



Qualcomm® Wi-Fi 7 Quick Reference Guide

Wi-Fi 7 is the latest advancement in wireless networking, promising to revolutionize the way we connect and communicate. This reference guide is designed to provide a comprehensive understanding of this technology and address commonly asked questions. Whether you are a network professional, a technology enthusiast, or simply curious about the future of wireless connectivity, we hope that this guide will serve as your go-to resource to understand Wi-Fi 7, its underlying principles, and its practical applications.

What is Wi-Fi 7?

[Wi-Fi 7](#), the 7th and latest generation of Wi-Fi, is designed to deliver unparalleled performance. It aims to provide extremely high throughput, deterministic low latency, and increased network capacity, enabling immersive and content-rich wireless experiences in cutting-edge applications such as XR, gaming, 4K/8K streaming, and real-time collaboration.

What are the key features of Wi-Fi 7?

Built upon the IEEE 802.11be Extremely High Throughput (EHT) standard, Wi-Fi 7 introduces remarkable enhancements. It incorporates ultra-wide 320MHz channels, allowing for massive capacity gains and accommodating the ever-growing demands of modern connectivity. Additionally, the implementation of 4K QAM modulation enables peak speeds to surge for lightning-fast data transfer. Wi-Fi 7 introduces Multi-Link Operation (MLO), a groundbreaking feature which significantly boosts throughput and maintains consistent low latency even in highly congested environments. These advancements enable users to enjoy seamless wireless experiences, regardless of the surrounding network conditions.

What is the role of Qualcomm Technologies in Wi-Fi 7?

With a rich history of pioneering wireless technologies and leadership in industry standards, Qualcomm Technologies is at the forefront of driving the transition to Wi-Fi 7. Through our cutting-edge connectivity solutions such as [Qualcomm® FastConnect™ 7800 Mobile Connectivity System](#), [Qualcomm® Networking Pro Series](#) platforms, [Qualcomm® Immersive Home Platforms](#), and [Qualcomm® 10G Fiber Gateway Platform](#), Qualcomm Technologies is unlocking unparalleled performance for a comprehensive device ecosystem. This ecosystem encompasses access points, routers and mesh systems, broadband gateways, smartphones, PCs, XR devices, and more. By leveraging Qualcomm Technologies' expertise and innovative solutions, users can expect to experience the full potential of Wi-Fi 7, enjoying virtually seamless connectivity and enhanced wireless experiences across a wide range of devices.



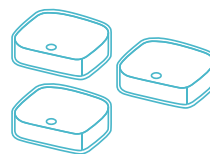
Mobile



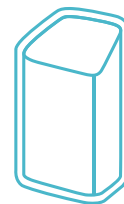
Compute



XR



Mesh Wi-Fi



Gateway



Enterprise

How does Wi-Fi 7 compare to Wi-Fi 6/6E and why upgrade to Wi-Fi 7?

[Wi-Fi 6](#) (IEEE 802.11ax standard) was primarily focused on delivering increased capacity through multi-user technologies such as OFDMA and MU-MIMO. Building upon this, [Wi-Fi 6E](#) extended the application of these capabilities, for the first time, into wider and more abundant channels within the unlicensed spectrum of the 6GHz band. Wi-Fi 7 builds upon these enhancements and further surges performance, particularly in terms of low latency, extremely high throughput, and even greater capacity through the most efficient use of spectrum.

Wi-Fi 7 offers several improvements over Wi-Fi 6/6E. It doubles the channel bandwidth to 320MHz, enhances throughput and capacity with 4K QAM modulation, and introduces Multi-Link Operation (MLO) and efficiency updates like preamble puncturing. These advancements enable reduced and consistent latency, even in congested environments. Wi-Fi 7 is designed to support immersive and bandwidth-intensive applications for home and enterprise environments.



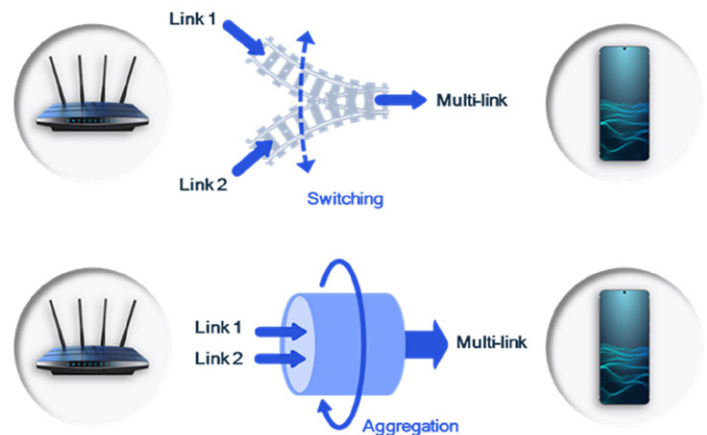
What is Multi-Link Operation (MLO) in Wi-Fi 7 and how does it work?

Multi-Link Operation is a key feature of Wi-Fi 7 that brings significant improvements in throughput, latency, and reliability. In the past, Wi-Fi client devices like smartphones were limited to operating on a single channel within the 2.4GHz, 5GHz, or 6GHz band. However, with the introduction of Wi-Fi 7 Multi-Link Operation (MLO), clients can now utilize multiple links across frequency bands.

Simultaneous Multi-Link Operation allows traffic to be aggregated across multiple bands, resulting in peak throughput and low latency, while *alternating* Multi-Link Operation dynamically switches traffic between bands to avoid wireless interference, ensuring deterministic and predictable low latency even in heavily congested environments.

Qualcomm Technologies' expert implementation of Multi-Link technology is at the heart of realizing massive gains in performance, including the most powerful multi-link client implementation called High Band Simultaneous Multi-Link (HBS Multi-Link), as well as mesh Wi-Fi networking with Qualcomm® Multi-Link Mesh technology.

Learn more: [Pushing the limits of Wi-Fi performance with Wi-Fi 7](#)



What is High Band Simultaneous (HBS) Multi-Link and what advantages does it offer?

The implementation of Multi-Link Operation methods known as High Band Simultaneous Multi-Link (HBS Multi-Link) offers exceptional benefits in terms of capacity, stability, and latency. HBS Multi-Link utilizes the high bands, which includes the 5GHz and 6GHz unlicensed radio bands with wide channels, including channels up to a peak 320MHz in the 6GHz band. With HBS Multi-Link, Wi-Fi 7 client devices like smartphones and PCs can establish two simultaneous high band channels and combine the throughput of both links to achieve significantly higher data rates and reliable connections. In regions where the 6GHz band is not available or 320MHz channels are not supported, HBS Multi-Link allows for the aggregation of available channels to maximize capacity. FastConnect 7800 with HBS Multi-Link is a key differentiator for next-gen smartphones, PCs, XR devices, and more, as it can enable the full performance of Wi-Fi 7 globally and optimizes the potential of both the increasingly accessible 6GHz spectrum and regions with only 5GHz availability, leaving the 2.4GHz spectrum for legacy Wi-Fi, Bluetooth, and IoT.

[View explainer video](#)

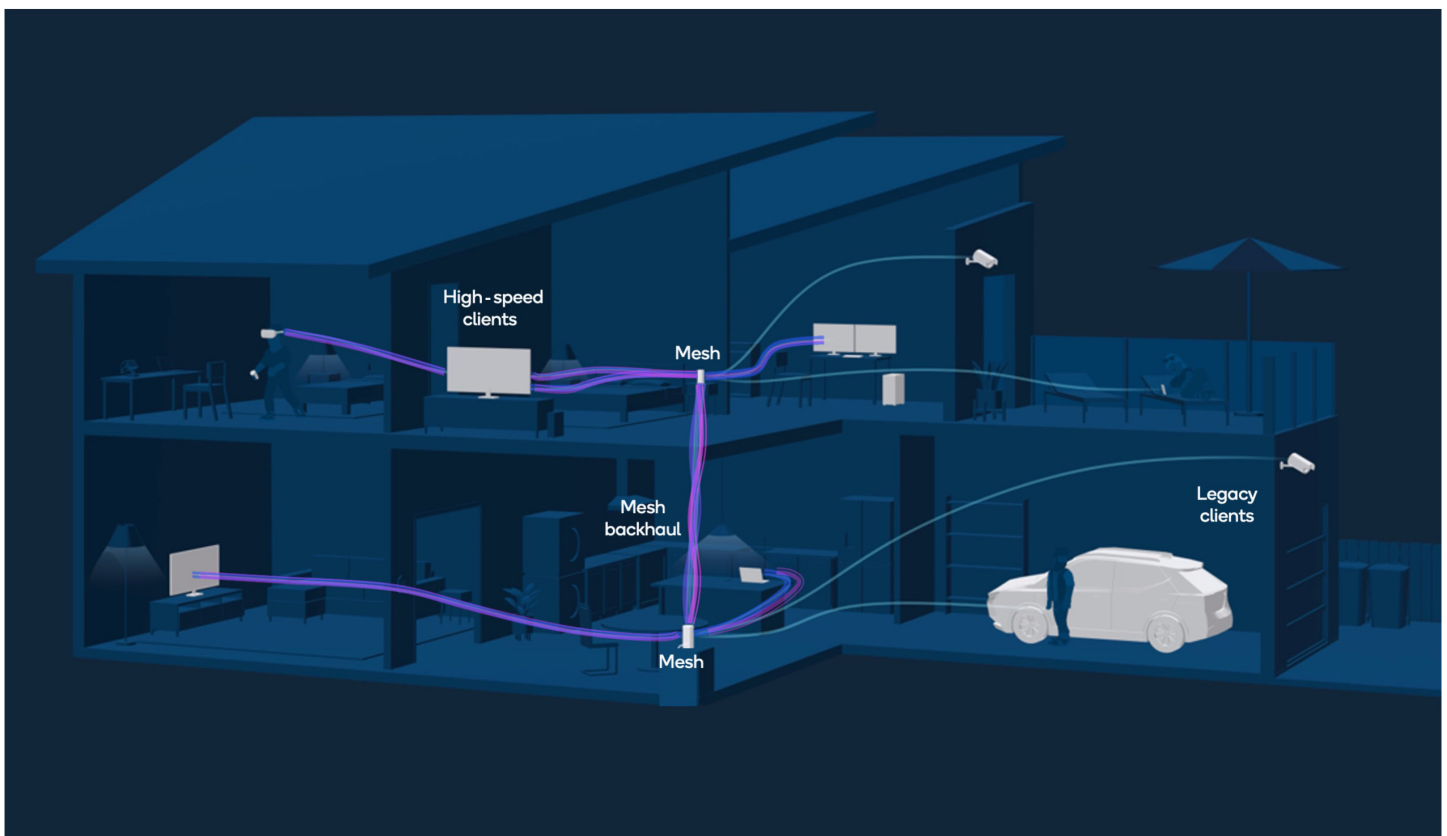
Learn more: [Qualcomm makes Wi-Fi 7 history at IFA 2022 with HBS Multi-Link](#)

How does Qualcomm Multi-Link Mesh harness Multi-Link Operation?

Multi-Link Operation is especially powerful in the context of mesh Wi-Fi. Qualcomm Multi-Link Mesh harnesses this Wi-Fi 7 innovation to introduce a new approach to mesh networking, reshaping the management of backhaul and fronthaul mesh connections by replacing these dedicated connections with dynamically managed links. Through intelligent selection, aggregation, or alternation of links based on network conditions, this technology enables both legacy devices and the latest Wi-Fi 7 connected devices to achieve deterministic low latency and optimal throughput. As a result, users can enjoy virtually lag-free gaming experiences, seamless video streaming, and smooth collaboration even in today and tomorrow's highly congested Wi-Fi network environments. Qualcomm Multi-Link Mesh is a key feature enabled by Qualcomm Wi-Fi 7 networking platforms.

[View explainer video](#)

Learn more: [Level up your mesh Wi-Fi: A deep dive into Qualcomm Multi-Link Mesh \[+video\] | Qualcomm](#)



What advantages does a 320MHz channel offer?

Wi-Fi 7 is the first standard to support super-wide 320MHz channels, which is twice the size of the maximum channel width in previous generations. This significant expansion in channel width is one of the most notable performance enhancements offered by Wi-Fi 7 and the 6GHz band. It enables double the data transfer rates compared to previous Wi-Fi standards, paving the way for multi-gigabit throughput to client devices such as smartphones, PCs and XR devices. This groundbreaking advancement empowers users like gamers and content creators to enjoy the freedom of untethering themselves from wired connections.

Although 320MHz offers immediate advantages to Wi-Fi 7 users, it's important to note that not all Wi-Fi 7 devices can support this implementation of the standard. Fully featured implementations of the Wi-Fi 7 standard, such as the FastConnect 7800, have the capability to support this feature.

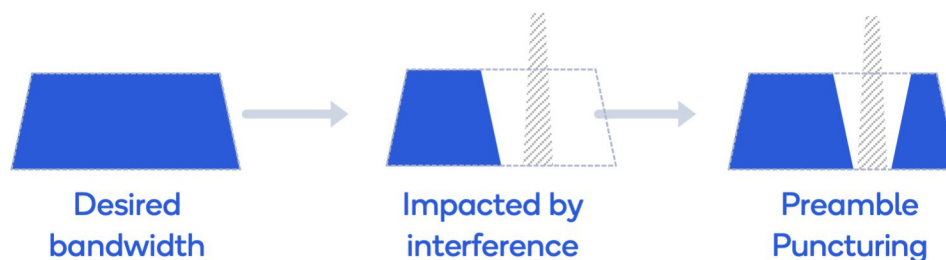


Wider Channels

Doubles the max channel to 320MHz: Delivers higher speed, lower latency transfers

What is preamble puncturing and what advantages does it offer?

Preamble puncturing in Wi-Fi 7 allows for a more efficient and flexible utilization of the spectrum in environments with wireless interference from overlapping Wi-Fi networks or non-Wi-Fi incumbents. In previous Wi-Fi generations, interference on the Wi-Fi channel would hinder transmissions from utilizing the remaining spectrum. However, with Wi-Fi 7, preamble puncturing effectively isolates the interfered portion of the spectrum, enabling the full remainder of the channel to be utilized. This enhancement significantly improves spectrum efficiency by providing wider channels, even in the presence of interference. As a result, data transmissions are faster, and users experience a better overall performance in congested environments.

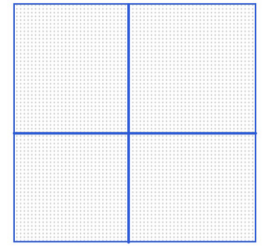


Adaptive Interference Puncturing

Maximizes channel bandwidth in the presence of interference

What is 4K QAM and what advantages does it offer?

4K QAM significantly enhances peak data rates by encoding 20% more data compared to previous generations that use 1K QAM. Quadrature Amplitude Modulation (QAM) is a technique for encoding digital information into symbols for wireless transmission. While Wi-Fi 6/6E utilizes a maximum of 1K QAM (equivalent to 1024 symbols) carrying 10 bits of data per symbol, Wi-Fi 7 improves the modulation efficiency to 4K QAM (equivalent to 4096 symbols) carrying 12 bits of data per symbol. This advancement enables Wi-Fi 7 to achieve up to 20% higher throughput than Wi-Fi 6/6E, resulting in faster downloads and uploads, making it ideal for 4K/8K streaming and other media-rich experiences.



4K QAM

Advanced modulation:
impactful performance
improvements

What is Wi-Fi 7's peak speed?

Wi-Fi 7 is designed to provide peak speeds that surpass those of previous Wi-Fi generations. The actual peak speed experienced by Wi-Fi 7 smartphones and PCs is defined by the device's capabilities including the supported channel width, modulation scheme, and Multi-Link Operation capabilities. FastConnect 7800 fully featured implementation of Wi-Fi 7 with HBS Multi-Link, 320MHz, and 4K QAM operation empowers users to experience exceptional ultra-high speeds of up to 5.8 Gbps*. This cutting-edge technology supports seamless streaming, gaming, and other data-intensive activities.

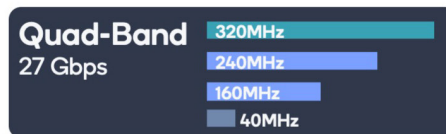
Aggregate Capacity

Regions with 1200MHz of 6GHz allocated



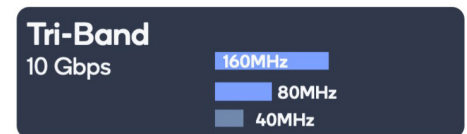
16-stream

Regions with 480MHz of 6GHz allocated



16-stream

Regions without 6GHz allocation



12-stream

The aggregate system capacity of Wi-Fi 7 networking devices (access points, routers, mesh systems and broadband gateways) is defined by the number of spectrum bands and spatial streams supported. Qualcomm Technologies offers modular and scalable Wi-Fi 7 [platform architectures](#) that cater to various design requirements, ranging from 6-stream to 16-stream, while supporting 320MHz, 4K QAM, and Multi-Link Operation, setting new industry benchmarks for networking performance by delivering wireless capacity of up to 33 Gbps*. When paired with [5G fixed wireless access](#), [10G-PON fiber](#), and advanced cable protocols, these Wi-Fi 7 platforms deliver next-generation connectivity today.

* Peak speed refers to maximum physical layer (PHY) rate

Is Wi-Fi 7 backward compatible with older Wi-Fi generations?

Yes. Wi-Fi 7 is designed to maintain full backward compatibility, ensuring seamless compatibility between the latest Wi-Fi 7 devices and legacy devices from earlier generations. It is important to note that Wi-Fi 7 client devices connected to Wi-Fi 7 access points can fully leverage the advantages of the latest technological advancements, such as 320MHz wide channels, Multi-Link Operation, 4K QAM, and preamble puncturing, in order to achieve the highest throughput and lowest latency.

How quickly is Wi-Fi 7 being adopted?

The Wi-Fi 7 era is already well under way, with device manufacturers having introduced a wide range of innovative products for home and enterprise applications. Wi-Fi 7 offers global value, even in regions where the 6GHz band is not yet available, leading to widespread device adoption worldwide. As of January 2024, Qualcomm Technologies has announced over 450 Wi-Fi 7 designs¹ launched or in development including 200+ mobile, compute, and XR designs based on FastConnect 7800 and 250+ Wi-Fi networking devices designs based on Qualcomm Networking Pro Series Platforms, Qualcomm Immersive Home Platforms, and Qualcomm 10G Fiber Gateway Platform.

To find your next Wi-Fi 7 smartphone or networking device check out our device finders:

[Wi-Fi 7 Smartphones](#)

[Wi-Fi 7 Networking Devices](#)

¹ Qualcomm Technologies, Inc. internal data as of January 2024

What is Wi-Fi CERTIFIED 7™?



Launched in January 2024, Wi-Fi CERTIFIED 7 is an industry certification program built on the IEEE 802.11be technology. Developed by the Wi-Fi Alliance, a global network of member companies, the Wi-Fi CERTIFIED 7 interoperability certification program ensures that Wi-Fi 7 devices adhere to stringent standards for seamless connectivity and interoperability. This certification program supports a thriving ecosystem of advanced devices worldwide, guaranteeing consistent implementation of cutting-edge features that push the boundaries of wireless connectivity and deliver exceptional user experiences.

Leading the way in this Wi-Fi revolution, Qualcomm Technologies' Wi-Fi 7 solutions, the FastConnect 7800 and Qualcomm Networking Pro Wi-Fi 7 Series tri-band and quad-band platforms, are among the first products to achieve Wi-Fi CERTIFIED 7. These solutions not only underwent rigorous testing to meet the highest standards but also serve in the test bed for the certification program itself.

Can Wi-Fi 7 devices support Standard Power operation in the 6GHz band?

While many countries around the world have enabled low-power Wi-Fi 6E and Wi-Fi 7 [operation in the 6GHz band](#), the U.S. and Canada have also enabled a higher-performance, longer-range version of 6GHz operation with the Standard Power (SP) operating class. Standard Power access points are able to transmit up to sixty-three times stronger signal, enabling end users to benefit from a higher-power, longer-range version of 6GHz Wi-Fi indoors. Standard Power operation also allows 6GHz Wi-Fi access points to operate outdoors, opening the door for many use cases such as wireless internet service provider (WISP), campus, and outdoor event venue coverage. It's important to note that in order to ensure coexistence with incumbent users in the 6GHz band, Standard Power access points are required to consult with an Automated Frequency Coordination (AFC) system before operating at standard power levels.



[Learn more about AFC and the Qualcomm® AFC Suite](#)

To learn more visit: [qualcomm.com](https://www.qualcomm.com)

Qualcomm

Nothing in these materials is an offer to sell any of the components or devices referenced herein.

"Qualcomm" may mean Qualcomm Incorporated, Qualcomm Technologies, Inc., and/or other subsidiaries.

©2024 Qualcomm Technologies, Inc. and/or its affiliated companies. All Rights Reserved. Snapdragon and Qualcomm branded products are products of Qualcomm Technologies, Inc. and/or its subsidiaries. Other products and brand names may be trademarks or registered trademarks of their respective owners.