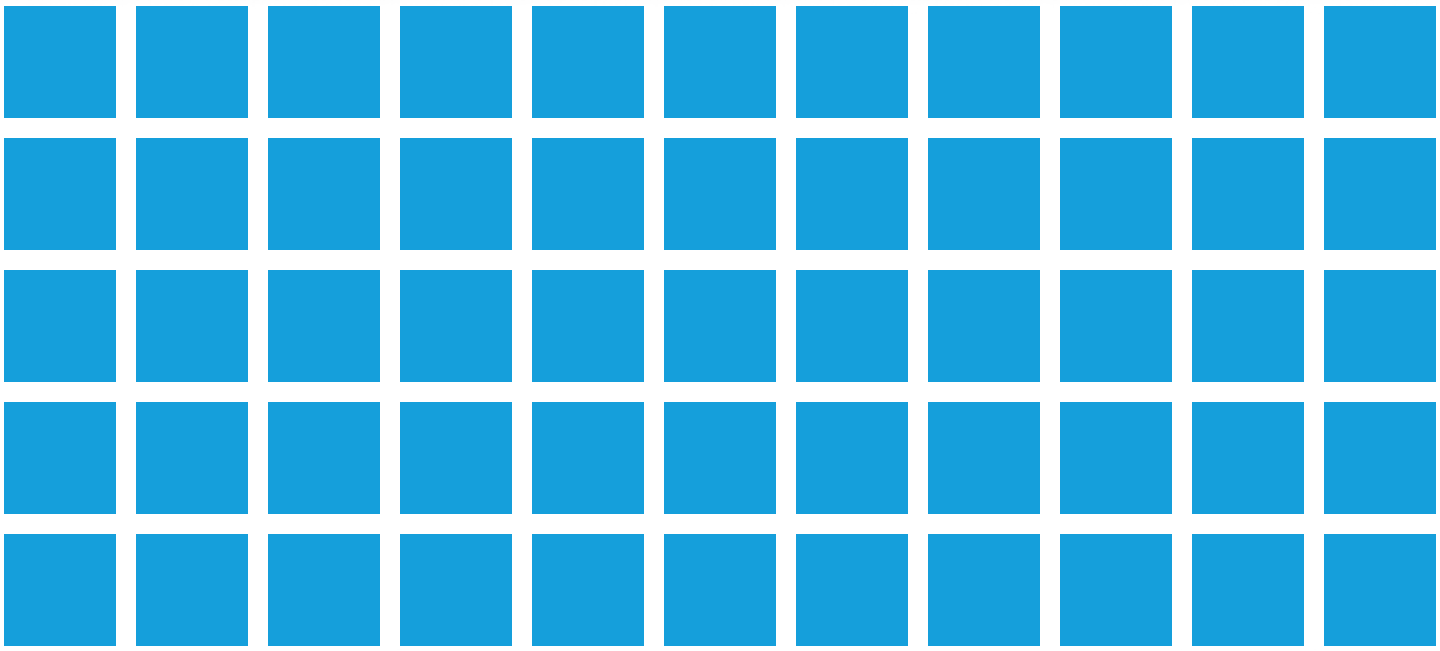
Don't always believe what you see

Comparing Three Wi-Fi 7 Clients with Identical Specs.

EXCENTIS



Hermann grid illusion (Hermann, 1870).
Those weird dark spots pop up at the intersections of the white lines, except where you're looking directly. Just goes to show, **you can't always believe what you see!**

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1 Introduction

You know that moment. You're finally ready to treat yourself to a sleek new pair of headphones. The hunt begins. Not just any headphones, the perfect ones. Noise cancelling? Check. Long battery life? Must-have. Rich, immersive sound and a mic so crisp you could host a podcast in a thunderstorm? Absolutely.

You dive into the internet.
Endless models. Thousends of specs. Glowing reviews. Wishlist growing.
They all look great on paper.

But here's the catch: **you can't hear paper.**

Because the real test? That happens when they're actually on your head.
Do they clamp your skull? Or feel like clouds?
Do they slip off if you turn too fast?
Does that "crystal-clear mic" actually make you sound like you're underwater?

The truth is, specs **don't tell the whole story.** It's the little things, the invisible details, that make or break the experience. So yeah, they all **look** right. But until you try them, you're just guessing. And that's the wild ride of finding your perfect match in a sea of near-identical promises.

As you know, Excentis isn't involved with headphones, we specialize in all-access networks. And **when it comes to Wi-Fi cards, the story is no different.**

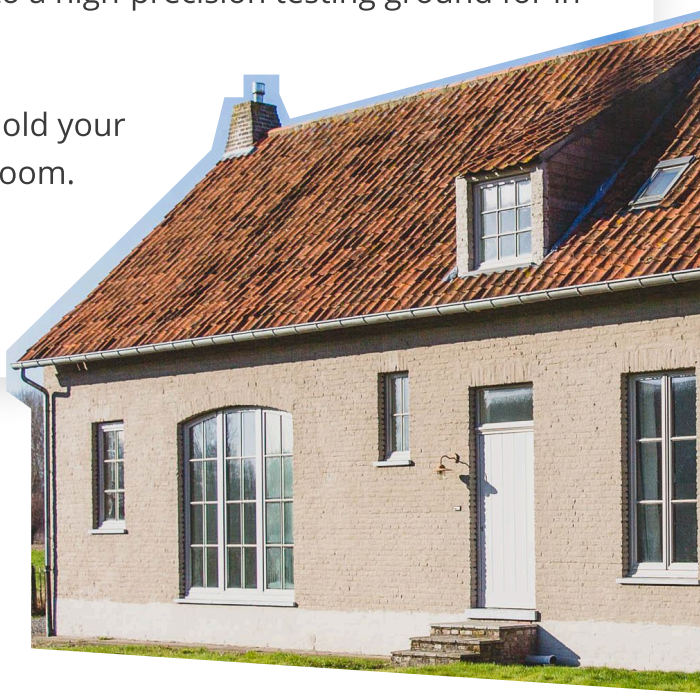
They might look identical on paper, same specs, same promises, but when it comes to real-world performance? You can't truly trust them until they're put to the test.
And that's exactly what we did **at the Excentis Wi-Fi House.**

2 Step Inside the Excentis Wi-Fi House

Yes, it's a real house, it's built with real materials, real walls, real devices, just like any modern home. It may look ordinary, but it's been transformed into a high-precision testing ground for in-home Wi-Fi scenarios.

Because in the end, lab specs don't stream your movie, hold your video call, or reach that dead-zone corner of your living room.

Step inside our Wi-Fi House!



Real customers need real testing.
And that's what we're all about.

What did we do?

Wi-Fi 7, also known as the IEEE 802.11be, Extremely high Throughput (EHT) standard, is the latest leap forward in wireless networking. Promising single-band speeds of up to **23 Gbit/s,** it introduces a powerful new suite of features (specs) designed to push the limits of what's possible in wireless performance. Well, of course, nothing comes for free, **23 Gbit/s is theoretical**, applies at the physical layer, and assumes you're equipped with at least eight antennas. Definitely not the most common device.

In this series of Wi-Fi tests, we compared the performance of three PCI-E Wi-Fi 7 network cards in a straightforward, real-world setup. On paper, all three adapters (each powered by a different Wi-Fi chipset) should have delivered comparable performance.

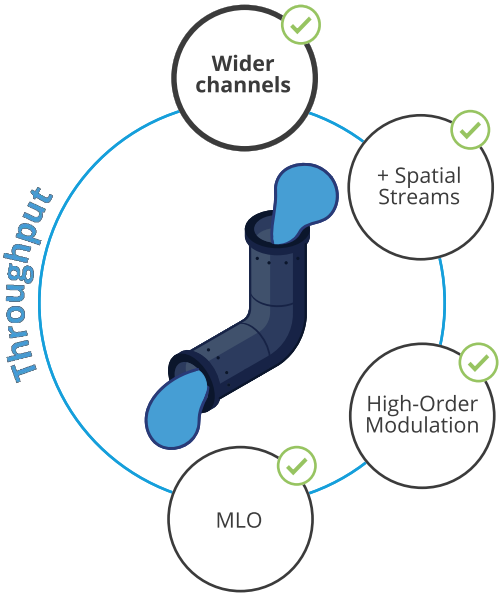
But what we found was anything but predictable.

Beneath the surface of identical specs, the cards behaved very differently once put to the test. What caused the gap? That's where things get interesting, and where the real story begins.

3 Wi-Fi 7: ”The Specs”

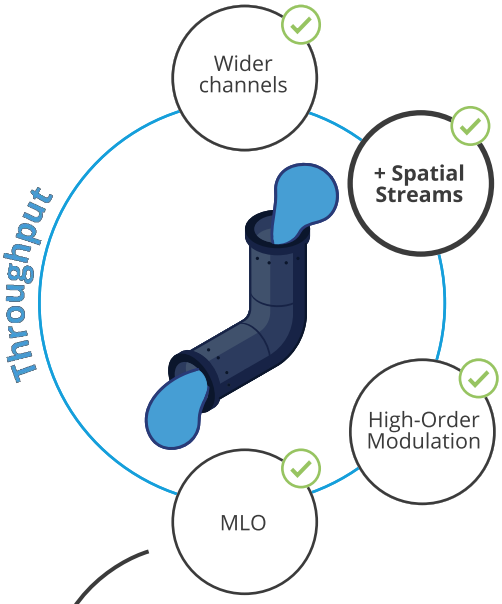
Before diving into test results, here’s a quick overview of the key features that make Wi-Fi 7 (802.11be) a major step forward from previous standards. Consider this your Wi-Fi 7 ”cheat sheet”.

Throughput-Boosting Specs



Wider channels

The previous Wi-Fi standard supported a maximum channel width of 160 MHz. Wi-Fi 7 doubles this to 320 MHz, effectively doubling the maximum throughput in this band. Note that 320 MHz operation is available only in the 6 GHz band.

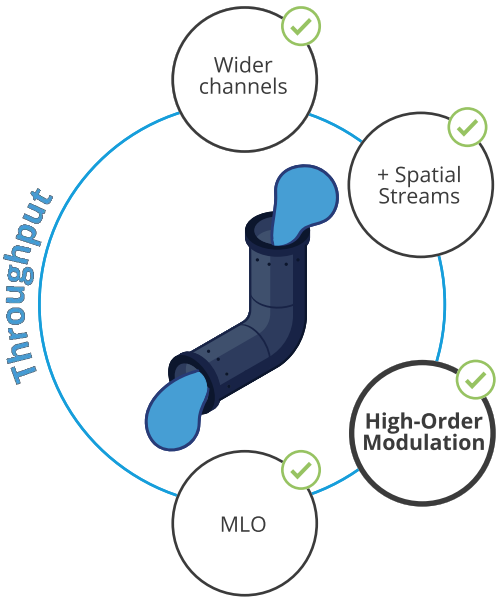


More Spatial Streams

Wi-Fi boosts the maximum number of spatial streams to 16 per band doubling it from the previous maximum of 8. Since the amount of spatial streams has a direct impact on the number of required antennas. Most non-AP devices however only have 2 antennas (per band) so for a single client usage scenario device there is no benefit with respect to throughput. In the case of multiple clients operating at the same time however MU-MIMO can significantly improve the total throughput of the Wi-Fi system.

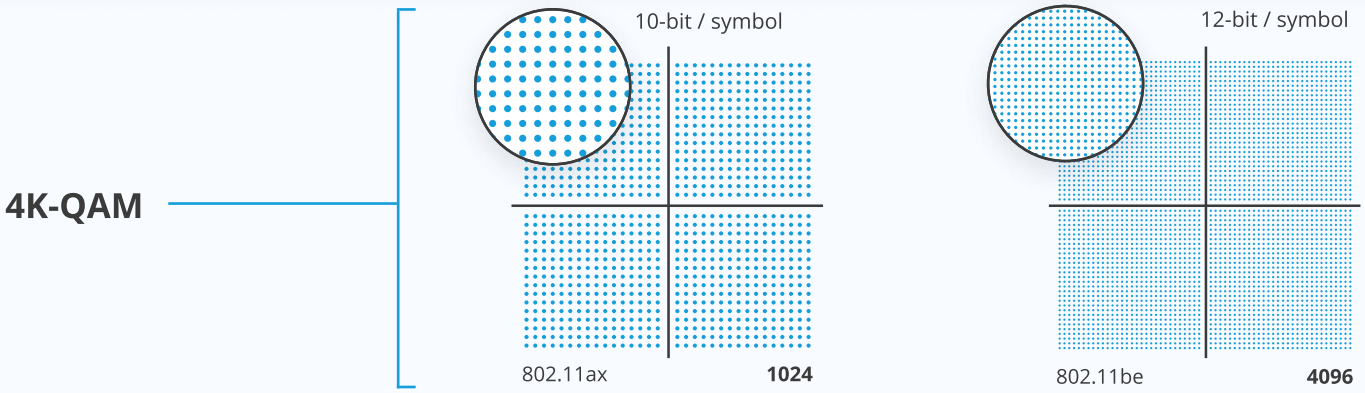
Learn more about spatial streams!

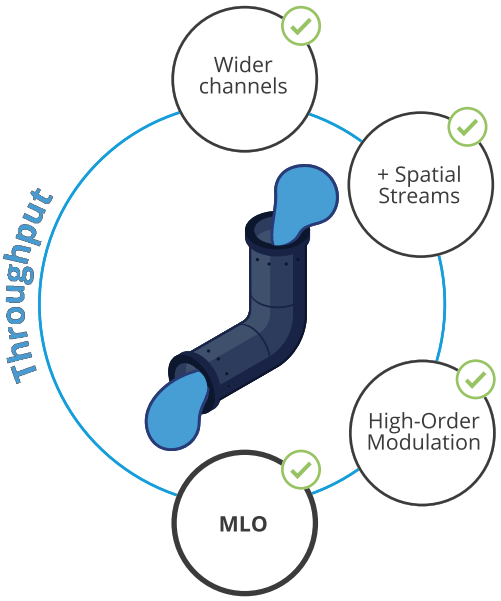
Become a Wi-Fi expert in our Wi-Fi 7 training



High-Order Modulation

Wi-Fi 7 increases the maximum modulation order from 1024 QAM to 4096 QAM. Every symbol can now encode 12 bits, while this was 10 bit before, this increases the maximum throughput by a factor 12/10 or 20%. Do note that 4096 QAM will only work at short ranges since a high signal quality is needed to be able to use this modulation.





Multi-Link Operation (MLO)

Before Wi-Fi 7, non-AP devices supported multiple bands but typically used only one (2,4, 5, or 6 GHz) at a time, switching as needed based on the environment.

With Wi-Fi 7, devices can be associated with the access point (AP) across multiple bands simultaneously. However, 'associated' doesn't necessarily mean that data is being transmitted on all bands at the same time. Device implementation limits impose various constraints on how and when multiple bands are actually used for data transmission.

But, why is MLO so misunderstood?

MLO: Powerful, but Misunderstood

Multi-Link Operation is one of the most talked-about features of Wi-Fi 7, but also one of the most misunderstood.

While the specification enables simultaneous multi-band operation, **actual support depends heavily on device capabilities** and chipset implementations.

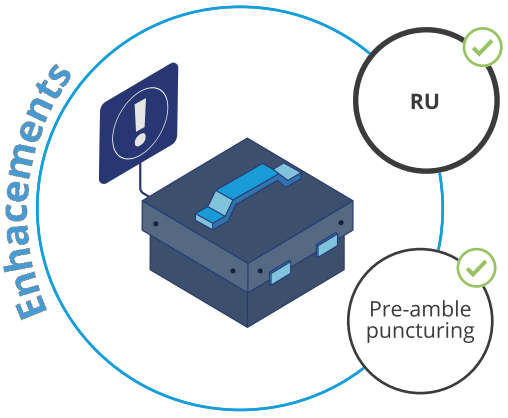
Many current client devices can connect across multiple bands but may **not support true parallel transmission or reception.**

In practice, “MLO support” often refers to **negotiated multi-link connectivity** rather than guaranteed concurrent data throughput.

Understand MLO inside and out at our Wi-Fi 7 training

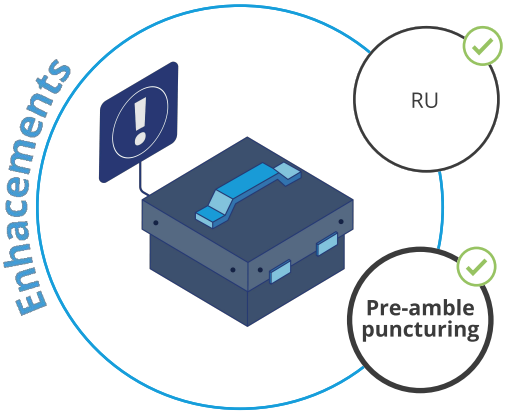
Additional Specs for Challenging Environments

Wi-Fi 7 also includes features designed to improve performance in congested or high-interference conditions:



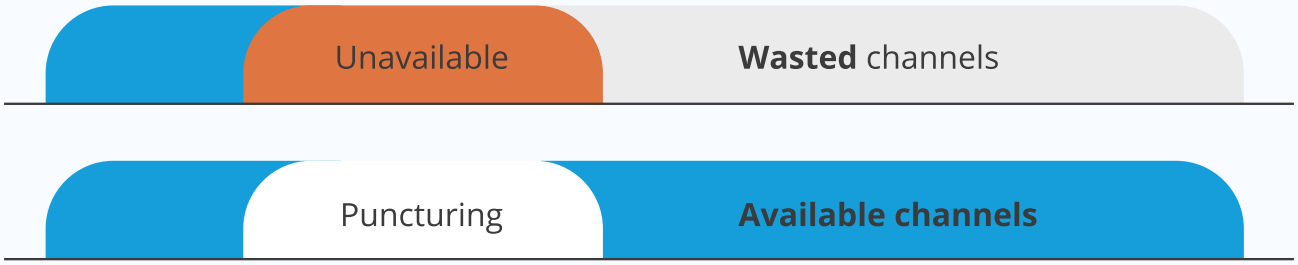
RU

OFDMA Resource Units (RUs) are used to transmit information from multiple devices simultaneously by allocating each device a portion of the spectrum. RUs come in a fixed set of widths, but in previous standards, it was not possible to assign more than one RU to a single client. This often led to inefficient spectrum use, for example, if a packet slightly exceeded the capacity of a 4 MHz RU, it would have to be placed in the next available size, such as 8 MHz, leading to wasted bandwidth.
With Wi-Fi 7, multiple RUs (e.g., a 4 MHz and a 2 MHz RU) can be combined and assigned to a single client. This flexible allocation reduces waste and improves efficiency.



Pre-amble puncturing

The feature of pre-amble puncturing allows to have certain blocks of spectrum in the channel to be disabled. This allows better usage of spectrum resources in the case that Wi-Fi networks are present that are for e.g. a block of 20 MHz in the middle of a 160 MHz wide channel. With puncturing a transmission on the 160 MHz wide channel is not possible when there's activity on the 20 MHz channel. With puncturing the 20 MHz would not be used and the 160 MHz channel would effectively be a 140 MHz channel, that could get much more airtime due to the fact that it has no dependency on the activity on the 20 MHz channel.



4 What did Excentis see?

The used Wi-Fi 7 AP specs claimed 22 Gbps. All clients were specified for 5.8 Gbps, mainly because they had 2 antennas (for each band) and limited support for simultaneous operation across the different bands. To learn more about how Wi-Fi 7 features have an impact on maximum throughput, please check our **Wi-Fi 7 training.**

Our testing didn't just confirm suspicions, **it exposed them.** In real-world conditions, we measured performance differences of up to 4x between devices that, on paper, looked virtually identical. Yes, four times the difference. Same specs, wildly different results.

It's a clear reminder: if you're serious about choosing the best Wi-Fi 7 devices, lab specs alone won't cut it. **Real testing is not optional, it's essential.**

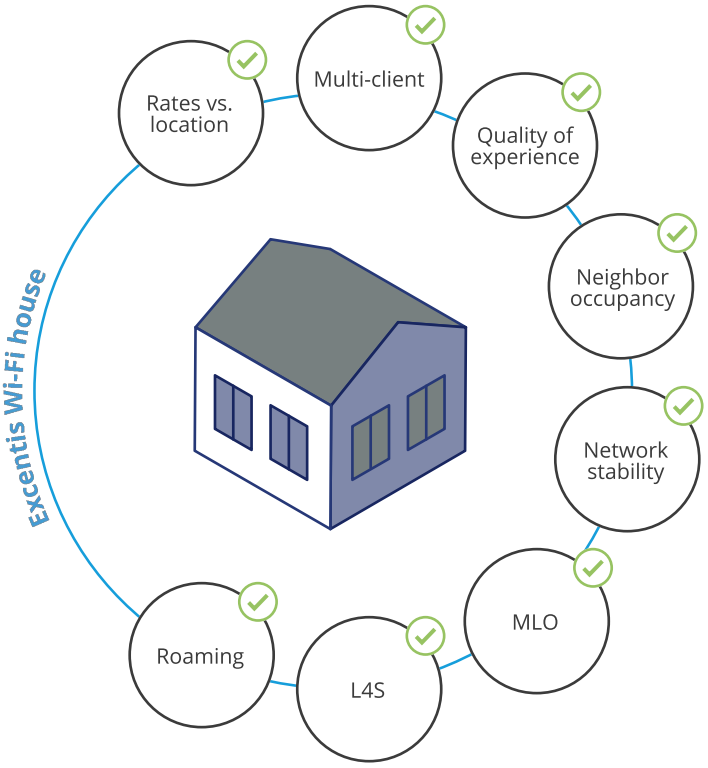
What Happens Inside the **Excentis Wi-Fi House**?

The Excentis Wi-Fi House is a testing environment designed to validate Wi-Fi performance in realistic, controlled conditions. Constructed to mimic a typical family home, using common materials like concrete, wood, and metal, it allows vendors and ISPs to assess how their Wi-Fi devices behave in true-to-life scenarios.

At its core, the Wi-Fi House offers automated, reproducible testing using the **ByteBlower + Endpoint system.**

This setup enables the measurement of real user experience, covering scenarios such as roaming, rates vs. location, multiclient, quality of experience, neighbor occupancy, network stability, multi-client performance, MLO (Multi-Link Operation) capabilities, and L4S (Low Latency, Low Loss, Scalable Throughput) performance.

Both standalone access points and mesh Wi-Fi systems can be evaluated.



Package options **Starter** **Standard** **Premium**

Tailored to different needs and client loads. Whether you're comparing access points, analyzing throughput at various locations, or validating performance under neighboring network interference, the Wi-Fi House delivers comprehensive data.

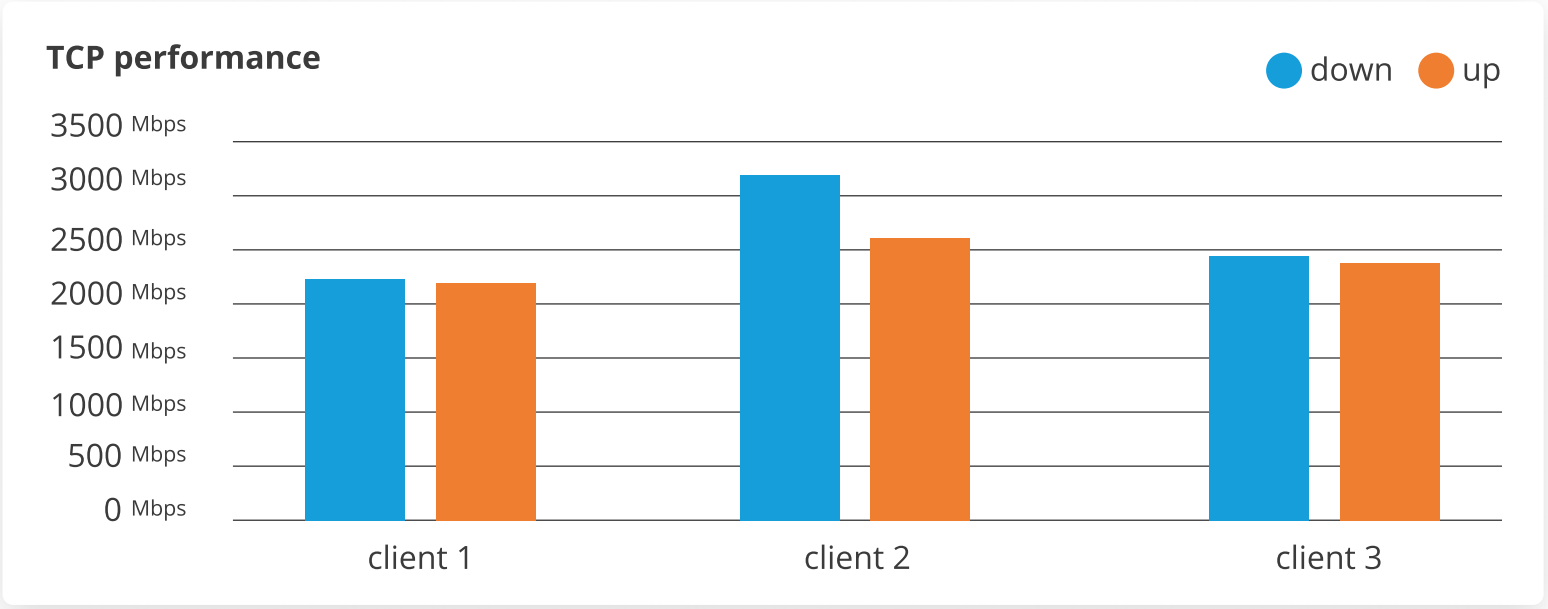
The facility is ideal for profiles seeking to fine-tune device performance, reduce customer complaints, and gain a competitive edge by proving real-world superiority of their Wi-Fi solutions, especially with emerging technologies like Wi-Fi 7.

Learn more about The Excentis Wi-Fi House

5 The Numbers

At proximity

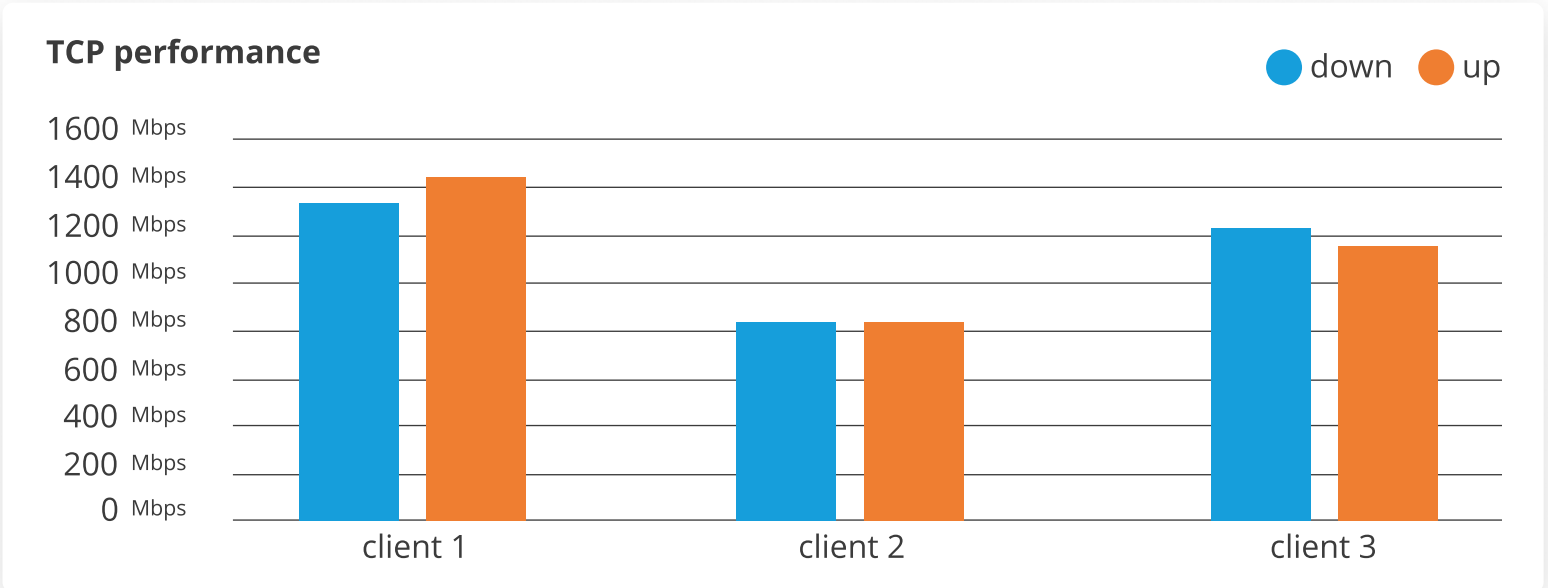
In this first test we measured the performance of the three adapters at very close range of about 1.2 meter.



The clear winner is client 2, in the downlink it performs almost 50% better than client 1.

At medium range

In this second test, we measured the performance of the three adapters at a medium range of approximately 12 meters, on the same floor as the previous test.



The clear winner in this case is client 1, outperforming client 2 by almost 50%.

At large range

In this third test, we measured the performance of the three adapters at a longer range of approximately 14 meters, on a different floor with more walls. The conditions were less optimal.

In this case client 1 outperforms client 2 in the downlink direction even by 400%. In the uplink the difference is about 200%.

6 Real-World Wi-Fi 7: What the Numbers Don't Tell You

At proximity (~1.2 meters)

Client 2 takes the lead, with ~50% higher downlink throughput than client 1.

clients 1 and 3 showed similar, lower performance.

At medium range (12 meters)

Client 1 pulls ahead, outperforming client 2 by nearly 50%.

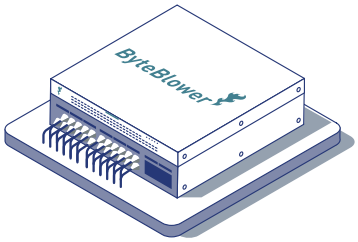
Client 3 stays close to Client 1 but slightly behind.

At large range (14 meters / upper floor)

Client 1 dominates with:
400% better downlink performance than client 2.

200% better uplink Client 2 struggles at distance, while Client 3 performs steadily but still below Client 1.

What can
EXCENTIS
do for you?



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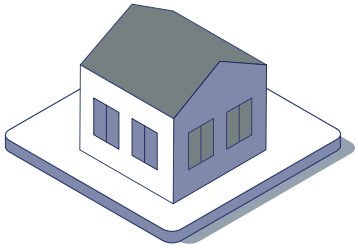

Test Wi-Fi 7 capabilities in **real world conditions.**

Specs might look the same, but chipset quality, driver optimization, and hardware design **create big performance gaps in the real world.**

These insights were only possible thanks to the powerful testing combination of the Excentis Wi-Fi House and the ByteBlower + Endpoint tool.

The Wi-Fi House is a controlled environment, a building, a real home, using materials such as concrete and wood to simulate everyday challenges.

With ByteBlower Endpoint, we could automatically measure how each device behaved in realistic conditions like multi-client traffic and roaming. This setup helps identify how well a Wi-Fi device truly performs (beyond the marketing claims) and gives manufacturers and service providers the data they need to deliver reliable, high-quality Wi-Fi.

Learn more