Dell PowerConnect W AirWave 7.2

VisualRF User Guide

Contents

About this Guide

This preface provides an overview of this guide and contact information for Dell, and includes the following sections:

Document Organization

This user guide includes instructions and examples of the graphical user interface (GUI) for installation, configuration, and daily operation of VisualRF in AWMS 7.2.

Table 1 *Chapter Organization and Purposes*

Chapter	Description
Chapter 1, "Overview of VisualRF" on page 5	Introduces VisualRF, lists its major features, provides a list of terminology, and provides an overview of basic and advanced navigation.
Chapter 2, "Setting Up and Tuning VisualRF" on page 13	Explains how to set up preferences and server settings, optimize resource utilization, fine-tune location services, and view floor plans on a basic level.
Chapter 3, "Planning and Provisioning" on page 33	Provides detailed instructions on creating floor plans, campuses, and buildings, as well as planning regions and provisioning APs.
Appendix A, "VisualRF Performance" on page 45	Goes into further detail on improving the performance of VisualRF.
Appendix B, "Importing from CAD" on page 47	Provides detailed instructions on importing images from CAD formats.
Appendix C, "Importing from a Dell PowerConnect W Controller" on page 51	Provides instructions on importing from a Dell PowerConnect W Controller.
Appendix D, "VisualRF Location API" on page 53	Includes basic information on the VisualRF location APIs.

Note, Caution, and Warning Icons

This document uses the following icons to emphasize advisories for certain actions, configurations, or concepts:

NOTE: Indicates helpful suggestions, pertinent information, and important things to remember.

CAUTION: Indicates a risk of damage to your hardware or loss of data.

⚠ WARNING: Indicates a risk of personal injury or death.

Contacting Support

Table 2 *Website contact*

Web Site	
Main Website	dell.com
Support Website	support.dell.com
Documentation Website	support.dell.com/manuals

Chapter 1

Overview of VisualRF

This overview chapter includes the following topics:

The VisualRF module is an add-on to the Dell PowerConnect W AirWave Wireless Management Suite (AWMS) that provides a real-time picture of the actual radio environment of your wireless network and the ability to plan the wireless coverage of new sites.

To understand what is happening on your wireless network, you need to know where your users and devices are located - and you need to monitor the RF environment in those areas. The VisualRF module puts this information at your fingertips through integrated mapping and location data.

VisualRF uses sophisticated RF fingerprinting to accurately display coverage patterns and calculate the location of every wireless device in range. Moreover, VisualRF does not require dedicated RF sensors or a costly additional location appliance - all the necessary information is gathered from your existing wireless access points and controllers.

Features

- Floor plan upload wizard enables direct importation of JPEG, GIF, PNG, PDF and CAD files for floor plans.
- Batch upload wizard enables batch uploads of multiple CAD files with corresponding walls, and access points.
- Accurate calculation of the location of all client devices (laptops, RFID Tags, PDAs, Phones) using RF data from your existing APs and controllers. Location accuracy increases with higher density, providing more data points to triangulate the location of each device. Further improvements in accuracy can be achieved with site surveys.
- 3D navigation allows your Help Desk to view floor plans simply by clicking on the appropriate campus, building, or floor.
- Tree view allows customer to navigate to a specific campus, building, or floor via a tree navigation.
- Heatmaps depict the strength of RF coverage in each location.
- Color-coded channel maps help you reduce interference and quickly identify or detect potential coverage holes.
- Data rate view which depicts the highest possible data rate at every location on a floor plan.
- Integrates with the Dell PowerConnect W AirWave Wireless Management Suite for onscreen display of alerts and error conditions (for instance, an AP icon will display in red when a critical alert is active or when usage conditions exceed pre-defined thresholds).
- Location playback viewer which allows visual tracking of up to 24 hours of location history.
- Dynamically recalculates path loss and device locations based on real-time data from your wireless LAN, for increased location accuracy.
- Calibrates RF data from multiple vendors' APs (and across different product lines from the same vendor) for accurate display even in multi-vendor and multi-architecture environments.
- Full planning capabilities based on data rate or signal requirements.
- Google Earth integration for depiction of outdoor coverage and device location.

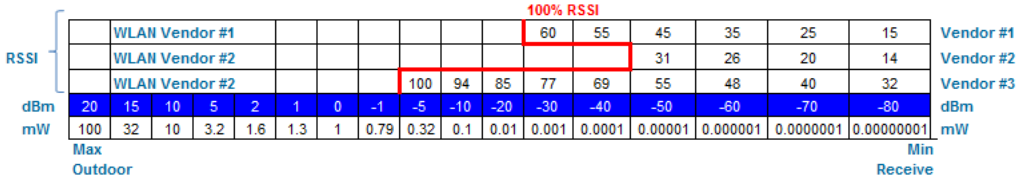
Useful Terms

- **VisualRF** - The service within AMP that calculates location, calculates path loss, and provides floor plan editing capabilities.
- **VisualRF Plan** - Makes the planning portions of VisualRF available in an offline software package that does not require a server.
- **QuickView** - Flash front-end for VisualRF which displays information generated by the backend service.
- **mW** - 1/1000 of a Watt. It is a linear measurement (always positive) generally used to represent transmission.
- **dB (Decibels)** - difference/ratio between two signal levels.
- **dBm** - dB as compared to 1 mW. It is a logarithmic measurement (integer) which is typically used in place of mW to represent receive-power level. AMP normalizes all signals to dBm, so it is easy to evaluate performance between various vendors.
- **RSSI (Received Signal Strength Indicator)** - IEEE defines RSSI is a mechanism by which RF energy is to be measured by the circuitry on a wireless NIC (0-255). RSSI is not standard across vendors. Each vendor determines their own RSSI scale/values.
- **AP-to-AP Signal (Neighbor)** - Some APs/Controllers have the ability to report the signal strength of APs that they hear. AMP uses these signal strength readings to dynamically attenuate floor plans to increase the accuracy of client locations and heat maps.
- **Unassociated Client Information** - Some APs/Controllers have the ability to report the signal strength clients they hear, but are not associated with a radio on the AP. AMP also uses these signal strength readings to more accurately place clients.
- **Client Surveys** - Client surveys within VisualRF use access points to understand which clients they hear and at what signal strength.
- **Rogue Surveys** - Rogue surveys are facilitated by AMC, VisualRF and the client's radio to understand which access points they hear and what signal strength.

AWMS is the only WLAN management application that understands unique RF characteristics for every enterprise WLAN manufacturer. This includes receive sensitivity at all data rates, antenna characteristics, and supported transmit power levels for every architecture and individual model.

AWMS normalizes signal metrics which might come as RSSI or SNR into dBm enabling customers to visualize and compare different vendors, models, and architectures as shown in Figure 1:

Figure 1 *Example Vendor-Specific Implementation of RSSI*

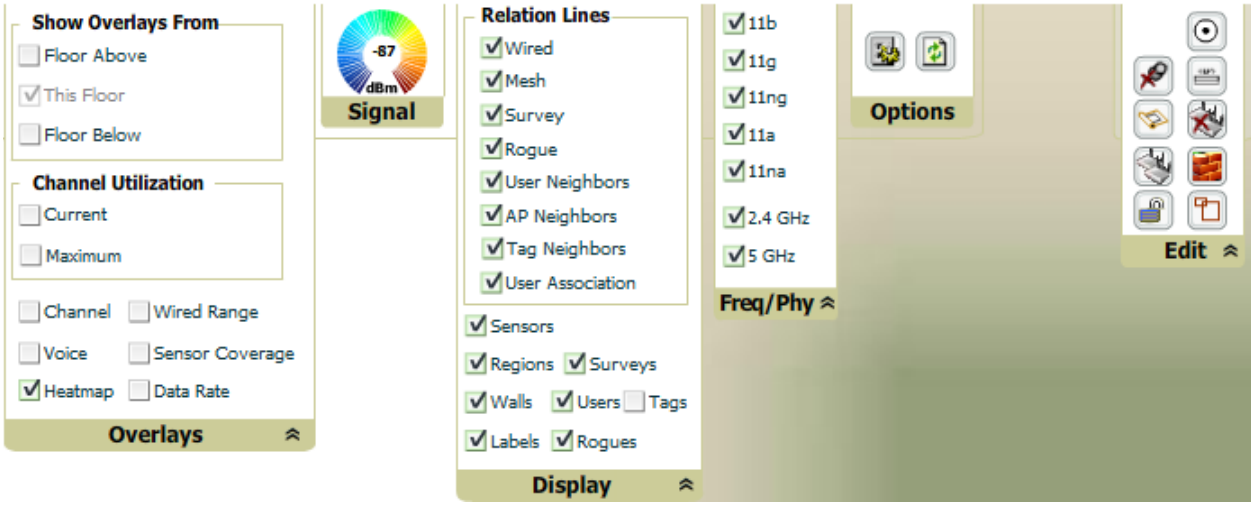


	WLAN Vendor #1										60	55	45	35	25	15
	WLAN Vendor #2												31	26	20	14
	WLAN Vendor #2								100	94	85	77	69	55	48	40	32
dBm	20	15	10	5	2	1	0	-1	-5	-10	-20	-30	-40	-50	-60	-70	-80
mW	100	32	10	3.2	1.6	1.3	1	0.79	0.32	0.1	0.01	0.001	0.0001	0.00001	0.000001	0.0000001	0.00000001

Basic QuickView Navigation

QuickView is designed to be very intuitive with easy-to-use drop-down menus. The RF drop-down menus are split into two major categories: display toggles and editing tools, as shown in Figure 2. Selecting some of these options can cause other submenus to appear.

Figure 2 *Display and Edit Menus (Fully Extended)*



Display Toggles

Overlays - select which overlay to view:

- Channel - provides channel interferences by color and PHY
- Wired Range - Displays the distance an Ethernet cable can be pulled from an IDF. The max range is equal to 300 feet minus 5 percent minus 1.1 times the floor height.
- Voice - provides coloring based on number of radios covering each grid cell with a minimum of -70 dBm of signal and assuming a client transmit power of 100 mW.
- Sensor Coverage - provides the farthest area which a sensor can hear.
- Heatmap - provides the highest dBm (energy level) for all areas of a floor plan.
- Data Rate - provides the highest data rate a user will receive for all areas of a floor plan.
- Show Overlays From - combines all floors APs selected to show the highest achievable signal for each grid cell on the floor.
  - Floor Above - show the heatmap from APs located on the floor above
  - This Floor (default)
  - Floor Below - show the heatmap from APs located on the floor below

Overlays Widget - provides ability to increase or decrease the current overlay

- Heatmap (RSSI Ring) - Evaluate coverage based on signal levels.
- Channel Overlay (Data Rate Slider) - Evaluate coverage based on data rate.
- Data Rate (User Xmit) - Evaluate coverage based on xmit power of client.
- Channel Utilization - When you select Current or Maximum, a new menu appears to select Total, Receive, Transmit or Interference information.

Display

- Sensors - Toggle sensors on or off. Off by default on all views.
- Regions - Toggle regions on or off. Off by default on all views.
- Surveys - Toggle surveys on or off. Off by default on all views.

- Walls - Toggle walls on or off. On by default on all views.
- Users - Toggle wireless users on or off. On by default on all views.
- Tags - Toggle WiFi Tags on or off. Off by default on all views.
- Labels - Toggle labels on or off. Off by default on all views.
- Rogues - Toggle surveys on or off. Off by default on all views.
- Relational Lines Sub-menu - expanded by clicking on the down arrow
  - Wired - Toggle lines between APs/sensors and their IDF.
  - Mesh - Toggle lines between Mesh portals and nodes.
  - Survey - Toggle lines between client (x,y) to APs by client during survey.
  - Rogue - Toggle lines between rogue AP and radios which hear the AP
  - User Neighbors - Toggle lines between client and radios which hear the client excluding the radio of association.
  - AP Neighbors - Toggle lines between APs which heard each other.
  - Tag Neighbors - Toggle lines between WiFi Tags and radios which hear the Tags. For Tags there is no radio of association.
  - User Association - Toggle line between the wireless user and AP of association.

NOTE: All 2.4 GHz lines are blue and 5 GHz lines are green. If both PHYs apply to a line, then it is yellow.

Frequency & PHY - select the desired frequency and PHY

- 2.4 GHZ (lines are always blue)
  - 11b
  - 11g
  - 11ng
- 5 GHz (lines are always green)
  - 11a
  - 11na

Options - Buttons

Table 3 *Options Icons and Descriptions*

Operation	Icon	Description
Refresh		Refresh the floor plan to see changes
Preferences		Configure personal viewing preferences

- **Refresh** - Refresh client locations.
- **Preferences** - Provides ability to configure user preferences (overlay types, grid lines, alerts, icon sizes). User preferences are stored per browser. They can vary between users and between browsers. See "Configuring QuickView Personal Preferences" on page 17 for more details.
  - **General**
    - Enable Auto-Refresh - Will refresh data in the quick view at the specified interval.
    - Show grid lines and size - Will overlay grid lines at the specified location making it easier to judge distance.

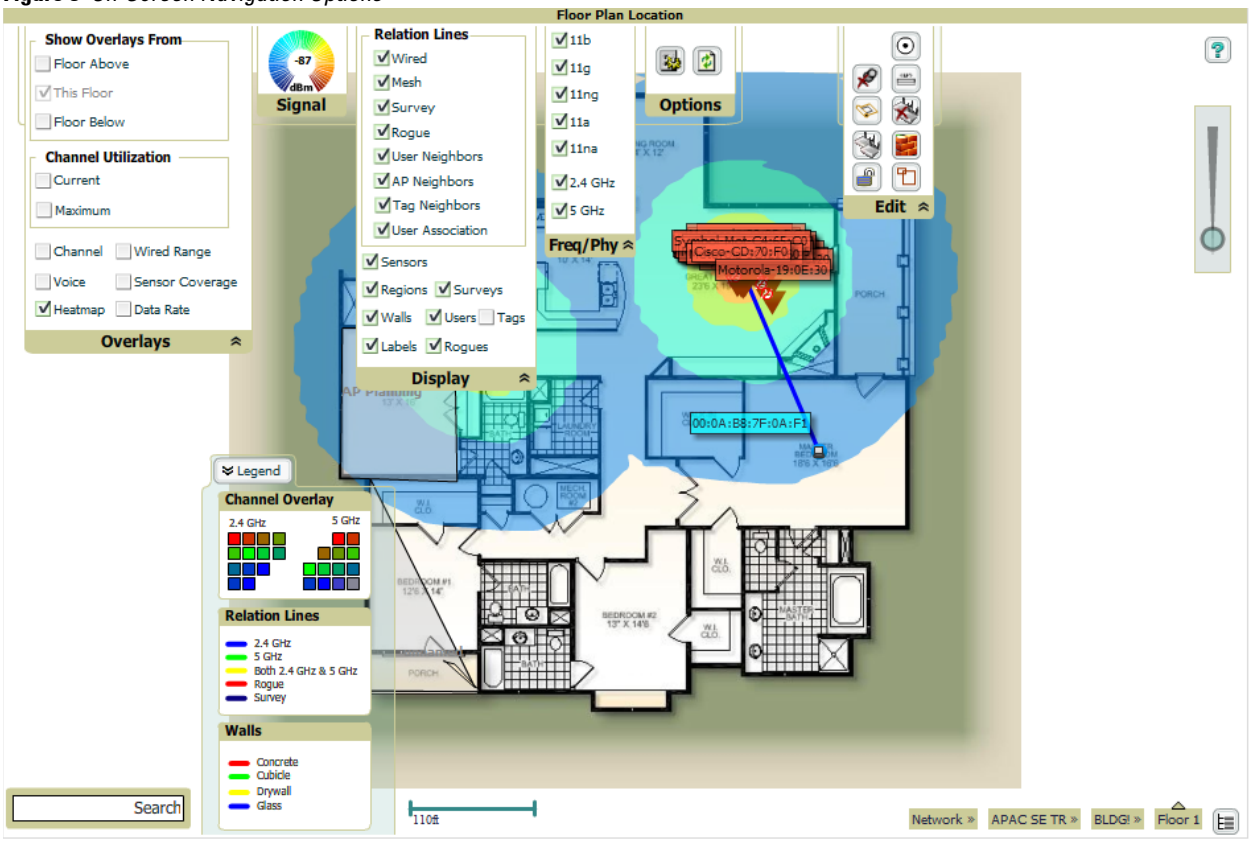
        - Show scale - Enable or disable the scale that is displayed in the bottom of the quick view.
    - **APs**
        - AP Triggers preferences
        - Display channel in AP label
        - Display transmit power in AP label
        - AP icon size
    - **Users**
        - User Trigger preferences
        - User icon size
    - **Overlays** - Specify how the overlays should be displayed. Vector will display a smoother image and break down the overlay into ~5 buckets. Grid will display a higher granularity but is broken up into square cells.
        - Heatmap
        - Channel
        - Data Rate
        - Sensor
        - Voice
    - Navigation
    - Campus and Building Trigger preferences
    - Campus, Building, and Floor icon size Vector
- **Edit** - Explained in Table 4:

Table 4 *Edit Icons and Descriptions*

Operation	Icon	Description
Set Orientation		Set Orientation for proper vertical floor plan alignment.
Delete Survey		Remove all surveys (rogue and client) on floor plan.
Resize Floor		Change the size of the floor plan.
Plan APs		Manually plan APs onto a floor plan (APs not managed by AWMS).
Delete APs		Remove all access points on a floor plan.
Provision APs		Provision APs onto a floor plan (APs managed by AWMS).
Add Walls		Add walls onto a floor plan.
Edit Lock		Edit floor plans by locking of a floor plan by locking it.
Add Regions		Add regions onto a floor plan. Region types include Planning, IDF, Location Probability, Location Testing and Informational.

Figure 3 shows additional navigation controls. In the bottom left corner of the window is the search box and legend menu. In the top right corner is the zoom control. You can also zoom by using your mouse wheel as well or the + and - keys. In the bottom right corner are navigation tools related to network, campus, and building.

Figure 3 *On-Screen Navigation Options*



General Navigation Tips

- **Search** - Use the search box in the bottom left of the window to quickly find a wireless client, AP, or rogue device displayed on the floor plan. Search will do substring matches on username, MAC address and model.
- **Click** - clicking on an object will display monitoring statistics about that object.
- **CTRL+ Click** - select multiple objects for deleting or simulating failure.
- **Click + Hold** - enables panning on the floor plan or background image.
- **Right-Click** - left clicking on an object will allow you to edit that object.
- **CTRL+ALT+Shift+X+M+L** - displays the XML behind Flash output which is useful for debugging.
- **Roll Mouse Wheel** - zooms in or out of a floor plan or campus, building view.

VisualRF Workflow

The following is the general workflow of using VisualRF:

1. Setup and Tuning VisualRF - enabling the service and ensure the proper performance characteristics
2. Configure QuickView Personal Preferences - configure RF toggles
3. Creating Campuses and Buildings - each floor must be associated with a building and campus
4. Importing a Floor Plan - the Floor Plan Importation Wizard walks through several steps
   - Background image importation
   - Image cropping
   - Image sizing

- Assign image properties: floor number, name, number of grid cell size, and other floor plan information

NOTE: VisualRF supports all versions of CAD (dwg, dxf, and dwf) files versions 1999 - 2011.

5. Provisioning Existing Access Points onto Floor Plan
6. Increasing Accuracy - Dell recommends drawing only interior walls when working with legacy APs.
   - Drawing Walls - only need to incorporate exterior walls, because VisualRF will automatically calculate interior Path Loss.
   - Client Training for Stationary Devices - used for desktop or other stationary wireless devices
   - Remote Client Surveys - the ability to remotely survey the RF environment via any wireless client connected to the network. Provides additional RF inputs for low-coverage areas.
   - Fine Tuning Location Service - grid cell size and deviation variation
   - Ensure RF Data Frequency - configuring AMP and the infrastructure to provide timely RF statistics
   - AP placement for capacity versus location accuracy
7. Using QuickView to Assess RF Environments
   - User View
   - AP View
   - Floor Plan View
   - Network > Campus >Build View
   - Tree View
8. Pre-deployment Provisioning and Planning
   - Manually provision access points onto floor plan
   - Automatically provision access points onto floor plan
   - Replicate floor plan vertically
   - Print Bill of Materials (BOM) report
   - Export campus
   - Import exported campus
   - Match access points

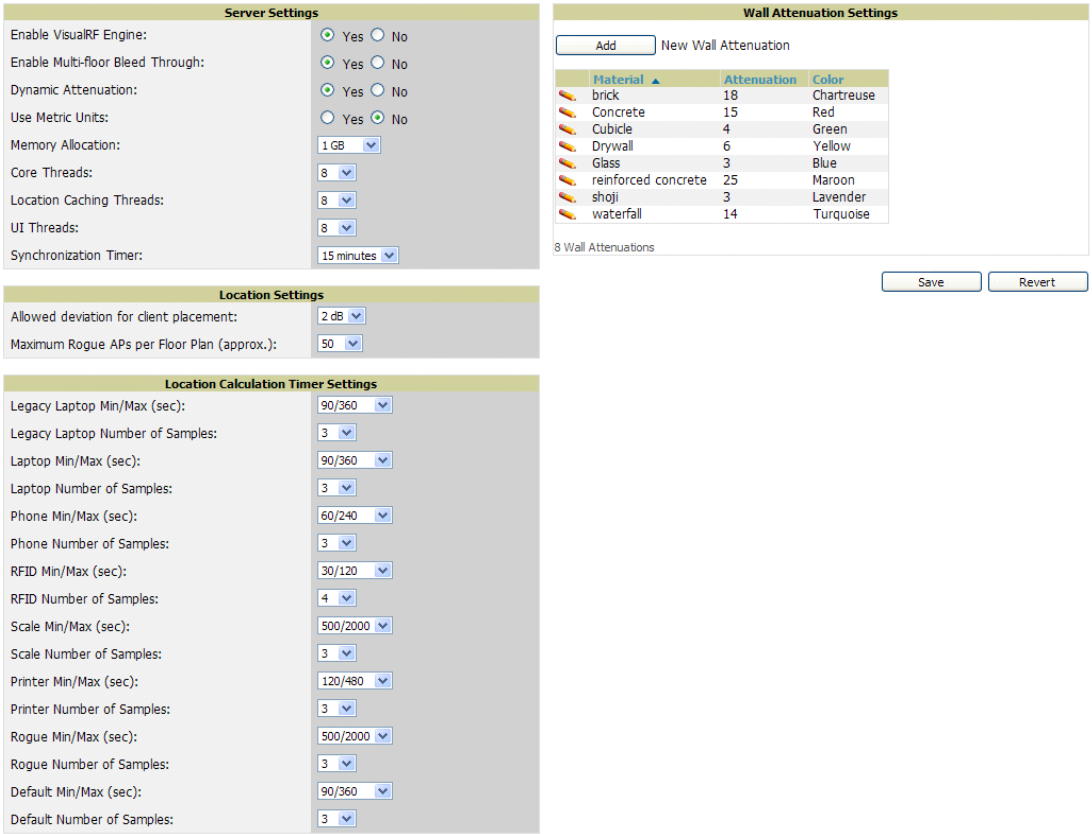
This chapter explains how to set up and fine-tune VisualRF, and includes the following topics:

Using the Settings in the VisualRF > Setup Page

The **VisualRF > Setup** page, illustrated in Figure 4, configures advanced settings for VisualRF. Please reconfigure these settings very carefully because these settings can impact your server's performance as well as your location accuracy.

NOTE: Selecting **Save** will cause VisualRF to restart, disrupting or delaying the usability for up to 5 minutes.

Figure 4 *The VisualRF Setup Page*



To enable VisualRF and tune memory and performance, navigate to the **Server Settings** section on this page. The settings in this section are detailed in Table 5:

Table 5 *Server Settings Section of the VisualRF > Setup Page*

Setting	Default	Description
Enable VisualRF Engine	No	Enables or disables the VisualRF engine. This setting must be enabled to use VisualRF. If you do not have a license for VisualRF, this page will not appear.
Enable Multi-floor Bleed-Through	Yes	Enables or disables calculating the impact APs on floors above and below the currently viewed floor in the Quick View.
Dynamic Attenuation	Yes	Incorporate AP to AP readings as well as site survey information and dynamically recalculate the path loss of each radio to every grid cell on the floor plan, increasing coverage and location accuracy.
Use Metric Units	No	Instructs the VisualRF engine to display all units of measurements in metric
Memory Allocation	512 MB	The amount of memory dedicate to VisualRF. It is not dynamically allocated and all the memory is consumed upon starting the service. Be sure to check the memory and swap utilization in the **Systems > Performance** page before making any changes. The exact amount of memory used per floor plan will vary heavily based on the size, number of devices and number of grid cells on the floor plan. • 25 floors or less 512 MB • 50 to 75 floors 1 GB • 75 to 100 floors 1.5 GB • 100 to 200 floors 3GB • 200 to 300 floors 5 GB (64-bit only) • Above 300 8 GB (64-bit only) **NOTE:** If you see Out of Memory errors in the SSL error log on the **System > Status** page, you should increase memory allocation.
Core Threads	1 times number of cores	Number of threads that calculate path loss for each floor. These threads also regenerate a floor's RF properties when new APs, walls, or regions are added to a floor plan.
Location Caching Threads	1 times number of cores	Number of threads that calculate the location of all clients associated with access points on this floor plan.
UI Threads	1 times number of cores	Number of threads that service the users accessing QuickView, as well as AMP-to-VisualRF communication. **NOTE**: If users experience timeout errors while using QuickView, allocate additional UI Threads.
Synchronization Timer	15 minutes	This timer indicates how often VisualRF will synchronize security for APs within AWMS.
Restrict visibility of empty floor plans to the role of the user who created them	No	When enabled, only the creator can view an empty floor plan.

To tune location accuracy, navigate to the **Location Settings** section on this page as described in Table 6:

Table 6 *Location Settings Section in VisualRF > Setup*

Setting	Default	Description
Allowed deviation for client placement	4 dB	When VisualRF locates a client or rogue it utilizes signal metrics from all the APs that hear the client or rogue device. VisualRF builds a fingerprint location for all clients with similar transmit-power capability. All subsequent clients that fall within the deviation is placed on the same location fingerprint or *x, y* coordinates. **Example:** AP #1 hears client1 at -72, and AP #2 hears client 1 at -64. VisualRF calculates the client's location to be at coordinates 100, 200. Client2 is heard by AP#1 at -71 and AP#2 at -65. VisualRF will use the average of the difference in signals (AP#1 -72 and -71) to see if the client matches a pre-calculated location fingerprint. 1 + 1 (differences in signals) / 2 (# of APs) = 1 which falls within the deviation of 2, hence the client would be located at 100,200.
Maximum Rogue APs per Floor Plan	20	Sets the maximum number of rogues AMP will place on a Floor. Use this filter in combination with the **RAPIDS Export Threshold** configured on the **RAPIDS > Setup** page to intelligently control the number of rogue devices displayed per floor. **NOTE:** Increasing this value could increase the load on the server and the clutter on the screen.

To tune the frequency for calculating device locations within the VisualRF UI navigate to the **Location Calculation Timer Settings** section as described in Table 8:

Table 7 *Location Calculation Timer Settings Section of VisualRF > Setup*

Setting	Default	Description
Legacy Laptop Min/Max (sec)	90/360	This timer determines how often to calculate location for legacy laptop devices. Taken with the data samples the calculation would follow: After minimum timer (90 seconds) check to see if the number of data samples received from all APs that hear this client are greater than or equal to the number of samples setting for legacy laptop devices (default of 3 data samples). If so (**Yes** to question above) then recalculate the client device's location based on the samples received. If not (**No** to the question above) then wait until the number of sample setting is met and recalculate. If the number of samples is never met, wait until the maximum timer (360 seconds) and recalculate.
Legacy Laptop Number of Samples	3	See definition above.

All of the other device types (phone, printer, scale, and so on) use the same methodology as detailed above.

To edit the wall settings and select a color for wall types within the VisualRF UI, navigate to the **Wall Attenuation Settings** section and select the pencil icon next to each of these settings as described in Table 8:

Table 8 *Wall Attenuation Settings in VisualRF > Setup*

Setting	Default	Description
Glass Attenuation (dB)	2	Specifies the attenuation for any glass walls that are drawn in VisualRF. **NOTE:** All of these values are global variables that cannot be overridden for individual floor plans. VisualRF uses these values to calculate path loss and client locations. Walls within VisualRF are interpreted as pure dB loss without adjusting for wall thickness.
Cubicle Attenuation (dB)	4	Specifies the attenuation for any cubicle walls drawn in VisualRF.
Drywall Attenuation (dB)	6	Specifies the attenuation for any drywall walls drawn in VisualRF.
Concrete Attenuation (dB)	15	Specifies the attenuation for any concrete walls drawn in VisualRF.

VisualRF Resource Utilization

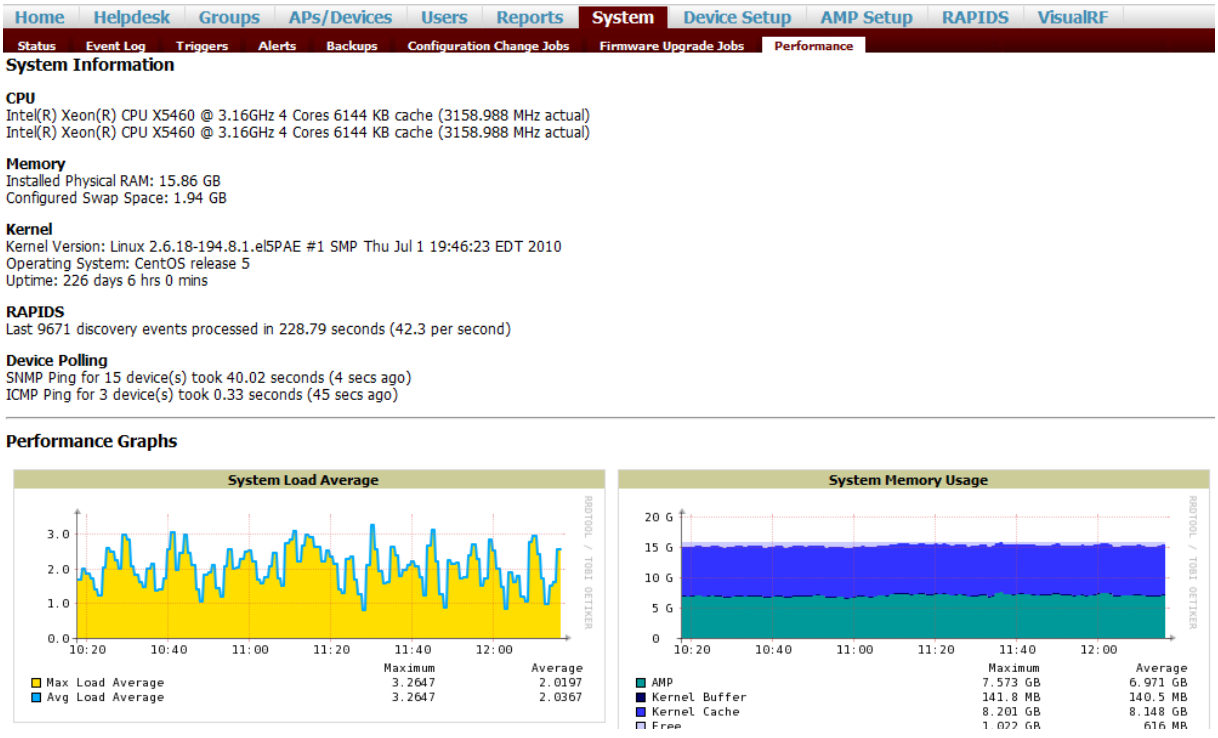
When tuning the VisualRF server, Dell recommends using the default settings as recommended. If you do change any of these settings above, change one at a time and see how the system performs. Each time you restart VisualRF, it will take at least 30 minutes to return to normal processing.

If you use the 'top' command to check on VisualRF resource utilization, ensure you use the 'l' and 'H' flags to show cores and threads. Remember 'top' also takes 1-2 minutes to normalize and provide accurate data.

NOTE: It is normal for VisualRF to consume 20% of each core with a combination of threads. It will utilize excess CPU cycles on all cores when required.

On the **System > Performance** page in AWMS, you can quickly determine if the system is overloaded. The system load should not average more than the number of cores.

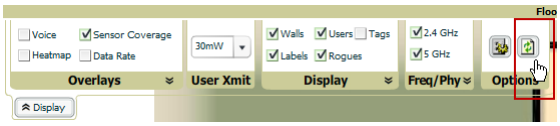
Figure 5 *System Performance Graphs*



Configuring QuickView Personal Preferences

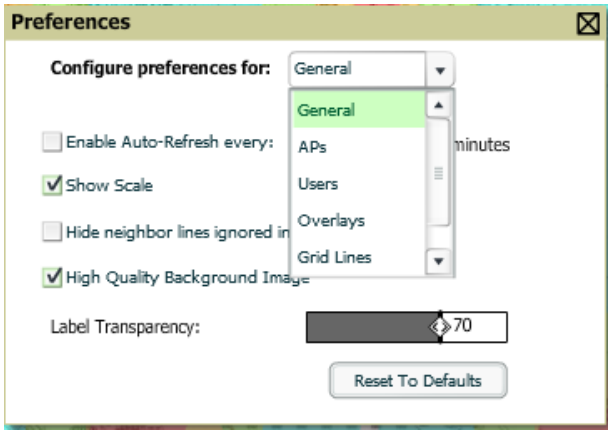
To configure your personal preferences in QuickView, expand the **Display** menu at the top of the screen and select the **Preferences** icon in the Options section (illustrated in Figure 6) as follows:

Figure 6 *The Preferences icon in the Options section of the Display menu*



- **General** - select from the **Configure Preferences** drop-down menu:
  - Enable auto-refresh toggle
  - Refresh Interval in minutes
  - Show Scale toggle
  - Show Scale
  - Hide neighbor lines ignored in location calculation
  - High Quality Background Image - you can disable to increase rendering speed
  - Label transparency slider

Figure 7 *QuickView Preferences Page Illustration (General preferences selected)*



- **APs** - select from the **Configure Preferences** drop-down menu:
  - BW - select the kbps threshold for normal (green), high (yellow), and excessive (red)
  - # of Users - select the number of users threshold for normal (green), high (yellow), and excessive (red)
  - % of Uptime for the last 24 hours for normal (green) and excessive (red)
  - Radio Status - display red or green depending on the status of the radios within the AP.
  - AP Status - display red or green in relation to up/down status of AP.
  - Show Channel in Label toggle.
  - Icon Size - select the size of the AP icon display on the floor plan.
  - Show Channel in Label.
  - Show Transmit Power in Label.
- **Users** - select from the **Configure Preferences** drop-down menu:
  - BW - select the kbps threshold for normal (green), high (yellow), and excessive (red)
  - Signal Strength - select the dBm client threshold for excellent (green), average (yellow), and poor (red).
  - Icon Size - select the size of the client device icon display on the floor plan.
- **Overlays** - select type of overlay
  - Grid - non vector overlay

- Vector - provides much smoother overlay with mouse-over capabilities

- **Grid Lines** - Toggle grid lines on or off
  - Distance between grid lines
  - Color of grid lines
- **Navigation** - select from the Configure Preferences drop-down menu (campus and buildings):
  - % of APs Up for the last 24 hours for normal (green) and excessive (red)
  - Icon Size for campus, building and floor

NOTE: These preferences are stored in the database, so they should be retained across browsers and machines.

NOTE: The remaining sections in this chapter apply to networks, campuses, buildings, and floor plans that have already been set up in VisualRF. If you do not yet have any of this information in VisualRF for your network, refer to Chapter 3, "Planning and Provisioning" on page 33.

Increasing Location Accuracy

The Location Service will use all RF information available to increase location accuracy of clients, tags, and rogue devices. Understanding your infrastructure's inherit capabilities helps you learn the extra effort required to ensure location accuracy.

There are three key elements read from controllers or access points that increase location accuracy: signal strength of a client as heard by the AP of association, signal strength of a client as heard by APs other than the AP of association, and signal strength at which an AP hears other APs.

These factors are detailed further in Table 9:

Table 9 *Elements Read From Controllers to Increase Location Accuracy*

MFG/Model	Client Signal Associated AP	AP-to-AP Signals (Dynamic Attenuation)	Unassociated Client Signal	Rogue APSignal
Aruba	Yes	Yes	Yes	Yes
Cisco LWAPP	Yes	Yes	Yes	Yes
Cisco IOS	Yes	No	No	With WLSE
Cisco VxWorks	Yes	No	No	No
Trapeze	Yes	No	No	Yes
Meru	No	No	No	Yes
Proxim	Yes	Yes	Yes	Yes
Symbol Thick AP	Yes	No	No	Yes
Symbol Thin AP	Yes	No	Yes	Yes
Proxim AP-2000	Yes	No	Yes	Yes
Proxim AP-4000	Yes	Yes	Yes	Yes
ProCurve WeSM	Yes	Yes	No	Yes

Table 9 *Elements Read From Controllers to Increase Location Accuracy (Continued)*

MFG/Model	Client Signal Associated AP	AP-to-AP Signals (Dynamic Attenuation)	Unassociated Client Signal	Rogue APSignal
ProCurve 530	Yes	Yes	Yes	Yes
ProCurve 420	Yes	Yes	No	Yes

AMP provides four main methods to increase accuracy once your access points are deployed:

- Adding Exterior Walls - increases location accuracy by reducing the statistical probability of placements outside the office confines. See "Adding Exterior Walls" on page 19.
- Client Training for Stationary Devices - ensures non-mobile clients like desktops or scales will always remain in a defined static location. Statically assigning non-mobile devices reduces the CPU load on your server because VisualRF does not evaluate any signal metrics for this MAC address when associated with an AP on the floor plan. See "Location Training for Stationary Devices" on page 20.
- Remote Client Surveys - provides additional attenuation inputs for corners and low-coverage areas without the burden of actually carrying a laptop to the physical location. See "Adding Client Surveys" on page 20.
- Location Probability Regions - Probability regions will increase or decrease the chances of a device being located within the region. See "Adding Location Probability Regions" on page 21.

Adding Exterior Walls

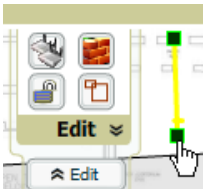
Because VisualRF utilizes much existing RF information, generally only external walls are required for accurate client locations. VisualRF's Dynamic Attenuation feature uses AP-to-AP information to calculate attenuation for interior areas, negating the need to enter interior walls. If your devices support AP-to-AP information in the table above, you should only draw exterior walls.

1. Select **Draw Walls** icon (Brick Wall) in the Floor Plan Edit Tools widget. A green border appears around the icon.
2. The cursor changes to a crosshair. Use this to draw the wall directly over the floor plan.

Figure 8 *Drawing a wall*

To move or resize the wall, select the **Wall** icon in the Edit menu again. The cursor changes to a hand, and the ends of the wall is highlighted. Click and drag the end point handles to change the wall.

Figure 9 *Moving and resizing an existing wall*



- To change the attenuation of a wall select wall and select the appropriate building material.
- To delete a wall select wall and select the **Delete Wall** option.

3. Once all walls are provisioned on the floor plan, select **Save** (floppy disk icon). A **Save Changes** dialogue box appears.
4. Select **OK** to commit the change. A **Changes Saved** dialog box appears.

5. Select **OK** to continue.

NOTE: Dell recommends only drawing outside walls. If you are seeing inaccurate client locations or heat maps after entering exterior walls, proceed to Client Surveys. If you still experience problems, then you can proceed to adding interior walls.

Location Training for Stationary Devices

QuickView provides the ability to statically assign a permanent *x*, *y* coordinate to stationary devices like PCs, Scales, and Point-of-Sale terminals. This will reduce the calculation requirements on the VisualRF location service and increase the accuracy of the RF characteristics of individual floor plans.

1. Drag the client device to the proper location.
2. Select the device and a popup menu appears. From that menu, select **Surveys and Training.**
3. Click the **Add** button for Static Training.

To remove a statically trained device, select client, and select the Surveys and Training option. Select **Delete** button for Static Training.

NOTE: The static locations are automatically saved, so the save button (floppy disk icon) will not appear.

Adding Client Surveys

Client surveys provide a method for increasing the accuracy of the attenuation grid by taking real signal samplings from client devices associated with the WLAN.

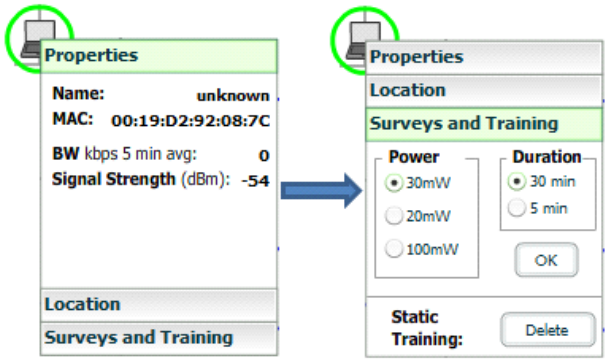
Key differentiators of AMP's client surveys are: (1) they take readings from the access points and not the client and (2) they take numerous samples. This produces a more accurate representation because signals obtained from the client's card (the signal level at which a client hears the AP) can vary from vendor to vendor.

The signal levels at which APs can hear a client are already normalized. Using multiple samples alleviates spikes or troughs that come from using a single sample.

To start a client survey, follow these steps:

1. Drag the client to the proper location.
2. Select the client to see the **Properties** pop-up menu, as shown in Figure 10.

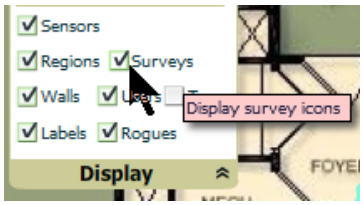
Figure 10 *Client Surveys*



3. Select the **Surveys and Training** option.
4. Select the appropriate transmit power for the wireless client. Default to **30mW** if you are unsure.
5. Select the **Duration** or the time that you want to sample the client's signal measurements. Longer durations will increase Path Loss accuracy and location accuracy.
6. Select **OK** to begin the survey.

To display survey locations, double-click the **Display** menu widget and select **Survey**, as shown in Figure 11:

Figure 11 *Survey toggle*



Note the following information about this procedure:

- Ensure the client will remain in the same location for at least the duration of the survey.
- You should delete and resurvey an area or a floor plan after a remodel or significant interior movement.
- Surveys should be conducted during normal business hours to reflect normal RF activity on the floor.
- 11a clients automatically inherit the proper transmit power from the 11g configuration. Example: 30mW Pre-2006 laptops equate to 20mW for 11a clients.
- AMP dynamically assigns a transmit power to every client based on OUI as shown in Table 10. This step increases the accuracy for surveys by allowing an override.

Table 10 *Auto-assigned Client Type and Transmit Power*

Client Type	Transmit Power 11g
Pre-2006 Laptops	30 mW
Post -2006 Laptops	100 mW
SOHO WLAN Cards (D-Link, Net Gear, LINKSYS)	30 mW
RFID Tags	10 mW
PDA	20 mW
iPhone	20 mW
Desktop	100 mW
Cisco Cards	100 mW

Adding Location Probability Regions

Location probability regions are optional regions that can be used to increase the accuracy of device location in VisualRF.

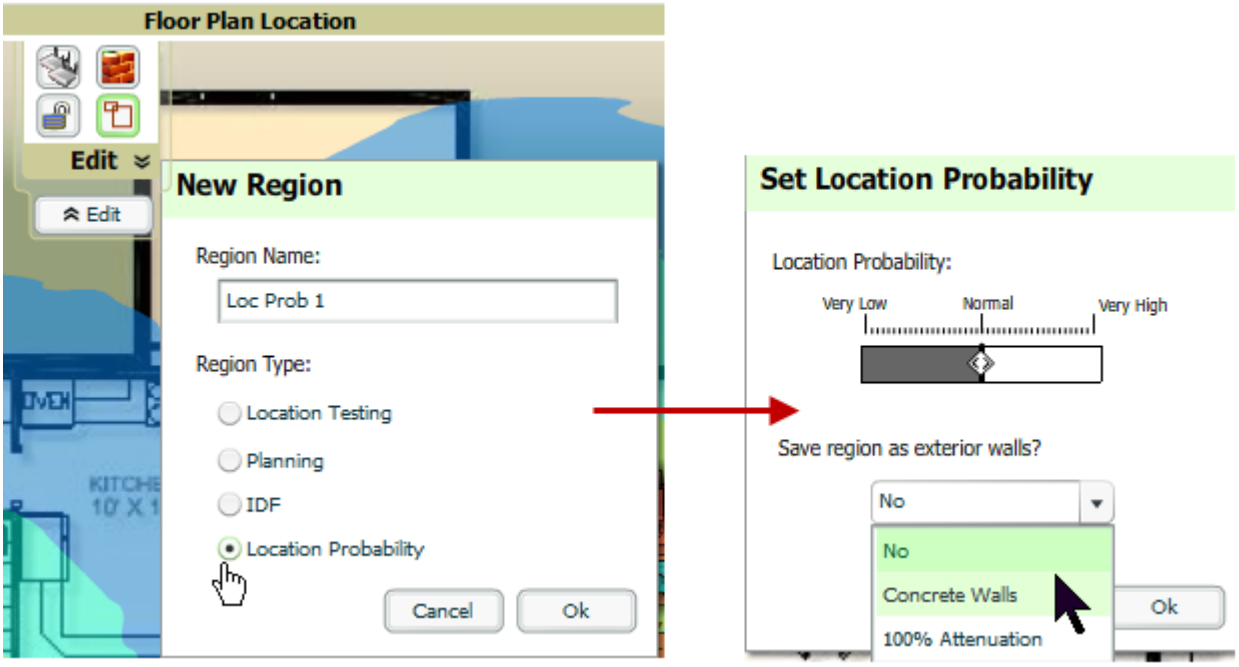
VisualRF calculates device locations based on probability. VisualRF determines the probability of a device being located in every grid cell and places the device where the probability is the highest.

Probability regions will add or remove up to 20% chance from the device location probability. They can be used to push users into regions where they are more likely to be located, like conference rooms and cubical farms, or they can be used to pull users out of regions where they are less likely to be like parking lots and courtyards.

To add a probability region to a floor plan, follow these steps:

1. Select the **Edit** menu and click the **Draw Regions** icon (red empty squares).
2. Outline the desired probability region. Double click to end the outline process.
3. Name the region, select a Region Type of **Location Probability** and select OK.
4. Move the location probability slider to the desired level. **Very Low** will decrease the probability of a device being placed in that region by 20%. **Very High** will increase the probability of a device being placed in that region by 20%.

Figure 12 *Adding a New Location Probability Region*



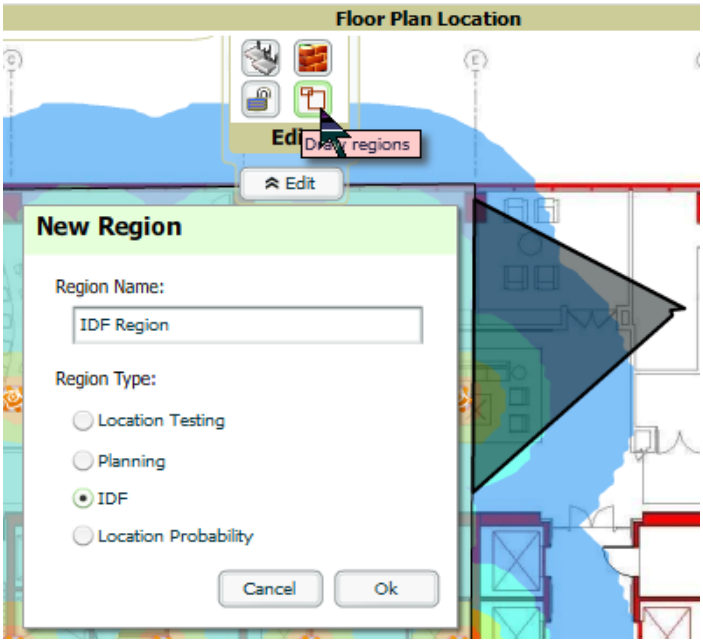
5. Optionally, you can save the location region as the exterior walls. 100% attenuation can be selected to force VisualRF to only place devices inside of the selected region. No device will ever be placed outside of the probability region when 100% attenuation is selected. 100% attenuation is only recommended for tall buildings where it is extremely unlikely that any user is located outside of the building. No heat map or attenuation grid is calculated for devices outside of the 100% attenuation region.

Adding an IDF

To add an IDF to VisualRF, follow these steps:

1. Expand the **Edit** widget and select the **Draw Regions** icon (red empty squares).
2. Outline the desired IDF region. Double-click to end the outline process.
3. Name the region, select a Region Type of **IDF**, and select **OK**.

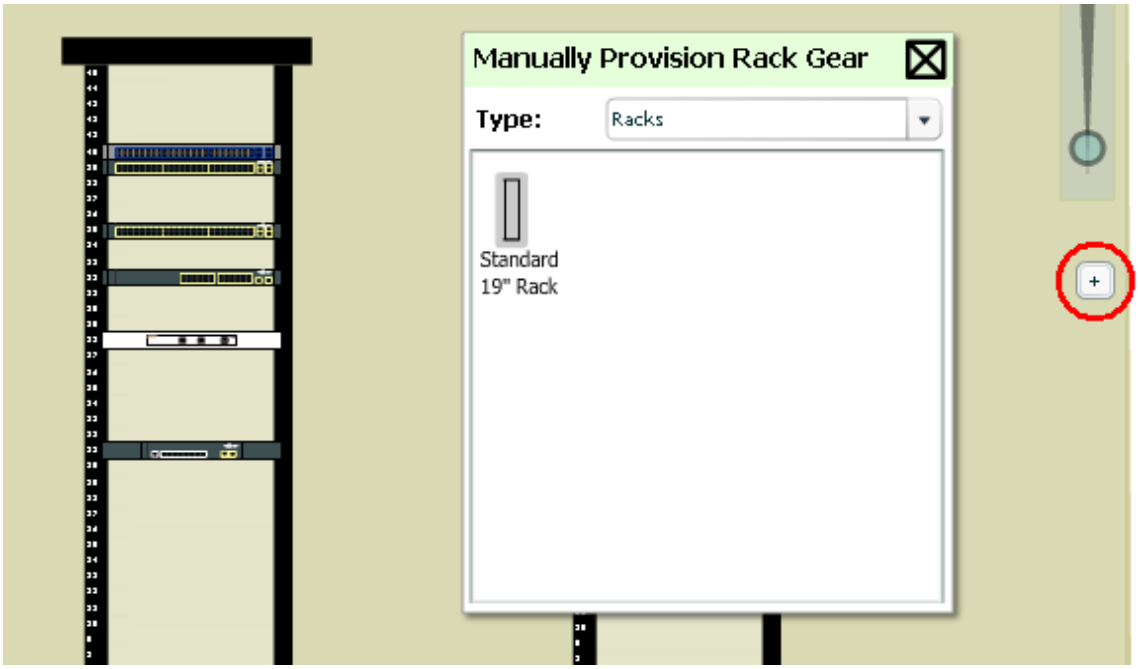
Figure 13 *Adding a new IDF Region*



Now that the IDF is defined you will see a green IDF icon on your floor plan. Double click that icon to navigate into the IDF.

1. Add a rack to the IDF by clicking on the plus icon to bring up the **Manually Provision Rack Gear menu**. Select type **Racks** and drag the **Standard 19" Rack** onto the IDF. Wired devices can now be added to the provisioned rack.
2. To add a planned device, select the appropriate type from the drop down and drag it into the rack at the appropriate location.
3. To add a wired device that is currently being monitored by AMP, right-click the rack and select **Add Monitored Switch**.
4. Locate the device to be added in the **Devices by Group List** menu.
5. Drag the device to the appropriate location in the rack.

Figure 14 *Provisioning Wired Devices*



Wired devices that are added to an IDF is included in any BOM report covering that floor.

Fine-Tuning Location Service in VisualRF > Setup

There are several options on the **VisualRF > Setup** page which increase client location accuracy. All of these items will increase the processing requirements for the location service and could negatively impact the overall performance of AMP.

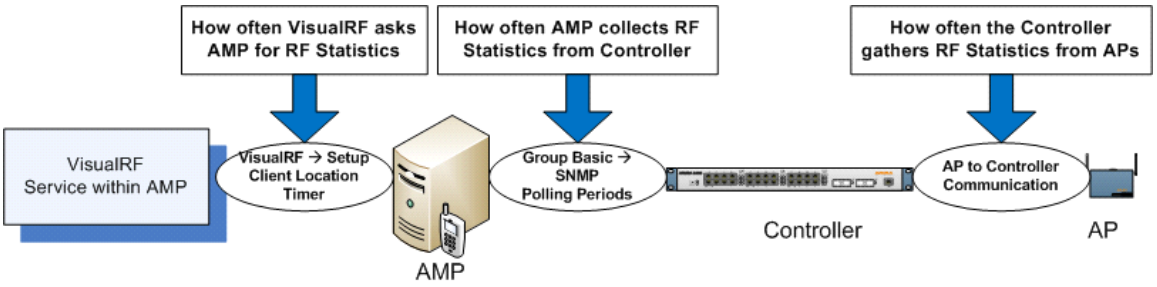
- **Grid Size** - decreasing the grid size will enable the location to place clients in a small grid which will increase accuracy. You can right-click on a floor plan within a building view and change this setting.
- **Dynamic Attenuation** - enabling dynamic attenuation (which is on by default) instructs the location service to sample the current RF environment and to dynamically adjust Path Loss.

Configuring Infrastructure

Ensure that the hardware is configured to retrieve the RF information and that it provides this information on a timely basis. There are three unique timing mechanisms which impact location accuracy: how often the

infrastructure collects and correlates RF statistics in their MIB, how often the AMP queries those MIB entries, and how often VisualRF service queries AMP for this RF information.

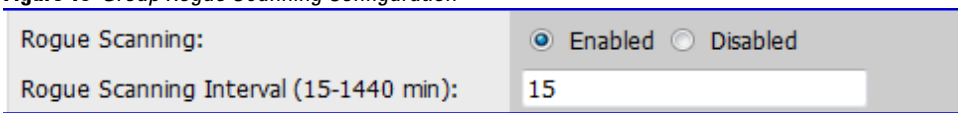
Figure 15 *Timing Factors Impacting Location Accuracy*



Dell recommends these best practices when configuring hardware infrastructure:

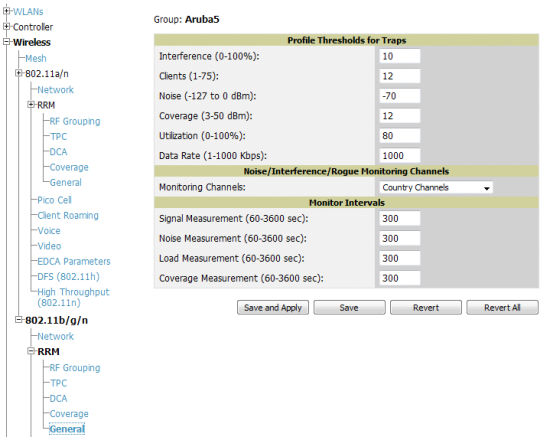
- For legacy autonomous APs, ensure on the **Group > Radio** page that **Rogue Scanning** is enabled and the interval is accurate.

Figure 16 *Group Rogue Scanning Configuration*



- For thin APs, ensure that the controllers are configured to gather RF information from the thin APs frequently.
- For Cisco LWAPP, navigate to **Groups > Cisco WLC Config** page in AMP. Navigate the tree control to the **Wireless** section, and for each PHY navigate to **RRM > General** section.

Figure 17 *WLC RRM Configuration in AMP*



- Review the values in the **Monitor Intervals** section. These should be configured to a recommended setting of 180 for better accuracy.

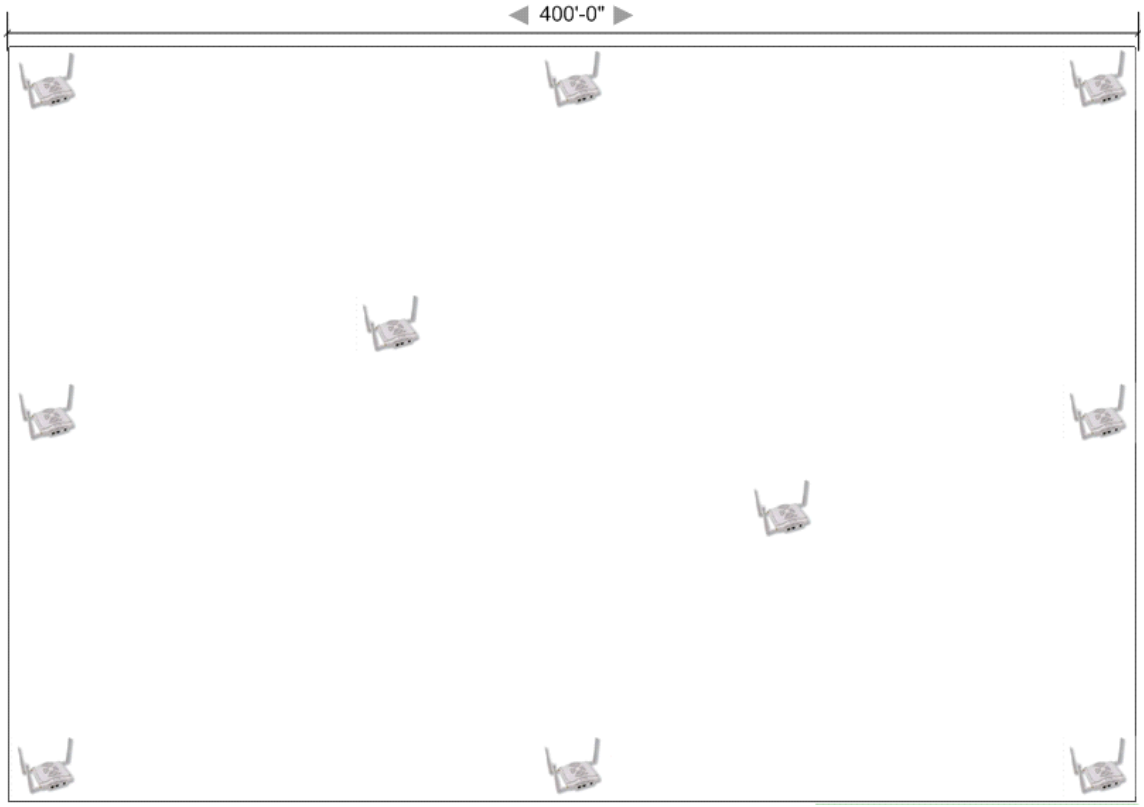
Deploying APs for Client Location Accuracy

Deploying access points for client location accuracy can be different than deploying access points for capacity. Follow these guidelines for best results:

- Ensure that at least 3 radios can hear each client devices at -85 dBm or below
- Ensure that you deploy an access point approximately every 3,500 square feet.
- For square or rectangular floor plans ensure access points are deployed on the exterior walls of each floor with access points in the middle as well.

Refer to Figure 18 for an example.

Figure 18 *Rectangular Floor Plan AP Deployment*



Using QuickView to Assess RF Environments

QuickView has four distinct views or entry points: client view, access point view, floor plan view, and network, campus, and building view.

This section contains the following corresponding topics:

Viewing a Wireless User's RF Environment

1. Navigate to the **Users** tab in AMP.
2. Click the link under the **Location** column for the user of interest, as shown in Figure 19. A QuickView window of that location opens and indicates the client with a Username label, as shown in Figure 20:

Figure 19 *Link to user's thumbnail (the Location column)*

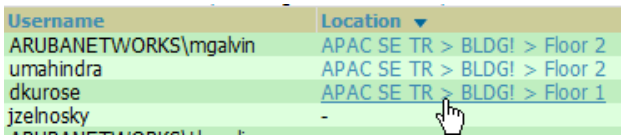
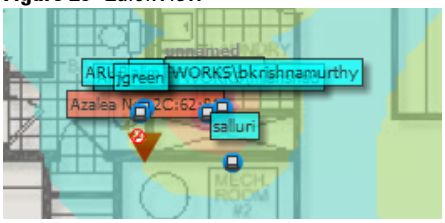


Figure 20 *QuickView*



You can also access this information from the **Users > User Detail** page by selecting the QuickView thumbnail, located next to the **Current Association** section of this page as shown in Figure 21:

Figure 21 *QuickView thumbnail in Users > User Detail*

This view is focused on the wireless user enabling you quick resolution of a user's issues and therefore disables most RF objects by default.

- Users - only the user in focus is displayed
- APs - only the access point in which the focus client is associated with is displayed
- Radios - the heatmap represents only the radio to which the client in focus is associated
- Rogues - all rogues are off

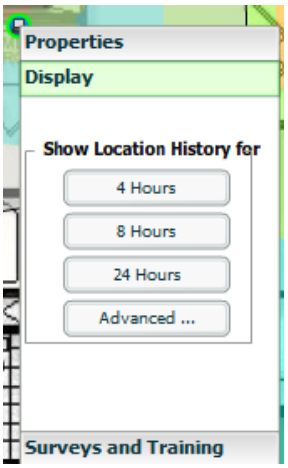
- Client/Rogue Surveys - all surveys are off
- Walls - all walls are displayed
- Lines - client to AP of association
- Labels - all labels are disabled

To further diagnose client issues, QuickView provides several toggles as follows:

Tracking Location History

Select the client icon in the Floor Plan and select Display from the pop-up menu shown in Figure 22:

Figure 22 *Show Location History*



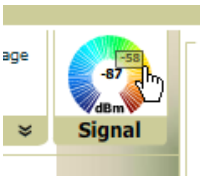
A location history player, illustrated in Figure 23, appears at the bottom of the QuickView window.

Figure 23 *Location History Player*

Checking Signal Strength to Client Location

1. On a Floor Plan, locate the **Signal** menu widget.
2. Click within the dBm selector color wheel to desired signal level to display. The heatmap updates immediately.

Figure 24 *dBm Selector Wheel*

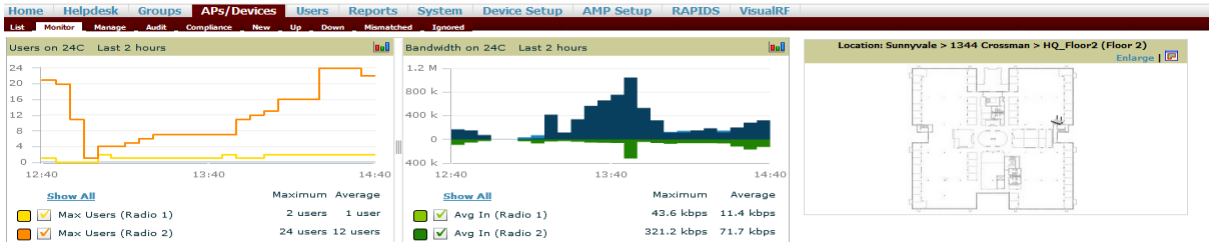


Viewing an AP's Wireless RF Environment

To view an access point's RF environment from **APs/Devices > Monitor** page:

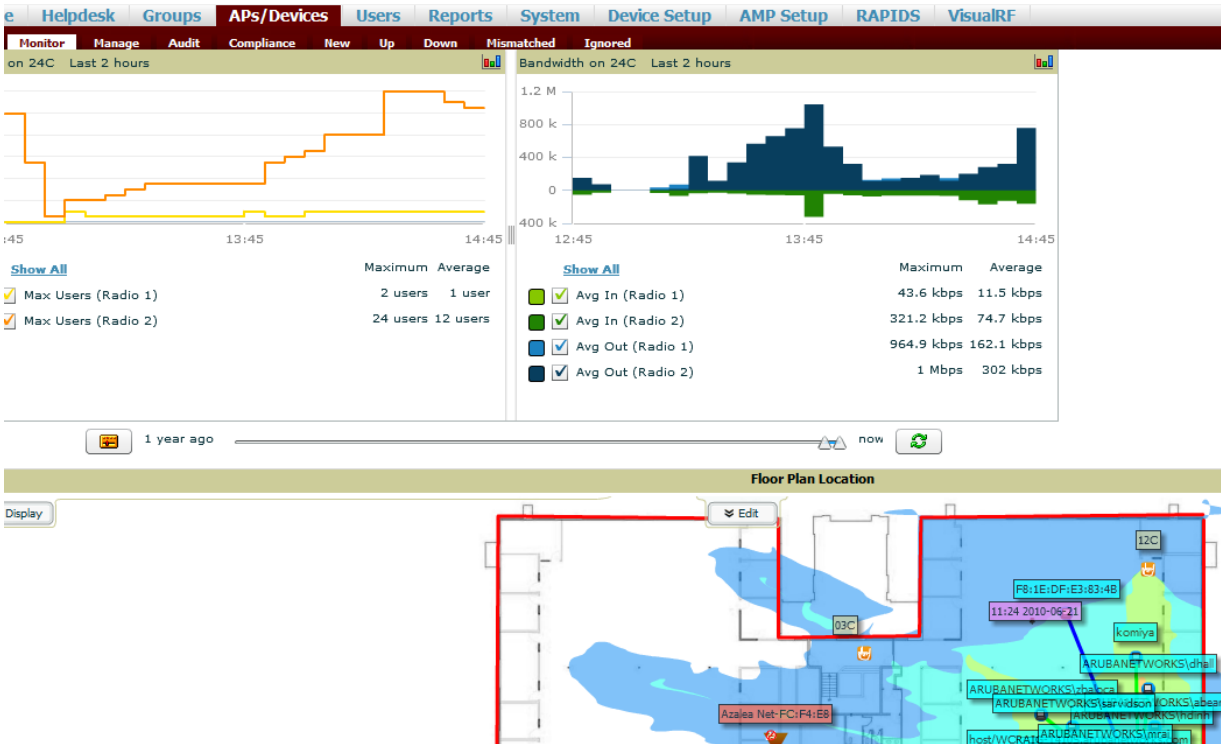
1. Select a device of interest from **APs/Devices > List**, or any other AMP page that lists your APs. The **APs/Devices > Monitor** page opens.
2. Click on the QuickView thumbnail showing the location of the AP, shown on the right side of Figure 25:

Figure 25 *QuickView Thumbnail in APs/Devices > Monitor page for an AP*



A fully interactive QuickView display opens below the thumbnail on the same page (not in a new window), as shown in Figure 26:

Figure 26 *QuickView in APs/Devices > Monitor page for an AP (partial view)*



This view is focused on enabling quick resolution of AP issues and therefore disables many RF objects by default as follows:

- Users - only users associated with radios within access point of focus are displayed
- APs - only the access point in focus is displayed
- Radios - the heatmap represents all radios within the access point of focus
- Rogues - all rogues are **off**
- Client/Rogue Surveys - all surveys are **off**
- Walls - all walls on displayed
- Lines - client to AP of association are displayed
- Labels - all labels are disabled

Viewing a Floor Plan's RF Environment

1. View a floor plan's RF environment from **VisualRF >Floor Plans** page. This page has a fixed sorting filter of Campus > Building > Floor number.

Figure 27 *Floor Plans List View*

Campus	Building	Floor	Site Name	Size	Location Calc Duration	Last Location Calc Time	Next Location Calc Time	# of APs	# of Radios	# of Clients	# of Rogues	File Size	Last Modified Date
Madrid	Brich Tower	0	Dan Augustine	150' x 115'	2.58	5/22/2007 4:25 PM	5/22/2007 4:26 PM	1	2	0	0	92 KB	4/13/2007 9:43 AM
San Mateo	Borel	2	A.G. Edwards	500' x 386'	23.03	5/22/2007 4:24 PM	5/22/2007 4:25 PM	0	0	0	0	86 KB	1/3/2007 7:54 AM
San Mateo	Borel	3	Borel Financial	4164' x 3218'	3.66	5/22/2007 4:25 PM	5/22/2007 4:26 PM	1	2	1	0	278 KB	5/18/2007 3:06 PM
San Mateo	Borel	4	Remax	500' x 386'	0.00	5/22/2007 4:25 PM	5/22/2007 4:26 PM	2	1	0	0	121 KB	1/2/2007 3:12 PM
San Mateo	Borel	5	AirWave	124' x 161'	40.36	5/22/2007 4:24 PM	5/22/2007 4:25 PM	4	8	4	0	483 KB	5/21/2007 8:52 AM
San Mateo	Borel	6	Penthouse Suite	400' x 309'	0.00	5/22/2007 4:24 PM	5/22/2007 4:23 PM	6	9	0	0	302 KB	5/18/2007 1:47 PM
San Mateo	Borel	20	400by300PNG	400' x 309'	0.00	5/22/2007 4:25 PM	5/22/2007 4:26 PM	3	3	0	0	139 KB	5/7/2007 10:02 AM

This page provides a snapshot of how VisualRF is performing, as described in Table 11:

Table 11 *Floor Plans list columns*

Field	Description
Campus	Campus associated to the floor.
Building	Building associated to the floor.
Floor	Floor number. The decimal place can be used for mezzanine levels.
Floor Name	Optional name of a floor. (If the name is not changed, it displays the name as Floor [Number] by default.)
Size	The height and width in feet of the floor plan, including white space.
Location Calc Duration	How long in seconds it took VisualRF to calculate path loss for the floor plan.
Last Location Calc Time	Last date and time that VisualRF calculated client locations for the floor.
Next Location Calc Time	Next date and time when VisualRF will calculate client locations for the floor.
# of APs	The number of access points on the floor.
# of Radios	The number of radios associated with access points on the floor
# of Users	The number of wireless users associated with access points on the floor. **NOTE:** Locating users consumes significant VisualRF resources. A floor with hundreds or thousands of clients can take a long time to process.
# of Rogues	The number of rogue devices heard by access points on the floor. This number reflects the filters configured on the VisualRF > Setup. This means that while APs on the floor might hear more rogue devices, they are being filtered because of weak signal, they haven't been heard recently, or they are ad-hoc.
File Size	The floor plan background or image reported, in kilobytes. The larger the file, the longer it will take to render in the canvas.
Original Floor Plan	A link to download the original image background file.

2. Select the floor plan of interest using the floor number or name link. A QuickView window opens, as shown in Figure 28:

Figure 28 *Floor Plan View After Clicking a Floor Number or Name Link*

This view is focused on providing insight into the RF environment of an entire floor as follows:

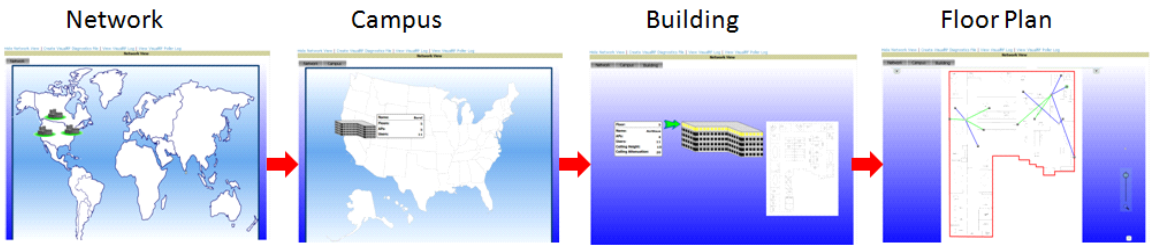
- Users - all users associated with all access points on this floor
- APs - all access points on this floor
- Radios - all radios for all access points on this floor are displayed
- Rogues - all rogues are **off**
- Heatmaps - all are **off** by default
- Client/Rogue Surveys - all surveys are **off**
- Walls - all walls are displayed
- Lines - client to AP of association
- Labels - all labels are disabled

Viewing a Network, Campus, Building View's RF Environment

To view floors from a geographical perspective:

1. Navigate to the **VisualRF > Floor Plans** page.
2. This will launch the visual QuickView navigation system as shown in Figure 29. Click on each network, campus, or building successively to drill down further until you reach the floor plan.

Figure 29 *Floor Plan View*



This navigation provides information in each view as follows:

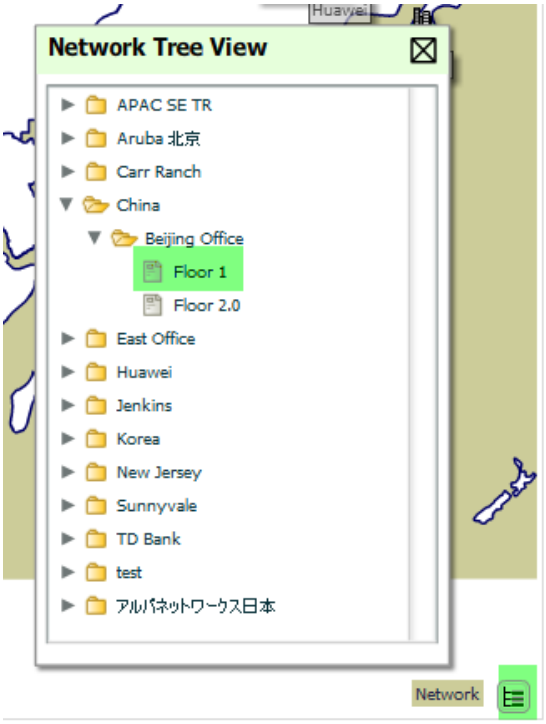
- Network View - contains all campuses within your WLAN
- Campus View - all buildings within a campus
- Building View - all floors within a building
- Floor Plan View - all devices access points, clients, and rogues within the floor

Viewing Campuses, Buildings, or Floors from a Tree View

As an alternative to using QuickView, you can use the Tree View to view floors from a hierarchical tree, as follows:

1. Navigate to the **VisualRF > Floor Plans** page.
2. Select the **Tree** icon ( )at the bottom right of any view. The Network Tree View window, shown in Figure 30, appears on the screen.

Figure 30 *Network Tree View - Floor and Tree icon highlighted*



3. Use the arrow icons to drill down into the folders to select the Campus, Building, or Floor. Select the folder or floor plan icon to open the view you have selected to see. The Network Tree View window will remain on the screen until you close it with the X box at the top right-hand corner.

Chapter 3

Planning and Provisioning

VisualRF provides the capability to plan campuses, buildings, floors, and access points prior to the actual access point deployment. The following procedure describes the workflow:

Creating Campuses and Buildings

Floors are associated with a building and buildings are associated with a campus. In order to create a new floor, you must first create a campus and building.

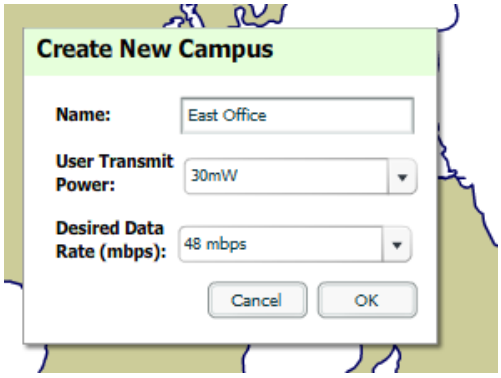
Campus Creation

To create and place your campus, follow these steps:

1. Navigate to **VisualRF > Floor Plans**.
2. Right-click the map on the page and select **New Campus.** The Create New Campus window, illustrated in Figure 31, appears.
3. Enter the following campus information:
   - **Name** of the campus
   - **User Transmit Power** - used in auto placement of access points onto floors within this campus. The range is 30mW to 100mW.
   - **Desired Data Rate** - used in auto placement of access points onto floors within this campus. The range is 6 to 200 mbps.

NOTE: Buildings and floors inherit transmit power and data rate from the campus.

Figure 31 *Create New Campus window*



4. Select **OK** to save. You will see a new Campus icon appear on the campus canvas. (AMP ships with a default campus and building.)
5. Add appropriate network geographical background or upload a personalized image by right-clicking on the background.
   - Set Map - allows you to browse with the included maps.
   - Custom - launches the image upload wizard documented in "Importing a Floor Plan" on page 36.
6. Drag the new Campus icon to the appropriate location on the map background.

NOTE: QuickView automatically saves background map images, campus locations, building locations, and building types

Building Creation

1. Select newly created Campus icon from the previous step. You will drill into to a blank canvas without a background.
2. Right-click the background and select **New Building...**
3. When the New Building window appears, enter the following information:
   - Building name
   - Select Campus from drop-down
   - Enter Longitude and Latitude
   - Distance between floors
   - Attenuation between floors
   - User (client device) Transmit Power
   - Desired data rate
   - Address (optional)

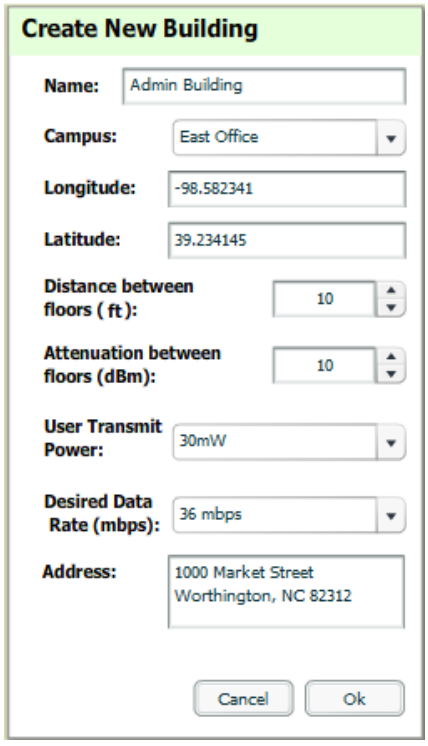
Table 12 *New Building Fields and Descriptions*

Field	Description
Name	Name of the building; located on an existing campus.
Campus	Lists all campuses configured on your AMP.
Longitude & Latitude	These fields are used to represent a building on Google Earth.
Distance between Floors	The normal distance between floors in the building. This value can be overridden as each floor is created, but this is the default value for every new floor added to the system. This data element can be imported or exported to external planning tools like Ekahau. It is not currently utilized by AWMS and VisualRF.

Table 12 *New Building Fields and Descriptions (Continued)*

Field	Description
Attenuation between Floors	Enter the attenuation loss in decibels between floors. This value can be overridden as each floor is created, but this is the default value for every new floor added to the system. This data element can be imported or exported to external planning tools like Ekahau. It is not currently utilized by AWMS and VisualRF.
User Transmit Power	This value is used when auto-provisioning access points onto a floor plan.
Desired Data Rate	Data rate will determine the new access points when auto-provisioning Greenfield deployment.
Address	Building or Campus address.

Figure 32 *Create New Building Window*



4. Select **OK** to save. You will see a new **Building** icon appear in the middle of the canvas.
5. Drag the Building icon to the appropriate location on the map background.

NOTE: QuickView automatically saves background map images, campus locations, building locations, and building types.

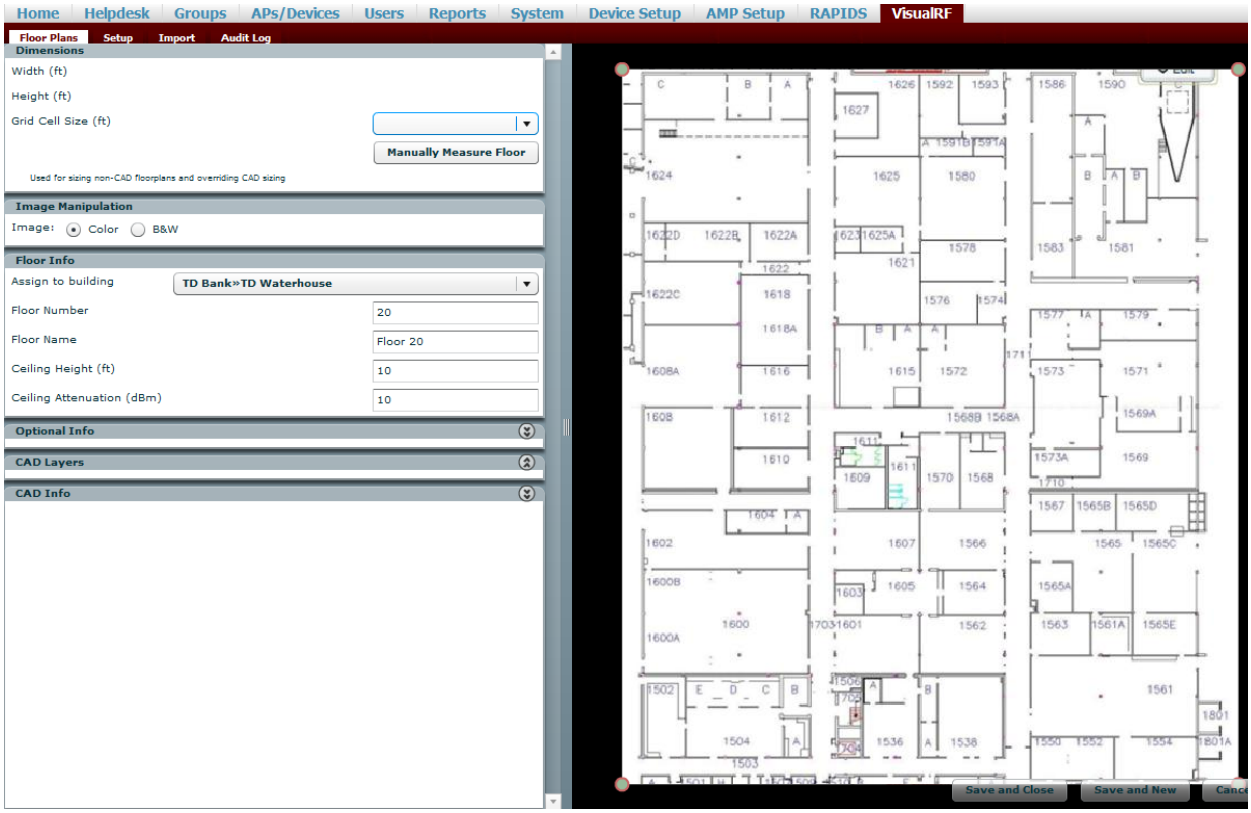
6. Add appropriate geographical background or upload a personalized image by right-clicking on the background.
   - Set Map - allows you to browser with the included maps.
   - Custom - launches the image upload wizard documented in "Importing a Floor Plan" on page 36.
7. To change building types, right-click the **Building** icon.
8. Select proper building type.
9. Select newly created **Building** icon from the previous step. You is redirected to a blank canvas without a background. You are now ready to import your floor plan.

Importing a Floor Plan

The following steps show how to import a floor plan background image file.

1. In **VisualRF > Floor Plans**, click **Add New Floor Plan**.
2. Select **Browse** to locate a floor plan image file.
3. Select the proper file and click **Open**.
4. In VisualRF, select **Upload**. This opens the image file along with VisualRF planning tools on the left hand side.

Figure 33 *Floor Plan Imported into VisualRF*



- If floor plan does not require cropping, sizing, or layer control, then click **Save and Close** to begin provisioning APs or **Save and New** to upload a new floor plan.
- If floor plan does require cropping, sizing, or layer control, then proceed to the next procedure.

Editing a Floor Plan Image

There are many ways to edit a floor plan that you have uploaded, as explained in the following topics:

- "Cropping the Floor Plan Image" on page 37
- "Sizing a Non-CAD Floor Plan" on page 37
- "Removing Color from a Floor Plan Image" on page 37
- "Assigning Campus, Building and Floor Numbers" on page 38
- "Assigning Optional Planner, Owner, or Installer Information for the Floor Plan" on page 38
- "Controlling the Layers in the Uploaded Floor Plan (CAD only)" on page 38
- "Error Checking of CAD Images" on page 38

Cropping the Floor Plan Image

Use the cropping handles (red circles) to remove extra white space around the floor plan. VisualRF will calculate an attenuation grid for the entire map including white space. Reducing the white space on a floor plan will increase location accuracy and decrease the load an on the server. A good rule of thumb would be about ½ inch white space, if possible, on all sides.

VisualRF dissects each floor plan into a grid consisting of cells specified in this setting. The Core Thread service calculates the path loss for every radio to every cell on the floor plan.

By default the importation wizard allocates 2,500 grid cells to each site based on dimensions. If you have a site that is 250 ft. by 100 ft, the Floor Plan importation wizard would calculate the grid cell size at 10 feet. 250 ft. x 100 ft. = 25,000 ft. 25,000 ft. / 2,500 ft. = 10 ft.

NOTE: Decreasing the grid cell size will increase accuracy, but it also increase CPU consumption by the floor caching threads and the location caching threads. Check the System ' Performance page to ensure your server is functioning properly when you make a change to this setting.

Other items worth noting:

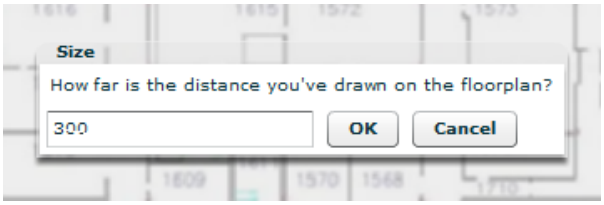
- If this is a CAD file, then the Floor Plan creation wizard will automatically inherit height and width from the drawing.
- If this is a non-CAD file, then the height and width is zero.
- CAD files are converted to a JPG with a resolution of 4096 horizontal pixels at 100% quality prior to cropping. If you crop, then you will lose clarity.
- CAD files may not exceed 10 MB.
- Metric CAD files are supported.
- Importing GIF files for floor plans will result in blank QuickView thumbnails.

Sizing a Non-CAD Floor Plan

You should not have to resize a CAD drawing unless you see nonsensical dimensions. To resize a non-CAD image if you already know the dimensions, follow these steps:

1. Select the **Manually Measure Floor** button in the **Dimensions** section. The pointer changes to a cross-hair icon.
2. Locate two points within the floor plan that you know the distance. Most door jams (door openings) are 3 feet.
3. Select and hold to establish the first point and drag your mouse to the second point and release.
4. A distance dialogue box appears. Enter the proper length in feet, as shown in Figure 34.

Figure 34 *Manually Measuring a Floor Plan*



5. Select **OK**.

Floor plans can be resized in VisualRF after they have been uploaded. Within VisualRF you will also be able to zoom in on a room or doorway to increase the accuracy of your sizing.

Removing Color from a Floor Plan Image

To remove color, locate the **Image Manipulation** section and select **B&W** in the **Image** field.

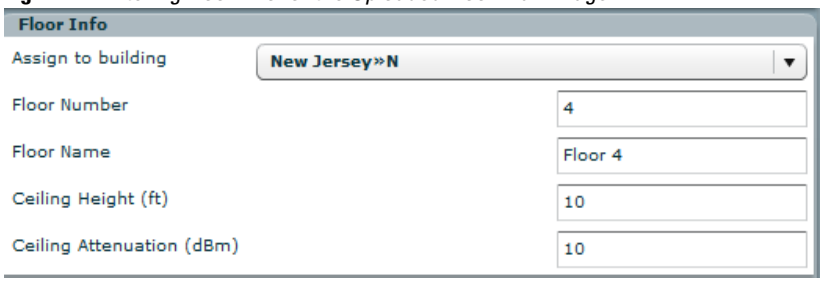
Assigning Campus, Building and Floor Numbers

Locate the **Floor Info** Section and assign the following information, as detailed in Table 13 and illustrated in Figure 35:

Table 13 *Assigning numbers*

Setting	Default	Description
Building drop-down	N/A	Use this drop-down to associate the floor with a building which associate it to a Campus as well.
Floor Number	0.0	The floor number. You can enter negative numbers for basements. **NOTE:** Each floor plan within a building must have a unique floor number.
Floor Name	Floor [Number]	A descriptive name for the floor. It inherits the floor number as a name if nothing is entered.
Ceiling Height	10	Specifies the height from the floor to the ceiling. This will default to the ceiling height for the building, but you can override here if needed for atria or basements.
Ceiling Attenuation	20	Specifies the attenuation characteristics in dB of the ceiling or the floor above.

Figure 35 *Entering Floor Info for the Uploaded Floor Plan Image*



Assigning Optional Planner, Owner, or Installer Information for the Floor Plan

Locate the **Optional Information** section and enter the following information in Table 14:

Table 14 *Optional Information for the Floor Plan*

Setting	Default	Description
Owner	N/A	The owner of the floor (used in diagnostics and alerts).
Planner	N/A	The person in charge of planning the RF layout for the floor.
Installer	N/A	The person in charge of installing RF equipment for the floor.

Controlling the Layers in the Uploaded Floor Plan (CAD only)

Follow these steps for CAD images:

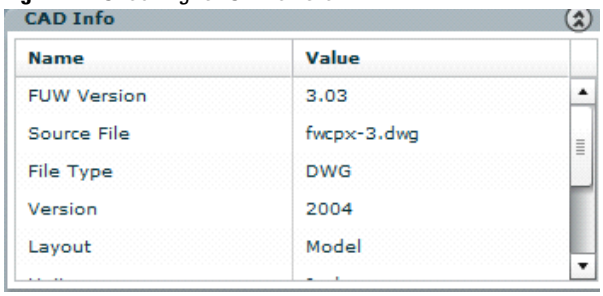
1. Find the CAD Layers section on the page.
2. Unselect the layers which are not required. There is slight delay because each request makes a round trip to the server.

Error Checking of CAD Images

VisualRF will check for errors in your uploaded CAD image. You can view any issues as follows:

1. Locate the **CAD Info** section, as shown in Figure 36.
2. Review the CAD version, units of measurement, and raw width and height numbers.

Figure 36 *Checking for CAD errors*



Last Steps in Editing an Uploaded Image

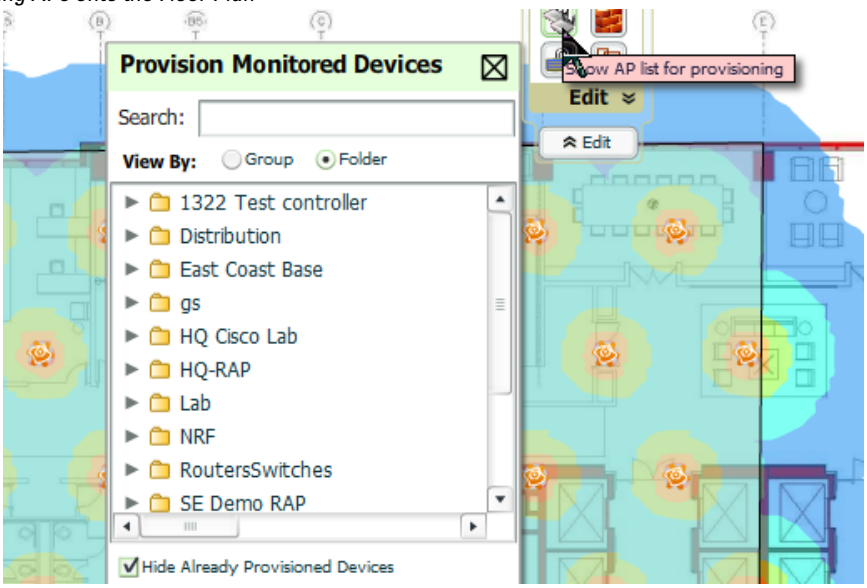
Click the **Save and Close** button to begin provisioning APs or **Save and New** to upload another floor plan. After clicking **Save and Close**, you is redirected back into QuickView where you can provision APs, IDFs, and wired infrastructure.

Provisioning Existing Access Points onto the Floor Plan

To provision existing AP in your network onto the floor plan you just uploaded, follow these steps:

1. Navigate to **VisualRF > Floor Plans**.
2. Select the floor plan you have uploaded using the floor number or name links in the list.
3. Select the **Show AP List For Provisioning** icon (stacked APs) in the **Edit** menu widget. A popup window list of devices in your AMP appears on the screen, as shown on Figure 37.

Figure 37 *Provisioning APs onto the Floor Plan*



4. Select whether to navigate by Group or by Folder in the **View By** field.

NOTE: Alternatively, you can use the **Search** field.

5. Expand the Group or Folder containing the access points which need to be provisioned on this floor plan.
6. Click and hold on an AP which has an AP icon next to it. The red circle with a line through it means the AP has already been provision onto this or another floor plan.
7. Drag the AP to its proper location on the floor.
8. Once all APs are provisioned on the floor plan, select **Save** (floppy disk icon) in the top right of the QuickView window.

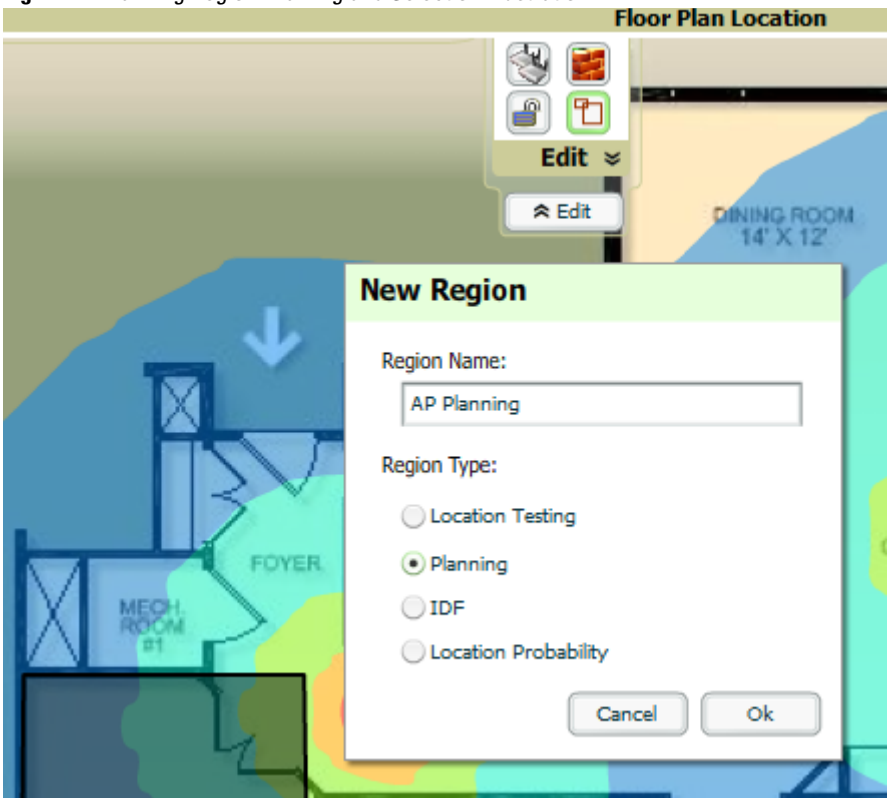
NOTE: The floor is submitted to one of the core threads to recalculate path loss and then to one of the location caching threads to recalculate client locations. All changes may not be visible on a refresh until this process complete.

Automatically Provisioning APs onto a Floor Plan

To automatically provision your access points onto your floor plan:

1. Select the **Draw Regions** icon from Edit Tools widget. A new provisioning popup appears as shown in Figure 38 with a crosshair pointer.
2. Draw your polygon as follows:
   - Left-click to initiate the process. The tool will automatically shade in your provisioning area.
   - Complete the polygon by double-clicking.
3. Once you have finished drawing the region, select a Region Type of **Planning**. Then select **OK.**

Figure 38 *Planning Region Drawing and Selection Illustration*

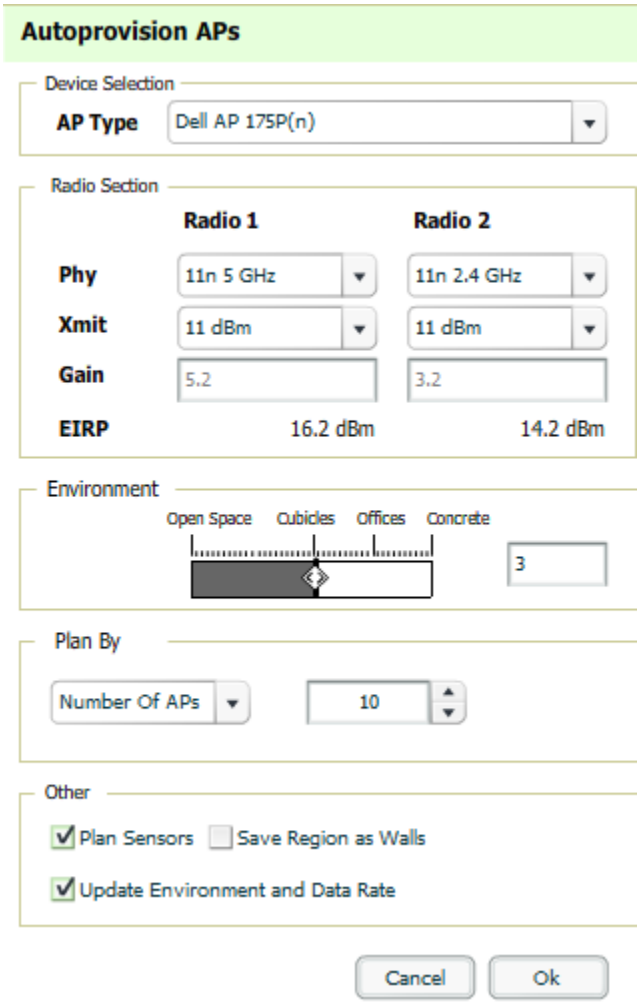


4. Enter the following information into the **Autoprovision APs** window as described in Table 15 and illustrated in Figure 39:

Table 15 *Fields in the Autoprovision APs Window*

Field	Description
Device Section	
AP Type	The type of AP used in this planning region.
Radio Section	
Phy	Whether they PHY is set to 11n or no radio.
Xmit	Transmit power of the APs.
Gain	Gain of the APs.
EIRP	EIRP of the APs.
Environment	A range from 1-4 that best describes whether the environment is related to an office space, cubicles, offices, or concrete.
Plan By Section	
Coverage	Coverage by Data Rate or Signal.
Number of APs	Number of APs to place in the planning region.
Other Section	
Plan Sensors	Whether to plan sensors into the region.
Save Region as Walls	Whether to save the edges of the planning region as walls.
Update Environment and Data Rate	Whether to update the environment and data rate in case of changes.

Figure 39 *Autoprovision APs Window Illustration*



5. When you're finished selecting the desired options, select **OK**.

Tweaking a Planning Region

If the planning layout does not meet your expectations, you can edit by right-clicking within the region to see the following options:

- **Delete Planned APs in the Region** - deletes only provisioned APs in the region
- **Delete the Region** - deletes the region and all planned APs.
- **Edit the region** - change the name of the region
- **Copy the Region to floors above** - will copy the region and auto plan for floors above**.**

NOTE: The starting floor will add one to the highest floor in the building and the ending floor defaults to 10 more than the starting floor.

To replicate a floor plan, follow these steps:

1. Navigate back to the Building view by clicking on the navigation tags in the bottom-right corner of the window.
2. Right-click the floor and select **Duplicate**.

3. Enter the following information:
   - Starting and ending floors
   - Select the toggles to copy walls, regions, data rates, and AP placement

NOTE: The starting floor will add one to the highest floor in the building and the ending floor defaults to 10 more than the starting floor.

4. Select **OK** to save your changes.
5. Manually refresh page and your is redirected to the **VisualRF > Floor Plan** page. The Building view will reflect the new floors.

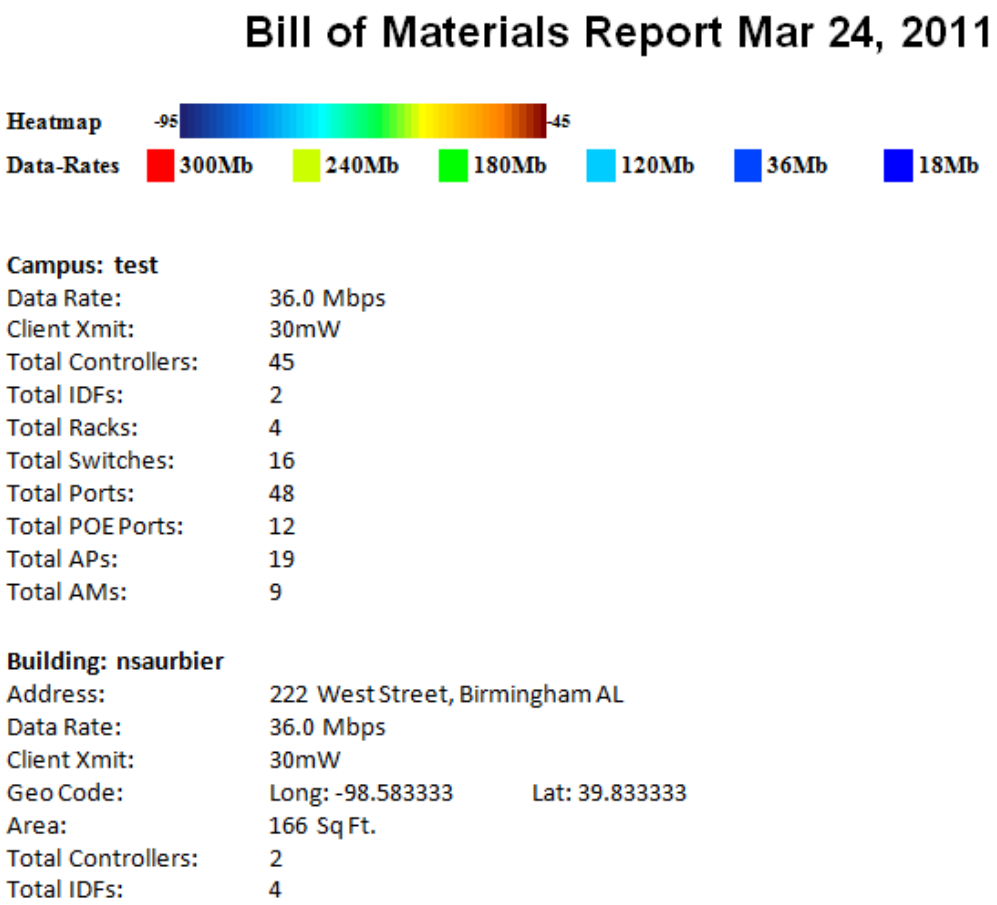
NOTE: You should see all replicate floors with matching number of access points.

Printing a Bill of Materials Report

You can generate a Bill of Materials Report from within VisualRF in Word format. Follow these steps:

1. Navigate back to the Network view.
2. Right select Campus icon and select **Show Bill of Materials**. A generating report popup appears.
3. Select options such as heatmap, data rate, sensor coverage, wired range, and summary.
4. Select **OK**. A BOM report appears in Microsoft Word as illustrated in Figure 40:

Figure 40 *Bill of Materials Report Illustration*



Exporting a Campus

To export a campus from VisualRF so you can import it into another AMP, follow these steps:

1. Navigate back to the **Network** view.
2. Right-click the **Campus** icon.
3. Select **Export**. An object selection window appears.
4. Select the objects to export and select **Export**. A File Download window appears.
5. Select **Save** and save the zipped file to your local hard drive for importation to another AMP.

At this point, you are ready to deploy a production AMP and manage devices by importing your exported campus and matching the access points to your plan. For more information, refer to the *Dell PowerConnect W AirWave 7.2 User Guide*, which can be downloaded from support.dell.com/manuals or from **Home > Documentation** in AMP.

Appendix A

VisualRF Performance

The first place to check for performance issues is the **VisualRF > Floor Plans** page. If any floor's location calculation duration exceeds the location caching timer value configured on **VisualRF > Setup**, then VisualRF is not able to calculate locations for clients per your desired interval.

Floor Specific Elements Impacting VisualRF Performance

- Number of clients - VisualRF calculates location for every client associated with access points on the floor per the value of location calculation timer. Hundreds or thousands of clients on a floor may cause location calculations for that floor to take minutes instead of seconds.
- Dimensions of floor plan - VisualRF calculates path loss for every radio to every cell on the floor plan. If the floor is 2,000 feet by 1,500 feet and grid cell size is 5 x 5 and there are 50 dual radio access points, then VisualRF will need to make 12,000,000 path loss calculations (400 cells * 300 cells * 100 radios).
- Number of APs/Radios on a floor plan - VisualRF calculates path loss for every radio to every cell on the floor plan.
- Floor plan image size - the bigger the file size the longer the floor will take to render.
- Number of Rogue devices on a floor plan - VisualRF calculates location for every rogue device heard by APs on the floor per the value of the rogue calculation timer.

Identifying Performance Problems

- Ensure all floors are calculating locations per specifications - navigate to the VisualRF' Floors page.
- Check Memory Utilization - navigate to the System' Performance page and locate System Memory Usage graph. Ensure there is free memory. Check trending after adding new floors or making change to the VisualRF ' Setup page.
- Check Swap Utilization - navigate to the System' Performance page and locate the System Swap Usage graph. Ensure the server is not swapping.
- Check System CPU Utilization - navigate to the System' Performance page and locate System CPU Utilization graph. Ensure the server has average idle time.
- Check System Load Average - navigate to the System' Performance page and locate the System Load Average graph. Ensure that load average is below 2 times the number of cores. For example if you have a dual-core server, the average load time should be at or below 8.

Resolving Performance Problems

Floor location calculation duration exceeding Client Location Timer

- Migrate to faster hardware
- Increase Core Caching Threads
- Increase Location Caching Threads
- Decrease the Location Caching Timer
- Increase Grid Cell Size

Memory or swap issues

- Add more memory
- Reduce polling intervals on AMP on the Group ' Basic page
- Reduce polling interval polling router and switches

Server load issues

- Migrate to faster hardware
- Decrease polling frequency of various polling buckets on **Groups > Basic** page
- Increase Min/Max timers and samples per devices on **VisualRF > Setup** page
- Increase Cell Grid Size
- Increase the AMP Synchronization timer on **VisualRF > Setup** page
- Tweak Rogue Location Filters

Other Areas to Check for Performance Issues

1. Review the VisualRF log file:
   - Check for validation errors
   - Check for timing errors
2. Review the ssl_error_log and error_log:
   - Check for out of memory errors
   - Check for Apache web server errors
3. Review **VisualRF > Floor Plans**. It provides a complete status of how long each floor plan is taking to generate and when it is generated next (you can tell if AMP is keeping up).
4. Review the **System >Performance page**; AMP could be out-of-memory, or AMP/Apache could be so bogged they can't service VRF.
5. Send customer support the VisualRF Diagnostic Tar file as follows:
   - Navigate to **VisualRF >Floor Plans**.
   - Click on the **Create VisualRF Diagnostic Tar File** link.
   - Save the tar file locally.
   - Email tar file to support.dell.com.

Consult the *Dell PowerConnect W AirWave 7.2 Sizing Guide* located in support.dell.com/manuals to properly size your production server to support VisualRF.

Appendix B

Importing from CAD

The Floor Plan Upload Wizard (FUW) should inherit all pertinent information from your CAD file if you follow this procedure:

1. Determine UNITS - all modern CAD versions (2001 and newer) support UNITS
2. Determine MEASURE - Legacy CAD versions (2000 and older) used a simplistic Imperial or Metric system.
   - If UNITS are 0 or undefined, then the standard dictates defaulting to MEASURE value
   - If MEASURE is 0 or undefined, then the standard dictates defaulting to English and inches
3. Find MODEL VIEW - If the drawing contains multiple views the FUW will default to the Model view
4. Determine Bounding Box - FUW will encompass all lines and symbols on the drawing and create a bounding box which is generally smaller than entire drawing. It is based on the UNITS or MEASUREMENT above.
5. Convert to JPG - FUW will convert the bounding box area to a JPG file with a resolution of 4096 horizontal pixels at 100% quality.
6. Start Web UI of FUW Step #1 - This is the cropping step.

This and all subsequent steps use the converted JPG file. The greater the floor plan dimensions, the less clarity the background image provides.

Table 16 *DXF Strings and Meanings*

DXF String	Meaning	Time Frame
AC1009	Release 9	1987
AC1010	Release 10	1988
AC1012	Release 11 & 12	1992
AC1013	Release 13	1994
AC1014	Release 14	1997
AC1015	Release 15	2000
AC1018	Release 18	2004
AC1021	Release 21	2007
AC 1021	Release 22	2008
AC 1023	Release 23	2009
AC1024	Release 24	2010

Table 17 *MEASURE Meanings and Values*

MEASURE Meaning	MEASURE Value
English	0
Metric	1

Table 18 *Units Meanings and Values*

Units Meaning	Units Value
Undefined	0
Inches	1
Feet	2
Miles	3
Millimeters	4
Centimeters	5
Meters	6
Kilometers	7
Microinches	8
Mils	9
Yards	10
Angstroms	11
Nanometers	12
Microns	13
Decimeters	14
Dekameters	15
Hectometers	16
Gigameters	17
Astronomical	18
LightYears	19
Parsecs	20

Batch Importing CAD Files

This process provides the ability to automatically upload many CAD files and auto provision existing walls and access points.

Requirements

- Operating System: Client machine must be Windows XP, Windows Vista, or Windows 7
- Flash: Version 9 or later

Pre Processing Steps

1. Increase Memory Allocation on **VisualRF> Setup**
   - 25 floors or less 512 MB
   - 25 to 75 floors 1 GB
   - More than 75 floors 1.5 GB
2. Massage the output data.

3. Increase the **Location Caching Timer** to 1 hour so that VisualRF does not overload the server calculating client locations while calculating path loss and process floor plan images.

Upload Processing Steps

1. Create CAD XML files which contain drawing filename, dimensions and optional information like device manufacture and model, device coordinates, wall coordinates and building material. This step is usually performed by your facilities or CAD department. The output of AutoCAD will not be properly formed XML, so you may need to massage the output data.
2. Copy all CAD drawings and corresponding XML files into a single directory on Windows machine. All files must be in a single directory.
3. Compress all files into a single *.zip file.
4. Open your browser and navigate to your AMP: https://<AMP_NAME>/visualrf/site_batch.
5. Select **Browse** to launch the File Explorer Window.
6. Select the zip file containing the upload instructions and click the **Open** button. The File Explorer Window will disappear you will return to the Batch Floor Upload Wizard.
7. Select **Next**.
8. The application validates the following information
   - Well-formed XML
   - All drawing files are accessible
   - All APs are present
   - All Building and Campuses are present
9. If there are any errors, none of the floor plans are created.

Post Processing Steps

1. Decrease the Location Caching Timer to previous value.
2. Review the **VisualRF > Floor Plans** page to ensure server is keeping up.

Sample Upload Instruction XML File

```
<?xml version='1.0' encoding='ISO-8859-1'?>
<visualrf:site_batch xmlns:visualrf='http://www.airwave.com'
    xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'
    version='1' origin='lower-left'>
 <floor name='T-0607' number='21' building-id='218'>
    <image filename='T-0607_WLS_02.dwg'/>
    <access-points>
      <access-point id=29648 x=177.51 y=293.15/>
      <access-point id=29678 x=312.78 y=293.63/>
      <access-point id=29746 x=450.95 y=292.60/>
      <access-point id=29741 x=384.51 y=358.78/>
      <access-point id=29682 x=417.12 y=431.99/>
      <access-point id=29751 x=243.33 y=358.51/>
      <access-point id=29620 x=385.79 y=223.88/>
      <access-point id=29734 x=244.34 y=224.19/>
      <access-point id=29644 x=192.79 y=414.77/>
      <access-point id=29748 x=259.15 y=432.62/>
      <access-point id=29692 x=309.50 y=415.45/>
    </access-points>
    <walls>
      <wall type=4 x1=135.94 y1=159.43 x2=135.94 y2=453.16/>
      <wall type=4 x1=135.04 y1=453.16 x2=439.83 y2=453.16/>
```

```
      <wall type=4 x1=439.83 y1=453.16 x2=439.83 y2=418.16/>
      <wall type=4 x1=439.83 y1=418.16 x2=465.71 y2=418.16/>
      <wall type=4 x1=465.71 y1=418.16 x2=486.61 y2=405.60/>
      <wall type=4 x1=486.61 y1=405.60 x2=486.61 y2=140.16/>
      <wall type=4 x1=486.61 y1=140.16 x2=348.94 y2=140.16/>
      <wall type=4 x1=348.94 y1=140.16 x2=486.61 y2=168.22/>
      <wall type=4 x1=486.61 y1=168.22 x2=201.69 y2=168.22/>
      <wall type=4 x1=201.69 y1=168.22 x2=201.69 y2=158.89/>
      <wall type=4 x1=201.69 y1=158.89 x2=135.94 y2=158.89/>
      <wall type=2 x1=136.69 y1=404.85 x2=449.13 y2=404.86/>
      <wall type=2 x1=449.13 y1=404.86 x2=459.50 y2=394.45/>
      <wall type=2 x1=459.50 y1=394.45 x2=459.48 y2=390.96/>
      <wall type=2 x1=459.48 y1=390.96 x2=466.75 y2=390.87/>
      <wall type=2 x1=466.75 y1=390.87 x2=471.75 y2=385.87/>
      <wall type=2 x1=471.75 y1=385.87 x2=471.75 y2=378.52/>
      <wall type=2 x1=471.75 y1=378.52 x2=485.85 y2=378.52/>
    </walls>
 </floor>
 <floor name='T-0068' number='22' building-id='218'>
    <image filename='T-0068_WLS_01.dwg'/>
 </floor>
 <floor name='Test JPG' number='23' building-id='218' width='523.34' height='231.34'>
    <image filename='F1wst IT_dwg.jpg'/>
 </floor>
</visualrf:site_batch>
```

Most Common Importation Problems

- Improper or undefined UNITS or MEASURE
- Text embedded into the Model view which causes an inconsistent bounding box
- Large dimensions which cause grainy resolution upon zoom
- Legacy CAD versions prior to Release 15 or AutoCAD 2000.

Appendix C

Importing from a Dell PowerConnect W Controller

The instructions below will enable you to seamlessly migrate all building, campus, and floor plan information previously entered into a Dell PowerConnect W controller.

Pre-Conversion Checklist

Prior to importing floor plans ensure you VisualRF's memory allocation is sufficient for the anticipated number of floors plans.

To change the memory allocation, navigate to the **VisualRF > Setup** page and configure the memory allocation accordingly. Memory allocation should equal .5 GB for 1-75 floor plans, 1 GB for 76-250 floor plans, 1.5 GB for 251-500 floor plans, and 2 GB for 501-1,000 floor plans.

NOTE: Importing a large number of floor plans can impact performance of the AWMS server. VisualRF must create a thumbnail, provision APs, create attenuation grid, and locate all clients on each imported floor plan. This can cause the **VisualRF > Floor Plans** page to be unresponsive.

Process on Controller

1. On the controller's UI navigate to the **Plan > Building List** page.
2. Select the buildings to be exported and select **Export**.
3. When the dialog box appears, make sure that you have included all images and select **Save to a file**.

Process on AWMS

1. Navigate to **VisualRF > Import**.
2. Select the **Import floor plans from a Dell PowerConnect W Controller** link.
3. Select the **Begin Importing Floor Plans** link.
4. When prompted for input file, use the file saved from the controller process.

Appendix D

VisualRF Location API

VisualRF provides the following location APIs:

Site Inventory: **`https://[amp_host]/visualrf/site.xml?site_id=...`**

- You can find the site_id from the Floor Plan List query defined on the XML API page
- This interface provides floor details including access points, walls, regions, surveys, etc.
- The corresponding example XML and schema are attached in visualrf_site_inventory.*

Device Location: **`https://[amp_host]/visualrf/location.xml?mac=...`**

- Provide the radio MAC of the client to locate.
- The corresponding site where the user was placed is provided along with the dimensions
- If a client is heard on multiple floors, it will only be placed on the floor that contains the AP it is associated with.

Sample Device Location Response

```
<visualrf:device_location version="1" xmlns:visualrf="www.airwave.com">
 <device mac="00:13:02:C2:39:28" name="Peter"
    site_id="4f674301-4b47-4ac6-8417-4eba3f7df3a6"
    site_name="NewYork">
    <site-width>124.51</site-width>
    <site-height>161.14</site-height>
    <x>82.50</x>
    <y>37.50</y>
 </device>
</visualrf:device_location>
```

Sample Site Inventory Response

```
<amp:amp_site_inventory version="1"
    xmlns:amp=http://www.airwave.com
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
 <site id="b45e7a49-23b5-4db0-891a-2e60bff90d2c" version="677">
    <name>Remax</name>
    <uom>ft</uom>
    <width>314.45</width>
    <height>425.88</height>
    <property name="site_owner" value="" format="" />
    <property name="name" value="Remax" format="" />
    <property name="installer" value="" format="" />
    <property name="planner" value="" format="" />
    <image type="background">
      <filename>/var/airwave/snapshot/b45e7a49-23b5-4db0-891a
          -2e60bff90d2c.677/background.jpg</filename>
      <relative-url>/snapshot/b45e7a49-23b5-4db0-891a
          -2e60bff90d2c.677/background.jpg</relative-url>
      <pixel-width>1151</pixel-width>
      <pixel-height>1557</pixel-height>
```

```
    </image>
    <image type="thumbnail">
      <filename>/var/airwave/snapshot/b45e7a49-23b5-4db0-891a
        -2e60bff90d2c.677/thumb.jpg</filename>
      <relative-url>/snapshot/b45e7a49-23b5-4db0-891a
          -2e60bff90d2c.677/thumb.jpg</relative-url>
      <pixel-width>230</pixel-width>
      <pixel-height>311</pixel-height>
    </image>
    <ap id="12615" name="AP-4000M-1">
      <x>118.97</x>
      <y>130.38</y>
      <total-bandwidth>0</total-bandwidth>
      <total-clients>0</total-clients>
      <status>down</status>
      <uptime>0.0</uptime>
      <radio index="1" phy="g" mac="00:20:A6:5A:63:66" beamwidth="0.0"
          gain="1.5" antenna="" orientation="0.0" mount="Ceiling"
          valid="false">
        <discovering-radio id="11276" index="1" dBm="-85" />
        <discovering-radio id="11828" index="1" dBm="-93" />
      </radio>
    </ap>
  </site>
</amp:amp_site_inventory>
```