

How To Do a Successful RF Site Survey

Overview

At some point in your job, you'll need to deploy a WLAN network. Don't be fooled by equipment that states it is 'self-configuring' or 'auto-negotiating'. Wi-Fi is very complex, and dozens of variables can affect the success of your network. A site survey is a crucial component of a WLAN deployment to guarantee these systems will work effectively in your network and ensure there are no dead spots in the office while someone is trying to host a video conference.

What is an RF site survey?

A Wi-Fi RF site survey is a process to gather information about the RF environment and the business WLAN requirements so the surveyor can design a WLAN that will have the coverage and capacity needed for a high-performance network.

Site surveys are often the most important steps in a WLAN design, since the information gathered will be used to estimate not only how much equipment, cabling or power is required for the WLAN, but also where best to place the access points.

When you conduct a survey you will need to examine:

- Sources of interference, and locations of those interferers
- Channel utilization expectations
- Effects of walls, floors, doors, windows, elevators, etc on RF signal behavior
- Signal strength Propagation studies to determine new and existing coverage areas
- Power outputs/cabling requirements

Ultimately, a site survey seeks to determine or validate the answers to the following questions:

- 1. How many access points need to be installed?**
- 2. Where should they be installed?**
- 3. How should they be configured?**

These questions are simple, but when thousands of dollars in equipment and services are on the line, you want to ensure that the client's budget for a deployment is money well spent. A thorough site survey will do just that.

Objectives Of This Guide

The Geeks at MetaGeek created this guide to help you get your job done and pull off a successful installation. This site survey guide will help you understand what the site survey process can and cannot do, different types of site surveys, and recommended tools to get the job done. You'll also be able to perform a basic site survey, step-by-step.

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Section 1: Research and Resources

Gathering information, requirements and expectations from the client site is just as important as conducting the actual survey, so don't skip this part! Schedule a consultation site visit ahead of time if possible to tour the facility and gather information from the client.

Information the client will need from you

- A brief explanation of WLANs and how Wi-Fi works. This will help your client get oriented with the site survey process.
- Purpose of a the site survey (what it can and cannot do). This will ensure that you and your client walk away from this job happy and maintain a good business relationship.

Information you will need from the client

To set expectations properly and get everyone on the same page, you'll want to find out exactly what the client's requirements are. The client may or may not know their own requirements in detail, so make sure to discuss the following topics during the consultation to get your bases covered:

- Business Requirements
 - Purpose of the network
 - Approximate number of client devices on the network, and type of devices
 - BYOD requirements
 - Applications to be used
 - Budget for the project
 - Expected timeframe for completion of the project
- Technical requirements
 - Performance Requirements
 - Number of users
 - Required Coverage
 - Roaming capabilities
 - Other existing LAN deployments (VOIP, other WLAN, etc.)
 - Facility limitations (inaccessible areas, cannot mount AP to ceiling, etc.)
- Security Requirements
 - WIPS requirements (Wireless Intrusion Protection System)
 - Security concerns for the business
 - Past security issues, if any
 - Guest access and/or captive portal capability
- Resources available to support the deployment
 - power outlet access and locations
 - power/server/communications closet locations
 - ethernet switches
 - access to floor plans (PDF, CAD drawing, image file) to use in site survey
 - ISP plan (what speed do they pay for?)

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As the project moves further on, it will become more costly and difficult to get stakeholders together to answer questions about their requirements, so ask as many questions as possible during this meeting and take detailed notes.

Section 2: Spectrum Analysis

Before performing a manual site survey, it's important to do a walk-through of the site with a spectrum analyzer to look for sources of interference and to get an overall baseline of the Wi-Fi environment. A spectrum analyzer is a device that measures a signal's amplitude as it relates to frequency. If interference is found, it's useful to know what types of devices are transmitting, how loud they are, and how the wireless deployment will be affected.

What is a Spectrum Analyzer?

There are three types of Wi-Fi interference that can affect your deployment: Co-Channel, Adjacent-Channel, and Non-Wi-Fi interference. Non-Wi-Fi interference can cause the most interference, as it can only be detected by a spectrum analyzer. Common non-Wi-Fi devices that can cause interference are:

- Wireless security Cameras
- Audio equipment
- Microwave ovens
- Cordless Phones



These devices operate in the same frequency (2.4GHz and 5GHz) space as Wi-Fi devices, but do not use the same communication protocols that Wi-Fi does. This causes Wi-Fi transmissions to be delayed or disrupted. As you're considering the space for the site survey, it is important to first rule out any interference issues, both from Wi-Fi and non-Wi-Fi devices. This is where Wi-Spy + Chanalyzer comes in.

Wi-Spy + Chanalyzer

Wi-Spy is a pocket-sized USB-based spectrum analyzer that plugs into your Windows laptop or tablet to capture raw RF signals. Wi-Spy's accompanying software, Chanalyzer, lets you visualize both Wi-Fi networks and Raw RF data signals that are captured from your computer and Wi-Spy. It then displays the RF data that you captured from the Wi-Spy and shows you the frequencies and channels on the 2.4 GHz and 5 GHz bands where possible interfering devices are operating.

Using a color-coded Utilization Graph, Chanalyzer allows you to see how constant the RF noise is across the Wi-Fi bands, and is useful in understanding just how consistent the interference is within a given range.



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of time. Using data from Chanalyzer, you can make educated decisions about where to place access points to avoid or mitigate interference.

Section 3: Site Survey Types

Site surveys can be conducted in both indoor and outdoor environments. Both environments have different characteristics that impact Wi-Fi performance and should be considered during a site survey. This section will focus primarily on indoor site surveys.

Indoor RF site survey characteristics

- RF interference source types and locations
- Channel utilizations and appropriate Wi-Fi bands for predetermined applications
- Effects of walls, floors, doors, windows, elevators, etc on RF signal behavior
- Propagation studies to determine new and existing coverage areas
- Power outputs
- Cabling requirements

If the building isn't easily accessible and you can't get on-site (geographically distant or unfinished), a virtual or **predictive planning** tool can help you determine approximate AP placement and network design. The "AP-on-a-stick" or manual survey method means putting an AP on a telescoping pole, surveying around it to see what the actual coverage looks like, and moving the AP to the next location.

Both methods are conducted with site survey software that uses a floor plan of the building or space to map the RF environment. There are a number of different requirements or considerations that must be taken into account before performing either one to ensure accuracy.

Predictive Site Surveys

Often built into site survey applications, predictive planning modes can help you design a network before it is installed. Coverage calculations may not perfectly coincide with real world RF propagation, but they can give you a very good idea of what AP coverage and cell overlap will look like. Predictive surveys offer an easy way to test multiple "what if" scenarios on AP placement and propagation from environmental elements like walls, doors, windows, and elevators.

Predictive modeling software uses algorithms to forecasts the following:

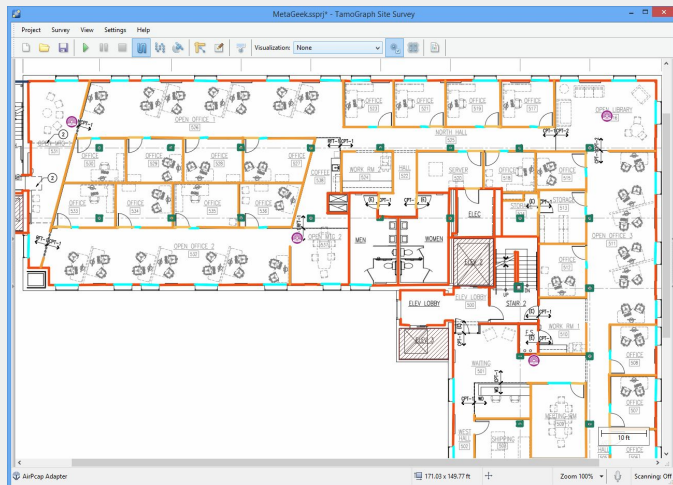
- AP Placement
- Power Output Settings
- How many APs are required
- Data Rates
- Coverage Areas
- Channel Settings

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Predictive modeling offers the convenience of being able to determine network design without having to be on-site. However, the accuracy of predictive modeling is limited to the information that is put into the software, so on-site conditions should be verified.

Predictive Site Survey Steps:

1. Import a floor plan image
 - a. A real floor plan (PDF, CAD drawing, image) works best.
 - b. You can get away with a picture of the fire escape plan in a pinch (just don't use it for really serious work)
2. Define the scale of the floor plan and calibrate
 - a. Grab a tape measure and measure a fairly long wall
 - b. A door frame usually isn't accurate enough; go for a 25+ foot wall
3. Draw in wall types
 - a. "This is a brick wall"
 - b. "This is drywall"
4. Draw in other features like columns, elevators, and metal shelving
5. Place and arrange virtual access points to get a rough idea of what the RF propagation will look like
6. Remember: a good, modern network is designed for capacity, not just coverage.



Preparing for predictive RF planning in TamoGraph

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Manual Site Surveys:

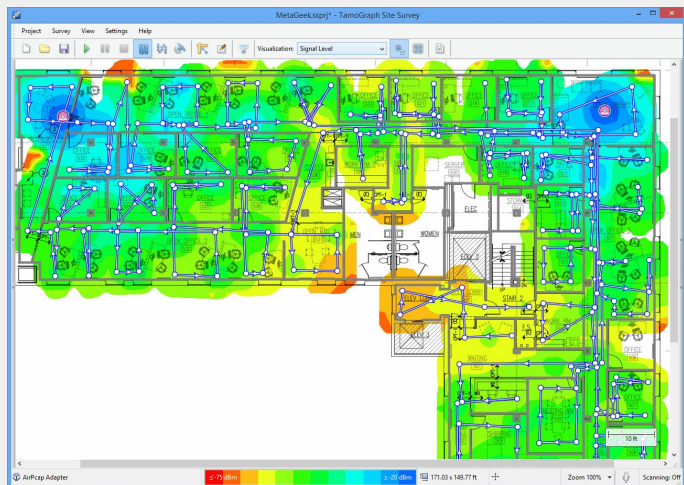
A manual site survey is done on-site, and requires a physical walk-through of the environment being surveyed. This gathers RF readings from the perspective of the client device offering a higher level of accuracy for modeling cell boundaries, however they are the most costly survey due to the amount of administrative overhead required. A manual site survey can be used to:

- Identify areas of noise and channel interference
- Determine optimal AP placement, channel assignment and output power settings
- Discover adequate bandwidth and data rates
- Model packet loss, retries and wireless speeds

Manual survey software can use either Passive or Active modes. Passive mode captures and compares ALL RF data in the area, while active mode captures throughput testing figures associated to a single AP for detailed connectivity testing.

Manual Site Survey Steps:

- 1) Import a floor plan image
 - a) A real floor plan works best
 - b) You can get away with a picture of the fire escape plan in a pinch (just don't use it for really serious work)
- 2) Define the scale of the floor plan
 - a) Grab a tape measure and measure a fairly long wall
 - b) A door frame usually isn't accurate enough, go for a 25+ foot wall
- 3) Enlist a helper for the site survey, who can:
 - a) Clear people out of the way
 - b) Lead you through the building
 - c) Unlock doors
- 4) During the site survey:
 - a) Walk in straight lines
 - b) Walk at a consistent pace
 - c) Click on your current location in the floor plan whenever you change direction
- 5) Cover the building as thoroughly as you can, while hitting the corner of each room and avoiding gaps in where you survey.



Tamograph manual survey of the MetaGeek office

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Recommended Site Survey Software

MetaGeek recommends the following site survey software. Each software title in the chart below has its own unique features and benefits, and each fits into a different price point to comply with budget constraints and requirements.

	VisiWave Site Survey	Tamograph Site Survey Pro	Ekahau Site Survey
Wi-Spy Compatibility	✓	✓	✓
Passive Wi-Fi Logging	✓	✓	✓
Signal Strength Map	✓	✓	✓
Wi-Fi Report Generation	✓	✓	✓
GPS Integration	✓	✓	✓
Channel Map	✓		✓
Active Ping Wi-Fi Scanning		✓	✓
TCP/UDP Data Rates		✓	✓
Virtual Wi-Fi Planning		✓	✓
Wi-Fi Auto-Planner			✓
Import CAD Files		✓	✓
Voice Planning			✓
RTLS Support			✓
Capacity planning			✓
Capacity analysis			✓
Read walls from CAD files			✓
Template-based, 100% customizable reporting			✓
Cisco integration			✓

Section 5: Reports & Deliverables

After completing the site survey, the next step is to compile all of your findings and recommendations into an easy-to-read report for the client. This report provides justification for the work you did and the recommendations you made to the client. The report is often the only physical deliverable your clients will receive at the end of the job, so the more detailed the report, the better.

Suggested Content for the Site Survey Report

Purpose Statement: A concise identification of what the customer required from you and what the given business justification is.

Customer Requirement Analysis: Anything given to you by the customer that includes requirements or business constraints.

Spectrum Analysis Results: The results of the spectrum analysis survey. Including where the interference is coming from, how it affected the LAN deployment, and if it is a problem that can or cannot be eliminated.

RF Coverage Analysis: Based on the aforementioned business goals, is the RF coverage where it needs to be? Are there any places of concern and can those concerns be fixed?

Performance and Capacity Analysis: The analysis of how you tested the deployment and what the results of that testing are.

Hardware Placement & Information: Where have the APs been placed? How are the devices powered? What are the settings for each device?

Wireless Security: Authentication recommendations.

Additional Information to Consider Including:

- Photos of recommended AP locations
- Antenna types as well as what mounting was used
- Cabling type, power requirements, and power source
- Areas of coverage and gaps
- Report showing predictive coverage of every AP

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We hope you've enjoyed reading this guide and taken away some valuable information that will help you do your job! For more training content on all things Wi-Fi and RF, visit the MetaGeek website at www.metageek.com

Special thanks to Robert Bartz from [Eight-O-Two Technology Solutions](#) for his CWNA and CWNP training for the team at MetaGeek.

For more information about the site survey products mentioned in this guide, or for help outfitting your site survey toolkit, head over to www.metageek.com

Additional Resources and Further Reading

Why One Access Point Per Classroom Approach Is Wrong, [WLANPros.com](http://www.wlanpros.com)
<http://www.wlanpros.com/one-ap-per-classroom-approach-wrong/>

CWNA Study Guide, available on [Amazon](#):
<http://www.amazon.com/CWNA-Certified-Wireless-Administrator-Official/dp/111812779X>