Introduction

An important early step in setting up a new WLAN or auditing an existing WLAN is conducting a Wi-Fi survey of the proposed site. One reason for this is because Wi-Fi (802.11) operates in the unlicensed radio frequency (RF) spectrum, which contains other devices that can cause RF interference, such as microwave ovens, CCTV, and even fluorescent lighting. However, the most significant source of radio interference will be other Wi-Fi networks operating in close proximity. Poor placement of radio transmitters can result in signal strength deterioration if two or transmitters overlap while operating on the same frequency channel.

Another reason for performing a Wi-Fi site survey is to ensure that you have sufficient radio coverage. Radio waves in an open area are predictable, but when you start to add obstacles, signal levels can fluctuate and even drop altogether. For this reason, a survey of the relative radio signal strength that covers the entire site is paramount when conducting a Wi-Fi audit. It is important to ensure that you have as uniform a signal across the entire site as possible, while minimizing unnecessary RF propagation beyond the site borders. This can be tricky, which is why heatmap tools are commonly used to visualize RF coverage. Heatmap tools allow for the visualization of RF coverage, signal strength, and signal interference levels over the entire site. Wi-Fi heatmaps use a color-coded key that ranges from poor to excellent. This allows a surveyor to make quick judgments, even in large, complex environments.

In this lab, you will learn how to conduct a Wi-Fi site survey. You will perform Radio Frequency coverage analysis using several key attributes and conduct Wi-Fi network discovery using professional-grade tools and techniques. Finally, you will apply this knowledge to identify potential sources of interference and implement remediations to improve coverage.

Lab Overview

This lab has three parts, which should be completed in the order specified.

1. In the first part of the lab, you will use a heatmap tool to visualize signal level coverage while performing a Wi-Fi site survey.

2. In the second part of the lab, you will use a heatmap tool to visualize other key attributes, including signal-to-interference ratio, PHY mode coverage, frequency band, and access point quantity.

3. In the third part of the lab, you will learn how to analyze key findings from the site survey and identify potential sources of interference.

Finally, you will explore the virtual environment on your own to answer a set of questions and challenges that allow you to use the skills you learned in the lab to conduct independent, unguided work - similar to what you will encounter in a real-world situation.

Learning Objectives

Upon completing this lab, you will be able to:

1. Conduct a site walkthrough and gather data.
2. Identify survey points on a floor plan.
3. Define the criteria that affect access point placement.
4. Identify dependencies between RF attributes.
5. Perform a site survey using professional-grade techniques and tools.

Topology

This lab contains the following virtual machines. Please refer to the network topology diagram below.

- vWorkstation (Windows Server 2019)

Tools and Software

The following software and/or utilities are required to complete this lab. Students are encouraged to explore the Internet to learn more about the products and tools used in this lab.

- NetSpot

Deliverables

Upon completion of this lab, you are required to provide the following deliverables to your instructor:

Hands-On Demonstration

1. Lab Report file, including screen captures of the following:

- NETGEAR01-5G access point details
- Signal levels recorded at the first sample point
- Heatmap for the FiOS-JOSMG group only
- FiOS-JOSMG signal levels detected at the first sample point
- Signal-to-interference ratio heatmap for the NETGEAR01-5G transmitter
- Netgear SIR levels detected at the first sample point

- Frequency band heatmap
- 2.4 GHz frequency band heatmap
- Updated quantity of access points heatmap
- Signal level heatmap with detailed sample points
- DIRECT-81C1860 Series access point details
- SIR values for the DIRECT-81C1860 Series access point

2. Any additional information as directed by the lab:

- Record the PHY mode for the NETGEAR01 transmitter.
- Record the PHY mode for the NETGEAR01-5G transmitter.

Challenge and Analysis

1. Lab Report file, including screen captures of the following:

- Signal levels for the AFSI-Guest group
- Signal interference ratio for the AFSI-Guest group
- Quantity of access points heatmap for the Guest area

2. Any additional information as directed by the lab:

- Record the Access Point’s SSID, frequency band, channel, PHY mode, vendor, and security protocol.

Hands-On Demonstration

Note: In this section of the lab, you will follow a step-by-step walk-through of the objectives for this lab to produce the expected deliverables.

1. **Review** the **Tutorial**.

   Frequently performed tasks, such as making screen captures and downloading your Lab Report, are explained in the Cloud Lab Tutorial. The Cloud Lab Tutorial is available from the User menu in the upper-right corner of the Student Dashboard. You should review these tasks before starting the lab.

2. **Proceed** with **Part 1**.

Part 1: Generate a Heatmap for Signal Level Coverage

Note: In this lab, you will be introduced to NetSpot, a software tool for Windows, MacOS, Android, and iOS that is used for scanning and assessing wireless network coverage and performance. NetSpot offers two modes: Discovery and Survey.

While operating in Discovery mode, NetSpot will detect and display any Wi-Fi radio transmitters that are detected within range of your device. The detectable range for NetSpot and similar tools is a maximum signal power level of -10 dBm and a minimum signal power level of -96 dBm (dBm = decibel milliwatts, or decibels in relation to a milliwatt). Signal level is a good indicator of the relative distance of a transmitter, where -10 dBm is very close and -96 dBm is quite far away. Within this range, NetSpot can discover a perhaps surprising number of Wi-Fi access points. For the purposes of conducting a site survey, it is important to be aware of neighboring access points, due to the fact that co-channel interference – that is, crosstalk between two radio transmitters using the same channel – can have a significant and negative attenuation impact on both signals. Knowing what competing signals are present across a site and on what channels will help a surveyor to optimally configure the new access point.

Due to the constraints of the virtualized environment, Discovery Mode will not be used in this lab, but you are encouraged to learn more about it or even download the Free version of NetSpot on your own device.

Survey mode is used for performing Wi-Fi site surveys. A Wi-Fi site survey can range from a surveyor wandering around a site and observing the signal strength on their laptop to a comprehensive data collection exercise that samples several RF attributes and conditions during the site walkthrough. When performing a site survey with NetSpot, a survey will need a scaled plan of the survey site – for example, an office floorplan. A site plan can be imported into NetSpot or drawn directly within the application. When Survey mode is active, NetSpot will automatically scan any open networks it detects, including the network that the surveyor’s device is currently connected to.

As the surveyor performs the walkthrough, they will mark sample points on the site plan that correspond to their current location, at which point NetSpot Pro will record key attributes of the local network and nearby Wi-Fi signals. These sample points will be displayed on the site plan and used to generate the heatmaps and visualizations that enable the surveyor to determine the overall condition of the radio spectrum at a glance. When the surveyor ends the scan, NetSpot will also attempt to identify the approximate location of the local network's access point based on the data it gathered during the scan. Naturally, NetSpot can sometimes get this wrong, but allows the surveyor to manually reposition the access point as needed.

In this part of the lab, you will be working with a sample NetSpot project that contains the site plan and survey data for a small office and family space. In the next steps, you will explore the NetSpot tool and learn how the signal level heatmap was created, what factors affect it, and how to gather more information about the local and nearby networks.

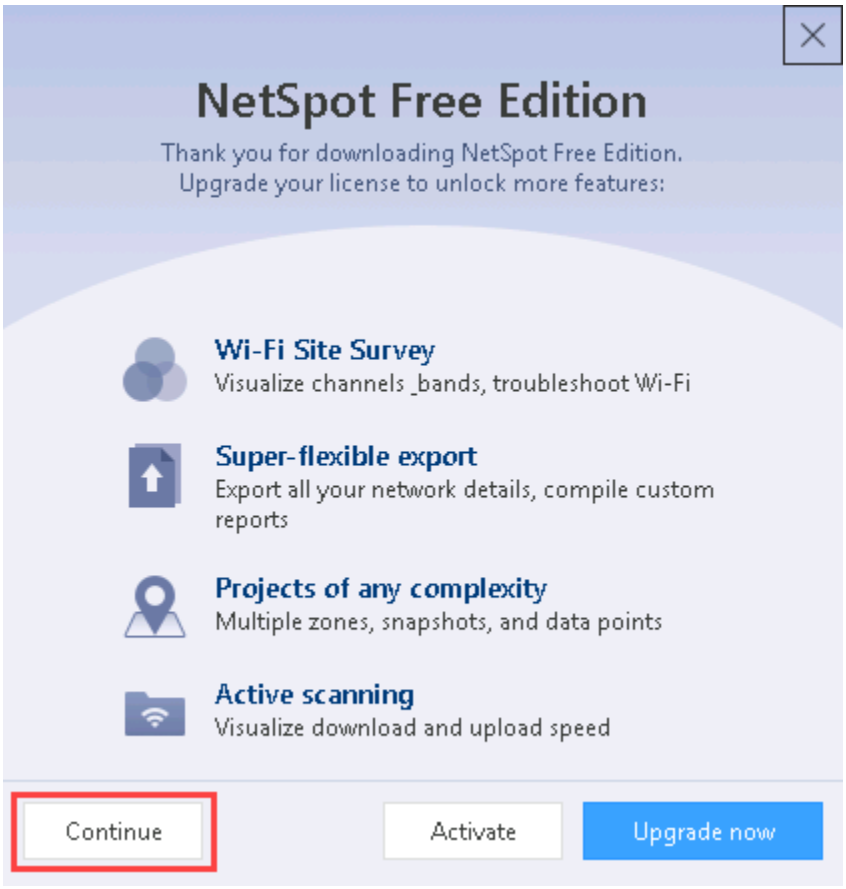
You will begin the lab on the vWorkstation machine (172.30.0.2). Administrator credentials are provided below for reference.

- Username: **`Administrator`**
- Password: **`P@ssw0rd!`**

1. On the vWorkstation, **double-click** the **NetSpot icon** to open the NetSpot application.

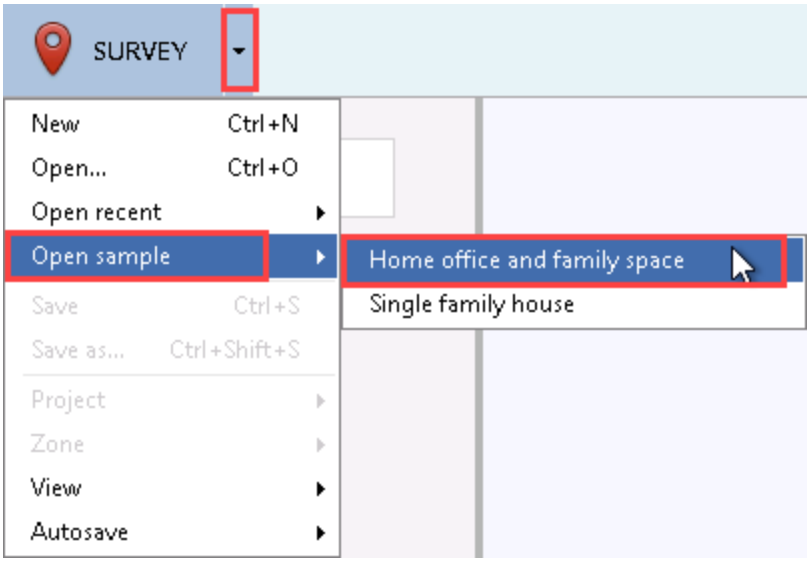
NetSpot icon

2. When prompted to upgrade NetSpot, **click Continue** to continue using the Free edition.



Continue

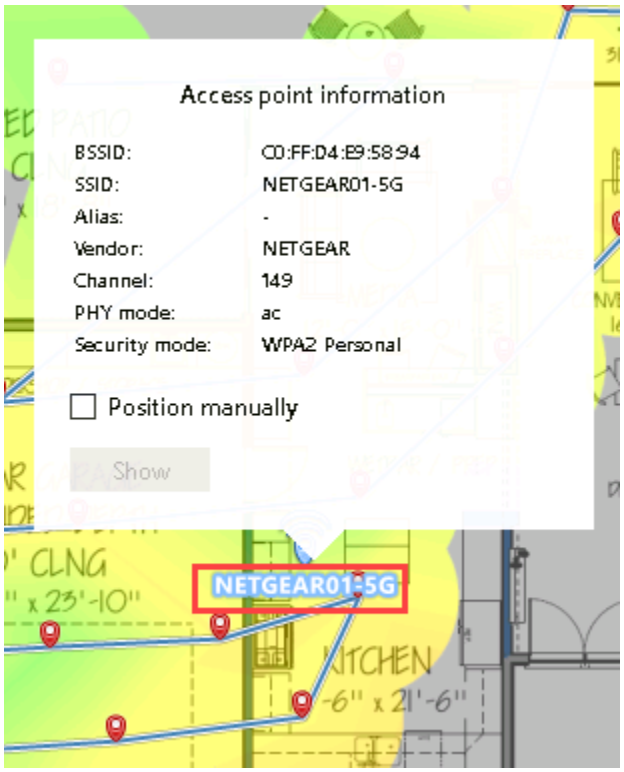
3. In the NetSpot window, **click** the **Survey menu** and **select Open sample > Home office and family space**.



Home office and family space sample

Note: By default, this sample project will display the signal level heatmap for a Wi-Fi site with a single Netgear access point.

4. In the Site pane on the right, **click** the **NETGEAR01-5G access point icon** to display detailed information about this access point.



NETGEAR01-5G access point icon

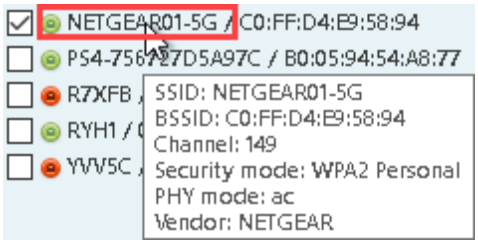
Note: This icon represents the location of the access point for the local network used while conducting the NetSpot scan. The detailed information includes the access point's BSSID, SSID, Alias, Vendor, Channel, PHY mode, and Security mode.

5. **Make a screen capture** showing the **NETGEAR01-5G access point details**.

6. In the Site pane, **click anywhere** to close the NETGEAR01-5G access point details.

7. In the Transmitters pane on the left, **hover your cursor** over the **NETGEAR01-5G transmitter**.

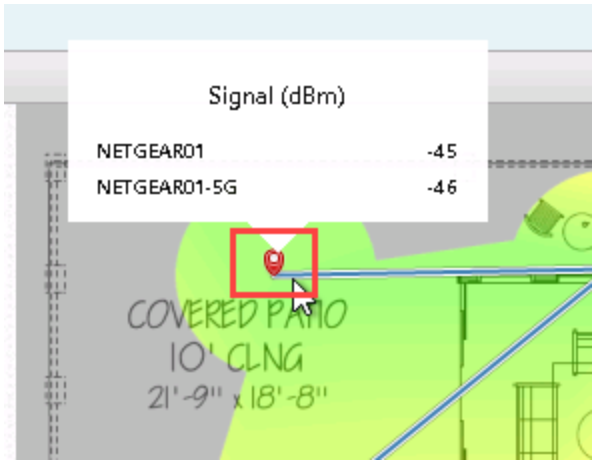
   You should notice that the information displayed matches the details you observed when you clicked the NETGEAR01-5G access point icon. You can therefore deduce that this transmitter corresponds to the NETGEAR01-5G access point that was used as the local network during the NetSpot scan.



NETGEAR01-5G transmitter

Note: The Transmitters pane contains the different Wi-Fi transmitters that were detected during the survey. Discovered transmitters are grouped according to SSID by default, but they can also be grouped by vendor, channel, frequency band, security mode, and PHY mode. Because the target of this NetSpot scan was the Netgear access point, you should see that its two radio transmitters (NETGEAR01 and NETGEAR01-5G) are the only transmitters that are currently selected.

8. In the Site pane, **click** the **first sample point** in the Covered Patio area to display the signal levels recorded at this sample point for the selected devices.



Sample point in the Covered Patio

Note: The sample points where Wi-Fi samples were taken during the initial site walkthrough are represented by red tags on the heatmap. Notice the diagonal approach taken by the surveyor, with

multiple sample points along the way.

You should also note the heatmap color key in the lower-right corner of the NetSpot window. According to the color key, poor quality is represented as blue and excellent quality is represented as red.

9. **Make a screen capture** showing the **signal levels recorded at the first sample point**.

Note: As previously mentioned, NetSpot displays all discovered RF transmitters as a list in the left pane. During the scan, NetSpot will attempt to sort the detected transmitters into groups according to common features. Typically, these groups will be defined according to shared SSIDs (commonly known as the network name, or ESSIDs, when multiple access points exist on a wireless network). For example, the FiOS group in this sample project likely refers to a Verizon hotspot that was detected during the NetSpot scan. NetSpot will also create groups for hidden transmitters that do not broadcast their SSID. All remaining devices will be sorted under the Ungrouped group.

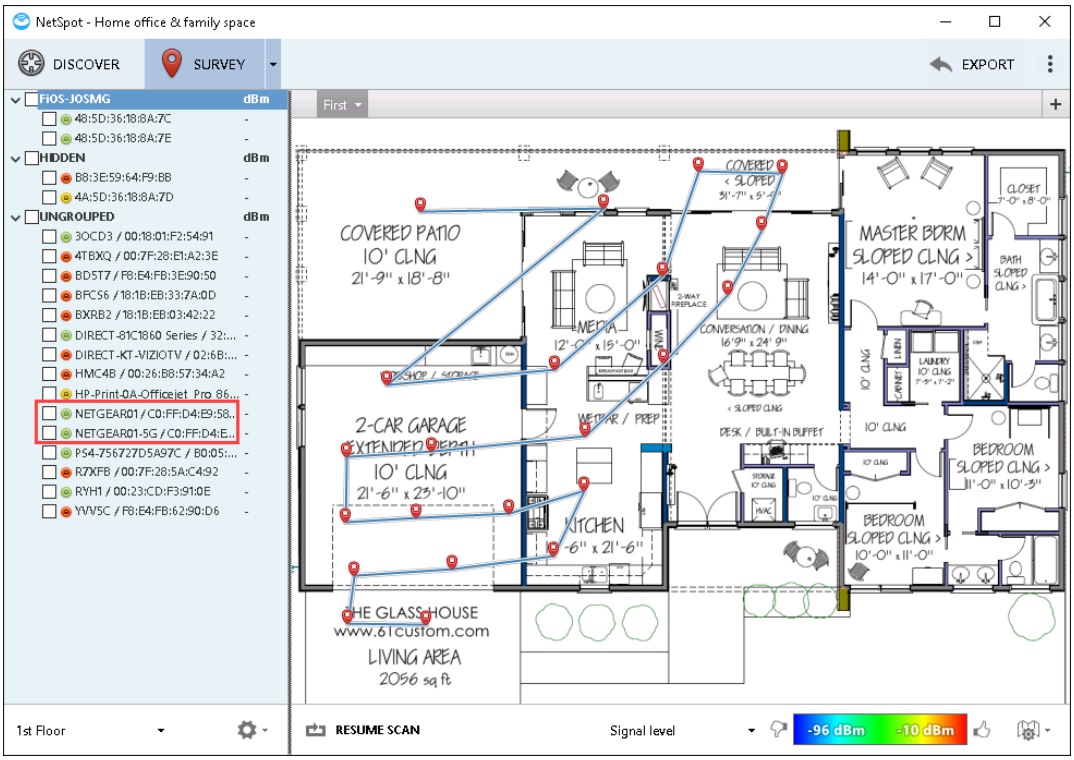
You may also notice that each transmitter has a checkbox and a color-coded icon next to its SSID. The checkbox allows you to show or hide the corresponding heatmap for each transmitter in the heatmap. The color-coded icon (green, orange, or red) indicates whether the transmitter's signal level was at the poor, moderate, or excellent end of the spectrum. Negative numbers are used because dBm is representing small, but positive, numbers on a logarithmic scale (log 10), where 0 dBm equals 1 milliWatt (mW) of power (and where 0 dBm represents the threshold of human hearing). For example, a signal level of -10 dBm means a power output of 0.1mW, while a signal level of -100 means a power output of 0.0000000001 mW. As you can see, such numbers can be difficult to read, so negative values are used for cleaner representation.

Math aside, so long as you are comfortable with negative numbers, you can let your intuition take over: the closer the dBm value is to zero (that is, the more positive it is), the more powerful the signal.

In the next steps, you will observe how the heatmap changes when you show or hide different transmitters.

10. In the Transmitters pane, **click** the **checkboxes** for the **NETGEAR01 and NETGEAR01-5G transmitters** to hide the corresponding heatmap.

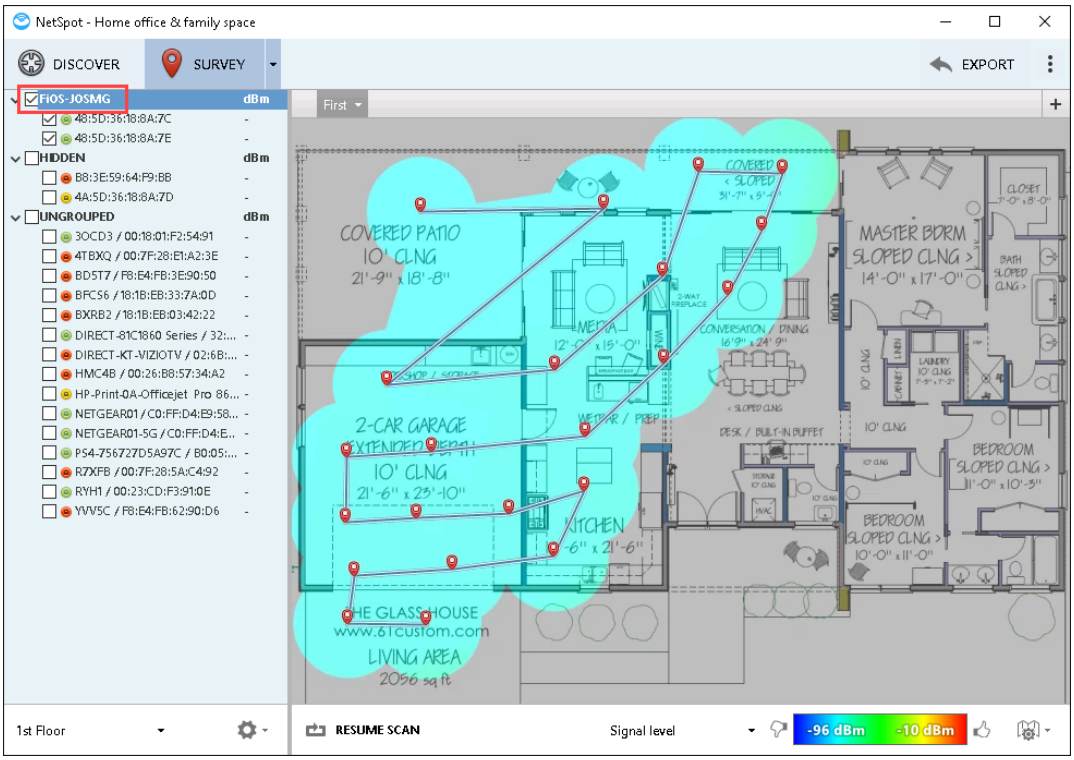
    The Site pane should now be entirely white, due to the fact that no transmitters are selected.



Hide the NETGEAR01 and NETGEAR01-5G transmitters

11. In the Transmitters pane, **click** the **checkbox** for the **FiOS-JOSMG group** to display the corresponding heatmap.

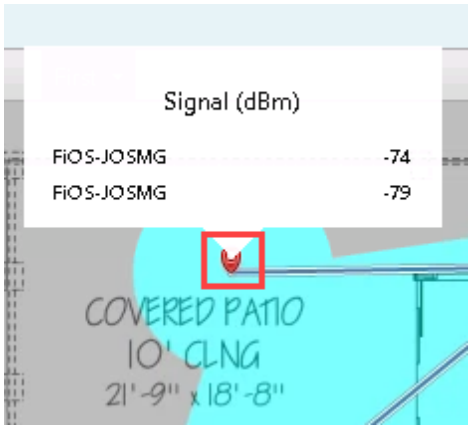
    You should notice that the signal level coverage for the FiOS-JOSMG group is uniformly poor across the entire surveyed site.



Display the FiOS-JOSMG group

12. **Make a screen capture** showing the **heatmap for the FiOS-JOSMG group only**.

13. In the Site pane, **click** the **first sample point** in the Covered Patio area to display the signal levels recorded at this sample point for the selected transmitters.



Sample point in the Covered Patio

14. **Make a screen capture** showing the **FiOS-JOSMG signal levels detected at the first sample point**.

Part 2: Generate Heatmaps for Other Key Attributes

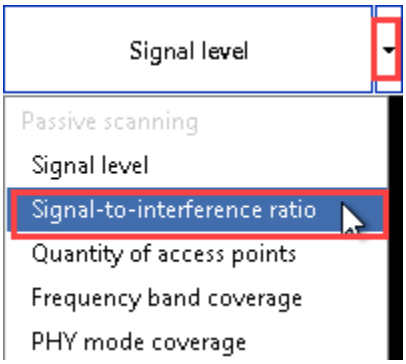
Note: In this part of the lab, you will learn how to create heatmaps for other Wi-Fi attributes, including signal-to-interference ratio (SIR), PHY mode coverage, frequency band, and quantity of access points.

1. In the Transmitters pane, **click** the **checkbox** for the **FiOS-JOSMG group** to hide the corresponding heatmap.

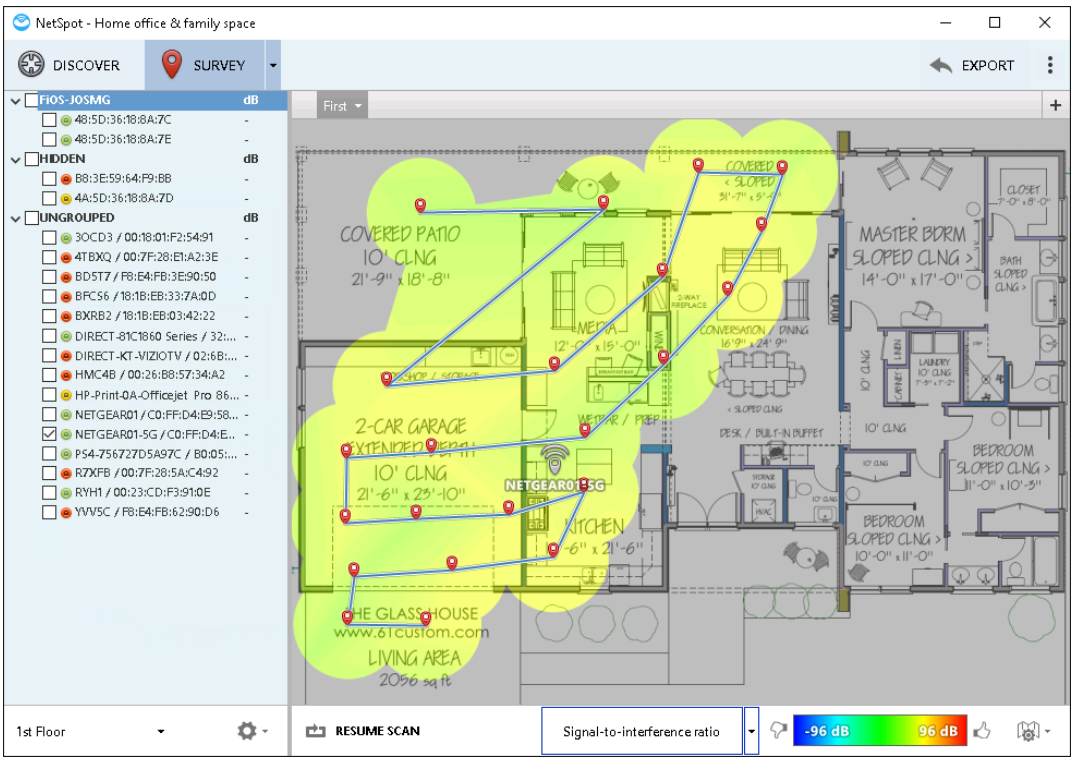
   The Site pane should now be entirely white again.

2. In the Transmitters pane, **click** the **checkbox** for the **NETGEAR01-5G transmitter** to display the corresponding heatmaps.

3. In the lower-right corner, **click** the **downward arrow** to the right of the Signal Level button to open the associated Options menu, then **select Signal-to-interference ratio** to display the Signal-to-interference ratio heatmap.



Options menu



SIR heatmap

Note: Signal-to-interference ratio (SIR) is the relative difference between the power level of a desired signal compared to those of competing Wi-Fi signals on the same channel. While signal level alone is a useful data point for assessing the distance to other Wi-Fi access points, the Signal-to-interference ratio is far more important to assessing signal quality at a given location. As a general rule, an SIR higher than 0 dB is considered to be acceptable.

4. **Make a screen capture** showing the **signal-to-interference ratio heatmap for the NETGEAR01-5G transmitter**.

5. In the Transmitters pane, **click** the **checkbox** for the **NETGEAR01 transmitter** to display the corresponding heatmap.

   In this case, the aggregate heatmap remains virtually unchanged.

6. In the Site pane, **click** the **first sample point** in the Covered Patio area to display the SIR levels recorded at this sample point for the selected transmitter.

Note: With both transmitters selected in the Transmitters pane, you can the see exact SIR levels for both transmitters at this sample point. You should notice that the SIR level for the NETGEAR01-5G transmitter is much higher than the SIR level for the NETGEAR01 transmitter, indicating that the NETGEAR01-5G transmitter would offer a better Wi-Fi connection at this location.

7. **Make a screen capture** showing the **Netgear SIR levels detected at the first sample point**.

8. In the Transmitters pane, **click** the **checkboxes** for the **NETGEAR01 and NETGEAR01-5G transmitters** to hide the corresponding heatmaps.

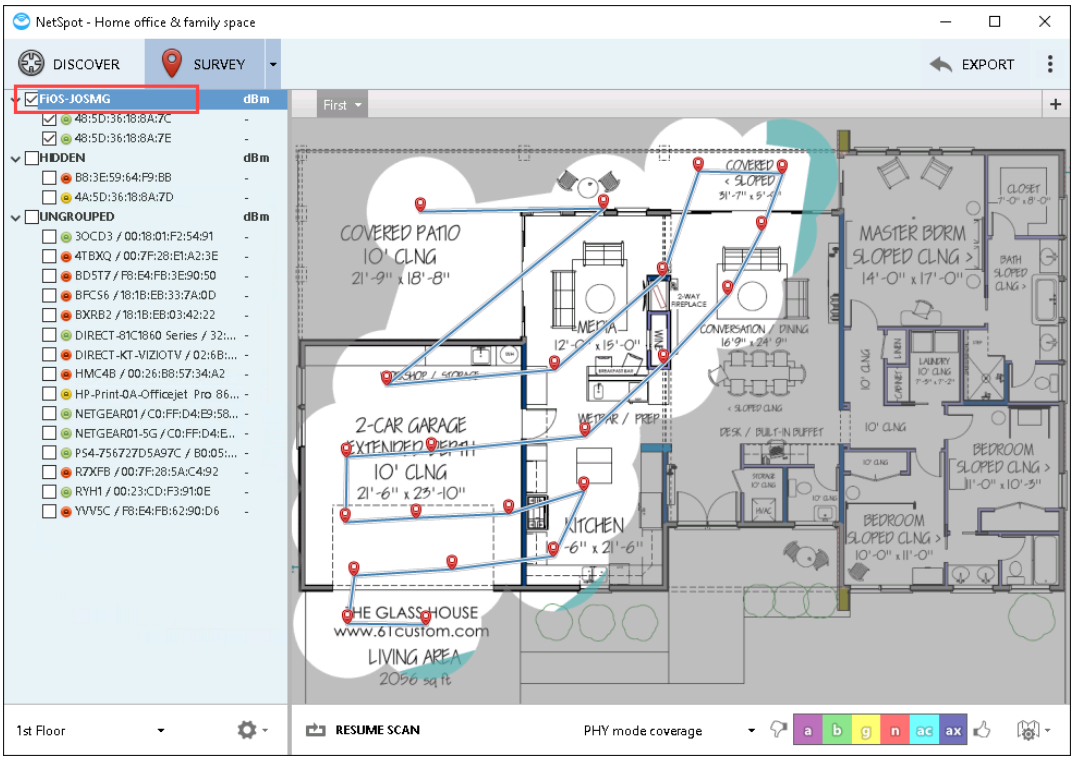
   The Site pane should now be entirely white again.

9. From the Options menu, **select PHY mode coverage**.

Note: PHY refers to the physical layer media standard. The PHY Mode Coverage visualization displays the 802.11 protocols (a, b, g, n or ac) that were detected for each transmitter during the walkthrough. As usual, each protocol is represented by a unique color according to the color key in the lower-right corner. When multiple PHY modes are detected, NetSpot will display a mix of their corresponding colors. For example, orange indicates a mix of 802.11n (red) and 802.11g (yellow). If you hover the cursor over a specific sample point, the protocols detected at that sample point will be outlined in black on the color key.

10. In the Transmitters pane, **click** the **checkbox** for the **FiOS-JOSMG group** to display the corresponding heatmap.

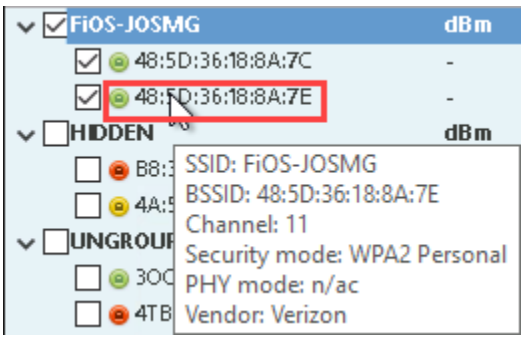
    The heatmap should now show some blue at the edges of the network site.



PHY Mode Coverage heatmap for the FiOS-JOSMG

11. In the Transmitters pane, **hover your cursor** over **either FiOS-JOSMG transmitter** to display information about the transmitter, including the PHY modes.

    You should see that the FIOS-JOSMG transmitters are using the 802.11n and 802.11ac standards.



FiOS-JOSMG transmitter detail

Note: 802.11n (also known as Wi-Fi 4), released in 2009, was notably the first Wi-Fi standard to operate in dual frequency bands. 802.11ac (Wi-Fi 5) was released in 2013 and continued this trend. At time of writing, the latest version is 802.11ax (Wi-Fi 6), which was formally approved by IEEE in 2021. While newer Wi-Fi standards, including 802.11ax (Wi-Fi 6), will gradually gain traction as new hardware is released to support them, 802.11n and 802.11ac are still widely used and supported in modern wireless infrastructures.

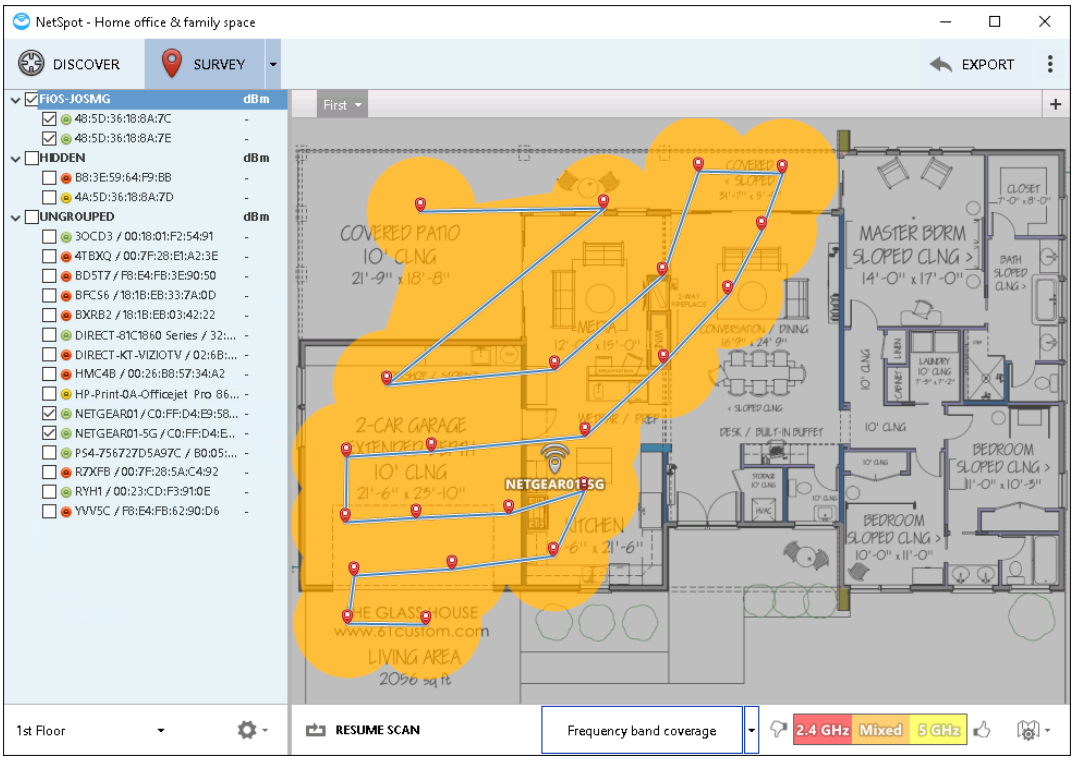
12. In the Transmitters pane, **click** the **checkbox** for the **NETGEAR01 transmitter** to display the corresponding heatmap.

13. **Record** the PHY mode for the NETGEAR01 transmitter.

14. In the Transmitters pane, **click** the **checkbox** for the **NETGEAR01-5G transmitter** to display the corresponding heatmap.

15. **Record** the PHY mode for the NETGEAR01-5G transmitter.

16. From the Options menu, **select Frequency band coverage**.



Frequency band coverage heatmap

Note: Frequency band refers to the unlicensed frequency bands that are available for Wi-Fi radios: 2.4 GHz and 5 GHz. As mentioned above, dual frequency band support was introduced with the 802.11n Wi-Fi standard in 2009. Previous generations of Wi-Fi operated solely in the 2.4 GHz frequency band.

Both frequency bands have their own unique advantages and disadvantages. For example, 2.4 Ghz can travel further because it is a lower-frequency radio wave. The lower frequency also means it can penetrate objects such as partition walls when used inside and leaves and foliage when used outdoors. The problem is that 2.4 Ghz is an extremely congested band that is used by a range of devices, such as microwaves, smart TVs, personal computers and mobile devices. The situation is unlikely to improve any time soon, as many legacy devices are automatically configured to use this band. Additionally, the 2.4 GHz band only offers 11 channels, and only 3 of these are non-overlapping (1, 6, and 11).

The 5 Ghz band is far less congested, permitting a total of 24 non-overlapping channels, making it ideal for modern devices with radios that can support 5 Ghz. However, the 5 GHz band has much shorter range than the 2.4 Ghz band and its signal is easily deflected or blocked altogether. However, it does support very high throughput due to its higher frequency. When possible, it is a best practice to offer both bands within the network coverage area – 5 GHz for high throughput on nearby client devices and the robust, ubiquitous 2.4 Ghz for general usage.

In Frequency band coverage mode, NetSpot will provide a simple heatmap with three colors.

According to the color key in the lower-right corner, 2.4 GHz coverage is represented as red, 5 GHz is represented as yellow, and mixed coverage is represented as orange. With the current transmitter selection, the entire map should be orange, indicating mixed coverage.

17. **Make a screen capture** showing the **frequency band heatmap**.

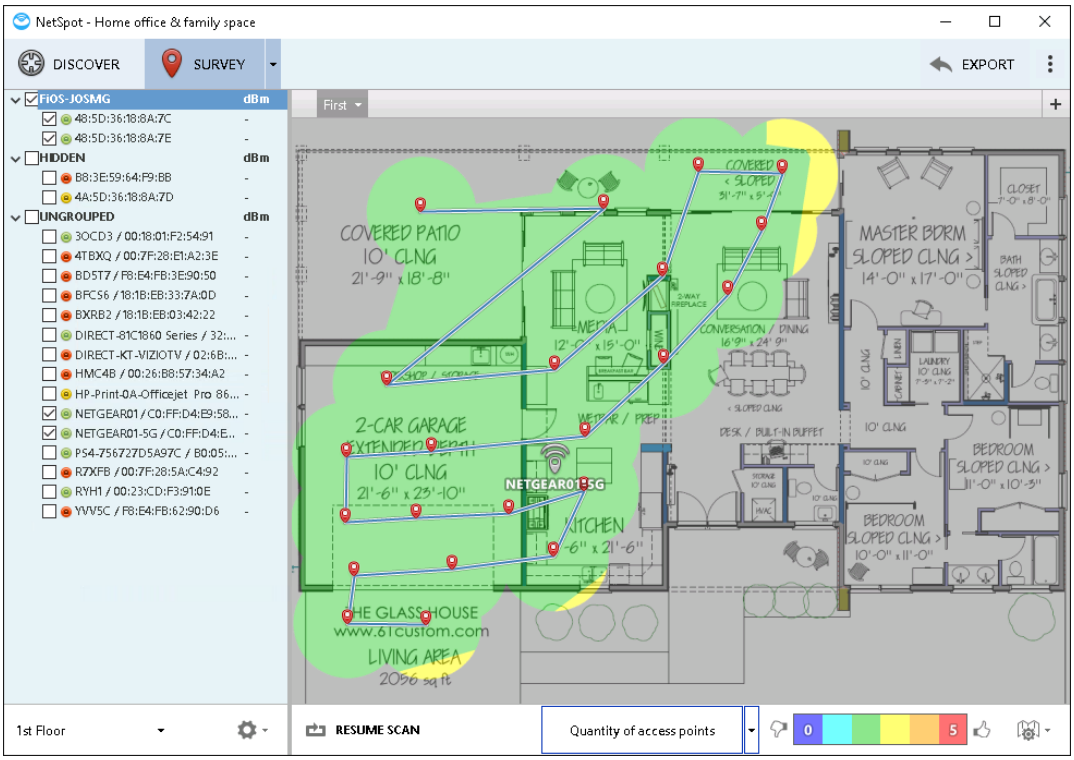
18. In the Transmitters pane, **click** the **checkbox** for the **NETGEAR01-5G transmitter** to hide the corresponding heatmap.

    The heatmap will change from orange to red, indicating that the NETGEAR01-5G radio is responsible for the only 5 Ghz transmitter among the currently selected transmitters.

19. **Make a screen capture** showing the **2.4 GHz frequency band heatmap**.

20. In the Transmitters pane, **click** the **checkbox** for the **NETGEAR01-5G transmitter** to display the corresponding heatmap.

21. From the Options menu, **select Quantity of access points**.



Quantity of access points heatmap

Note: The Quantity of access points heatmap will show the number of access points detected at each sample point. In this case, the heatmap will turn green, with some yellow at the edges. According to the color key in the lower-right corner, this means that most of the site is covered by two access points, while some parts at the edge are covered by three access points.

While somewhat counterintuitive, the quantity of access points in NetSpot actually refers to the total number of radio transmitters, rather than the number of physical access points. This is because a single physical access point can have two or more active radio transmitters, each of which can be configured as an independent access point.

Each radio can support different SSIDs, and even multiple SSIDs or virtual SSIDs (vSSIDs). This is because each radio can support up to 32 MAC addresses, which can be assigned to each interface or virtual interface configured on the device. However, creating 32 interfaces is not advisable, as all of the SSIDs (interfaces or sub-interfaces) must rely on the same set of finite resources, such as throughput and bandwidth. A rule of thumb is to configure no more than 3 vSSIDs on a single radio interface.

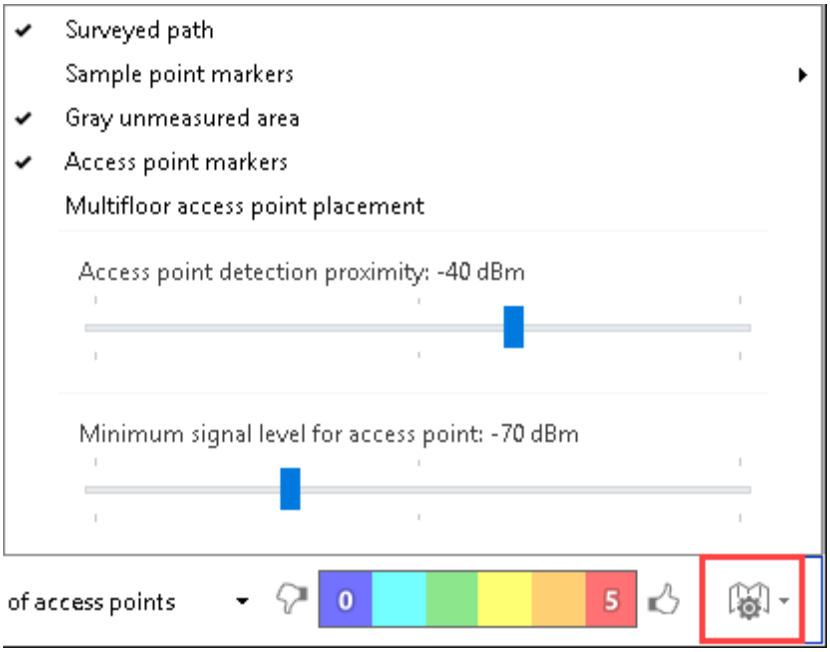
In this case, you can safely conclude that the Netgear access point contains two radios – one for the 2.4 GHz frequency band and one for the 5 GHz frequency band. Since the only other transmitters that are currently selected are the FiOS-JOSMG group, you can also conclude that the yellow areas on the edge of the survey site are where the Netgear transmitters overlap with one of the FiOS-JOSMG

transmitters.

22. **Make a screen capture** showing the **quantity of access points heatmap**.

Note: You may be wondering why one of the FiOS transmitters is only counted as an access point at the far edge of the survey site, despite the fact that their signals can be detected well within the core of the survey site, along with the many other transmitters listed in the Transmitters pane. This is due to a configurable setting in NetSpot that you will examine in the next steps.

23. In the lower-right corner of the NetSpot window, **click** the **Settings icon** to open the Settings menu.



Settings menu

Note: At the bottom of the Settings menu, you should see a setting titled Minimum signal level for access point: -70dBm. The corresponding slider can be adjusted to define the exact signal level that NetSpot will use as the threshold for displaying an access point. If you were to click any yellow portion

of the survey site, you would see that one of the FiOS transmitters is sampled at a level of -69dBm, which is just above the threshold to qualify as an observable access point.

24. From the Settings menu, use the slider to **change** the *Minimum signal level for access point* setting to **-65 dBm**.

    The heatmap should automatically update to show only two access points for the entire survey site.

25. **Make a screen capture** showing the **updated quantity of access points heatmap**.

Note: Other heatmap options offer similar settings that allow you to calibrate the range of values that NetSpot uses to develop its heatmaps.

Part 3: Identify Potential Sources of Interference

Note: When conducting a Wi-Fi site survey with NetSpot, it is important to have a specific objective in mind. For example, are you planning the Wi-Fi deployment at a brand new office space, or are you troubleshooting a performance issue on an existing network? The heatmap visualizations that you use and how you calibrate them can vary significantly based on what you are trying to accomplish.

For the purposes of this lab, imagine that you are examining the sample site survey that you explored earlier with the objective of verifying that the Wi-Fi coverage afforded by a single access point will be sufficient for the needs of your home office. The primary Wi-Fi attributes of interest in this project are Signal Level Coverage and Signal-to-Interference Ratio (SIR). The quantity of access points and PHY modes may be of secondary interest, as they could indicate a security issue, such as a rogue access point, or, more likely, overlapping WLANs from your neighbors. In this part of the lab, you will examine each heatmap in turn and draw conclusions from data collected during the NetSpot survey scan.

1. From the Options menu, **select Signal level**.

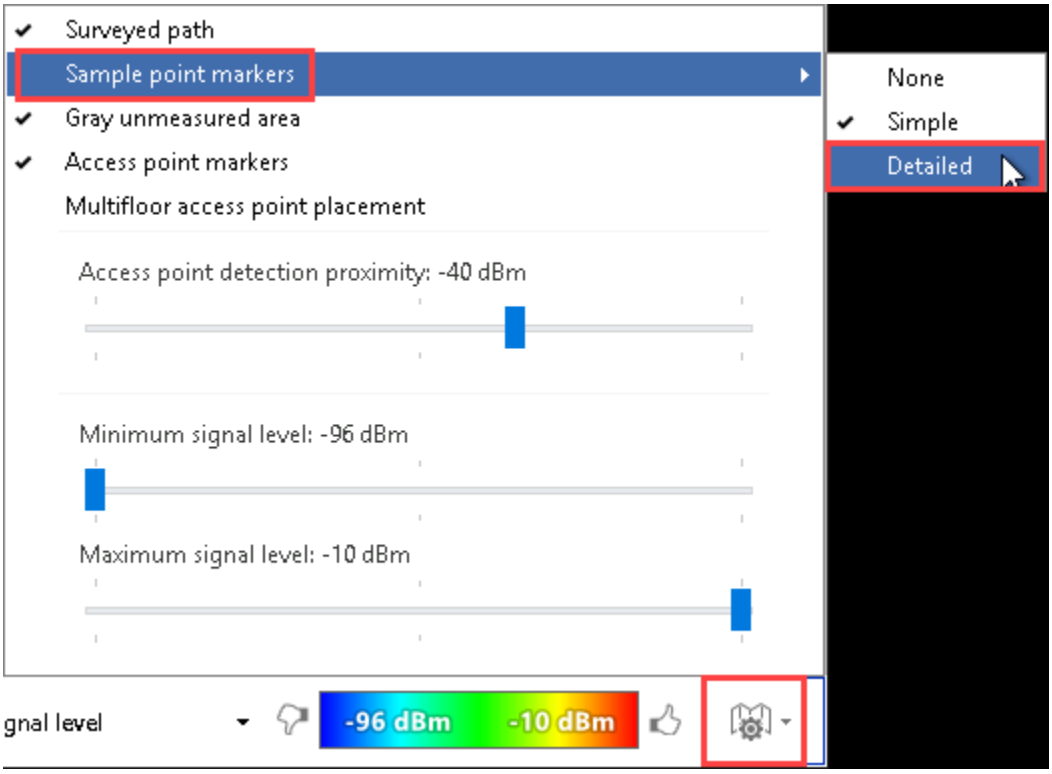
2. In the Transmitters pane, **click** the **checkbox** for the **FiOS group** to hide the corresponding heatmap.

   This should leave only the two Netgear transmitters that you own.

3. In the lower-right corner, **click** the **Settings icon**, then **select Sample point markers >**

Detailed.

Setting the sample point markers to Detailed allows you to easily see the signal levels at every sample point.

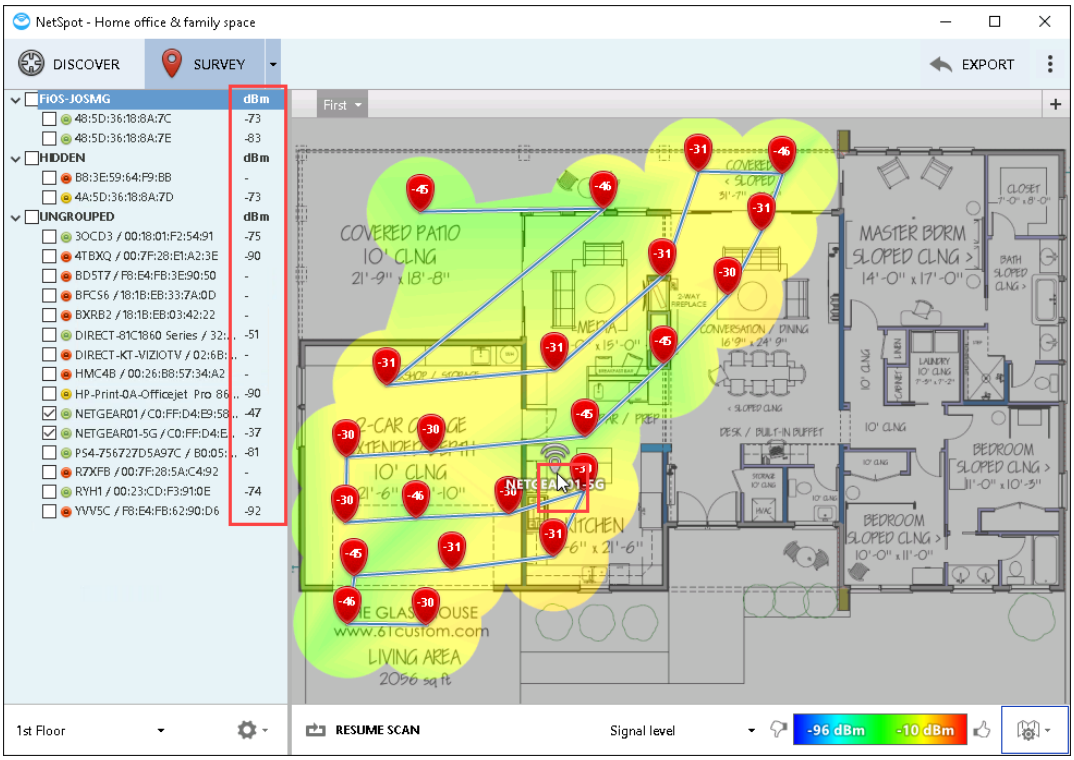


Sample point markers > Detailed

Note: As a rough comparison, you can think of -30 dBm as the equivalent of having five bars on your smartphone and -96 dBm as being barely one bar. If you observe the different signal levels across the site, you should see they are consistently between -30 dBm and -46 dBm, which indicates very favorable coverage.

4. **Make a screen capture** showing the **signal level heatmap with detailed sample points**.

5. In the Site pane, **hover your cursor** near the **NETGEAR01-5G access point icon** and **observe** the signal level values that appear next to each transmitter in the Transmitters pane.



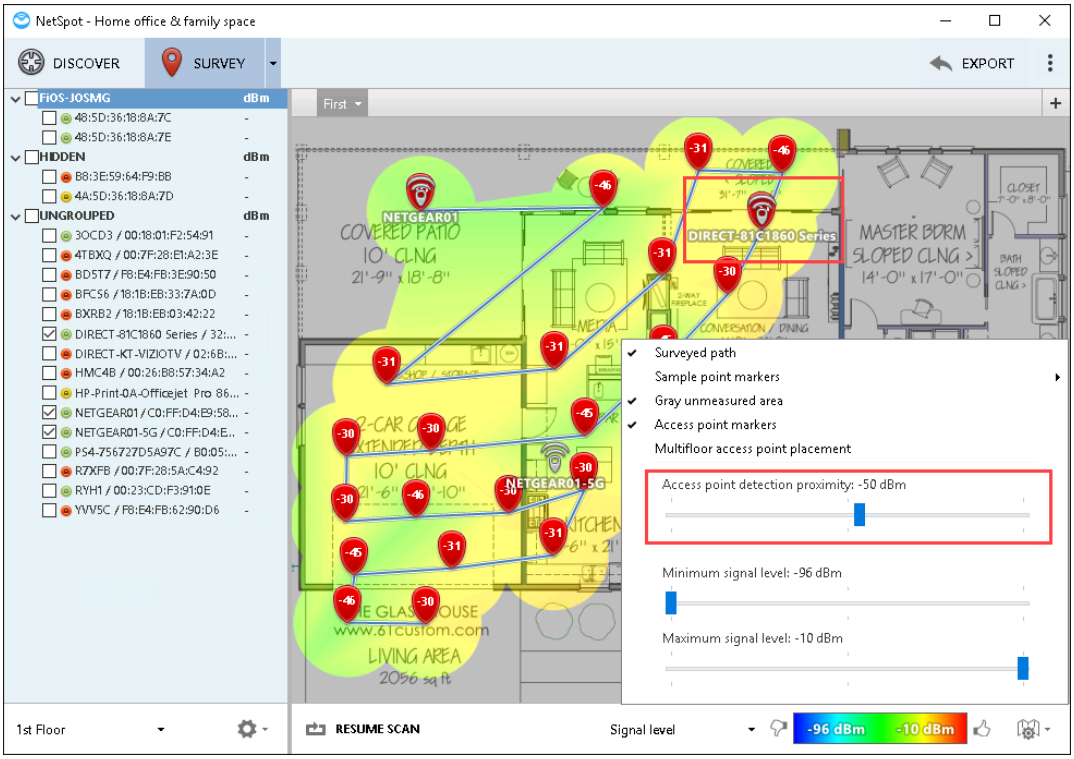
Signal level values

Note: The unchecked transmitters are your potential sources of interference in the part of the house that should otherwise have the strongest signal level from your NetGear access point. Most of these values are -70 dBm or higher – except for one transmitter, DIRECT-81C1860 Series. This transmitter is reporting a signal of about -50 dBm, which is much closer to -30 dBm than -96 dBm.

This seems like an access point we didn't know about! In many homes and offices, there may be Wi-Fi-enabled devices that have simply been forgotten about. Alternatively, this access point could be associated with a neighbor's WLAN or even a security threat. Either way, this should require further investigation, as it represents the most likely potential source of interference for the Netgear access point.

6. In the Transmitters pane, **click** the **checkbox** for the **DIRECT-81C1860 Series transmitter** to display the corresponding heatmap.

7. From the Settings menu, use the slider to **change** the *Access point detection proximity* setting to **-50 dBm**.



Change the access point detection proximity

Note: By expanding the access point detection proximity, NetSpot will attempt to identify the physical location of the access point based on the data it gathered during the scan. As discussed earlier, there's a good choice that it will get it wrong – as evidenced by the fact that NetSpot will also add a new access point icon for the 2.4 GHz Netgear transmitter – but it is still useful to introduce a visual marker for a nearby access point.

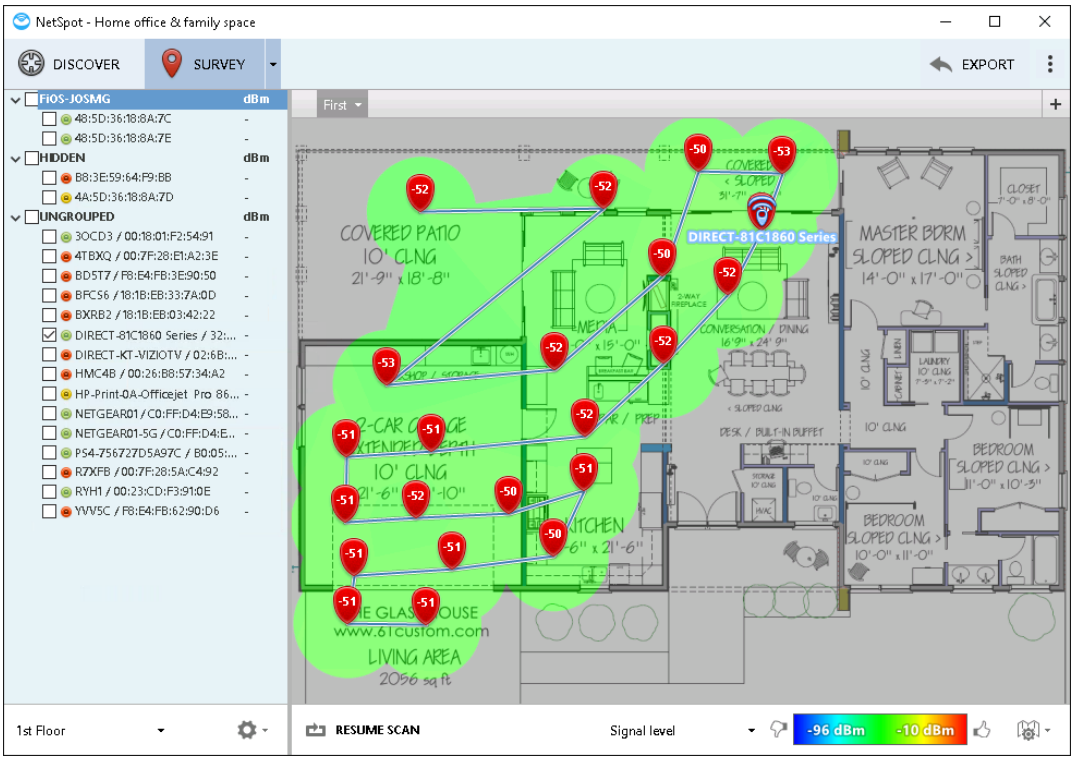
8. In the Site pane, **click** the **DIRECT-81C1860 Series access point icon** to display detailed information about this access point.

9. **Make a screen capture** showing the **DIRECT-81C1860 Series access point details**.

Note: At this point, your search for the DIRECT-81C1860 Series access point would likely require a return to the physical world and potentially a further NetSpot scan – neither of which are possible in this lab. However, before concluding this section, it is worth gathering some additional information to

understand why NetSpot placed the DIRECT-81C1860 Series access point where it did, which may provide some direction for locating the device in the physical world.

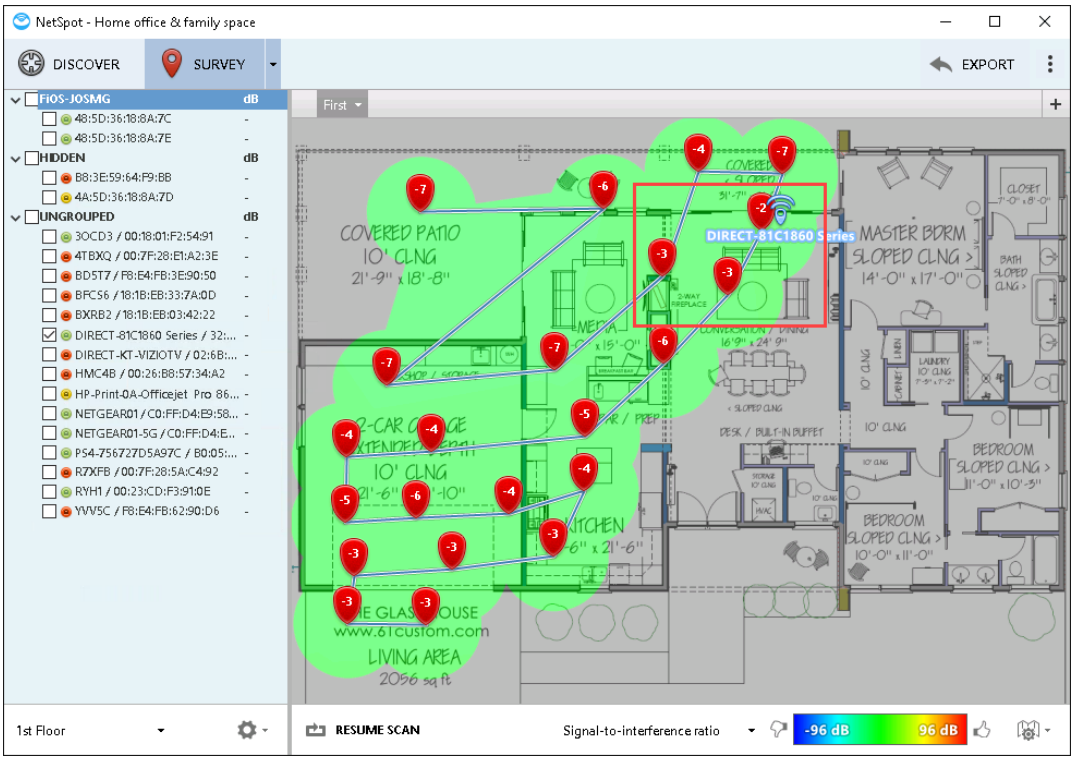
10. In the Transmitters pane, **click** the **checkboxes** for the **NETGEAR01 and NETGEAR01-5G transmitters** to hide the corresponding heatmap.



Signal heatmap for the DIRECT-81C1860 Series access point

Note: You should only see the signal level values for the DIRECT-81C1860 Series transmitter now. Unfortunately, they all look pretty uniform, with no obvious location where the signal is significantly stronger.

11. From the Options menu, **select Signal-to-interference ratio**.



SIR heatmap for the DIRECT-81C1860 Series access point

Note: If at any point you find that an access point icon is blocking your view of a sample point, you can move the access point icon by clicking it and selecting *Position manually*, then dragging the access point icon.

With the detailed sample markers activated, you can see that the sample points closest to the DIRECT-81C1860 Series access point icon all report SIRs of -2 dB and -3 dB. These SIR values are still below the acceptable threshold of 0 dB, and occur fairly close to the edge of the survey site, which suggests that the DIRECT-81C1860 Series access point may be located in the un-scanned parts of the site – possibly in the master bedroom. It's not much, but it's a start!

12. **Make a screen capture** showing the **SIR values for the DIRECT-81C1860 Series access point**.

13. **Close** the **NetSpot window**.

Challenge and Analysis

Note: The following exercises are provided to allow independent, unguided work using the skills you learned earlier in this lab - similar to what you would encounter in a real-world situation.

Part 1: Analyze Wireless Signal Strength and SIR

In this section of the lab, you will take on the role of a network consultant who has recently been hired to conduct an on-site survey of a client's wireless network. The location is a warehouse operated by the client that has recently been blanketed with an impressive collection of wireless access points. Considering this location receives frequent visits from investors who are toured through the facility, one of the client's top priorities is to ensure healthy connectivity throughout the guest network. You have completed your lengthy walkthrough of the warehouse and have now just sat down to begin your analysis. Your survey has been saved in the Single-family house NetSpot sample (the name is incorrect, ignore this), so you will need to open that up.

Once the survey is open, display the entire AFSI-GUEST network group and hide all others, then ensure that Signal level is set as the current filter.

Recalling that the usable signal range is typically considered to be from -30 dBm to -67 dBm you decide that anything lower is going to provide limited-to-no functionality, so set this as your criteria. In reality, you may have tested this to confirm the drop-off point, since your criteria may vary depending on the requirements of the network. Perhaps only light web-browsing and email functionality is required, in which case values in the -70 to -80dBm range may be considered contextually acceptable.

Next, locate the sample point that shows the lowest signal strength (remember that you can set your sample points to Detailed). Once you have discovered the marker with the lowest signal strength, change the AP detection proximity to -60dBm to display the guest APs in the visualization, then identify the BSSIDs of the closest access points.

Document the BSSID of the AP you discovered nearest the low-signal sample point.

While you have discovered a low sample point, you will also notice a fair amount of blue (poor signal level) in the visualization. This sample point is just one instance of poor coverage, but you can find various other points with values lower than -67dBm by clicking within these blue areas. Naturally, these areas would be addressed in your overall report, but for now you will complete your ruling on the sample point identified.

The signal level is not great, but what about the signal-to-interference ratio? That should provide a better indication of the wireless client experience at your sample point. If SIR is reasonable, then you can opt to run some additional testing, or at the least, have some data points to share with the client and determine whether this area is worth giving any more attention to at all. Change your filter to SIR to capture a fuller story, and then log your findings.

Document the SIR value of the low-signal sample point you identified above.

Part 2: Analyze Wireless Network and Frequency Coverage

Using the general consensus that anything with an SIR ratio of at least 0dBm will provide a reliable connection, there is now not so much to complain about, as your sample point passes that litmus test.

Now that you have evaluated their guest network, it is time to train your tool on the WPA2-guarded access points.

Note: An ESS, or Extended Service Set, is a group of multiple Basic Service Sets (BSS, an AP and its associated stations), all of which share a common identifier (the ESSID, sometimes still referred to as the SSID). ESS's provide greater coverage over a geographic area by distributing multiple instances of their same-named routers at strategic locations, enabling clients to maintain strong signals throughout the location by roaming between constituent BSS's – that is, automatically connecting to them based on a given criteria (usually signal level).
The client has three WPA2-enabled Extended Service Sets (ESS) at the location. First, there are AFSISupport2G and AFSISupport5G, which provide access to a management network reserved for company technicians and administrative personnel. These ESS are locked down with a WPA2-Enterprise (802.1X) implementation and advertise on both the 2.4GHz and the 5GHz frequency bands. The remaining network, AFSI-WPA, has a fleet of APs in WPA2-Personal security mode, and provides access to basic company resources such as email and their knowledge base. The client has requested that both 2.4GHz networks cover the entire survey site, so go ahead and confirm that.

Using an appropriate combination of filters and transmitter selections, determine if either of the WPA2-Personal 2.4GHz groups have any dead zones (zones with no connectivity).

Hint: Make sure to select only the APs relevant to the network you are interested in evaluating coverage for. If you have selected others, they may fill in otherwise blank/cold spots in the visualization, causing you to believe the target network is covering a greater area than it actually is.

Document the network(s) with any dead zone(s).

Make a screen capture showing the **dead zone you identified above**.

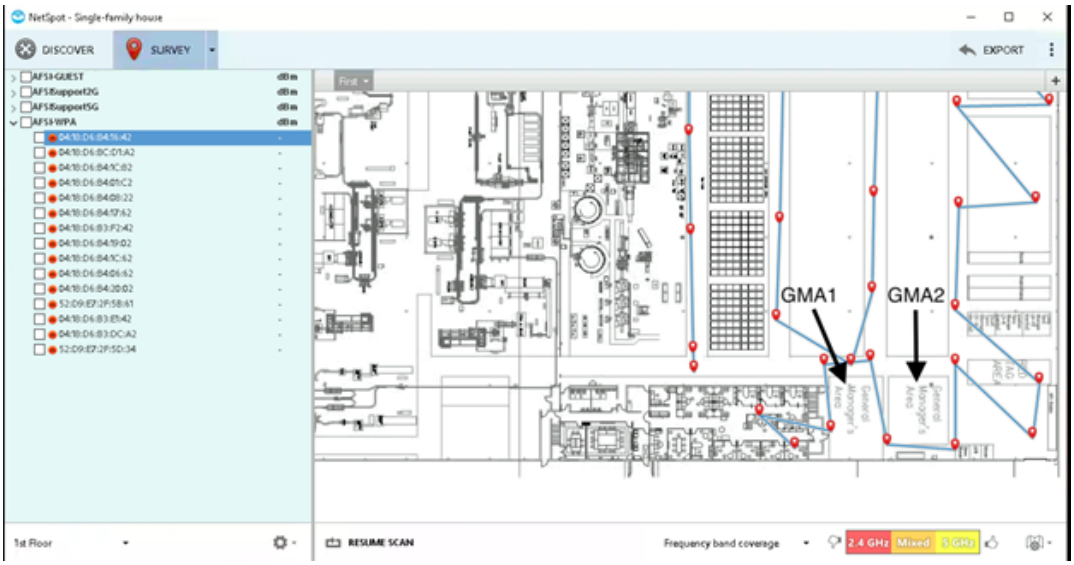
While you are in there, you should also take a look at 5GHz coverage, in case the client wanted to prioritize access to that band from any specific locations. Using the frequency band coverage filter and an appropriate transmitter selection, determine total 5GHz coverage.

Make a screen capture showing the **5GHz network coverage in the visualization**.

Part 3: Find the Sweet Spot

You have reported your findings to the client. You thought they may have been concerned that their 5GHz network was providing little-to-no coverage for the general manager’s area, but they noted they would be hard-wired there, and that the 5GHz was mostly for the floor, to circumvent interference generated by the various 2.4GHz appliances they use in the aisles. However, they had planned to convert one of these GM areas into a conference room, so they figure they should select the one with the best connection to the guest network. To you, this translates to “which office gives me the best SIR for AFSI-GUEST,” so you immediately set to find that out.

Document which GM area has the better SIR on the guest network (using GMA1 or GMA2 to answer, per the screenshot below).


NetSpot - Single-family house
DISCOVER
SURVEY
EXPORT
GMA1
GMA2
1st Floor
RESUME SCAN
Frequency band coverage
2.4 GHz
Mixed
5 GHz

GM areas