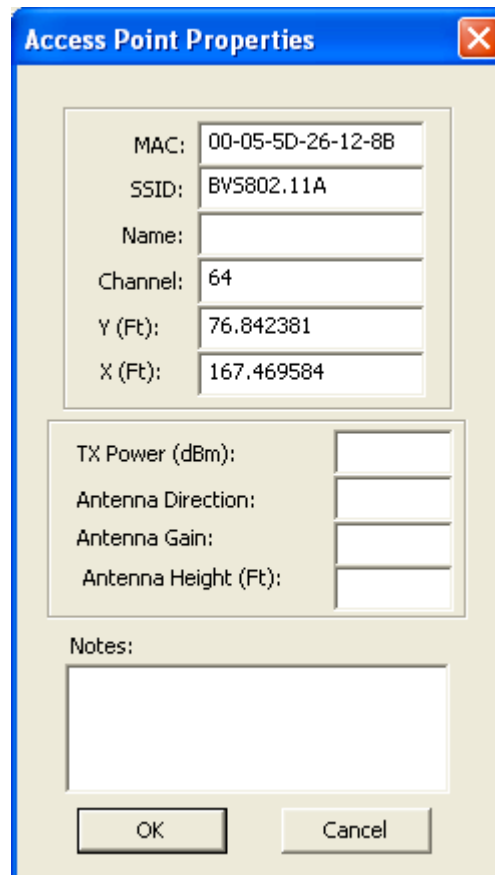
The other is to select how APs are grouped for analysis. By clicking on **the space** between the check box and the group label (SSID or Channel) the user will be able to choose how the AP(s) are grouped. By left clicking on the indicator the user will be able to toggle between individual mode and combined mode. After checking the AP, the analysis of that AP will be shown. There are four conditions the user has to choose from as shown in the following table:

Example	Example Grouping Description	Description
	Individual	Each selected AP is graphed in its own color indicated by the color of the star
	Group Selection By SSID	The best coverage for each SSID is shown using the APs selected.
	Group Selection By Channel	The best coverage for each channel is shown using the APs selected.
	Combined Selection	The coverage of the APs selected is combined and graphed in a single color.

Setting AP's Location

To set an access point's location, click the  hotkey, move to the location and left click on the map. Input the MAC Address when an AP property dialog box is shown up. It will match the location to the AP.


The AP location can also be set up by the following method. Double click on the MAC in the control window will also pop up the AP property dialog box. Please input the location of the AP. Click on the OK button will show the AP on the screen.



The dialog box is titled "Access Point Properties" with a blue header bar and a close button (X) in the top right corner. It contains several input fields for configuring an access point. The fields are arranged in two main sections. The top section includes MAC (00-05-5D-26-12-8B), SSID (BV5802.11A), Name (empty), Channel (64), Y (Ft) (76.842381), and X (Ft) (167.469584). The bottom section includes TX Power (dBm), Antenna Direction, Antenna Gain, and Antenna Height (Ft), all with empty input fields. Below these fields is a "Notes:" label followed by a large empty text area. At the bottom of the dialog are "OK" and "Cancel" buttons.

MAC:	00-05-5D-26-12-8B
SSID:	BV5802.11A
Name:	
Channel:	64
Y (Ft):	76.842381
X (Ft):	167.469584
TX Power (dBm):	
Antenna Direction:	
Antenna Gain:	
Antenna Height (Ft):	
Notes:	
OK Cancel	


Plot RSSI along Survey Path




To plot the RSSI along the survey path, click on the  button and then **select** the channel. A colorful drive path is shown below. The range in the map is from -75 dBm to -30 dBm by default. To change the range of RSSI, please use the [Range Control](#).

AP Coverage Analysis

When an AP is selected individually, click on the  button to create its RF coverage.


Combined Coverage Analysis with Color Code

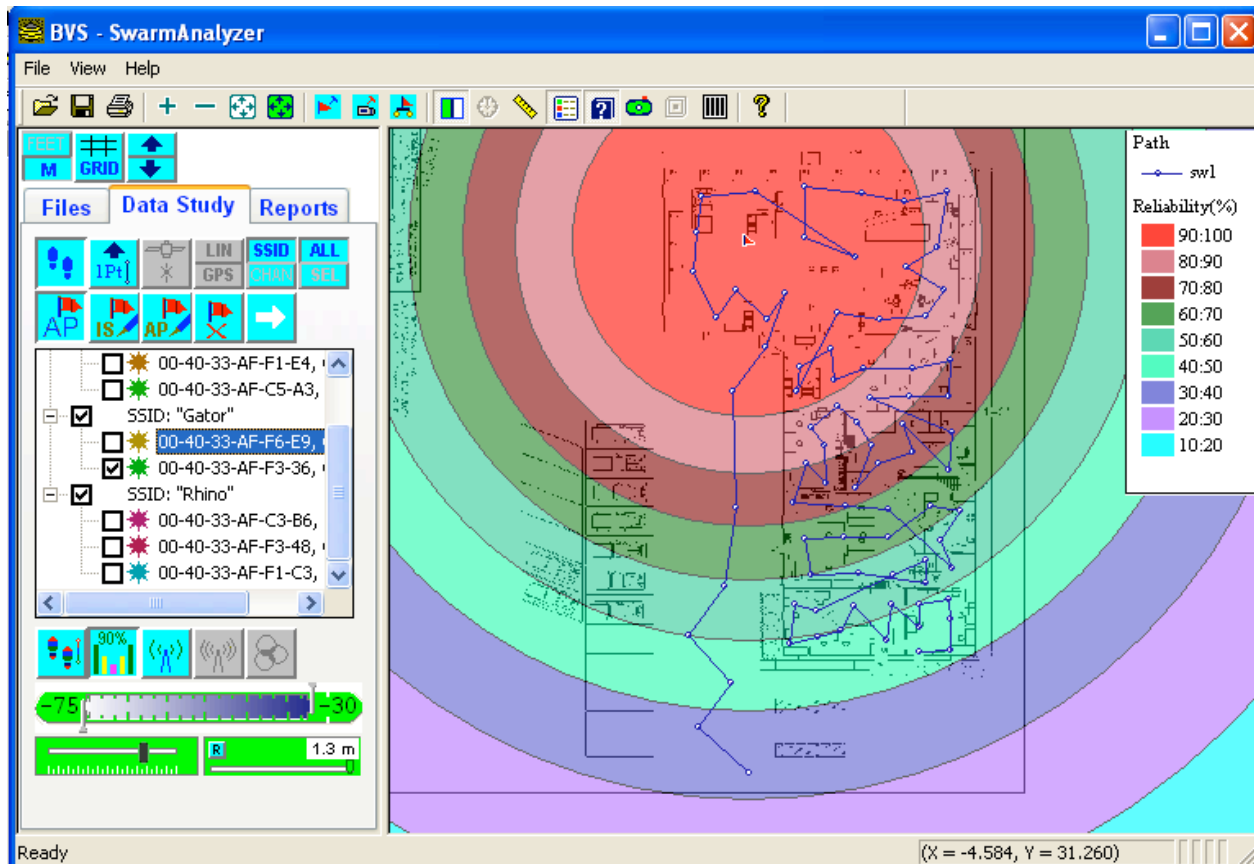
To analyze the coverage of a single AP or a group of APs with color code, first select the APs in the list. Then press the  button to analyze the coverage of selected AP(s).

Press the  button will show the RF Coverage of selected AP(s) and press the  button will show the overlay of APs. The legend for the color code takes the value of the range control (-75 dBm to -30 dBm by default) and can be shown by clicking on the  button.

Reliability Analysis

Reliability Analysis shows the Boundary Reliability of the AP(s). This feature provides the reliability performance of the AP(s) along with a visual of the coverage area on the map. AP(s) selection for Reliability Analysis is performed with the AP Selection List.

















After selecting the AP(s) from the AP Selection List, click on the  button to plot the reliable coverage. The reliability represents the probability that the received signal's strength is larger than the threshold (it is the low value of power range, -75 dBm by default). The Boundary Reliability represents the probability of the signal strength at the boundary of the circle.



Use the “R” button to set the default resolution

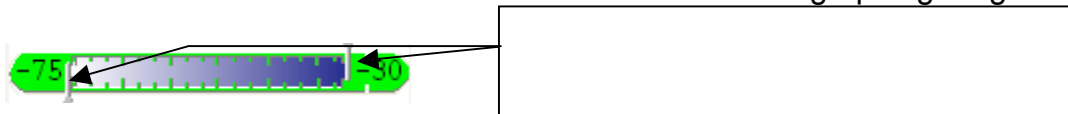
Use these sliders to control min. and max. settings

Buttons in the Section of Data Analysis in Control Window

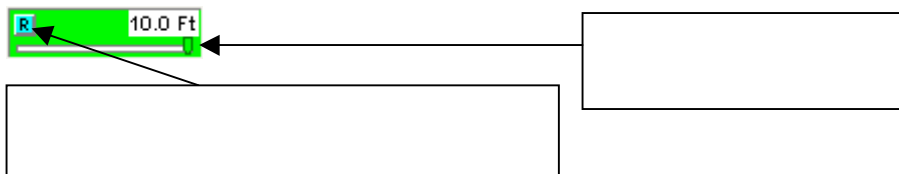
Buttons	Description
	Show/Hide Walk/Drive Path
	Change the Width of Walk/Drive Path
	Show/Hide Points without Enough Satellites to Fix (black dots)
	Change the coordination (Ft/M <-> GPS).
	Sort Access Points according to their SSID or Channels
	Show Selected APs only or All APs
	Show/Hide AP Markers
	Show/Hide Marked Interference Resources (manually recorded)
	Show/Hide Marked APs (manually recorded)
	Delete selected Access Points
	Plot RF coverage of selected APs with color code
	Show RSSI value along survey path with color code
	Show Reliability Analysis of selected APs
	Show RF Coverage of selected APs with color code
	Show RF Coverage of selected APs with color code
	Show AP overlays with color code

Range Control


This feature allows the user to control how the signal strength is represented using a graph. The two sliders set the minimum and maximum values for the graphing range.



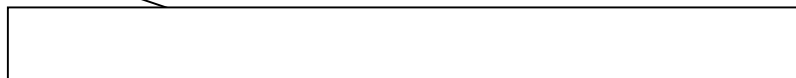
Resolution Control



Use this slider to change the transparency of the plot.



















The resolution control shows the size of the points calculated. Setting the control for larger points will reduce the calculation time and decrease the resolution. Typically this control is set to speed up calculations while setting up graphs. The button  resets the control to a reasonable default setting.

Transparency Control



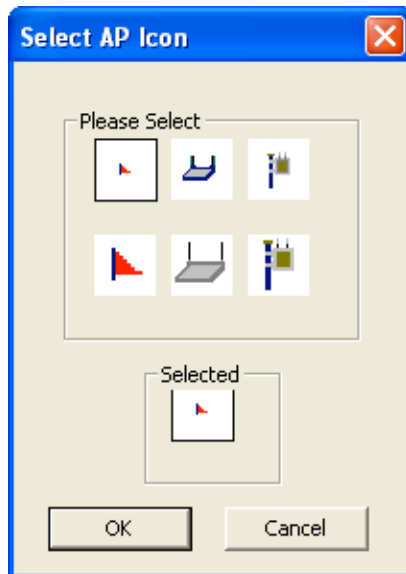
Buttons Controlling the View (On the Toolbar)

There are several hot buttons available to control the graph view.

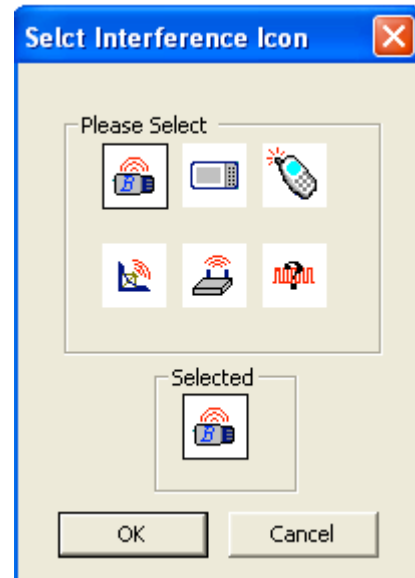
Button	Name	Description
	Open	Open an existing project
	Save	Save current project
	Print	Print current view
	“Zoom In” Tool	After clicking this hot button, the cursor changes to a magnifying glass.
	“Zoom Out” Tool	After clicking this hot button, the cursor changes to a zoom-out glass.
	Fit to Window	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.
	Insert an access point	Insert an AP to the map
	Insert an interference source	Insert an interference source to the map
	Move a source	Move a AP or an Interference source on the map
	Show Map	Show/Hide the map
	Show Direction	Show the direction of the map
	Ruler	Measure distance on the graph
	Legend Window	Show legends for the graph
	Information Window	Show the measurement and analysis information in detail where mouse hovers
	Take a snapshot	Save current view as a picture
	KML Report	Create a KML report
	Table Report	Create a Table report

Changing AP or Interference Source Icons

Right click on the AP or the Interference Source, select the command “Change Icon” and then a dialog with all icons is shown. Select the desired one and then click the “OK” button.




(a) Access point icons




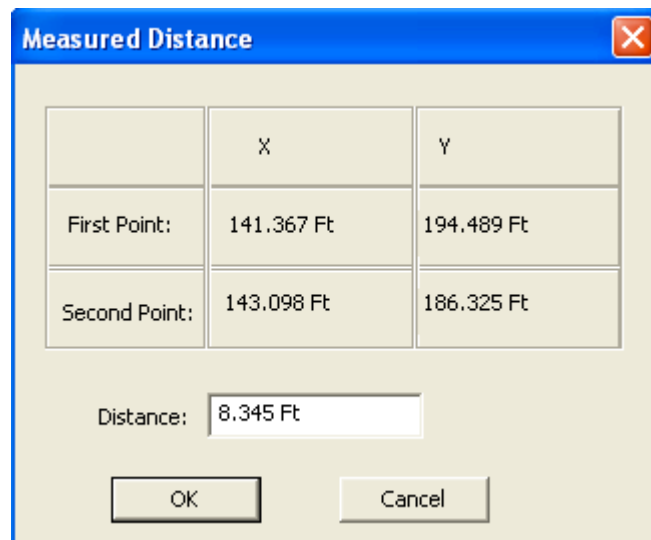
(b) Interference source icons

Moving an Access Point or Interference Source

To move an access point or interference source, click the  hotkey, left click at the center of the AP or interference source icon, hold on the graph and move it to the desired location.

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. By releasing the button the distance is displayed by a distance dialog box.

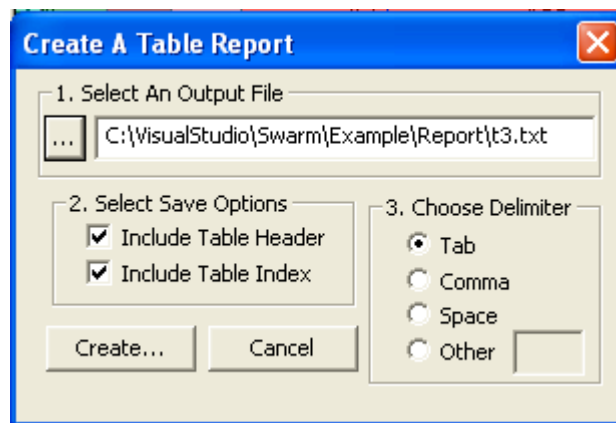


Printing

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

Table Report

To view the data point in tabular form, click on  button to generate a table report. The save table options dialog then appears. The table report can be created by the following steps: (1) Please select the output file; (2) Please select the save options; (3) Please choose the delimiter to separate the items in the field; (4) Click on the “Create...” button to create a table report.



The output is an ASCII file that can be customized for easier conversion to a specific program.

An example is show below:

#	Y	X	CH(MHz)	MAC	SSID	RSSI	Time
0	1180	1156	2412	00-40-33-AF-C3-B6	Rhino	-71	15:23:26
0	1180	1156	2412	00-40-33-AF-F1-E4	Coyote	-66	15:23:26
0	1180	1156	2437	00-40-33-AF-C5-A3	Coyote	-58	15:23:26
0	1180	1156	2462	00-40-33-AF-F1-C3	Rhino	-64	15:23:26
0	1180	1156	5320	00-05-5D-26-12-8B	BVS802.11A	-68	15:23:26
1	1176	1211	2412	00-40-33-AF-F1-E4	Coyote	-69	15:25:43
1	1176	1211	2412	00-40-33-AF-C3-B6	Rhino	-70	15:25:43
1	1176	1211	2437	00-40-33-AF-C5-A3	Coyote	-56	15:25:43
1	1176	1211	2462	00-40-33-AF-F1-C3	Rhino	-61	15:25:43
1	1176	1211	5320	00-05-5D-26-12-8B	BVS802.11A	-64	15:25:43
2	1107	1211	2412	00-40-33-AF-C3-B6	Rhino	-71	15:26:19
2	1107	1211	2412	00-40-33-AF-F1-E4	Coyote	-66	15:26:19
2	1107	1211	2437	00-40-33-AF-C5-A3	Coyote	-56	15:26:19
2	1107	1211	2462	00-40-33-AF-F1-C3	Rhino	-52	15:26:19
2	1107	1211	5320	00-05-5D-26-12-8B	BVS802.11A	-68	15:26:19
3	1063	1210	2412	00-40-33-AF-F1-E4	Coyote	-64	15:26:45
3	1063	1210	2412	00-40-33-AF-C3-B6	Rhino	-71	15:26:45
3	1063	1210	2437	00-40-33-AF-C5-A3	Coyote	-50	15:26:45
3	1063	1210	2462	00-40-33-AF-F1-C3	Rhino	-54	15:26:45
3	1063	1210	5320	00-05-5D-26-12-8B	BVS802.11A	-69	15:26:45
4	1072	1155	2412	00-40-33-AF-C3-B6	Rhino	-70	15:27:13
4	1072	1155	2412	00-40-33-AF-F1-E4	Coyote	-62	15:27:13
4	1072	1155	2437	00-40-33-AF-C5-A3	Coyote	-52	15:27:13
4	1072	1155	2462	00-40-33-AF-F1-C3	Rhino	-57	15:27:13
4	1072	1155	5320	00-05-5D-26-12-8B	BVS802.11A	-67	15:27:13
5	1125	1156	2412	00-40-33-AF-F1-E4	Coyote	-66	15:28:42
5	1125	1156	2412	00-40-33-AF-C3-B6	Rhino	-70	15:28:42
5	1125	1156	2437	00-40-33-AF-C5-A3	Coyote	-50	15:28:42
5	1125	1156	2437	00-40-33-AF-F3-48	Rhino	-74	15:28:42
5	1125	1156	2462	00-40-33-AF-F1-C3	Rhino	-60	15:28:42
5	1125	1156	5320	00-05-5D-26-12-8B	BVS802.11A	-70	15:28:42
6	1074	1104	2412	00-40-33-AF-F1-E4	Coyote	-58	15:30:13
6	1074	1104	2412	00-40-33-AF-C3-B6	Rhino	-61	15:30:13

where

RSSI: received signal strength indicator;

CH: Channel number;

MAC: media access control address;


SSID: Service Set Identifier.

The output is an ASCII file that can be customized for easier conversion to a specific program.

KML Report

Keyhole Markup Language (KML) files can be opened by [Google Earth™](#) and the current view will be shown on top of GoogleEarth. If no GPS projection files (*.gpf) exist and the data has GPS information, the Swarm software can generate a KML file automatically to

plot the graph on top of the map of GoogleEarth. To use this feature, use the  Hotkey.

If the map is shown on the graph, uncheck the  Hotkey to enable the KML Hotkey. Select a file name to store the file when the dialog box appears. After creating a KML file right click on the file and select "GoogleEarth" to open it. Pull down the scroll button at "Places" to the bottom and check the box before "Swarm RF Coverage", the view will be shown on top of GoogleEarth and the transparency can also be adjusted by the slider control underneath. It can also be saved in "My Places".



HTML Report

HyperText Markup Language (HTML) files can be opened by Internet Explorer and can contain formatted text and graphics. Swarm Analyzer can create a HTML report that has the information about the data survey files, the selected APs, the coverage of signal power and AP overlays.

To use this feature select **Report** section in Control Window. Select the items to be written

in the HTML report and then click the  button to create a HTML report. Select a file name to store the file when the dialog box appears. A dialog box for HTML report options will be shown. If the combined analysis with color code is not implemented, both

☐ Show AP Coverage and ☐ Show AP Overlay will be disabled.

If **Selected Files** **All Files** under ☒ Show SSD Files is selected, only selected file(s) are to be displayed in the report. Similarly, If **Selected APs** **All APs** under ☒ Show Access Points is selected, only selected AP(s) are to be displayed in the report. Otherwise, all AP(s) will be shown in the report.

Appendix A: Combining Indoor and Outdoor Site Survey Study

I. Site Survey Study

Site survey study has been used to validate and predict the RF coverage for the survey area. Current GPS technology makes it much easier and faster to collect the data with correct location information. However, for indoor cases, such as shopping malls, hospitals, enterprise buildings, and so on, GPS cannot provide the correct location information. Engineers have to record the measuring locations in order to process the collected data for RF coverage analysis. BVS Swarm software can be used for both indoor and outdoor survey study.

II. Combined Indoor/Outdoor Analysis

Based on the indoor site survey method, BVS provides a solution to do a combined analysis for the data from both indoor and outdoor site survey study. The following steps are used to collect the data with geo information,

1. Use BVS GPS Projector to get a geo-coded map (*.gpf). The example shown in Fig. 1 takes 6 points at the corners to geo-code the floor plan and the accuracy is 0.04second (about 3 feet in latitude and 4 feet in longitude). The GPS information for the six points is obtained from GoogleEarth.
2. Load the geo-coded map into the Swarm Collector Software. When the data are collected with this map, all the measurement points will be transformed to geo information (latitude and longitude). In this way, we can obtain geo-coded indoor data collection files (*.ssd).
3. To get the outdoor data collection files, it can be done in two ways,
 - a. Use GPS directly in the field to collect the data when the GPS status is good (which means the GPS information is obtained by 3D fix).
 - b. When GPS status is bad, the method to collect the indoor data files can also be used here to collect the data in the outdoor area.
4. Swarm Analyzer software can load both outdoor and indoor collection data files and analyze the collected data and RF coverage for the survey area.

Figure A1 shows the indoor site survey study with geo-coded floor plan. In this figure, we can see the direction of the map and the latitude and longitude of the measurement points. Figure. A2 shows the analysis of the indoor collection data, which have been geo-coded with the use of geo-projection file. Therefore, it can be used with the data collected outside with GPS to get a combined analysis of indoor and outdoor survey study.

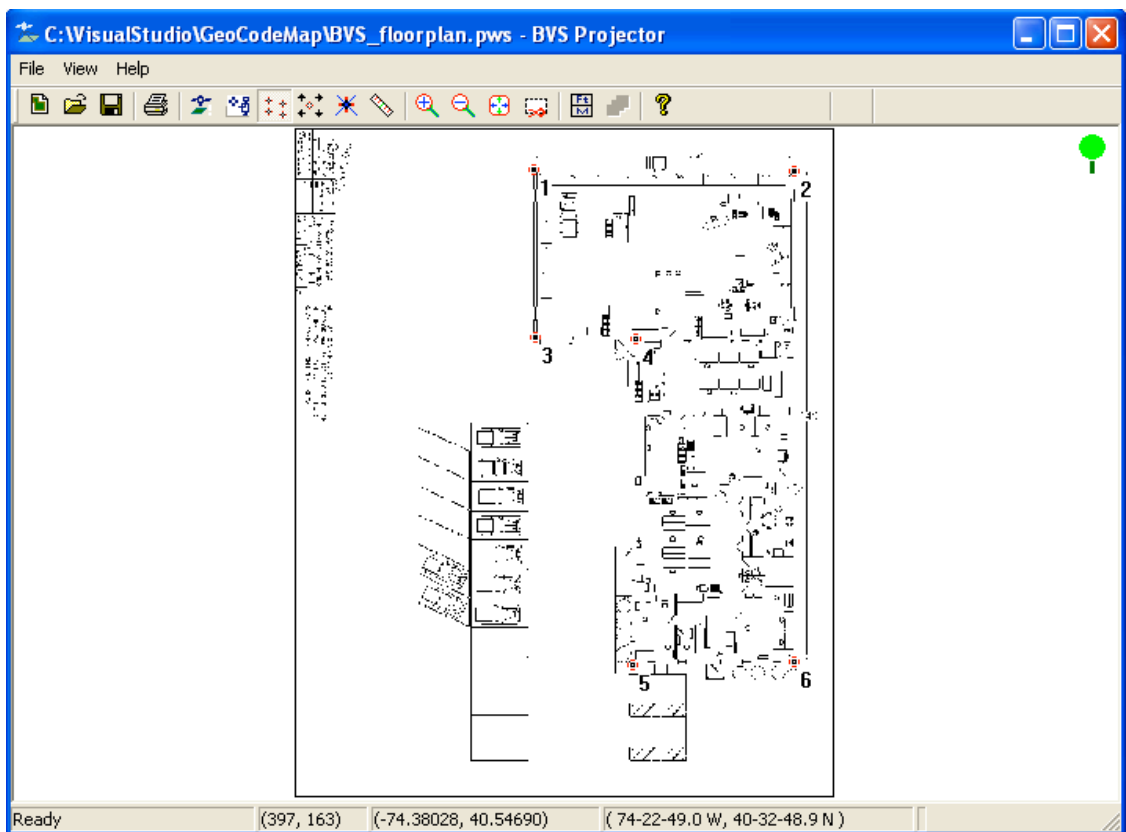


Figure A1. Geo-coded floor plan.

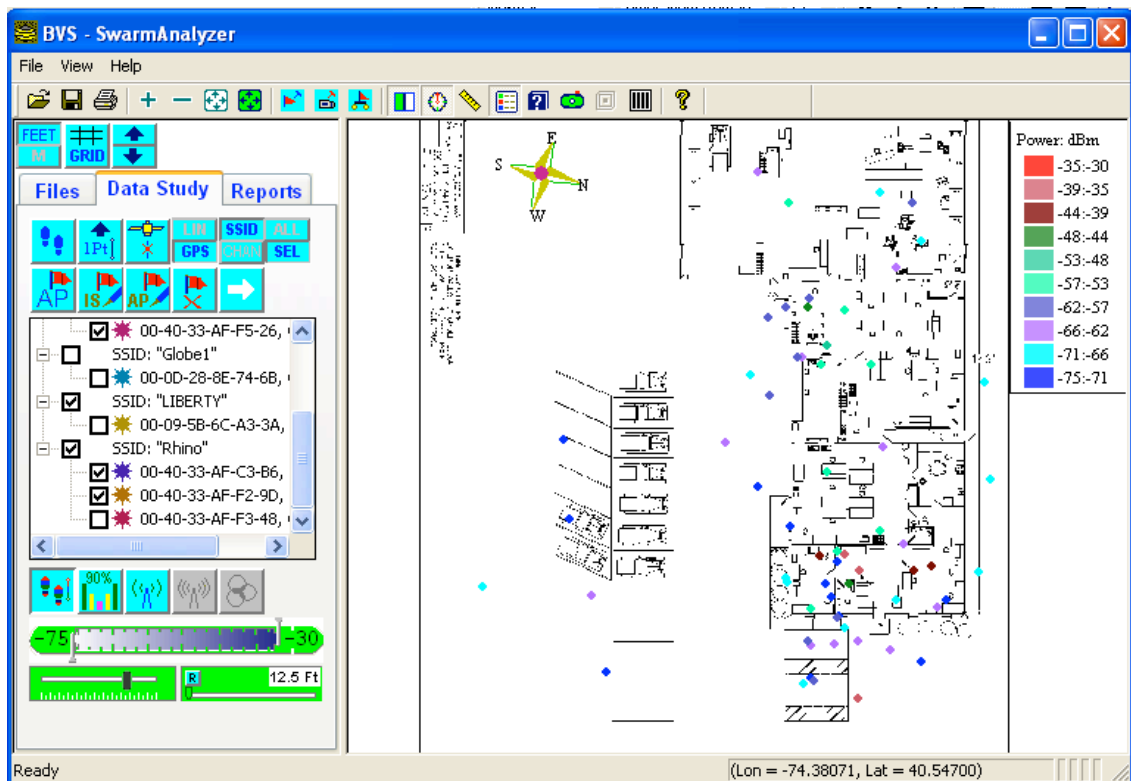


Figure A2. Analysis of indoor collection data with GPS projected file.