Optimize your Wi-Fi

Setting up a Wi-Fi network can be a daunting task. In this document, we elaborate on what to watch out for and what all those Wi-Fi parameters mean, so that you can set-up your Wi-Fi properly, and have a great broadband experience.

Use case

A broadband experience is largely determined by Wi-Fi

A lot of service providers are already offering gigabit speeds to the home. Unfortunately, it's the last couple of meters that determine the broadband experience; and 95% of the time, that is the Wi-Fi connection. A bad Wi-Fi connection can simply ruin the whole broadband experience, no matter how good the broadband to the home is.

Wi-Fi brings quite some quirks and problems with it. First, it is a wireless technology, very susceptible to interference. And, the spectrum is very dynamic: household devices being switched on and off, people passing by, new client devices being introduced, a mix of old and new Wi-Fi clients, ... all these impact the Wi-Fi signals.

So, to get a good user experience out of your Wi-Fi, you need to pay attention to both the placement and the configuration of your Wi-Fi router.

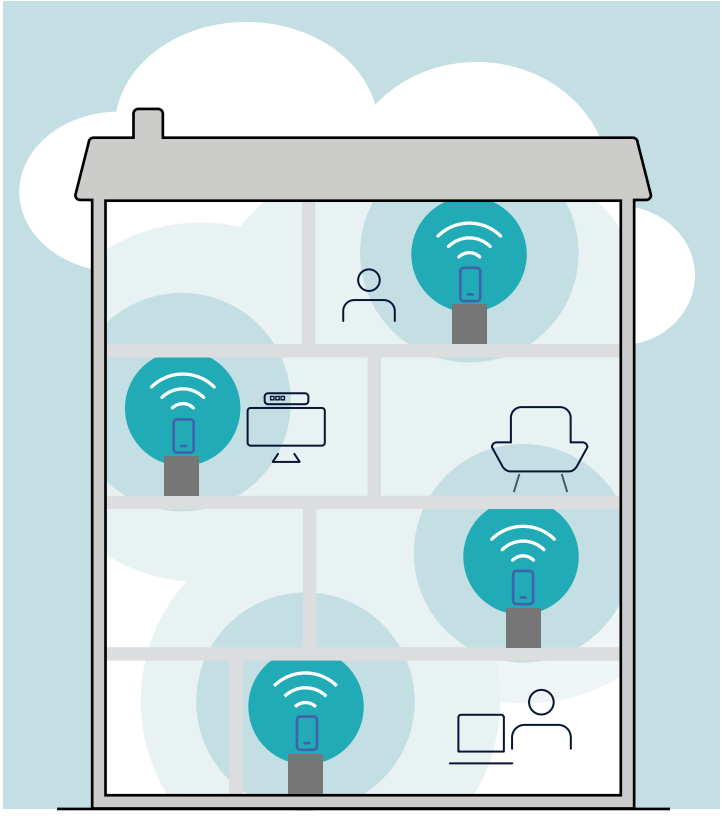
Placement of the Wi-Fi router

Wi-Fi in every room

Increasingly, people need Wi-Fi in virtually every room. Especially since the pandemic, with people working and studying from home, this need has become very clear. This extended coverage can pose a problem when using a single router.

Wi-Fi repeaters and extenders partially solve this problem, but also introduce new challenges of having to install and manage those devices and the fact that usually, they create a separate Wi-Fi network, so you need to log in to a new network when moving from one room to another.

A mesh network solves this problem. A mesh network consists of several Wi-Fi points, that interact with each other, creating a single, seamless Wi-Fi network. It has the same network name (or SSID) and the same password throughout the whole home, and supports roaming as well, so you can even start a video call in the kitchen, walk to the living, where you would be connected to a different Wi-Fi point, and not lose the connection.

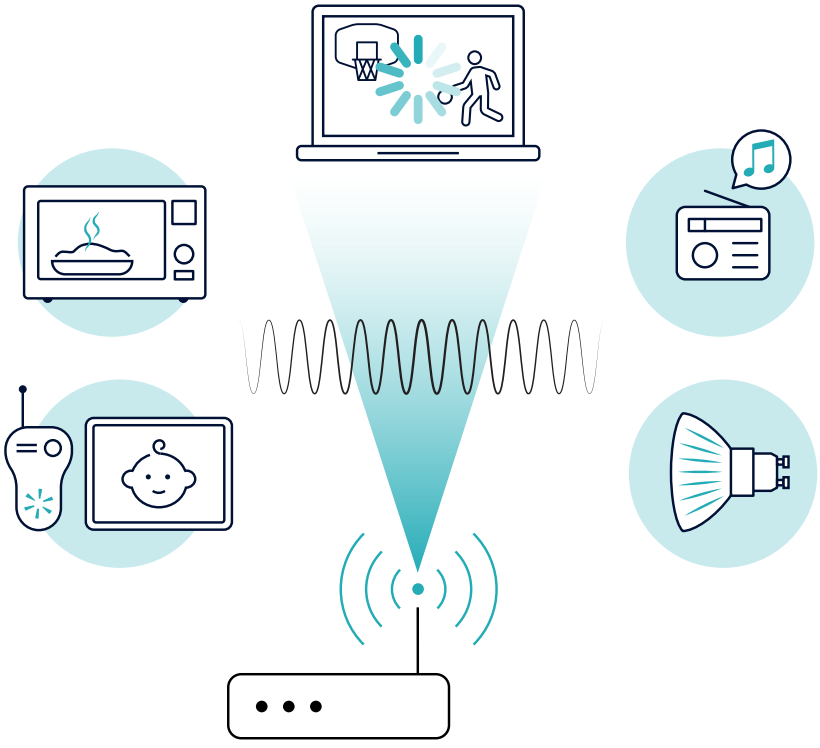


Avoid interference as much as possible

To minimize interference from furniture and people alike, it is best to put a Wi-Fi point high up, for example on top of a cupboard. And don't put it in a corner.

In addition, avoid placing the Wi-Fi point close to household appliances, like microwave ovens, Bluetooth devices, baby monitors, and the like.

Also avoid big metal surfaces, like fridges. They too have an impact on the Wi-Fi performance.



Which channel to choose?

Spectrum band

There are two main Wi-Fi bands to choose from: the 2.4 GHz and the 5 GHz bands. It is important to understand the difference between them.

The 2.4 GHz band:

- Gives a lower throughput (speed) than the 5 GHz band. This is due to the narrower channel width on the 2.4 GHz band (see 3.2 “Channel width”).
- Is more prone to interference: the household devices mentioned in chapter 2.2 “Avoid interference as much as possible” all use the same 2.4 GHz frequency.
- Has a limited number of channels to choose from, so it is harder to choose a channel that is not used by neighbors.
- All legacy Wi-Fi devices use this band, resulting in a lot of client devices all trying to use the same spectrum.
- Has a longer range than the 5 GHz band. In other words: you can be further away from the Wi-Fi point before you start losing the signal.

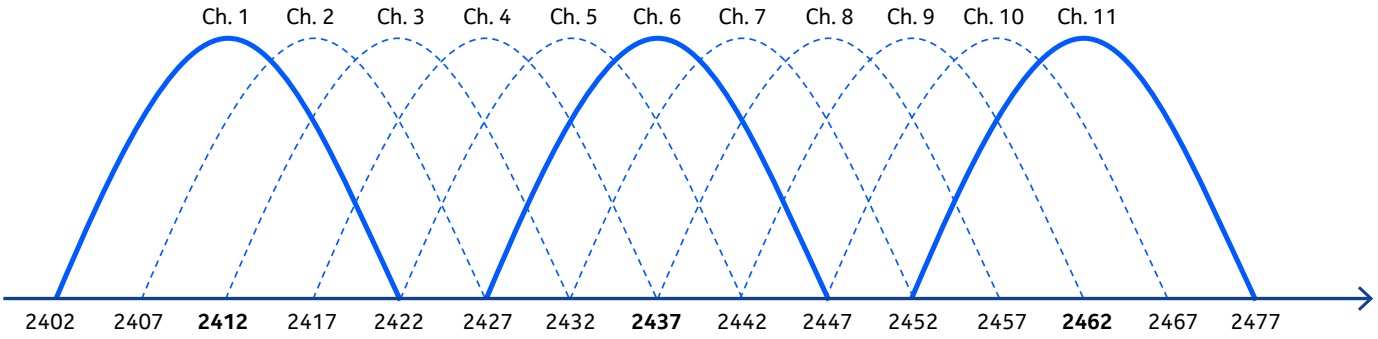
The 5 GHz band:

- Yields a higher speed, since it can use wider channels.
- Is less prone to interference, since hardly any household appliance uses this spectrum.
- Is less crowded, since only newer devices use this spectrum.
- Offers more channels to choose from, so it is easier to choose a channel which is not used by your neighbors.
- Has a shorter range than the 2.4 GHz band, so you may lose the Wi-Fi signal faster when moving away from your Wi-Fi point.

Channel width

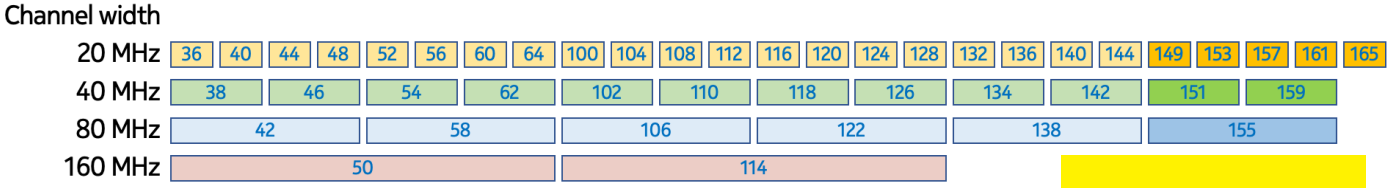
In the 2.4 GHz band, there are several pre-defined channels. The actual number of channels depends on the region or country. Commonly, 11 channels are pre-defined in this band. Every channel has a channel width of 5 MHz, but you need at least 20 MHz for Wi-Fi, so 4 channels are combined into a single channel with 20 MHz channel width. The wider the Wi-Fi channel, the higher the throughput. On the 2.4 GHz band, you can choose between 20 or 40 MHz channel width.

But that means that you must be careful which channel you select, otherwise some of the underlying channels will overlap between the “combined” channels, and overlap means interference, lowering the throughput. So, on the 2.4 GHz band, it is recommended to only use channels 1, 6 and 11, to avoid overlap, and to have the highest throughput. The following graph shows the channel allocations, with a 20 MHz channel width.



If you want to use 40 MHz channel width in the 2.4 GHz band, then only one non-overlapping channel can be used.

In the 5 GHz band, each channel has a 20 MHz channel width already. The channels range from 36 to 144 in Europe, and from 36 to 165 in the US. So there are a lot of channels to choose from. Even so, channels can be further combined to achieve higher throughput, with a channel width of 40, 80 or even 160 MHz.



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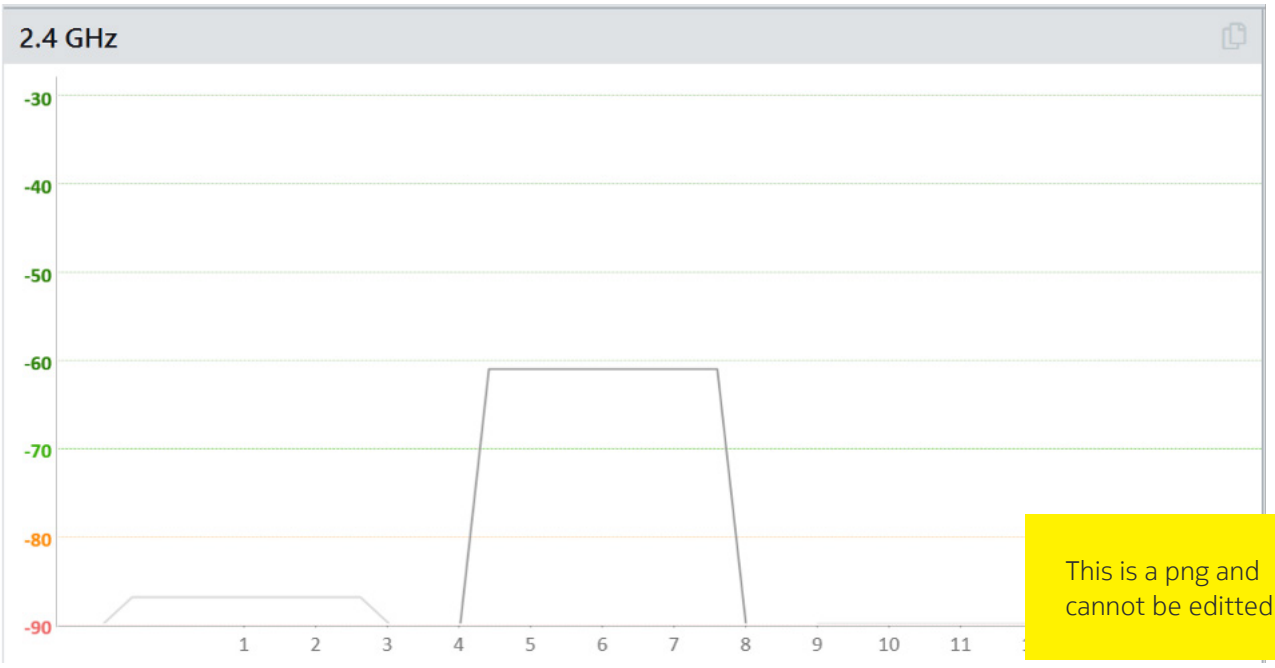
Select the right channel

The best channel is a channel that is not used in your neighborhood. That way, there is no overlap, and hence no interference from other Wi-Fi sources, like your neighbor's Wi-Fi. So, the first task is to figure out which channels are being used. Your current router may provide that information through its web graphical user interface (GUI). The web GUI can be accessed through your web browser, using the address of your router, usually 192.168.1.1.

Alternatively, several tools exist that can display the channel usage as well, like inSSIDer.

These tools will show a graph something like this:



For more information about Nokia's WiFi solution, click here.

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