

**\*Bandwidth**

**The maximum amount of data transmitted over an internet connection in a given amount of time.**

Bandwidth is often mistaken for internet speed when it's actually the volume of information that can be sent over a connection in a measured amount of time – calculated in megabits per second (Mbps).

**\*Bandwidth vs speed**

Bandwidth is how much information you receive every second, while speed is how fast that information is received or downloaded.

Example:

Let's compare it to filling a bathtub. If the bathtub faucet has a wide opening, more water can flow at a faster rate than if the pipe was narrower. Think of the water as the bandwidth and the rate at which the water flows as the speed.

\*What is bandwidth in wifi 2.4ghz mean and 5ghz

The primary differences between the two frequencies are the range (coverage) and **bandwidth** (**speed**) that the bands provide. The **2.4 GHz** band provides coverage at a longer range but transmits data at slower speeds. The 5 GHz band provides less coverage but transmits data at faster speeds.

\*What is better for WiFi 2.4 or 5GHz?

The primary differences between the **2.4** GHz and **5GHz** wireless frequencies are range and bandwidth. **5GHz** provides faster data rates at a shorter distance. **2.4**GHz offers coverage for farther distances, but may perform at slower speeds.

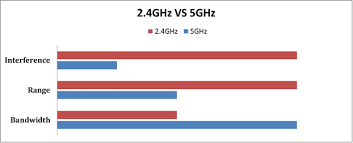
\*There are four main differences between the 2.4 GHz WiFi band and the 5 GHz WiFi band:

1. **WiFi network coverage**— When it comes to WiFi coverage, 2.4 GHz outshines 5 GHz. In the 2.4 GHz band, [the lower frequencies that are transmitted here can more easily penetrate solid objects](https://kb.netgear.com/29396/What-is-the-difference-between-2-4-GHz-and-5GHz), meaning the signal can be better carried out throughout your home.
2. **WiFi network speed**— The higher frequency 5 GHz band makes up for its shorter range with much faster WiFi speeds than the 2.4 GHz band. To compare, [the 2.4 GHz band will support speeds between 450 Mbps and 600 Mbps, while 5 GHz will support speeds of up to 1300 Mbps](https://www.howtogeek.com/222249/whats-the-difference-between-2.4-ghz-and-5-ghz-wi-fi-and-which-should-you-use/). (Of course, the kind of router you have will better dictate the WiFi speed you can achieve.)
3. **Co-channel interference**—Now we get to some of the major differences... In the 2.4 GHz band, you have the option to choose from 11 WiFi channels, where 3 of which are non-overlapping. In the 5 GHz band, you have the option to choose from 45 WiFi channels, where 24 of which are non-overlapping. Overlapping channels are what lead to network interference, so comparing the two WiFi frequency bands, we can easily see that 5 GHz provides less room for co-channel interference. It's also important to note that in the 2.4 GHz band, you aren't just receiving interference from other WiFi networks— [a decent amount of network interference here comes from other household appliances that also use 2.4 GHz for signal](https://www.lifewire.com/is-5-ghz-wifi-better-than-2-4-ghz-818293).
4. **Device compatibility**— Considering the fact that WiFi standard 802.11n (WiFi 4) has been around for nearly a decade now, the majority of our wireless technologies have been built to support both the 2.4 GHz and 5 GHz bands. But, if you have any old networking equipment or devices from pre-2009, there's a chance they may only be compatible with the 2.4 GHz band.

What is the bandwidth for 2.4 GHz?

Bandwidth comparison – 2.4 GHz vs. 5 GHz signal

|  |  |  |
| --- | --- | --- |
| **Frequency** | **Theoretical Speed** | **Real-World Speed** |
| **2.4 GHz** (802.11g) | 54 Mbps | 10 -29 Mbps |
| **2.4 GHz** (802.11n) | 300 Mpbs | 150 Mbps |
| 5 GHz (802.11a) | 6-54 Mbps | 3 - 32 Mbps |
| 5 GHz (802.11ac) | 433 Mbps - 1.7 Gbps | 210 Mbps - 1 G |



**Is 2.4 GHz safe?**

Both 5GHz and **2.4GHz** WiFi are 100% **safe** for human, the signal does not harm in any way. It is perfectly **safe**. Term “radiation” is often used to scare people. ... That is literally a 500,000 times higher frequency than what Wi-Fi transmits on, **2.4 GHz** or 5 **GHz**.

What is the side effect of WiFi?

Repeated Wi-Fi studies show that Wi-Fi causes oxidative **stress**, sperm/testicular damage, neuropsychiatric effects including EEG changes, apoptosis, cellular DNA damage, endocrine changes, and calcium overload.

Is it safe to sit near a WiFi router?

It is NOT **safe to sit beside a wifi router** all day at work. ... Oh, and don't worry about the radiation from the **router**. It won't hurt you. However, if it causes you too much worry, THAT could cause health effects.

Is it dangerous to sit near a WiFi router?

It is **safe** to sleep **next** to a **wireless router** as it produces radio waves that, unlike X-rays or gamma rays, do not break chemical bonds or cause ionisation in humans. In other words, radio waves do not damage the DNA of human cells. Damaged DNA can lead to cancer.

What Does IEEE 802.11 Mean?

Similar to how people follow etiquette and politeness rules to communicate with others, wireless devices do the same. They must follow a set of wireless standards or protocols, known as IEEE 802.11, to wirelessly communicate with other devices.

The WiFi standards were created by the Institute of Electrical and Electronics Engineers and are certified by the WiFi Alliance.

The goal is to create a better wireless LAN experience for the users. Therefore, these standards dictate the data throughput, range, and the use of frequency bands to achieve that goal.

What are the Different 802.11 Standards?

802.11 standards are developed every couple of years to fill holes in the current one and to account for the development of new wireless technology. New standards can be developed to improve speeds, range, security, or establish new frequency bands when applicable.

The following list of WiFi standers consists of the most well-known standards in the market for wireless local area networks (WLAN).

IEEE 802.11 - 1997

In 1997, the first WLAN standard was released - IEEE 802.11.

It was developed to operate on the 2.4 GHz ISM band and supported speeds of 1 Mbps - 2 Mbps. Compared to the speeds we have now, it would take longer to download files and cause challenges with group video calls, online gaming, and streaming.

The 802.11 standard became the “umbrella” for the standards that followed. Basically, it set the foundation.

IEEE 802.11a (WiFi 2)

802.11a was one of the first standards issued under the 802.11 umbrella in 1999.

Rather than using the 2.4 GHz band, it opted into using the 5 GHz frequency band. Generally, higher frequencies are coupled with faster speeds but shorter range. To achieve better speeds, it was the first to implement OFDM (Orthogonal Frequency Division Multiplexing) technology - a digital modulation method used to encode data on multiple frequencies- into its coding scheme, allowing it to have a theoretical maximum speed of 54 Mbps, which was a drastic improvement from the original WiFi standard.

In addition, since 802.11a operated under the 5 GHz band, it made the products more expensive. Therefore, it was mostly used in business networks.

IEEE 802.11b (WiFi 1)

While 802.11a was being developed, so was the 802.11b standard; it was also published in 1999.

802.11b uses [DSSS](https://www.controleng.com/articles/wi-fi-standards/) (Direct-Sequence Spread Spectrum) - a modulation method used to reduce signal interference - in the 2.4 GHz band, allowing it to have speeds up to 11 Mbps. The 2.4 band does a good job at penetrating [obstacles](https://www.signalboosters.com/blog/top-12-materials-that-block-wifi-signals/) to provide more WiFi coverage. Unfortunately, the data travels at a much slower rate, especially when it’s coupled with network interferences caused by devices operating on the same frequency, such as baby monitors, microwave ovens, cordless phones, appliances, and Bluetooth devices. Luckily, interferences can be mitigated by keeping your 802.11b devices away from the mentioned equipment.

Since WiFi 1 only used the 2.4 band, the products were much cheaper than 802.11a, making it more popular for home networks.

In addition, considering that 802.11b and 802.11a products don’t use the same frequency band, they are not compatible with each other. So, an 802.11b computer will not work with an 802.11a access point (AP) because the wireless adapter inside the computer will not register the AP, and vice versa.

IEEE 802.11g (WiFi 3)

To fulfill a growing demand for faster internet under the 2.4 GHz band, 802.11g joined the 802.11 family in 2003.

The developers took the best qualities of 802.11a and 802.11b to create the 802.11g standard. It supports a networking bandwidth up to 54 Mbps and operates under the 2.4 GHz band.

At the time backward compatibility was a must because many people still had access points and computers that used the previous standards. 802.11g is backward compatible with 802.11b products. However, WiFi products are only capable of tapping into the standard under which they operate. An 802.11b computer connected to an 802.11g AP can only go as fast as what the b standard allows. On the flip side, a g device connected to a b AP will only go as fast as what the AP offers.

IEEE 802.11n (Wireless-N or WiFi 4)

Wireless-N was developed in 2009 to improve speeds, reliability, and extend the range of wireless transmissions.

It was the first standard to use MIMO (Multiple-Input Multiple-Output) technology. MIMO products use a series of antennas to receive more data from one device at a time, which results in faster data transmissions. In addition, it was the first to allow the usage of two radio frequencies – 2.4 GHz and 5 GHz. The use of both frequencies makes the 802.11n standard compatible with 802.11a/b/g devices.

With all its improved functionalities, WiFi 4 supported bandwidth speeds up to 600 Mbps and a had theoretical range of 230 ft indoors, which is a huge upgrade from the previous standards.

[IEEE 802.11ac (Gigabit WiFi or WiFi 5)](https://www.signalboosters.com/blog/the-80211ac-wifi-standard-explained/)

The 5th generation of WiFi was established in 2013. To reduce interference in the 2.4 GHz band, it was developed to operate under the 5 GHz band.

Many 802.11ac WiFi devices are advertised as “dual-band” – technology that uses two frequency bands for wireless communication. To make that possible, some vendors incorporated Wireless-N technology to make ac products compatible with the 2.4 GHz band. Data rates differ based on which frequency is being used, bandwidth speeds up to 1300 Mbps can be achieved on the 5 GHz band, while the 2.4 GHz band has a max speed of 450 Mbps.

WiFi 5 was the first to use Downlink Multi-User MIMO. It took Wireless-N MIMO technology one step further to increase data transmission even more. DL MU-MIMO allows wireless routers to transmit information to multiple devices at the same time, improving bandwidth speeds and reducing latency.

With the help of Wireless-N technology, 802.11ac is compatible with 802.11a/b/g/n.

IEEE 802.11ad (WiGig)

Designed to provide a Multiple Gigabit Wireless System (MGWS) with high throughput data, 802.11ad became part of the 802.11 series in 2012.

It achieved blazingly fast speeds - up to 6.7 Gbps. Unlike the previous standards, it didn’t use the 2.4 or 5 GHz bands, it operated under the 60 GHz band. Remember, the higher the frequency, the shorter the range. Under perfect conditions, 802.11ad devices need to be about 30 ft from the access point.

IEEE 802.11ah (WiFi HaLow)

Adopted in May 2017, 802.11ah aimed to use unlicensed frequency bands below 1 GHz. Its purpose was to establish lower energy consumption and create extended-range WLANs that surpassed that of the 2.4/5 GHz bands.

WiFi HaLow operated on the 900 MHz band, allowing it to have a theoretical range of [543m indoors](https://www.sciencedirect.com/science/article/pii/S2405959516300650) (1,781.5 ft) and data transfer speeds up to 347 Mbps.

Due to its low energy needs, 802.11ah is beneficial for devices trying to communicate over long ranges without using a lot of energy.

[IEEE 802.11ax (WiFi 6 or High-Efficiency WLAN)](https://www.signalboosters.com/blog/wifi-6-the-next-generation-of-wifi/)

As of 2019, the 802.11ax standard has become the newest WiFi standard. Designed to deliver faster speeds, support more devices simultaneously, decrease latency, improve security, and increase bandwidth. To do so, it includes technologies like OFDMA, MU-MIMO, 1024-QAM, and more. With all of its improvements, it has a theoretical maximum speed of 10 Gbps.

In addition, it operates on the 2.4 and 5 GHz bands, which hasn’t been done since 802.11n. This allows it to be compatible with 802.11a/b/g/n/ac.

Come late 2020 or early 2021, WiFi 6 will have a subcategory known as WiFi 6E (WiFi 6 Extended). The FCC has made the 6 GHz frequency available for use. WiFi 6E devices will be able to operate on the 2.4, 5, and 6 GHz frequencies. As a result, compatible WiFi devices will benefit from less congested frequency bands.