

# **40MHz & Wide Channels**

In Dense Wi-Fi Deployments



### INTRODUCTION

Wi-Fi is the backbone of modern home connectivity. From video streaming and online gaming to smart home automation and video conferencing, reliable and fast wireless access is more important than ever. One way to boost the perceived Wi-Fi performance is by adjusting the channel width. In residential settings, users often have the option to set their routers to use 20, 40, 80 MHz or even wider channels. While wider Wi-Fi channels can offer higher throughput, they also come with trade-offs that can affect network reliability, interference, and overall performance.

In this article, we explore the pros and cons of using wide Wi-Fi channels in dense Wi-Fi deployment scenarios, helping you make an informed decision about your optimal setup.

# Understanding Wi-Fi Channel Width

Before delving into the pros and cons, it is important to understand what channel width means in the context of Wi-Fi.

Wi-Fi signals are transmitted over radio frequencies, and these frequencies are divided into channels. Each channel occupies a specific bandwidth:

**20 MHz:** a standard channel width which is less prone to interference and congestion due to cross channel and same channel interference;

**40 MHz:** doubles the bandwidth by bonding two 20 MHz channels and can provide higher throughput.

**80 MHz:** bonds four 20 MHz channels and offers even higher data rates, ideal for bandwidth-intensive tasks.

**160 MHz:** bonds eight 20 MHz channels, available with Wi-Fi 6E or 7 devices

**320 MHz:** bonds sixteen 20 MHz channels, available exclusively with Wi-Fi 7 device



The wider channels are available primarily on the 5 GHz (example above) and 6 GHz bands (the latter with Wi-Fi 6E or Wi-Fi 7), although 2.4 GHz can support 40 MHz in theory—but not without complications covered in more detail in the following sections.

### HIGHER THROUGHPUT AND SPEED

The main appeal of wider channels is their ability to deliver faster data rates. By bonding multiple 20 MHz channels, the resulting Wi-Fi configuration can transmit more data simultaneously. 40 MHz can theoretically double throughput compared to 20 MHz, while 80 MHz can offer up to four times the throughput of a 20 MHz channel, assuming ideal conditions, even while maintaining the same modulation scheme (bits/ Hz). Along with the evolution of Wi-Fi, more advanced modulation schemes were introduced, providing the increase in the available bandwidth even with the same channel width.

The increased bandwidth enabled by wider channel makes it highly beneficial for:

- Streaming 4K or 8K video
- Online gaming
- Large file downloads and backups
- Video conferencing

## BETTER UTILIZATION OF HIGH-SPEED INTERNET PLANS

With many residential broadband plans offering 300 Mbps, 500 Mbps, or even 1 Gbps speeds, narrow channels can become a bottleneck. Wider channels enable routers and devices to better utilize the available bandwidth, especially over short distances.

# REDUCED LATENCY FOR LOCAL NETWORK TASKS

For tasks within your local network—like streaming from a home server, using wireless printers, or accessing NAS devices—wider channels can reduce latency and improve responsiveness, making the experience smoother.

## ENHANCED PERFORMANCE FOR WI-FI 5/6/6E/7 DEVICES

Modern routers using Wi-Fi 5 (IEEE 802.11ac) and Wi-Fi 6 (IEEE 802.11ax) technologies are designed to take advantage of wider channels, particularly in the 5 GHz band. Wi-Fi 6 also introduces more efficient modulation schemes (like OFDMA) that are more effective when used with wider bandwidths.

# IMPROVED PERFORMANCE IN LOW-INTERFERENCE ENVIRONMENTS

In homes where neighboring Wi-Fi signals are minimal—such as suburban houses or detached properties—there is more freedom to use 40, 80, 160, or even 320 MHz channels without as much concern for interference. In such settings, the benefits of higher throughput are easier to realize.

# Wider Wi-Fi Channels: *Cons* **INCREASED INTERFERENCE AND OVERLAP**

One of the biggest drawbacks of wide channels is increased interference. Each additional 20 MHz chunk increases the likelihood of overlapping with other nearby Wi-Fi networks, especially in crowded neighborhoods or apartment complexes.



### FOR EXAMPLE:

- In the 2.4 GHz band, using 40 MHz effectively occupies two-thirds of the band.
- In the 5 GHz band, there are more non-overlapping 20 MHz channels, but only a few clean 80 MHz channels to use
- In the 6 GHz band, there are 30 available 40 MHz channels, 15 available 80 MHz, 7 available 160 MHz, and only three 320 MHz channels.

### MORE OVERLAP CAN LEAD TO:

- Packet collisions
- Retransmissions
- · Lower real-world throughput

A typical 2.4 GHz spectrum view for a medium density residential deployment is shown below. Note the presence of 40 MHz channels overlapping with a number of 20 MHz channel SSIDs present in the spectrum.



A typical 5 GHz spectrum view for a medium density residential deployment is shown below. Note the presence of 20, 40, and 80 MHz channels overlapping with a number of 20/40 MHz channel SSIDs present in the spectrum. No 160 MHz channels are present in this case.



# UNSTABLE PERFORMANCE IN CONGESTED ENVIRONMENTS

In areas with many Wi-Fi networks (e.g., urban apartments), using wide channels can degrade performance. Devices constantly contend for airtime, and the larger footprint of wider channels makes your network more vulnerable to neighboring interference.

#### This instability may manifest as:

- Slow or dropped connections
- · Inconsistent streaming quality
- Reduced effective speeds, especially during peak
  hours

# LIMITED DEVICE COMPATIBILITY AND CAPABILITY

Not all Wi-Fi devices support 40 or 80 MHz channel widths. Older smartphones, tablets, and laptops (devices released per 2010) may only use 20 MHz, even when connected to a router broadcasting wider channels. As a result, the benefits of wider channels are only realized by newer, compatible devices.

However, one has to also consider the IoT devices, which are typically built around much older, low cost Wi-Fi chipsets, typically restricting the device capability to only 20 MHz channel. Taking into account the limited throughput required by these devices and their focus on low power operation, the support for 20 MHz channel especially in the 2.4 GHz band will remain the requirement for many years to come.

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### SHORTER RANGE & PENETRATION ISSUES

# Wider channels are more susceptible to signal degradation due to:

- Increased noise sensitivity
- Lower power density (spreading the signal over a wider frequency)

#### This can reslut in:

- Shorter effective range, especially on 5 GHz and 6 GHz bands
- Weaker signal through walls and obstacles

In larger homes, this could mean certain areas receive slower or unstable connections unless additional access points or mesh systems are used.



### HIGHER POWER CONSUMPTION

Using wider channels requires more processing power and radio energy, both on the router and client devices. This can slightly impact battery life on mobile devices and increase heat/power usage on access points—though for most households, the impact is negligible.

### **REGULATORY AND DFS LIMITATIONS**

Some 5 GHz channels fall under Dynamic Frequency Selection (DFS) regulations, meaning they must avoid interference with radar systems. If an 80/160 MHz channel spans DFS frequencies and detects radar, it may be forced to vacate the channel—causing temporary network drops or switching to a narrower fallback channel.

This issue is particularly relevant in areas near airports or military installations.



# Real-World Considerations for

# **Residential Users**

### 2.4 GHZ VS 5 GHZ VS 6 GHZ

- 2.4 GHz: Avoid 40 MHz here unless you are in an isolated area. The band is too congested and only has only three non-overlapping 20 MHz channels.
- 5 GHz: Suitable for 40 MHz in most suburban homes.
  80 MHz can be viable but requires careful channel planning to avoid DFS and interference.
- 6 GHz (Wi-Fi 6E/7): Offers ample spectrum for multiple 80, 160, or 320 MHz channels with little interference—but only newer devices support it. Note that the 6 GHz band also enforces the use of WPA3, which has additional backward compatibility implications for any older or more feature limited devices.

### MESH NETWORKS AND BAND STEERING

Modern mesh systems often manage channel width dynamically. They may automatically downscale from 80 MHz to 40 or 20 MHz when they detect high interference or congestion. Band steering can also help move devices between 2.4 GHz and 5/6 GHz based on signal quality and channel availability.

### ROUTER PLACEMENT AND ENVIRONMENT

The success of using wider channels depends significantly on your home layout, wall materials, and router placement. Centrally located routers, away from thick walls and obstructions, will perform better with wider channels.

# Best Practices & Recommendations

### WHEN TO USE 40 MHZ WI-FI CHANNELS:

- You have multiple modern devices that can benefit from higher speeds.
- You live in a suburban or rural area with few nearby Wi-Fi networks.
- Your internet plan exceeds 100 Mbps.
- You need better performance than 20 MHz but 80 MHz is unstable.

### WHEN TO USE 80 MHZ OR WIDER WI-FI CHANNELS:

- You live in a standalone home with minimal Wi-Fi neighbors.
- You have high-speed fiber or cable internet (500 Mbps or higher).
- You use bandwidth-heavy applications like 4K streaming, VR, or large file transfers.
- Your devices are Wi-Fi 5/6/6E/7 capable, and you understand the risks of interference.

### WHEN TO STICK WITH 20 MHZ WI-FI CHANNELS:

- You live in an apartment or dense housing with many visible networks.
- You value stable connections over raw speed.
- Your devices are any older or low-end models and are unwilling or unable to upgrade them to something newer and supporting newer versions of IEEE 802.11 standard.

### CONCLUSION

Choosing the right Wi-Fi channel width is a balancing act between speed and stability. While 40 MHz and 80 MHz channels offer significant speed improvements and are attractive for modern, high-bandwidth households, they come with challenges—particularly in congested areas.

In residential environments, it is often best to start with 40 MHz on the 5 GHz band and monitor performance. If you find your network is stable and interference is low, upgrading to 80 MHz may provide a performance boost. Conversely, if you experience frequent disconnections or slowdowns, switching back to 20 MHz can improve reliability.

Ultimately, the key to maximizing home Wi-Fi performance lies not just in widening the channel, but in optimizing router placement, using modern hardware, and staying aware of your local wireless environment.



www.rgnets.com sales@rgnets.com 316 CALIFORNIA AVE RENO, NV 89509