

# (Optional Network Data)

## The 802.11 Family Explained

What is: Wireless Standards 802.11a, \*02.11b/g/n, and 802.11ac

Article summary: Wi-Fi Standards

Standard / Date / Speed / Frequency

802.11	1997	2 Mbps	
802.11b	1999	11 Mbps	2.4 GHz
802.11a	1999	54 Mbps	5 GHz
802.11g	2002/3	54 Mbps	2.4 GHz
802.11n	2009	300 Mbps	2.4 & 5 GHz
802.11ac	2013	1300 Mbps	5 GHz

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Home and business owners looking to buy networking gear face an array of choices. Many products conform to the 802.11a, 802.11b/g/n, and/or 802.11ac wireless standards collectively known as Wi-Fi technologies. (Bluetooth and various other wireless (but not Wi-Fi) technologies also exist, each designed for specific networking applications.

This article describes the Wi-Fi standards and related technologies, comparing and contrasting them to help you better understand the evolution of Wi-Fi technology and make educated network planning and equipment buying decisions.

### 802.11

In 1997, the Institute of Electrical and Electronics Engineers (IEEE) created the first WLAN standard. They called it 802.11 after the name of the group formed to oversee its development. Unfortunately, 802.11 only supported a maximum network bandwidth of 2 Mbps - too slow for most applications. For this reason, ordinary 802.11 wireless products are no longer manufactured.

### 802.11b

IEEE expanded on the original 802.11 standard in July 1999, creating the 802.11b specification. 802.11b supports bandwidth up to 11 Mbps, comparable to traditional Ethernet.

802.11b uses the same unregulated radio signaling frequency (2.4 GHz) as the original 802.11 standard. Vendors often prefer using these frequencies to lower their production costs. Being unregulated, 802.11b gear can incur interference from microwave ovens, cordless phones, and other appliances using the same 2.4 GHz range. However, by installing 802.11b gear a reasonable distance from other appliances, interference can easily be avoided.

Pros of 802.11b - Lowest cost; signal range is good and not easily obstructed

Cons of 802.11b - Slowest maximum speed; home appliances may interfere on the unregulated frequency band

### 802.11a

While 802.11b was in development, IEEE created a second extension to the original

802.11 standard called 802.11a.

Because 802.11b gained in popularity much faster than did 802.11a, some folks believe that 802.11a was created after 802.11b.

In fact, 802.11a was created at the same time. Due to its higher cost, 802.11a is usually found on business networks whereas 802.11b better serves the home market.

802.11a supports bandwidth up to 54 Mbps and signals in a regulated frequency spectrum around 5 GHz. This higher frequency compared to 802.11b shortens the range of 802.11a networks. The higher frequency also means 802.11a signals have more difficulty penetrating walls and other obstructions.

Because 802.11a and 802.11b utilize different frequencies, the two technologies are incompatible with each other. Some vendors offer hybrid 802.11a/b network gear, but these products merely implement the two standards side by side (each connected devices must use one or the other).

Pros of 802.11a - Fast maximum speed; regulated frequencies prevent signal interference from other devices.

Cons of 802.11a - Highest cost; shorter range signal that is more easily obstructed.

802.11g

In 2002 and 2003, WLAN products supporting a newer standard called 802.11g emerged on the market.

802.11g attempts to combine the best of both 802.11a and 802.11b.

802.11g supports bandwidth up to 54 Mbps, and it uses the 2.4 GHz frequency for greater range. 802.11g is backward compatible with 802.11b, meaning that 802.11g access points will work with 802.11b wireless network adapters and vice versa.

Pros of 802.11g - Fast maximum speed; signal range is good and not easily obstructed.

Cons of 802.11g - Costs more than 802.11b; appliances may interfere on the unregulated signal frequency.

802.11n can use either the 2.4 GHz or the 5 GHz band

802.11n (also sometimes known as "Wireless N") was designed to improve on 802.11g in the amount of bandwidth supported by

utilizing multiple wireless signals and antennas (called MIMO technology) instead of one. Industry standards groups ratified

802.11n in 2009 with specifications providing for up to 300 Mbps of network bandwidth. 802.11n also offers somewhat better

range over earlier Wi-Fi standards due to its increased signal intensity, and it is backward-compatible with 802.11b/g gear.

Pros of 802.11n - Fastest maximum speed and best signal range; more resistant to signal interference from outside sources.

Cons of 802.11n - Standard is not yet finalized; costs more than 802.11g; the use of multiple signals may greatly interfere with nearby 802.11b/g based networks.

## 802.11ac

The newest generation of Wi-Fi signaling in popular use, 802.11ac utilizes dual-band wireless technology, supporting simultaneous connections on both the 2.4 GHz and 5 GHz Wi-Fi bands. 802.11ac offers backward compatibility to 802.11b/g/n and bandwidth rated up to 1300 Mbps on the 5 GHz band plus up to 450 Mbps on 2.4 GHz.