

Wireless Site Surveys: The Secret to Great WLAN Coverage

What do building materials like rebar and chicken wire have in common with microwave ovens and tinted windows? They can all affect the signal strength and quality of a wireless local area network. Interference is a critical factor in planning proper placement of wireless access points in small and medium sized businesses, schools, and health care organizations. This guide shows IT teams how to physically survey their buildings before rolling out a new wireless network to account for factors like interference and deliver a great user experience.

A Plan for a Plan

With ubiquitous wireless device usage today, people expect glitch-free performance in multimedia content delivery and the ability to wander a room while maintaining constant connectivity. WLAN usage will only increase with expanding adoption of laptops, smartphones, and tablets as well as latency-sensitive applications such as interactive learning and Voice over IP.

Consistent and reliable wireless local area network (WLAN) coverage requires the right density of access points coupled with optimal placement of access points. During the site survey process described below, we will review how to physically test the wireless signal, identify interference, and map out the best placement of access points throughout the site.

Since every site is different, the site survey process can take a few hours for a single floor up to several days to assess a multi-story site with many users. The larger and more intricate the physical plant, the more experimentation may be necessary.



Site Survey Ingredients

A proper site survey requires:

- A test access point
- A laptop associated to the test access point
- Basic site survey software¹
- A physical or digital floor plan of the actual site

A digital floor plan loaded into the site survey software permits the coverage areas to be overlaid on the floor plan, delivering a complete digital visualization of the site. The survey software should allow calibration of the floor plan to scale.

5 Basic Steps of a Good Site Survey

The survey process includes five basic steps, which will be repeated throughout the site:

1. **Placement.** The test access point is placed in a location that could potentially be the final location of the deployment.
2. **Analysis.** The IT team member uses the site survey software to record the RF and network conditions between the laptop and the access point. Some common parameters to collect are:
 - *Data rate (Mbps).* This reading shows throughput: the higher the data rate, the better that multimedia and streaming applications can perform.
 - *Signal strength (dBm).* This measurement shows the quality of the connection between the laptop and the access point. A low signal rate lowers the data rate and makes it harder for clients to connect or maintain a connection.
 - *Background noise (dBm).* Unless interferers can be relocated, the design will need to account for this factor.
 - *Signal-to-noise (dBm).* This number is a calculation of the two factors above. A high signal to noise ratio means a better user experience.

¹ Several free survey applications are available on the Internet, including Wi-Spy, InSSIDer, Netstumbler, and AirMagnet.

3. **Threshold.** The IT team member should move gradually away from the access point and observes changes to the above parameters. If the signal strength falls below the threshold specified in the vendor's manual, the laptop has reached the outer boundary of an "acceptable" coverage area.
4. **Boundary.** The IT team member will navigate around the first access point site (including in adjacent rooms), defining the boundary of the acceptable coverage area on the floor plan. The boundary location and readings should be noted on the floor plan.
5. **Dead spots.** Within this coverage area, the tester will move around to identify any "dead spots," places where the signal drops below requirements.

Impact of RF Propagation

The site survey should also identify "interferers" in the environment, such as building construction and other wireless devices. For example, wood frame buildings permit a signal to pass more freely than reinforced concrete. This obstruction explains why sometimes a signal drops precipitously when a user changes rooms, even if the user remains physically near the access point itself. Other permanent features such as steel fire doors and elevator shafts can also block reception.

Table 1 provides some examples of the impact of a building's construction on a network. These figures are rated for 2.4Ghz. The losses are generally doubled at 5Ghz. For example, if a user carried a tablet from a room with an access point and stood in the hallway, the signal would drop by 20 dB. If the user went upstairs and stood directly above that access point, the reinforced ceiling between the device and the access point would cause a 25 dB drop. The chart is also useful for estimating coverage in areas of the building where the tester cannot gain access.

Obstruction	Loss dB
Clear Window	3
Tinted Window	5-8
Light Wall	5-8
Medium Wall	10
Heavy Wall	15-20
1 ft. Wall	20-25
Floor/Ceiling	15-20
Reinforced Floor/Ceiling	20-25

Table 1: Examples of the impact on signal of various building attributes.

Impact of RF Attenuation

In addition, the survey should document other devices in the environment that may interfere with wireless signals. For example, the site survey should capture the number and names of neighboring access points that the survey is detecting, and the RF channels/frequencies that the detected devices are using. This information will help during planning and implementation and after deployment should troubleshooting be necessary. Other access points in the neighborhood could justify the addition of a wireless controller that can intelligently direct wireless traffic to a different RF channel.

The wireless signal can also be affected by less obvious interferers, such as cordless telephones, motion sensors, Bluetooth devices, heavy machinery, and microwave ovens.

The location and readings of the potential interferers should be included in the site survey. Note that it may be possible to relocate interferers like cordless phones and microwave ovens. The final plan should also accommodate anticipated new or future uses of these and other wireless devices. For example, if the organization plans to convert a closet into a kitchen area, that room would likely include a microwave oven. The surrounding access point placement should allow for this interference.

Repeat This Procedure To Cover the Site

The rest of the survey repeats the five basic steps: placement, analysis, threshold, boundary, and dead spots. The IT team member will reposition the AP in another likely location and map out signal strength, dead spots, interferers, and competing networks again, repeating until every room and space has been mapped. The goal is to overlap the "acceptable" signal zones so that every part of the site has good coverage. A user could carry a laptop, tablet, or smartphone from one end of a room to another and into a separate room without dropping the connection or experiencing static on a voice call or video stream.

Site Survey Outcome

A site survey produces a bill of materials (BOM) for the appropriate number of access points, a map with desired locations of the access points, and a rough estimate of predicted coverage (similar to the “heat map” shown in Figure 1). The survey should also set expectations for the possible need for a wireless controller to manage around neighboring networks.

Post Deployment Troubleshooting

After installation, end users may find places where the network is not delivering the expected user experience. The annotated floor plan provides a way to ensure that the initial deployment matched planning assumptions about access point locations and interferers. In addition, sometimes users bring in interfering devices or add “rogue” access points to a network, or neighbors change their deployments. Troubleshooters should look for these changes and also verify that performance options on the wireless controller are working correctly. For example, the load-balancing feature should be moving users dynamically to the least loaded access points, and the channel selection capability should be maneuvering the network around neighbors’ deployments.

Conclusion

With this understanding of the process and value of a site survey, an organization should be well prepared to successfully plan the placement of access points. This modest amount of pre-work will help to ensure the right level of investment. Users can enjoy a satisfying wireless network experience while IT teams face the least possible maintenance effort and cost.

About NETGEAR

All NETGEAR ProSafe wireless access points deliver secure, reliable, and high-performance wireless local area networks (WLANs). NETGEAR wireless access points support multiple wireless LANs, so surveillance cameras, POS systems, employee wireless traffic, and customer access can be easily separated—maximizing available bandwidth and ensuring network security. ProSafe wireless access points provide a reliable centralized wireless management solution that is easy to use.

