
WLAN Design

Prepared for: VA Ann Arbor Healthcare System (VAAHS)

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Location: Building 1 (Main Campus) - 10th Floor



Table of Contents

- 1 Executive Summary
 - 1.1 Survey Overview
 - 1.1.1 Floor Plan Overview
- 2 Current AP Placement and Configuration
 - 2.1 AP Placement Overview
 - 2.2 AP Detail Breakdown
- 3 Current Deployment Site Survey
 - 3.1 Access Point Coverage Regions
 - 3.2 Overall Signal Coverage
- 4 AirWISE Validation Against Requirements
 - 4.1 AirWISE Requirement
 - 4.2 AP List
 - 4.3 Signal Coverage
 - 4.3.1 Redundant AP Coverage
 - 4.4 Channel Interference
 - 4.5 Channel Width
 - 4.5.1 Overall
- 5 Planner Report
 - 5.1 Planner AP List
 - 5.2 Planner AP Location Map
 - 5.3 Planner Signal Coverage
 - 5.4 Channel Interference
- 6 Conclusions

1 Executive Summary

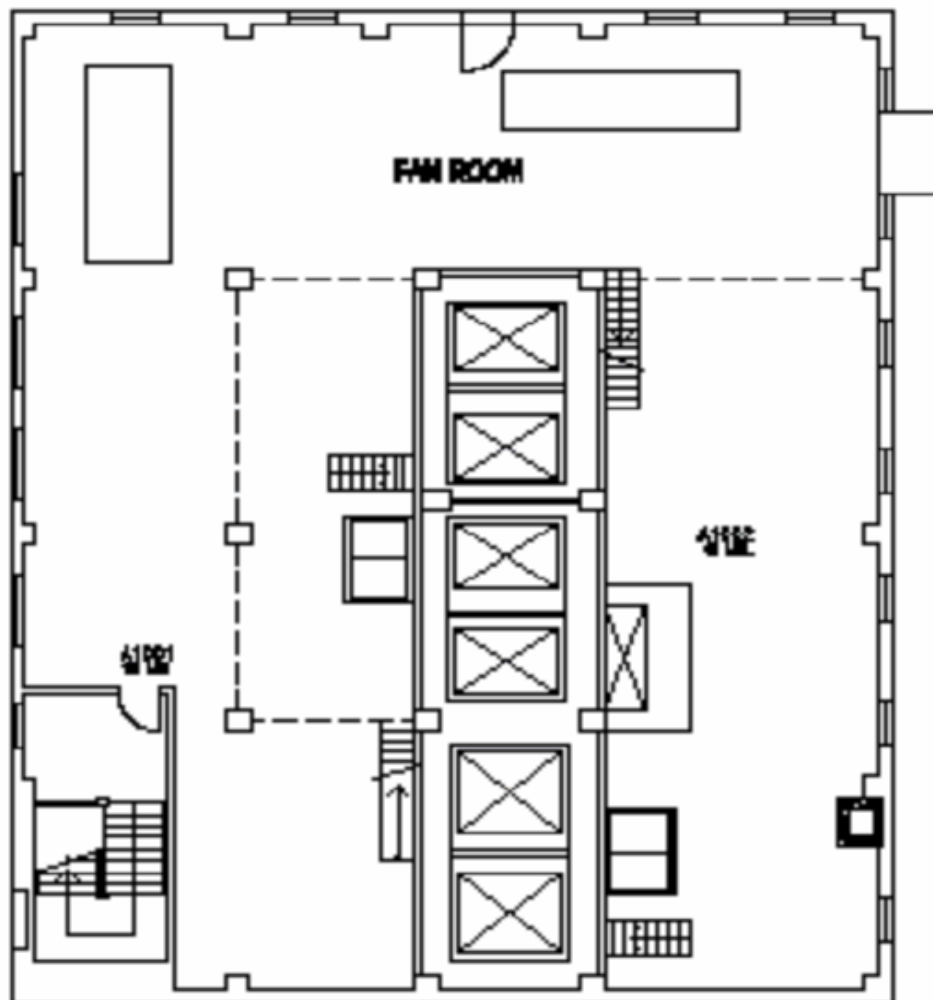
This wireless site survey and RF analysis were performed in order to gain an in-depth understanding of present RF interference sources and to meet overall wireless coverage requirements. The primary goal and subsequent objectives were designed with coverage, desired throughput and usability as primary driving requirements from the business group. This survey was created using an industry standard set of AirMagnet Survey PRO wireless tools and software, which are used for building and securing wireless networks. This survey encompasses site surveying, RF spectrum analysis surveying and real time active site surveying techniques. This document includes site survey specific information, Access Point configuration and installation data sheets, and RF coverage pattern maps. A wireless survey was performed at the customer site. The purpose of the survey is to determine the number and placement of wireless access points necessary to provide ubiquitous coverage for the entire building.

1.1 Survey Overview

1.1.1 Floor Plan Overview

The image below details the area that was surveyed. It includes the floor plan and the dimensions of the building. It can be useful to refer back to this view from some of the other graphs to help orient yourself.

Dimensions	
X	210.76 ft
Y	130.00 ft

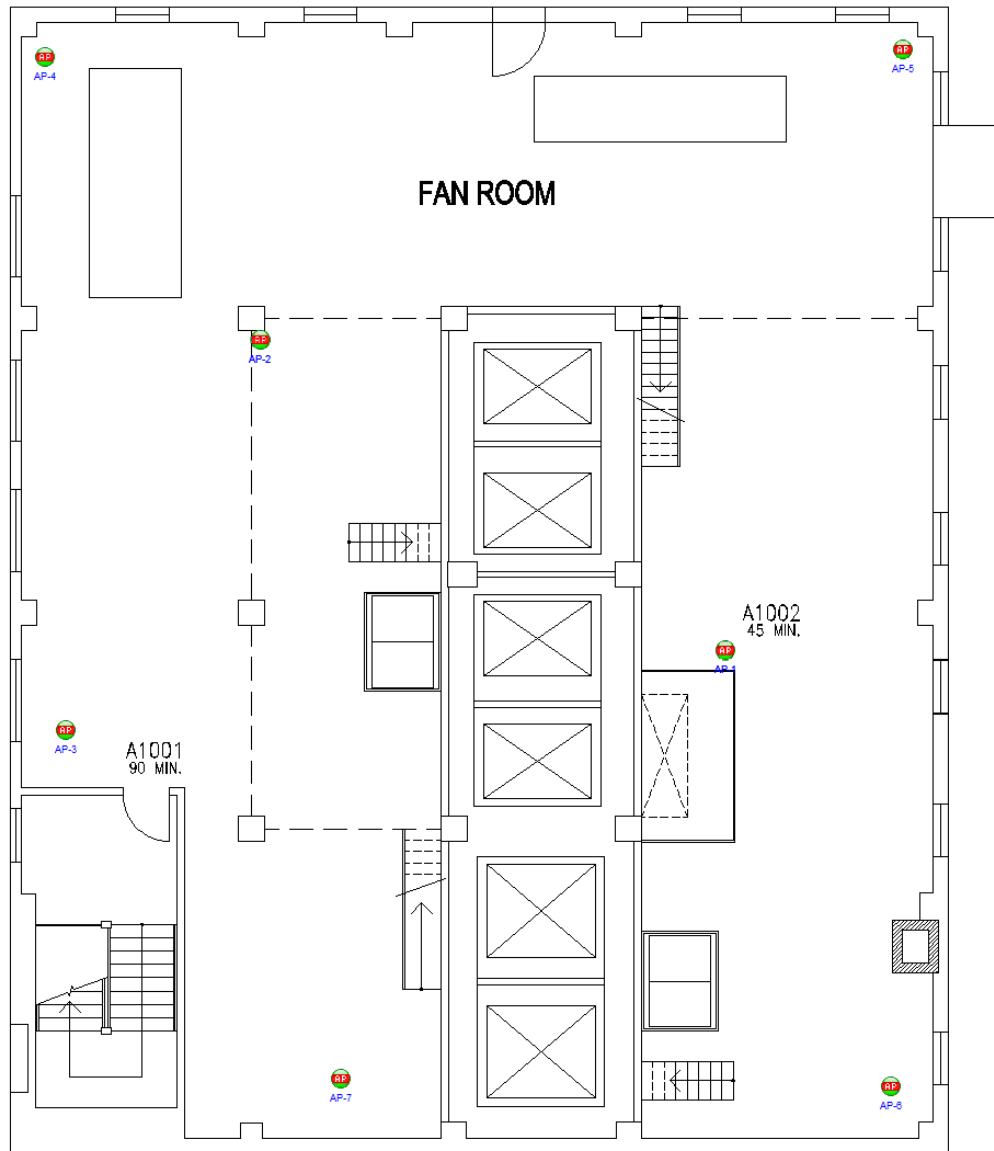


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2 Current AP Placement and Configuration

The floor plan below shows the locations of the currently installed APs or desired if this is a new deployment. The specific details for each AP are described in the section labeled "AP Detail Breakdown".

2.1 AP Placement Overview



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2.2 AP Detail Breakdown

Access Points

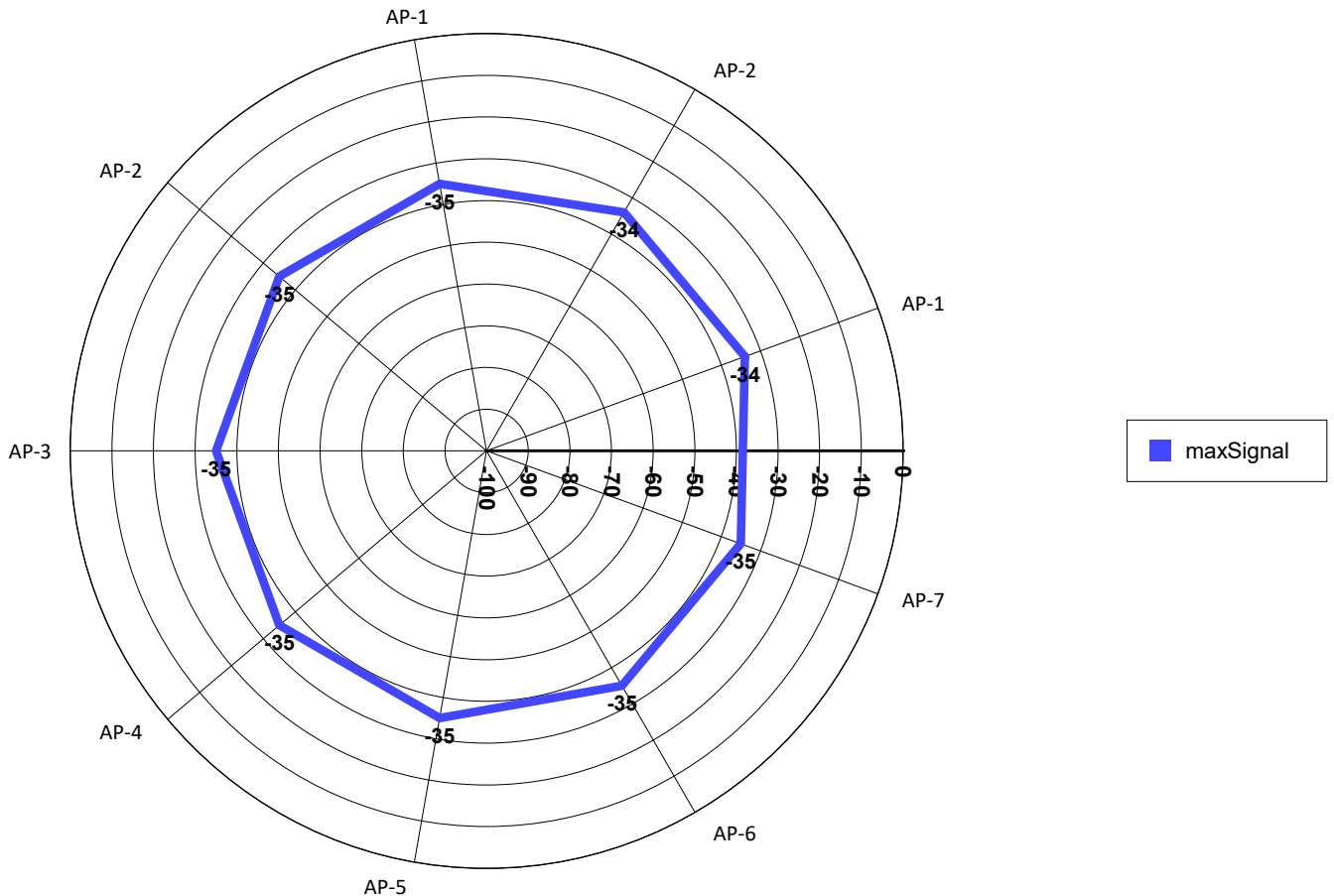
AP Name	Media Type	MAC Address	Channel	SSID	Power,mW	Max Signal
---- Non ACL, Neighbors, Rogues ----						
AP-1	802.11n-2.4 GHz	00:0D:C8:00:00:02	CH (1)	Unknown SSID	3	-34
AP-2	802.11n-2.4 GHz	00:0D:C8:00:00:04	CH (1)	Unknown SSID	3	-34
AP-1	802.11n-5.0 GHz	00:0D:C8:00:00:03	CH (36)	Unknown SSID	12	-35
AP-2	802.11n-5.0 GHz	00:0D:C8:00:00:05	CH (36)	Unknown SSID	12	-35
AP-3	802.11n-5.0 GHz	00:0D:C8:00:00:07	CH (36)	Unknown SSID	12	-35
AP-4	802.11n-5.0 GHz	00:0D:C8:00:00:09	CH (36)	Unknown SSID	12	-35
AP-5	802.11n-5.0 GHz	00:0D:C8:00:00:0B	CH (36)	Unknown SSID	12	-35
AP-6	802.11n-5.0 GHz	00:0D:C8:00:00:0D	CH (36)	Unknown SSID	12	-35
AP-7	802.11n-5.0 GHz	00:0D:C8:00:00:0F	CH (36)	Unknown SSID	12	-35

Number of AP 9

Total APs: 9

Total BSSIDs: 9

AP Signal Strength (dBm)

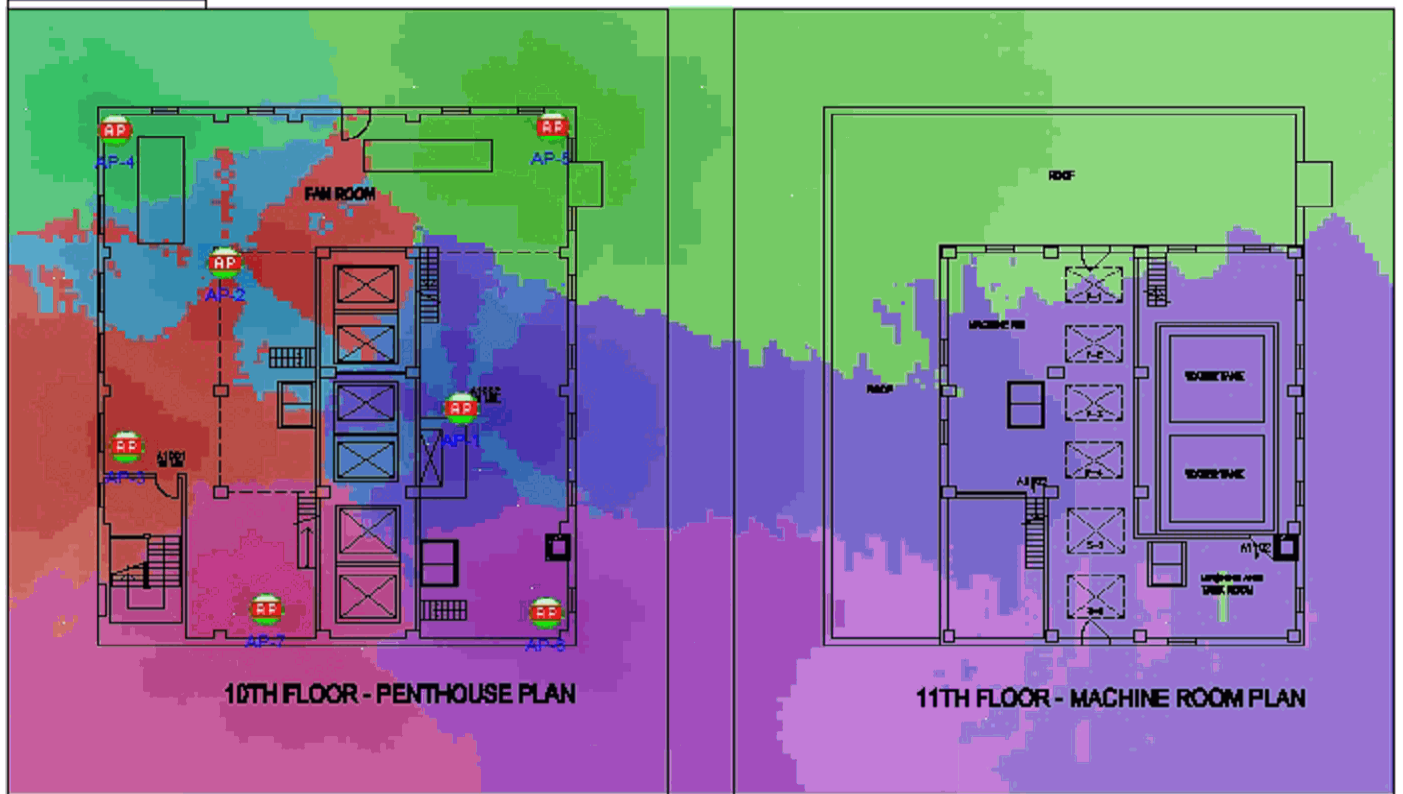


3 Current Deployment Site Survey

3.1 Access Point Coverage Regions

The image below shows the areas covered by the access points (in dBm). The color shown represents the AP with the strongest signal in any given area. This map will give you a visual representation of the Wi-Fi coverage area for the AP's.

1 in. = 30.11 ft Dimensions(X x Y): 210.76 ft x 130.00 ft



■ AP-1 [00:0D:C8:00:00:02]

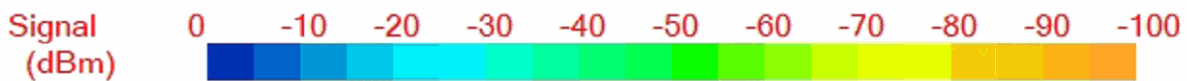
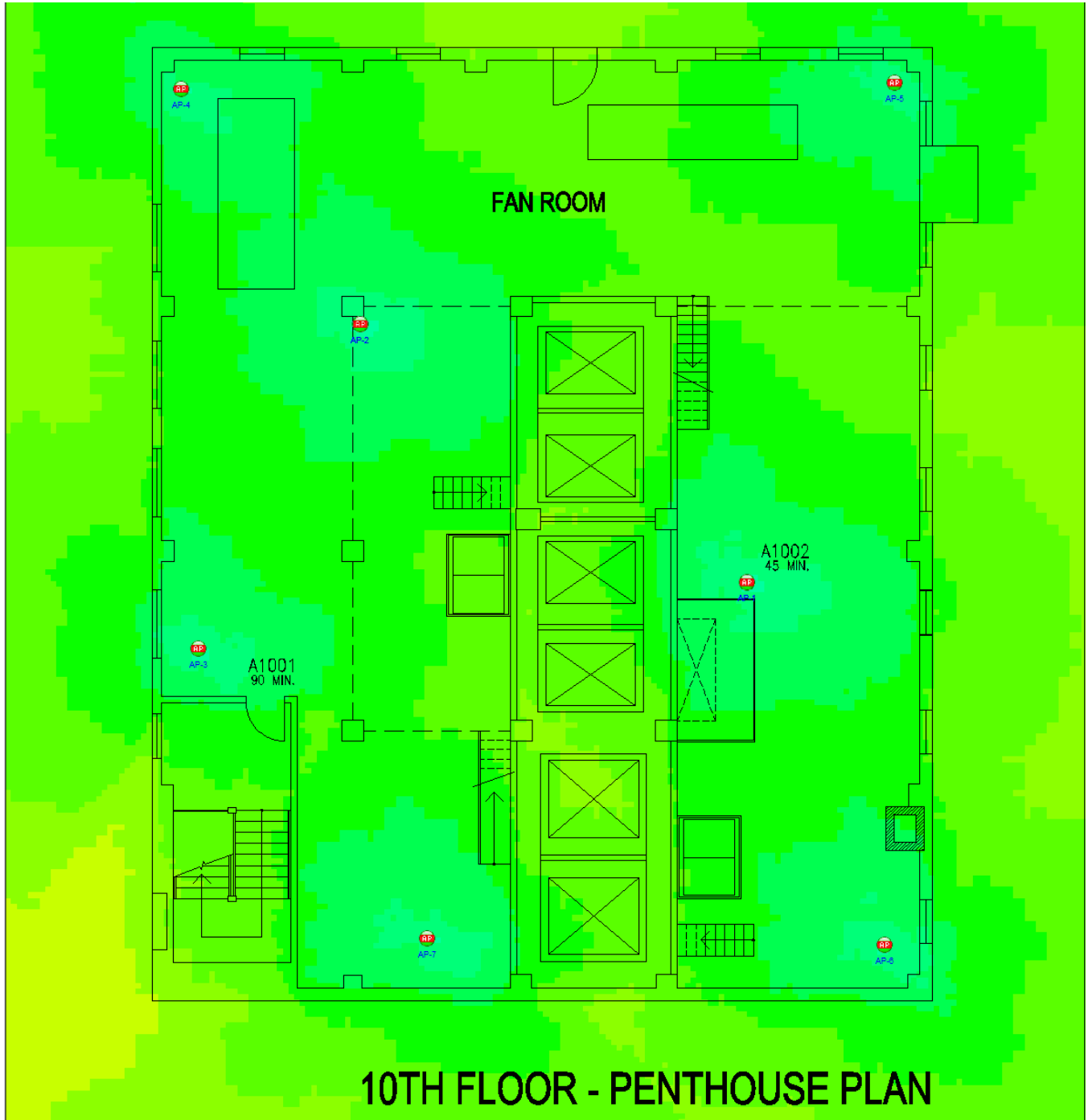
■ AP-2 [00:

3.2 Overall Signal Coverage

The image below displays the signal coverage (in dBm) at each point in the map layout. As a general rule, regions with signal levels below -67 dBm provide insufficient coverage for standard use (this value may vary depending on user requirements, service level agreements, applications used, number of users serviced, etc.).

APs are displayed in their detected locations (and reflect the existing power and antenna properties).

Note: An active Wi-Fi area can incorporate a variety of environmental factors that can vary throughout the day and may adversely affect RF coverage.




4 AirWISE Validation Against Requirements

This report section provides a comprehensive summary of all AirWISE data relating to the current survey project. AirMagnet's AirWISE engine allows users to specify minimum acceptable thresholds for various requirements within the network. It compares the data gathered during the survey process against the requirements. Requirements that are not met are highlighted in their respective sections. Several sections also contain signal heat maps that help demonstrate exactly where the threshold violations can be found. Each section provides a breakdown of each requirement and displays a pass/fail rating based on how well the collected results stand up against the objectives.

4.1 AirWISE Requirement

The chart below lists each AirWISE requirement configured for the current survey project file . These thresholds are governed by the settings in the AirWISE page and can be adjusted at any time (although any changes made to the AirWISE requirements will require that this report be regenerated). Every AirWISE setting below displays the percentage of the current project that meets its requirement; any areas that are below 90% show up in red, indicating that there is room for improvement in that particular category. The sections later in this report describe each AirWISE alarm in more detail.

Fail 		
Description	Value	Pass/Fail Result
Desired Signal Coverage	100.00% of Good Area.	Pass: 90.00% of Good Area. required to pass
Minimum AP signal strength required	-67 dBm	
Multiple AP Signal Coverage	99.70% of Good Area.	Pass: 90.00% of Good Area. required to pass
Number of APs required to provide coverage	3	
Minimum AP signal strength required to provide coverage	-67 dBm	
Channel Interference	0.00% of Good Area.	Fail: 90.00% of Good Area. required to pass
Interfered APs: Exclude APs if signal strength is weaker than	-75 dBm	
Interfering APs: Exclude APs if signal strength is weaker than	-85 dBm	
Channel Width	100.00% of Good Area.	Pass: 100.00% of Good Area. required to pass
40 MHz Channel Width	Allowed	
20HT MHz Channel Width	Allowed	
20 MHz Legacy Channel Width	Allowed	
80 MHz Channel Width	Allowed	

160 MHz Channel Width	Allowed	
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4.2 AP List

The table below displays information regarding each AP detected during the current survey project, including the AP name, media type, channel, SSID, power level, signal strength, and MAC address. As noted in the column headings, power is measured in increments of miliWatts and signal in dBm. This information can help reveal any unauthorized or unexpected APs detected within the network; should an unknown AP appear, steps can be taken to identify or eliminate it from the wireless environment.

AP Name	Media Type	MAC Address	Channel	SSID	Power,mW	Max Signal
AP-1	802.11n-2.4 GHz	00:0D:C8:00:00:02	1	Unknown SSID	3	-34
AP-2	802.11n-2.4 GHz	00:0D:C8:00:00:04	1	Unknown SSID	3	-34
AP-1	802.11n-5.0 GHz	00:0D:C8:00:00:03	36	Unknown SSID	12	-35
AP-2	802.11n-5.0 GHz	00:0D:C8:00:00:05	36	Unknown SSID	12	-35
AP-3	802.11n-5.0 GHz	00:0D:C8:00:00:07	36	Unknown SSID	12	-35
AP-4	802.11n-5.0 GHz	00:0D:C8:00:00:09	36	Unknown SSID	12	-35
AP-5	802.11n-5.0 GHz	00:0D:C8:00:00:0B	36	Unknown SSID	12	-35
AP-6	802.11n-5.0 GHz	00:0D:C8:00:00:0D	36	Unknown SSID	12	-35
AP-7	802.11n-5.0 GHz	00:0D:C8:00:00:0F	36	Unknown SSID	12	-35

Number of AP: 9

Total BSSIDs: 9

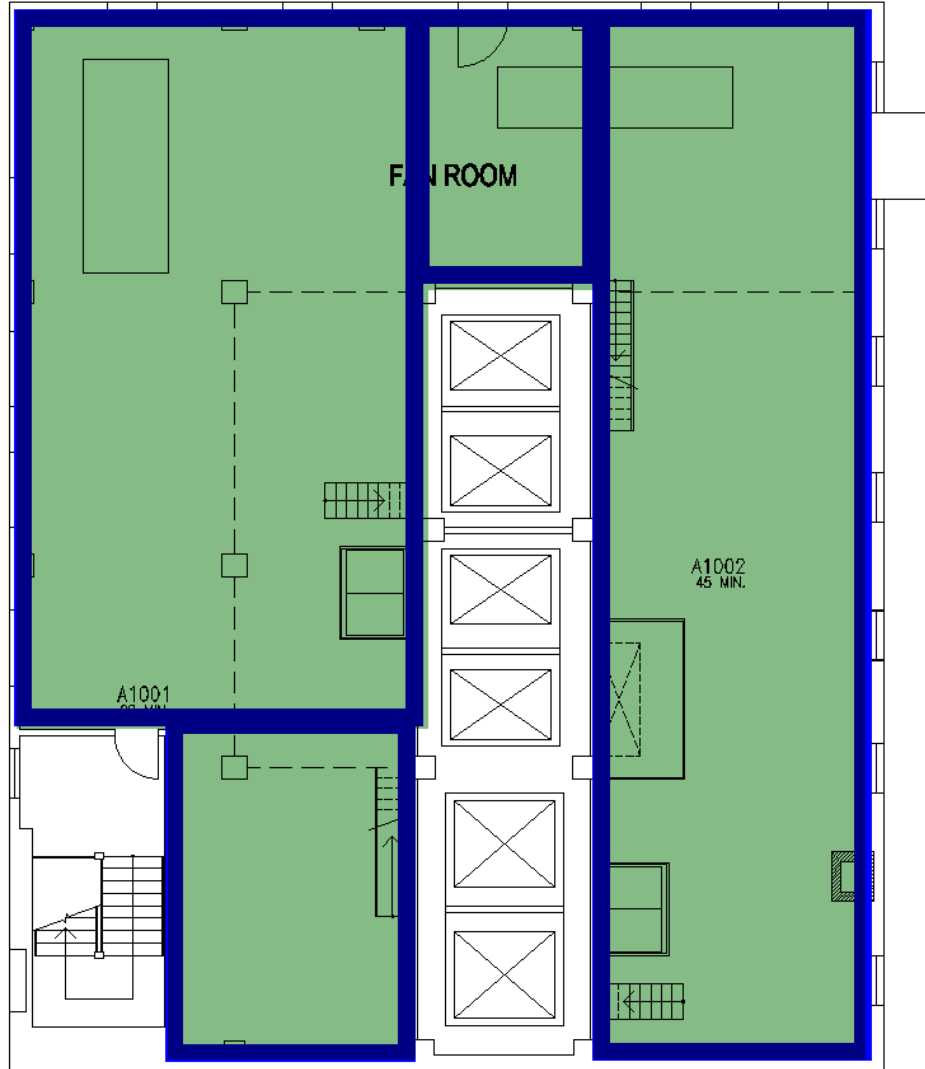
4.3 Signal Coverage

The Signal Coverage requirement allows the user to specify that certain regions of the deployment must have sufficient coverage to provide adequate service. Areas of the map that meet the current requirements for Signal coverage are labeled in light green. Areas that do not meet the requirement are displayed according to the color code on the slider bar below the image.

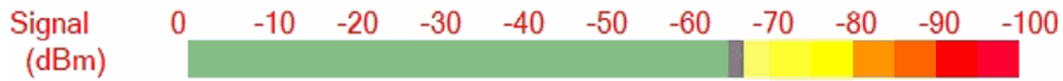
Desired Signal Coverage	
<i>Pass/Fail Result</i>	Pass: 100.00% of the surveyed area meets the Minimum requirement. (90.00% of Good Area. required to pass)
Minimum AP signal strength required	Minimum of -67 dBm

1 in. = 30.11 ft

Dimensions(X x Y): 210.76 ft x 130.00 ft



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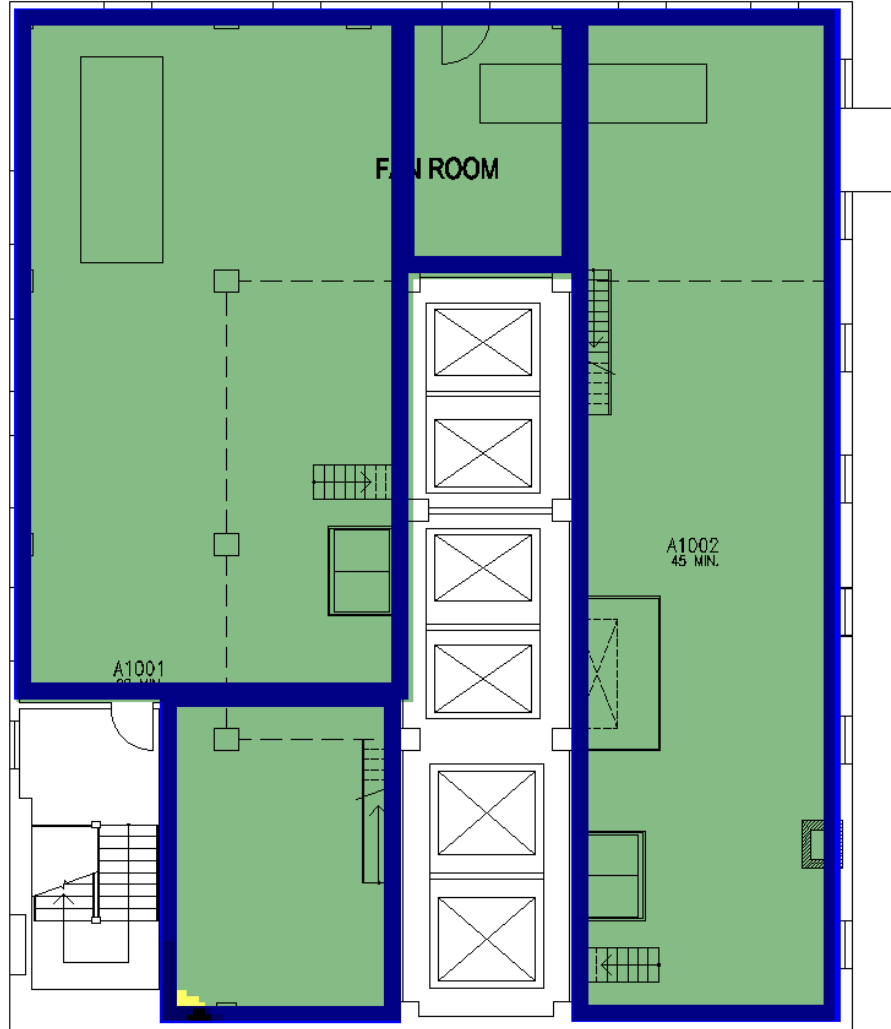
4.3.1 Redundant AP Coverage

The Redundant AP Coverage requirement allows the user to specify that certain regions of the deployment must have coverage from more than one AP in order to be considered adequate service . Areas of the map that meet the current requirements for AP coverage are labeled in light green . Areas that do not meet the requirement are displayed according to the color code on the slider bar below the image. This requirement contains two configurable thresholds: the user must specify the minimum number of APs required for the site as well as the minimum signal level that is considered acceptable for the APs to warrant consideration . If either one of these two thresholds is not met, the area is considered non-compliant.

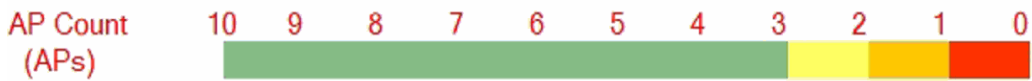
Multiple AP Signal Coverage	
<i>Pass/Fail Result</i>	Pass: 99.70% of the surveyed area meets the Minimum requirement. (90.00% of Good Area. required to pass)
Number of APs required to provide coverage	3
Minimum AP signal strength required to provide coverage	-67 dBm

1 in. = 30.11 ft

Dimensions(X x Y): 210.76 ft x 130.00 ft



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4.4 Channel Interference

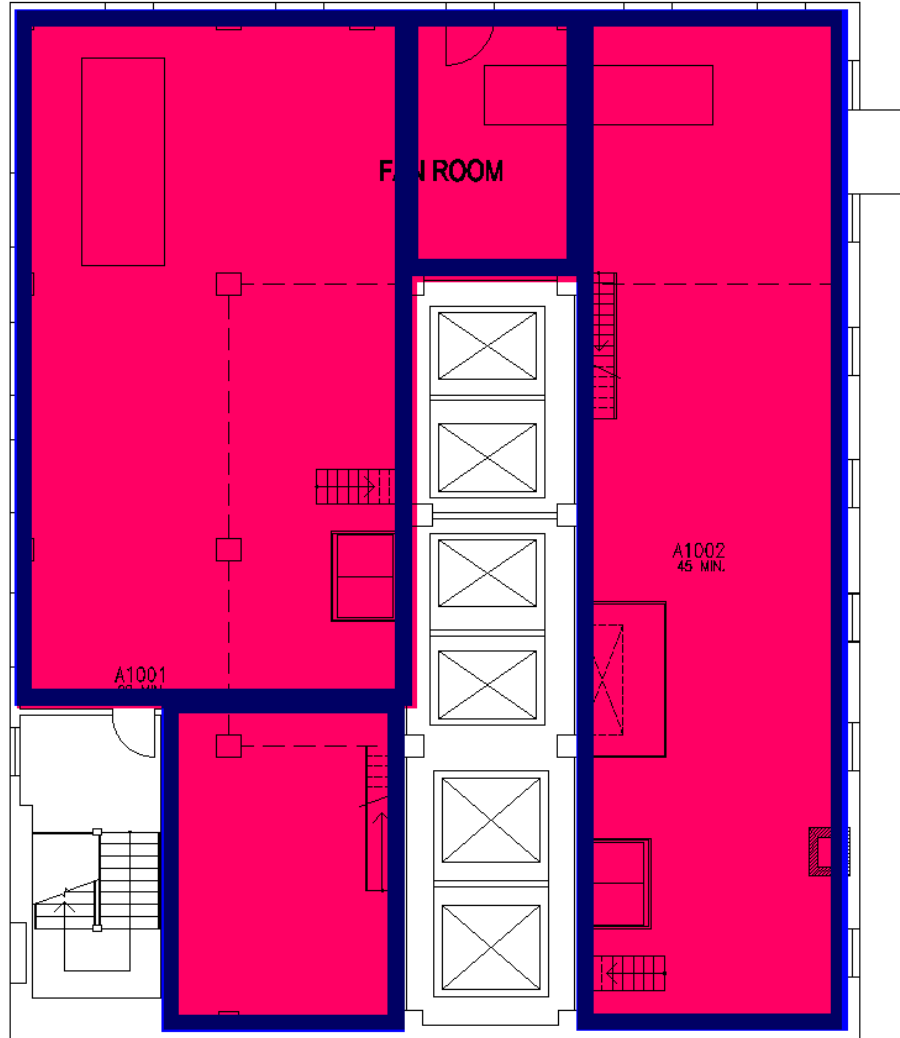
Areas of the map that meet the current requirement for Supported Speed are labeled in light green. Areas that do not meet the requirement are displayed according to the color code on the slider bar below the image. Let the mouse hover over any area of the map to show additional details.

Important Note: AirMagnet Survey measures interference from the point of view of a particular AP. Thus for a given AP, AirMagnet shows a cumulative view of all the various Wi-Fi sources that are interfering with that one AP. As a result, users should deselect all APs that are not the focus of investigation (using the device tree to the left on the Display page). The signals from de-selected devices are still considered when determining interference to other APs.

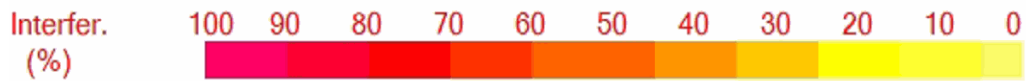
Channel Interference	
Pass/Fail Result	Fail: 0.00% of the surveyed area meets the Minimum requirement. (90.00% of Good Area. required to pass)
Interfered APs: Exclude APs if signal strength is weaker than	-75 dBm
Interfering APs: Exclude APs if signal strength is weaker than	-85 dBm

1 in. = 30.11 ft

Dimensions(X x Y): 210.76 ft x 130.00 ft



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4.5 Channel Width

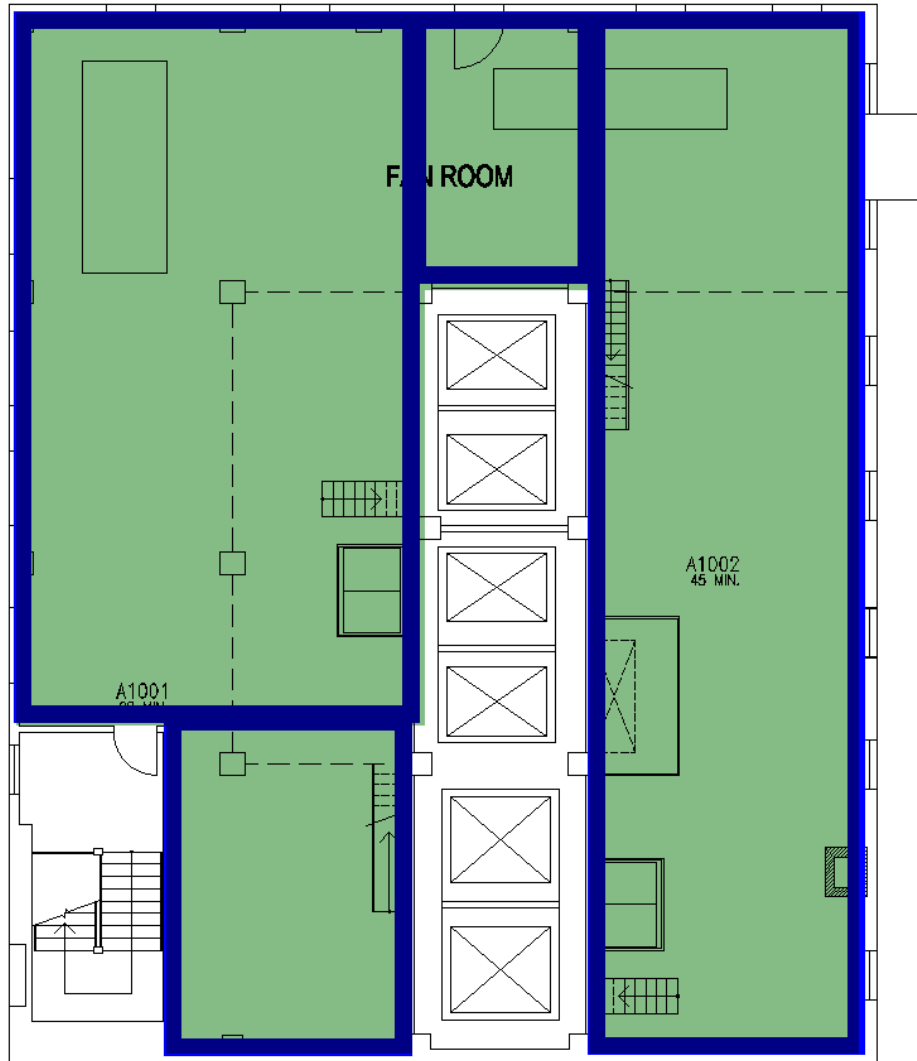
This section of the channel width requirements will show the actual detected channel usages detected. The heat map will show the areas that will be the cause of the pass or failure of the requirements specified for the channel width.

4.5.1 Overall

Channel Width	
Pass/Fail Result	Pass: 100.00% of the surveyed area meets the Minimum requirement. (100.00% of Good Area. required to pass)
40 MHz Channel Width	Allowed
20HT MHz Channel Width	Allowed
20 MHz Legacy Channel Width	Allowed
80 MHz Channel Width	Allowed
160 MHz Channel Width	Allowed

1 in. = 30.11 ft

Dimensions(X x Y): 210.76 ft x 130.00 ft



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Channel Width

Pass

Fail



5 Planner Report

AirMagnet Planner simulates Access Points as well as antenna and building characteristics to predict the number of Access Points needed and their respective locations before an actual WiFi deployment .

This report provides real-time Access Point signal coverage for the floor plan and recommends the number of Access Points needed and their locations on a floor plan (marked by numbers in red).

This report also provides detailed information for the Access Points being deployed :

- Name/ MAC address of the Access Point.
- Channel/SSID allocated.
- Planned location co-ordinates for the Access Point.
- Height of the Access Point/antenna above floor level.
- Type of the antenna and its specifications.

5.1 Planner AP List

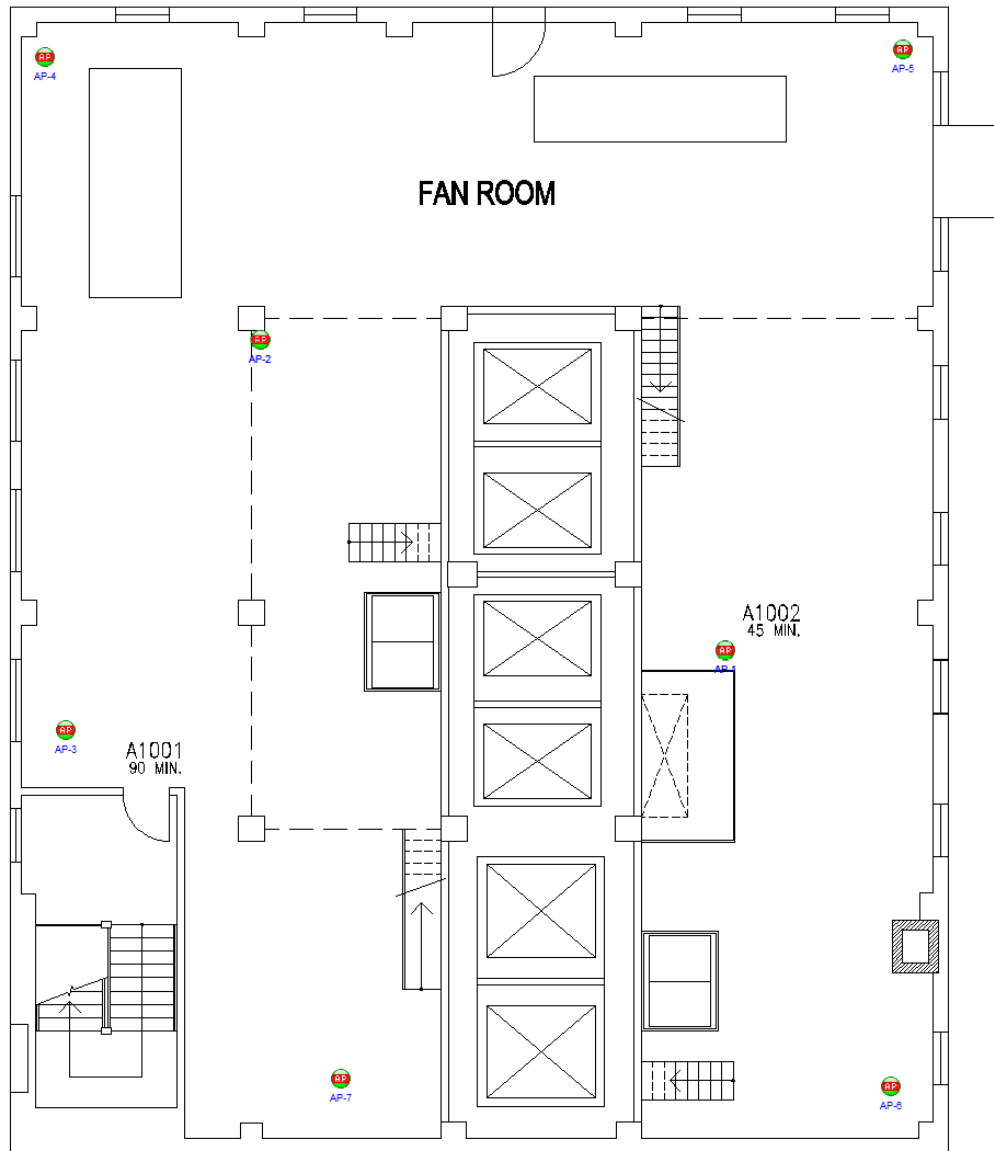
The table below lists the properties for each AP placed on the plan, including its name, location (as obtained from the grid on the previous page), MAC address, SSID, height, antenna type and angle of orientation, channel, and power.

Note that some APs may have two listings: the first represents the AP's 802.11a antenna, and the second 802.11b/g. Since these two mediums may have different antenna types and properties, they are separated in the table. This list can be used as a 'shopping list' or 'bill of materials list' for the wireless equipment to be purchased.

	AP Name	Location:	MAC	SSID	Heigth
1	AP-1(BGN)	4-D	00:0D:C8:00:00:02	Unknown SSID	10
	Antenna: Cisco Aironet 3700i 2.4GHz 4dBi A		Channel: 1	Angle: 0	Power: 3 mWatts
	AP-1(AN)	4-D	00:0D:C8:00:00:03	Unknown SSID	10
	Antenna: Cisco Aironet 3700i 5GHz 4dBi A		Channel: 36	Angle: 0	Power: 12 mWatts
2	AP-2(BGN)	2-C	00:0D:C8:00:00:04	Unknown SSID	10
	Antenna: Cisco Aironet 3700i 2.4GHz 4dBi A		Channel: 1	Angle: 0	Power: 3 mWatts
	AP-2(AN)	2-C	00:0D:C8:00:00:05	Unknown SSID	10
	Antenna: Cisco Aironet 3700i 5GHz 4dBi A		Channel: 36	Angle: 0	Power: 12 mWatts
3	AP-3(AN)	2-D	00:0D:C8:00:00:07	Unknown SSID	10
	Antenna: Cisco Aironet 3700i 5GHz 4dBi A		Channel: 36	Angle: 0	Power: 12 mWatts
4	AP-4(AN)	2-B	00:0D:C8:00:00:09	Unknown SSID	10
	Antenna: Cisco Aironet 3700i 5GHz 4dBi A		Channel: 36	Angle: 0	Power: 12 mWatts
5	AP-5(AN)	4-B	00:0D:C8:00:00:0B	Unknown SSID	10
	Antenna: Cisco Aironet 3700i 5GHz 4dBi A		Channel: 36	Angle: 0	Power: 12 mWatts
6	AP-6(AN)	4-E	00:0D:C8:00:00:0D	Unknown SSID	10
	Antenna: Cisco Aironet 3700i 5GHz 4dBi A		Channel: 36	Angle: 0	Power: 12 mWatts
7	AP-7(AN)	3-E	00:0D:C8:00:00:0F	Unknown SSID	10
	Antenna: Cisco Aironet 3700i 5GHz 4dBi A		Channel: 36	Angle: 0	Power: 12 mWatts

5.2 Planner AP Location Map

The image below displays the site map with a grid overlay to provide a means of describing each AP's location (for example, an AP placed in the top-left corner of the grid will be described by location "1-A"). The APs are numbered in the sequence that they were placed on the plan; these numbers correspond to the APs listed in the AP List

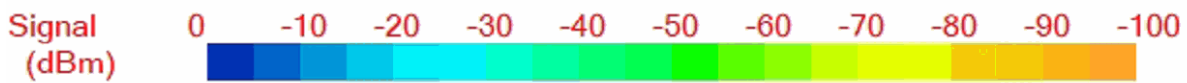
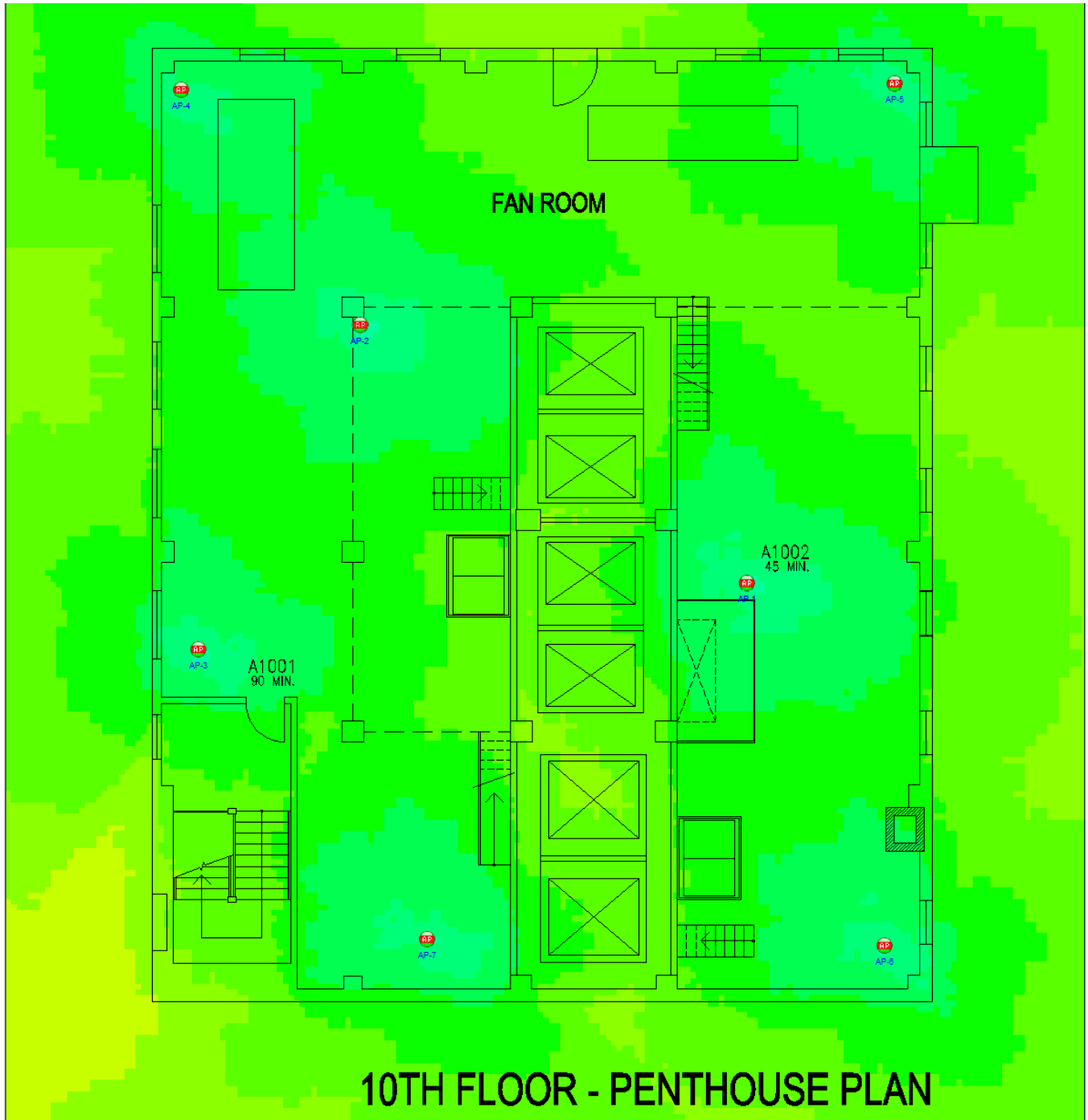


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5.3 Planner Signal Coverage

The image below displays the signal coverage (in dBm) at each point in the map layout. Refer to the legend below the map for the dBm values corresponding to each color region. As a general rule, regions with signal strengths below -67 dBm provide insufficient coverage for standard use (this value may vary depending on user requirements, service level agreements, applications used, number of users serviced, etc.). APs are displayed in their planned locations and reflect the specified power and antenna properties.

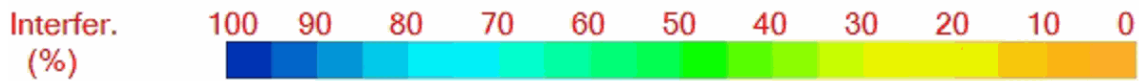
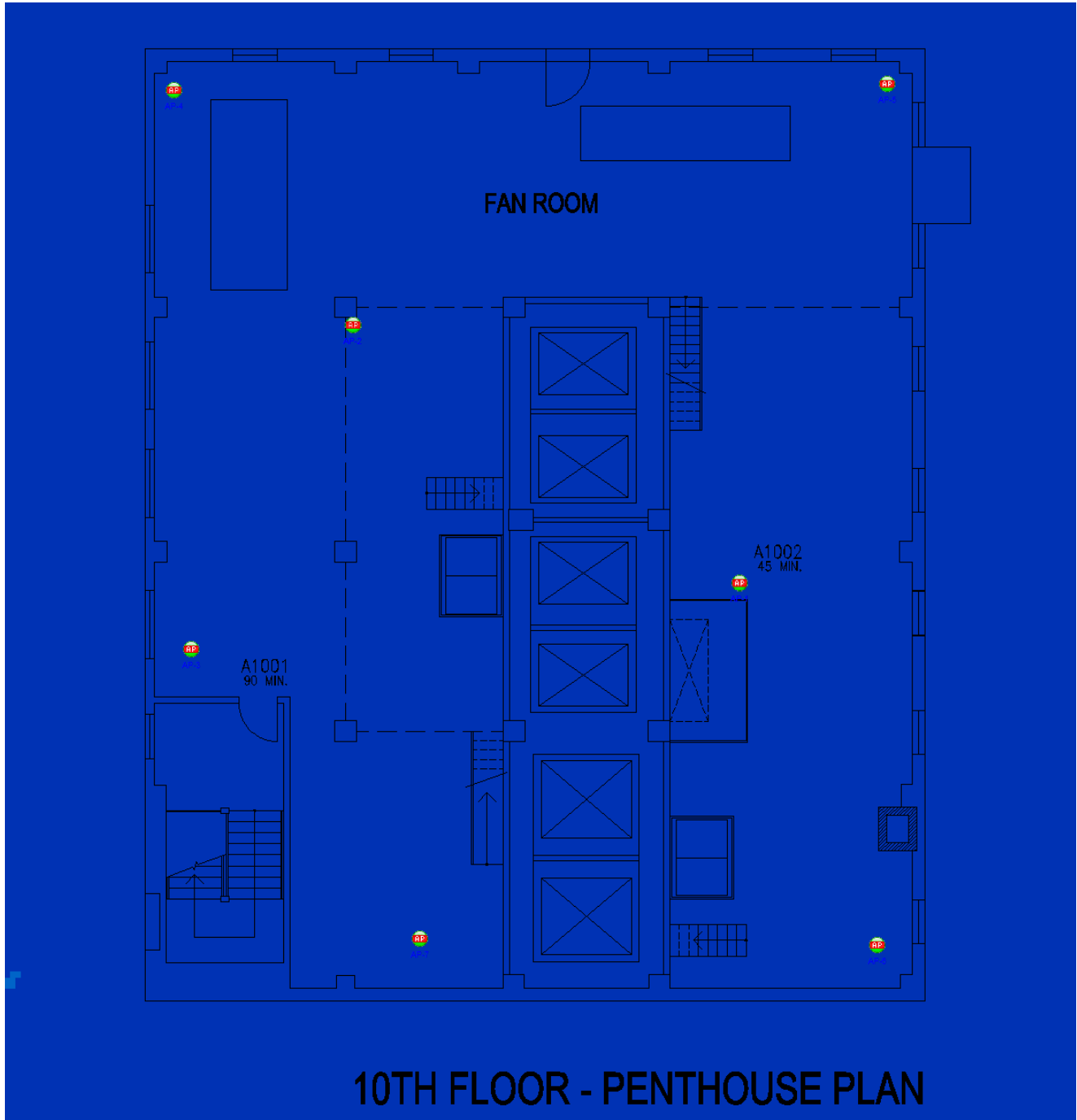
Note that an active WiFi area can incorporate a variety of environmental factors that can vary throughout the day and may adversely affect projected RF coverage.



5.4 Channel Interference

The image below displays the interference level (in percentage) at each point in the map layout. Refer to the legend below the map for the percent values corresponding to each color region. APs are displayed in their planned locations and reflect the specified power and antenna properties.

Note that the interference levels present in the environment can vary depending on several factors, such as the number of APs on a single channel, number of devices present, non-802.11 interferers, etc. It is also important to note that while the report may indicate a particular channel, the Radio Resource Management (RRM) on the Wireless Controller will choose a channel that best suits the deployed environment.



6 Conclusions

Overall, based on planned placement of the access points, more than 90% of the facility will meet the levels of RF signal strength (-67 dBm) as specified in the Statement of Work. Adjusting the scale to - 67 dBm showed 100% of the entire survey area is covered at this signal strength.

Description	Value	Pass/Fail Result
Desired Signal Coverage	100.00% of Good Area.	Pass: 90.00% of Good Area. required to pass
Minimum AP signal strength required	-67 dBm	
Multiple AP Signal Coverage	99.70% of Good Area.	Pass: 90.00% of Good Area. required to pass
Number of APs required to provide coverage	3	
Minimum AP signal strength required to provide coverage	-67 dBm	
Channel Interference	0.00% of Good Area.	Fail: 90.00% of Good Area. required to pass
Interfered APs: Exclude APs if signal strength is weaker than	-75 dBm	
Interfering APs: Exclude APs if signal strength is weaker than	-85 dBm	
Channel Width	100.00% of Good Area.	Pass: 100.00% of Good Area. required to pass
40 MHz Channel Width	Allowed	
20HT MHz Channel Width	Allowed	
20 MHz Legacy Channel Width	Allowed	
80 MHz Channel Width	Allowed	
160 MHz Channel Width	Allowed	