Wi-Fi performance comparison

Telenor Denmark
Wi-Fi Test Campaign – Fiber/Ethernet fixed access

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1 Executive summary

Telenor Denmark asked Excentis to assess the performance of their solutions with competitor solutions, making use of the Excentis Wi-Fi Test House to assess as close as possible to the real world scenarios. Telenor Denmark provided the following devices for test:

- Telenor - Icotera r2701
- YouSee - SagemCom D6
- Norlys - Nokia Beacon G6
- FastSpeed - Icotera i4882
- Hiper - ZyXEL EX3300-T0
- Waoo - AirTies 4960XR

The assessment includes the following tests:

- Rate versus location: Single client throughput test in various locations
- Multiclient: Airtime fairness with 10 clients connected to the access point.

The results of this assessment are elaborated in the following sections in this report.

2 Measurement results and comparison analysis

The Rate versus location test was executed with focus on the maximum throughput at short distance. For this reason, only the results for the nearest location in the Wi-Fi test house are measured for this test report. An overall Wi-Fi performance comparison was added for all Wi-Fi bands supported by the gateways.

Test traffic generation was done between the Wi-Fi clients and all available LAN ports on the gateways to assess the maximum possible throughput over the Wi-Fi channels through the gateway. Note that in an actual deployment the WAN interface can be the limiting interface for maximum Internet performance.

Also note that the maximum Internet speed is limited by the maximum speed of the WAN interface. The WAN interface of the Telenor - Icotera r2701, Norlys - Nokia Beacon G6 and Hiper - ZyXEL EX3300-T0 have a maximum speed of 2.5 Gbps. The WAN interface of the YouSee - SagemCom D6, Hiper - ZyXEL EX3300-T0 and Waoo - AirTies 4960XR have a maximum speed of 1 Gbps.

2.1 Maximum single-client Wi-Fi throughput

For each Wi-Fi gateway the graph shows the maximum achieved throughput in the specific direction for a single device. The reported maximum is the maximum over the two (2.4 GHz and 5 GHz) or three (2.4 GHz, 5 GHz and 6 GHz) bands supported by the gateway.

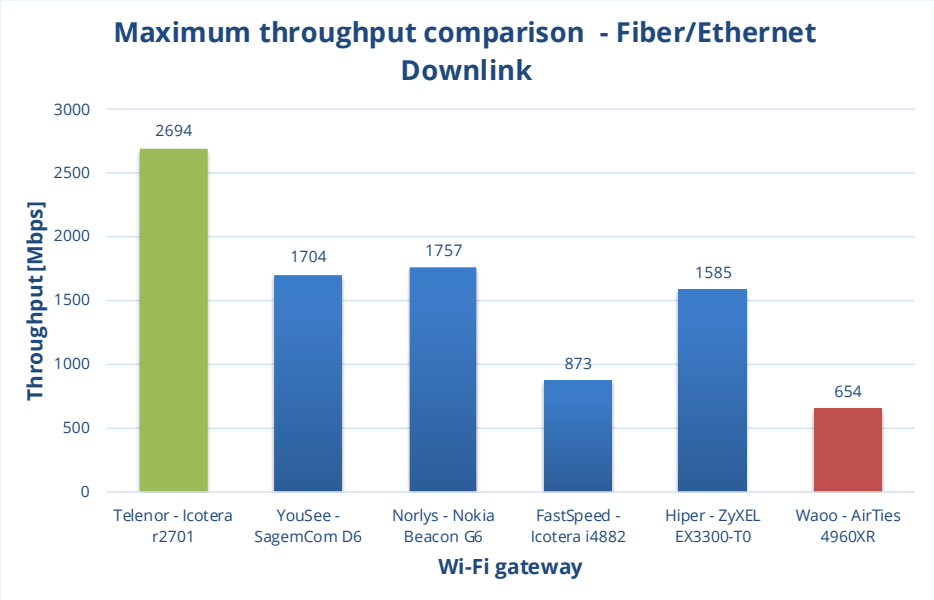


Figure 1 Maximum downlink single-client throughput

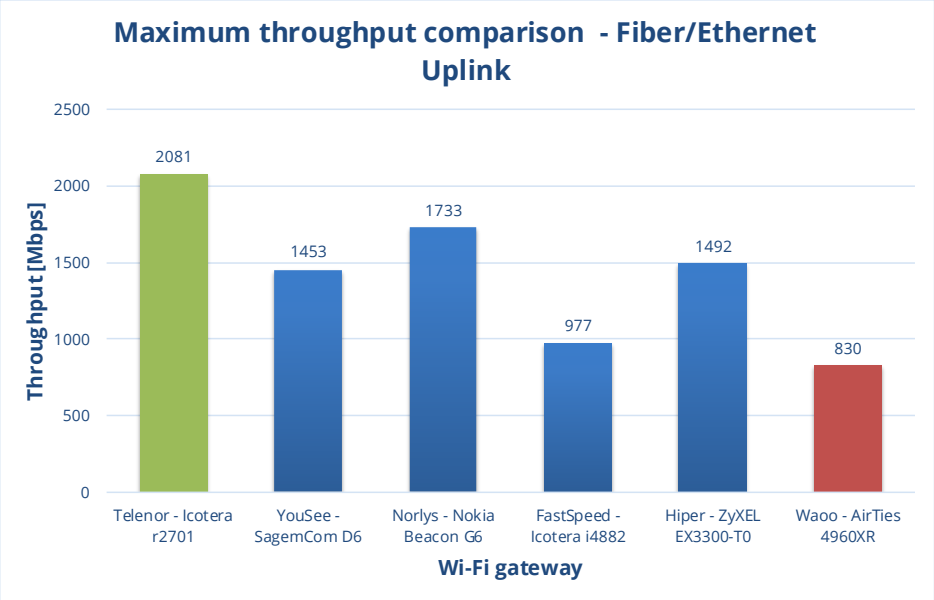


Figure 2 Maximum uplink single-client throughput

The Telenor - Icotera r2701 is the device that achieves the highest throughput for the single device test on a single Wi-Fi band. This is due to the fact that it is the only Wi-Fi gateway in the test which supports Wi-Fi 7 with 320 MHz channels on the 6 GHz band. The downlink performance (2.69 Gbps) is about 53% higher than the second best device in this test (1.76 Gbps on the Norlys - Nokia Beacon G6). Also the uplink performance (2.08 Gbps) is 20% higher than measured on the Norlys - Nokia Beacon G6 (1.73 Gbps).

Please note that to use the 6 GHz band with 320 MHz on the Telenor - Icotera r2701 gateway, the wireless client(s) also need to support Wi-Fi 7 with 320 MHz channels on the 6 GHz band.

The lower maximum throughput on the FastSpeed - Icotera i4882 can be mapped to the maximum bandwidth of 80 MHz on the 5 GHz band. The other gateways support 160 MHz bandwidth on the 5 GHz band.

The Waoo - AirTies 4960XR only has one 1 Gbps LAN connection. So, the gateway will never be able to use more than 1 Gbps throughput on its Wi-Fi network when communicating either over the LAN or WAN network.

2.2 Multiclient performance comparison

The graphs below show the result for the multiclient test: 10 clients are distributed over the house and active at the same time. The aggregated throughput (sum of throughput through each client) is reported in the graphs below. Specific details can be found in the test method description in section 6. Note that the clients are spread out over the Wi-Fi test house. This means that the aggregated throughput number cannot be compared to the one for a single client, single band Wi-Fi test.

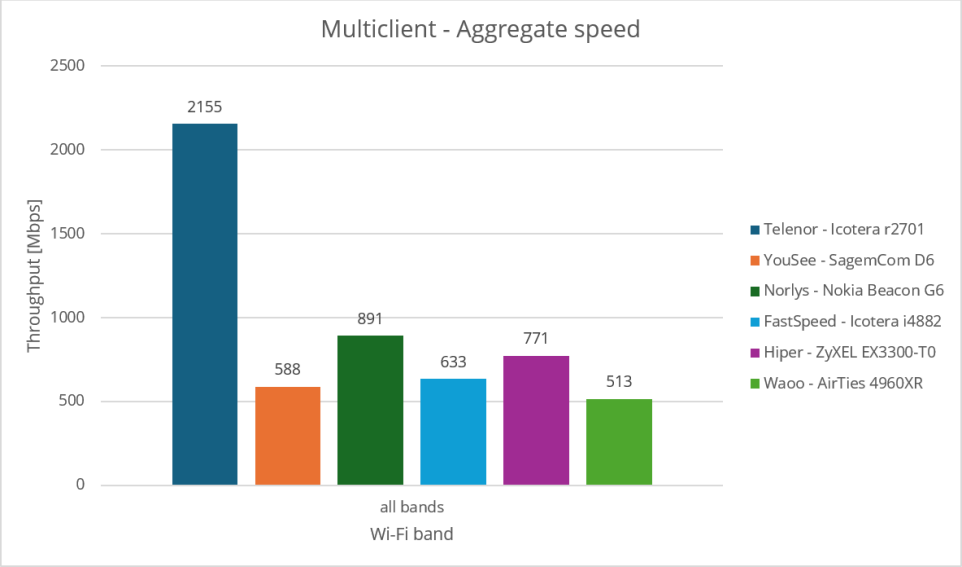


Figure 3 Multiclient test - Downlink aggregate speed

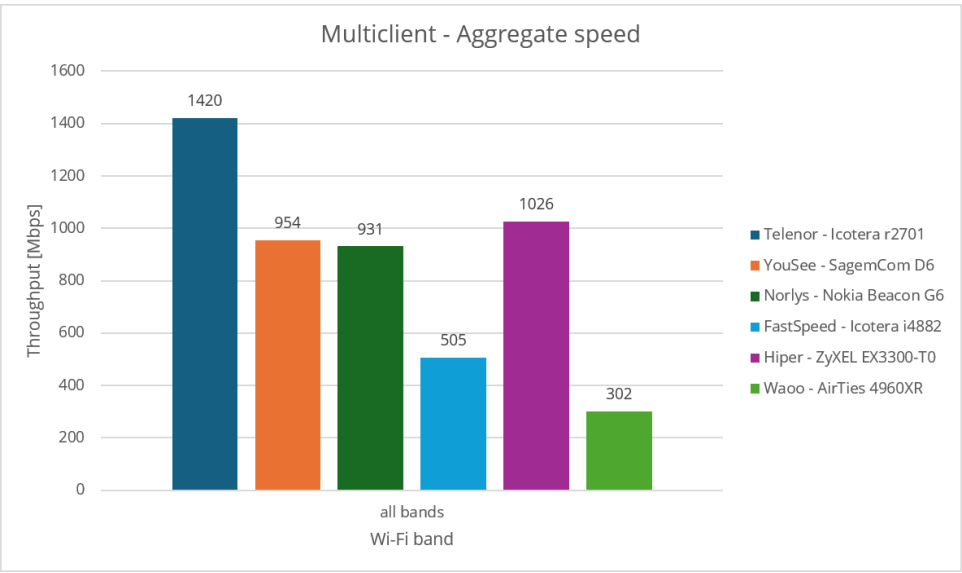


Figure 4 Multiclient test - Uplink aggregate speed

As can be seen in the graphs, the extra advantage of the 6 GHz band on the Telenor - Icotera r2701 is that both high-speed Wi-Fi bands (5 GHz and 6 GHz band) can be used simultaneously to increase the Wi-Fi capacity. Secondly, spreading multiple clients over different Wi-Fi bands also minimizes the chance of having congestions on the Wi-Fi channels.

The higher Wi-Fi capacity over multiple Wi-Fi bands will also allow to make use of the complete bandwidth for customers with higher than 1 Gbps connections.

2.3 Per Wi-Fi band comparison

For the single client rate versus location test per Wi-Fi band tests, we conclude the following:

Scenario		Best performance
2.4 GHz	Downlink	Norlys - Nokia Beacon G6 (*see notes in the next section)*
	Uplink	FastSpeed - Icotera i4882 (*close to Telenor - Icotera r2701 and Norlys - Nokia Beacon G6*)
5 GHz	Downlink	Telenor - Icotera r2701
	Uplink	Telenor - Icotera r2701
6 GHz	Downlink	*Only Telenor - Icotera r2701 supports the 6 GHz band*
	Uplink	*Only Telenor - Icotera r2701 supports the 6 GHz band*

On the 2.4 GHz band, there is some competition between the Norlys - Nokia Beacon G6 and FastSpeed - Icotera i4882 as also visible in the graphs in the next section. The Telenor - Icotera r2701 has similar good performance in the uplink, but lower performance in the downlink.

On the 5 GHz band, the Telenor - Icotera r2701 has very good performance, closely followed by the Norlys - Nokia Beacon G6.

2.3.1 2.4 GHz band

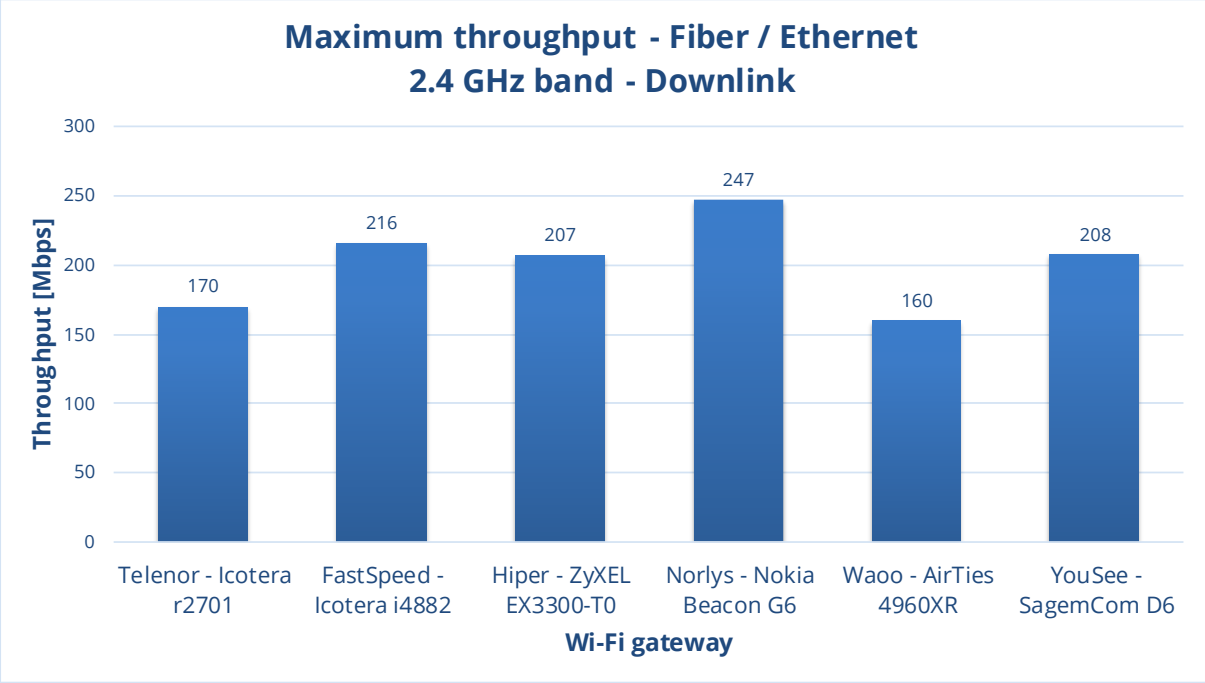


Figure 5 Downlink maximum throughput comparison on the 2.4 GHz band

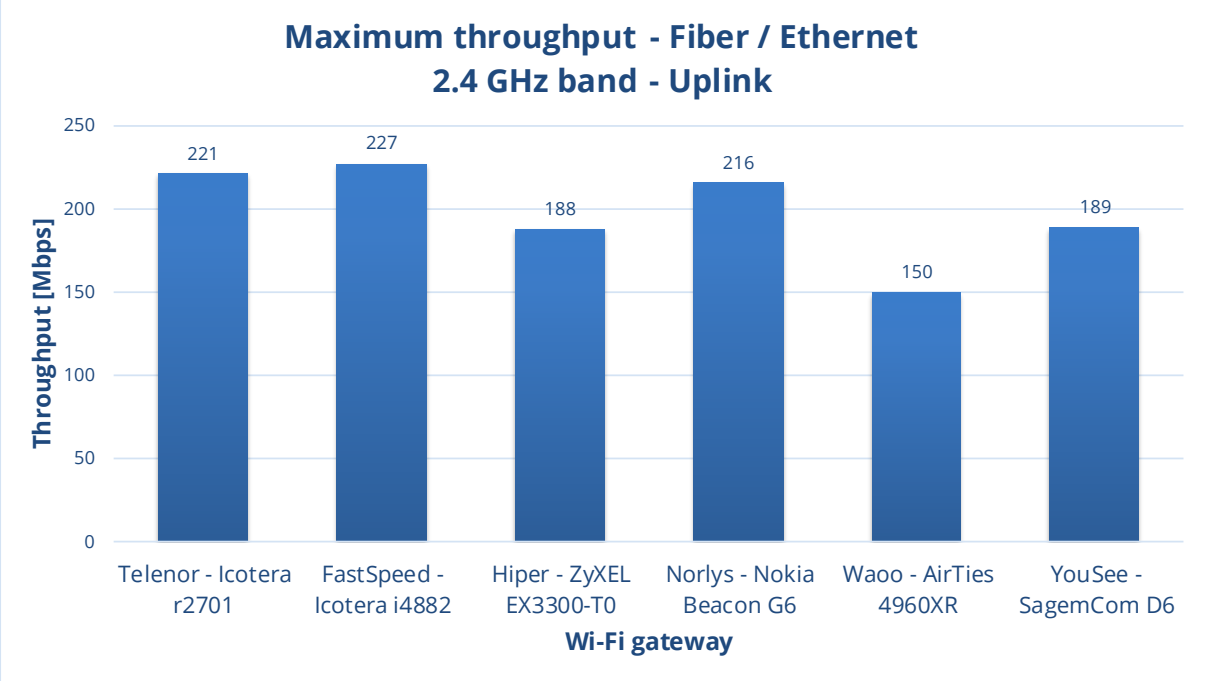


Figure 6 Uplink maximum throughput comparison on the 2.4 GHz band

On the downlink of the 2.4 GHz band, the Norlys - Nokia Beacon G6 shows the highest maximum throughput rates over all wireless clients (247 Mbps). The highest maximum throughput rates on the YouSee - SagemCom D6 are lower (208 Mbps), but from the detailed test results (not included in this document) it is seen that this access points has better results when looking over all wireless clients. The Telenor - Icotera r2701 has lower throughput than the other gateways (170 Mbps).

For the uplink performance, the FastSpeed - Icotera i4882 (227 Mbps) has the highest maximum throughput, second best is Telenor - Icotera r2701 (221 Mbps). The Norlys - Nokia Beacon G6 (216 Mbps) is following closely.

The Waoo - AirTies 4960XR has lower performance than what is typically seen on the 2.4 GHz band, both for the downlink throughput rates (160 Mbps) as for the uplink throughput rates (150 Mbps).

1.1.1 5 GHz band

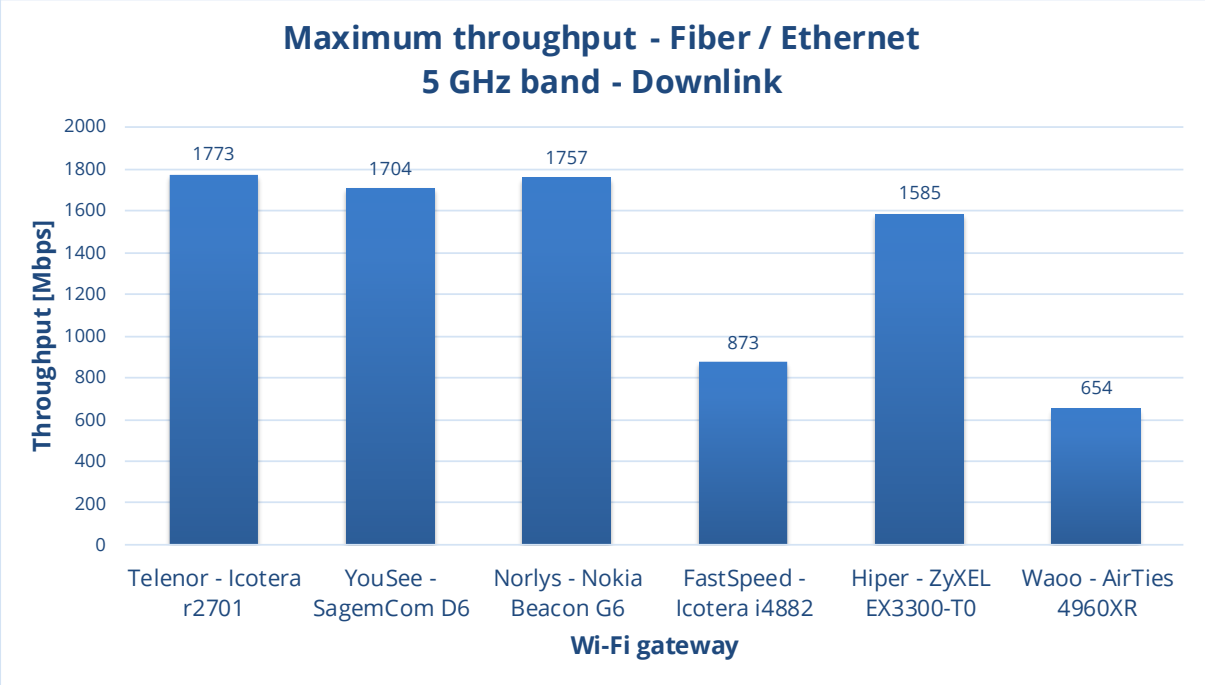


Figure 7 Downlink maximum throughput comparison on the 5 GHz band

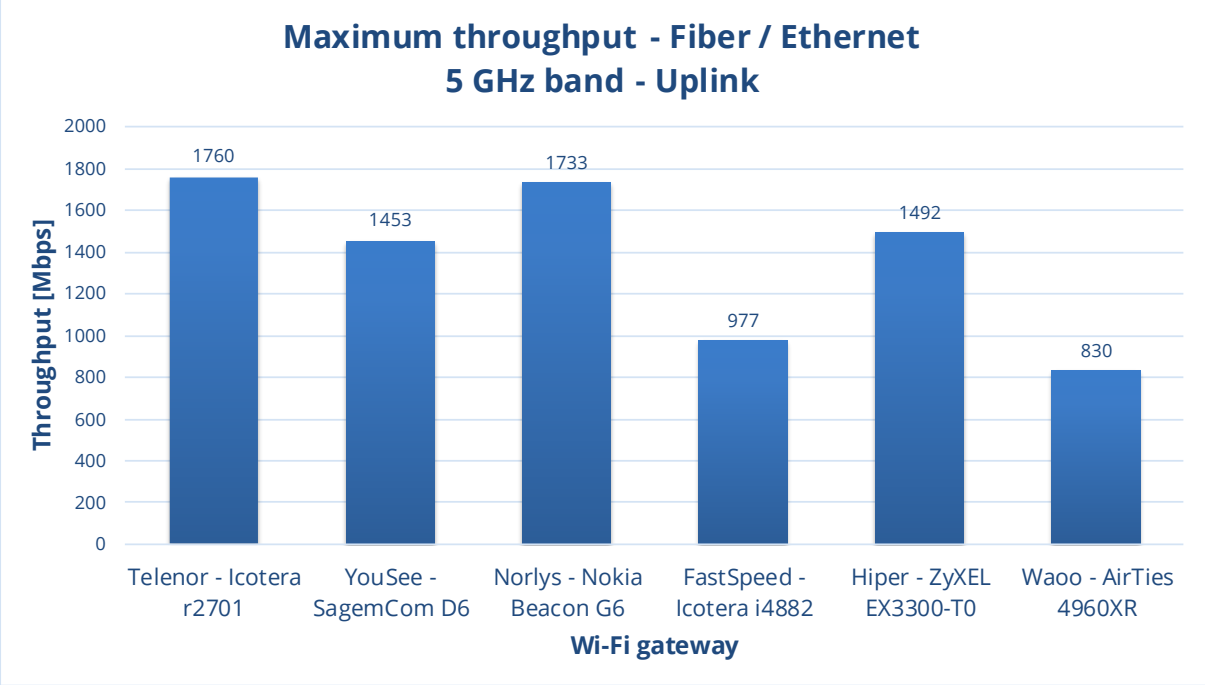


Figure 8 Uplink maximum throughput comparison on the 5 GHz band

The highest maximum throughput rates over all wireless clients are measured on the Telenor - Icotera r2701 both for downlink with 1.77 Gbps and uplink with 1.76 Gbps. On the downlink, the Norlys - Nokia Beacon G6 and YouSee - SagemCom D6 are in the same order of magnitude with 1.76 Gbps and 1.70 Gbps respectively. For the uplink, only the Norlys - Nokia Beacon G6 has similar throughput rates of 1.73 Gbps.

Two devices have a low performance with reference to the maximum throughput rates which are achievable on a 5 GHz band when using 160 MHz bandwidth.

The FastSpeed - Icotera i4882 has lower throughput on the 5 GHz band since it does not support 160 MHz channels, it is limited to 80 MHz.

The Waoo - AirTies 4960XR does have support for 160 MHz, but its WAN and LAN ports are limited to 1 Gbps. This means that the wireless clients will never be able to reach throughput rates higher than 1 Gbps even though the Wi-Fi bandwidth does allow it.

1.1.2 6 GHz band

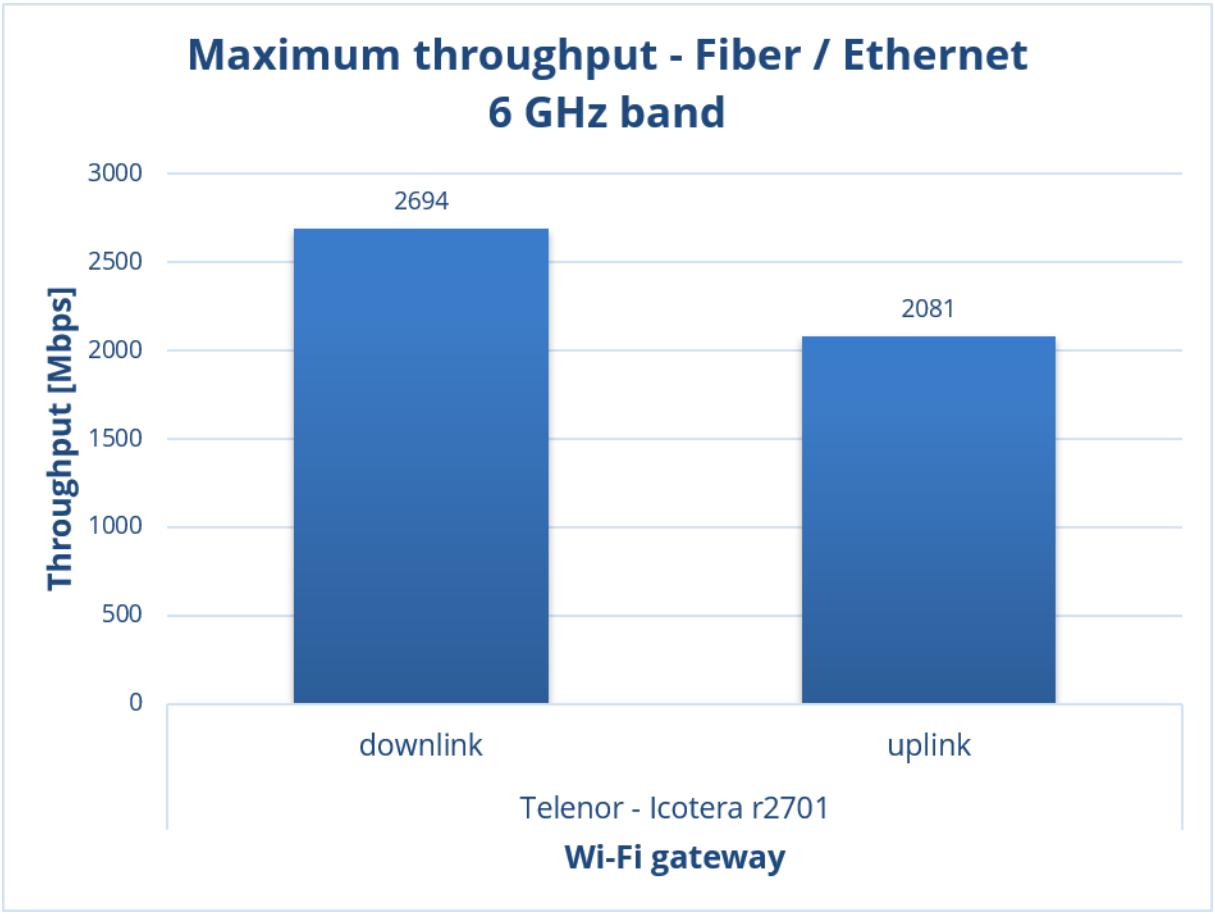


Figure 9 Maximum throughput comparison on the 6 GHz band

The maximum throughput over all clients in the graph above shows that the Telenor - Icotera r2701 is able to serve maximum throughput rates up to 2.69 Gbps downlink and 2.08 Gbps uplink with the selected wireless clients. This shows the benefits of Wi-Fi 7 with 320 MHz channels on the 6 GHz band.

3 Test Environment

3.1 Test house

Excentis' Wi-Fi test lab is a residential house in an interference-free environment. The ground floor and top floor are typically used for testing.

The access point is placed in a corner of the house, which allows us to create large distances between it and the wireless clients. This is useful for coverage tests and to really see the difference in device performance in a challenging environment.

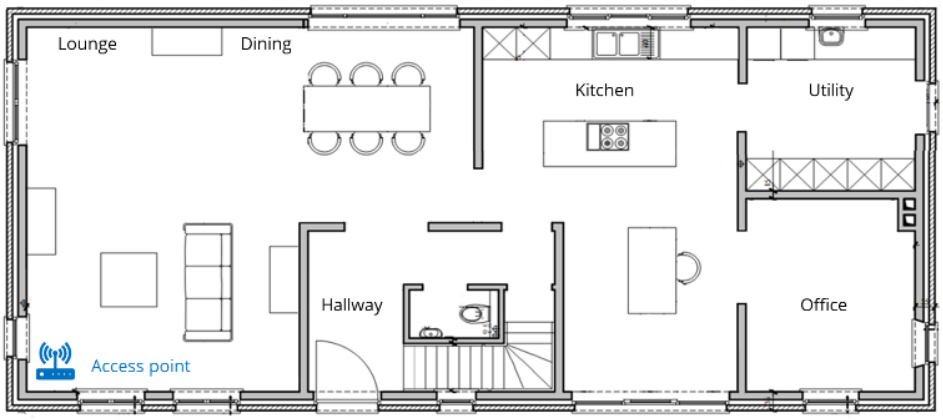


Figure 10 Ground floor with access point placement

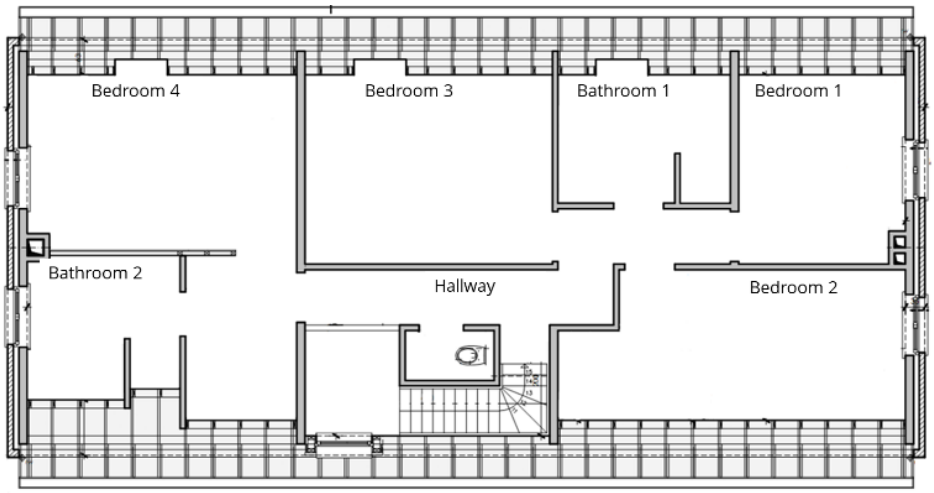


Figure 11 top floor (access point always stays downstairs)

The pictures below give an impression of the environment in which the tests are done, to accentuate the real-life character.

Figure 12 Outside view of the test house

Figure 13 Living room on the ground floor

3.2 Test traffic

Throughput tests are executed with TCP traffic flows that are not rate limited. Each test uses eight parallel TCP flows. This maximizes throughput since each potential short gap or drop in any TCP flow will be compensated by the other flows.

Each throughput test is a sequence of:

- 30 second downlink traffic (from access point to wireless client)
- 30 second uplink traffic (from wireless client to access point)

4 Device details

4.1 Wi-Fi access point

4.1.1 Telenor - Icotera r2701

- Hardware version: rev.2
- Firmware version: 1.0.0

4.1.2 YouSee - SagemCom D6

- Hardware version: 5DK80Y-07
- Firmware version: 2.26.4
- GUI version: 5.114.1

4.1.3 Norlys - Nokia Beacon G6

- Firmware version: n/a

4.1.4 FastSpeed - Icotera i4882

- Hardware version: HW rev.2
- Firmware version: 4882-0.4.0

4.1.5 Hiper - ZyXEL EX3300-T0

- Firmware version: V5.70(ACIF.2)C0

4.1.6 Waoo - AirTies 4960XR

- Firmware version: 4.177.8.8.888

4.2 Wireless clients

4.2.1 Clients for the Rate versus Location test

- OnePlus 15 (Wi-Fi 7): OxygenOS 16: CPH2747_16.0.5.703 Security updates April 2026
- Samsung Galaxy S25 (Wi-Fi 7): OneUI 8.5; Android 16; Security updates 5 april 2026
- iPhone 16 (Wi-Fi 7): iOS 26.5
- Samsung Galaxy S22 Ultra (Wi-Fi 6E): OneUI 8.0; Android 16; Security updates 5 Feb 2026
- Google Pixel 6 (Wi-Fi 6E): Android 16; Security updates 5 April 2026

4.2.2 Clients for multiclient test

- OnePlus 15 (Wi-Fi 7): OxygenOS 16: CPH2747_16.0.5.703 Security updates April 2026
- Samsung Galaxy S25 (Wi-Fi 7): OneUI 8.5; Android 16; Security updates 5 april 2026
- iPhone 16 (Wi-Fi 7): iOS 26.5
- Samsung Galaxy S22 Ultra (Wi-Fi 6E): OneUI 8.0; Android 16; Security updates 5 Feb 2026
- Google Pixel 6 (Wi-Fi 6E): Android 16; Security updates 5 April 2026
- MacBook Air M1 (Wi-Fi 6): Sequoia 15.7.7
- Samsung S20 (Wi-Fi 6): One UI 5.1; Android 13; Security updates 1 March 2025
- iPhone 15 Pro (Wi-Fi 6): iOS 26.5
- Windows 10 (Wi-Fi 5)
- MacBook Pro (Wi-Fi 5): Sequoia 15.7.7

5 Rate versus location test

5.1 Goal

The goal of the rate versus location test is to compare single client throughput rates between the access points. The inclusion of hard-to-reach locations will also give an indication of the device's coverage.

This is repeated with different wireless clients on all Wi-Fi bands to get a large data set. Additionally, this is repeated for each supported Wi-Fi band.

5.2 Test setup

The access point is placed in a corner of the house, which allows us to create large distances between it and the wireless clients. This is useful for coverage tests and to really see the difference in device performance in a challenging environment.

During this test, the access point remained stationary while the wireless clients were moved to eight discrete locations. The first four of these are shown on the floor plan below.

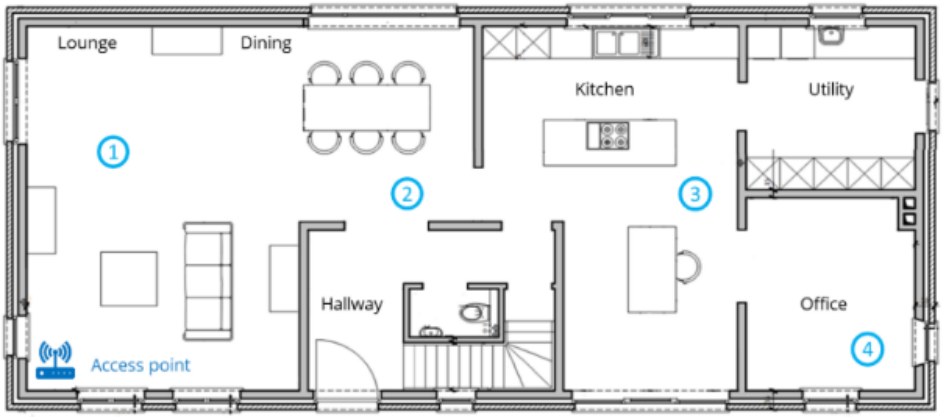


Figure 14 Four test locations on the ground floor

The remaining four test locations were on the top floor as shown below.

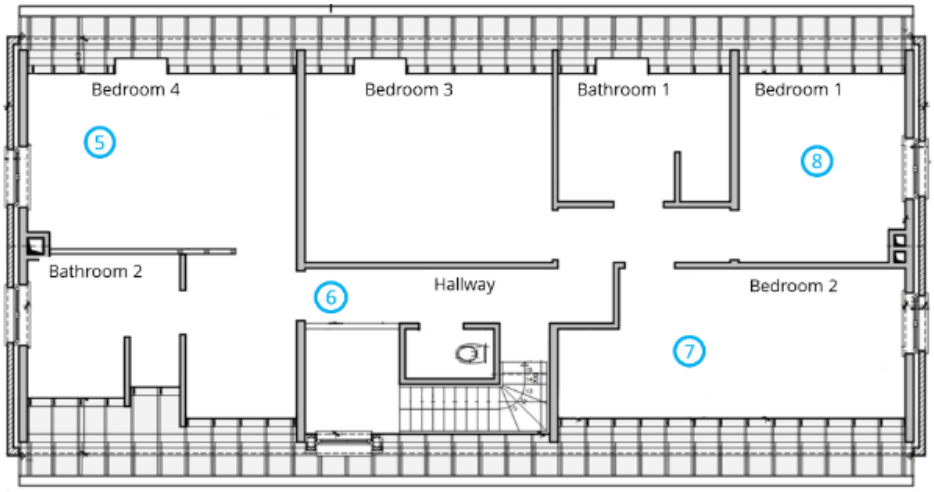


Figure 15 Four test locations on the top floor

5.3 Test parameters

Note: *For this test campaign the focus is on performance. Therefor the throughput was measured on a limited set of locations.*

The following wireless clients were used during this test:

- OnePlus 15 (Wi-Fi 7)
- Samsung Galaxy S25 (Wi-Fi 7)
- iPhone 16 (Wi-Fi 7)
- Samsung Galaxy S22 Ultra (Wi-Fi 6E)
- Google Pixel 6 (Wi-Fi 6E)

The access point is configured with separate SSID for all Wi-Fi bands to assess the performance of each band separately. Band-steering and MLO features are thus disabled to avoid the client moving to other Wi-Fi bands.

The test is executed with all available LAN ports connected. This will make sure that the LAN speed does not form the bottleneck for this maximum performance assessment. Please note that some gateways do have a limited total LAN speed (either number of ports or maximum link speed). For these devices the total LAN speed does not cover all available Wi-Fi bandwidth.

Additional graphs with maximum throughput over all wireless clients for the different Wi-Fi bands is added for a general overview.

On each of the test locations, both downlink and uplink are measured four times, with the wireless client placed in four orthogonal orientations (0, 90, 180 and 270 degrees). This will reveal any unexpected spatial sensitivity of the antennas. The final reported throughput is the *maximum* over these four measurements.

6 Multiclient test

6.1 Goal

Most real-life wireless networks typically have multiple clients connected. All these clients need to share the available airtime in a fair manner.

This test will verify that the access point is able to maintain a reasonably fair distribution of the airtime. An unfair distribution implies that some wireless clients get all airtime and others get almost nothing.

For the downlink, the access point is in control when assigning resources to all wireless clients. The performance indicators are:

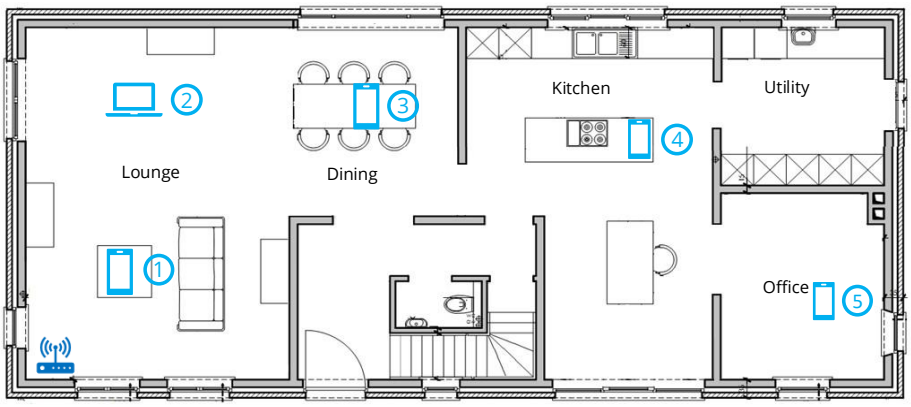
1. Is the airtime distributed fairly?
2. Are any wireless clients getting almost no airtime?
3. Is the total aggregate throughput rate according to expectations?

For the uplink, the wireless clients themselves have a large influence, and the access point is not so much in control as in the downlink. Here, the requirements are limited to two of the three:

1. Are any wireless clients getting almost no airtime?
2. Is the total aggregate throughput rate according to expectations?

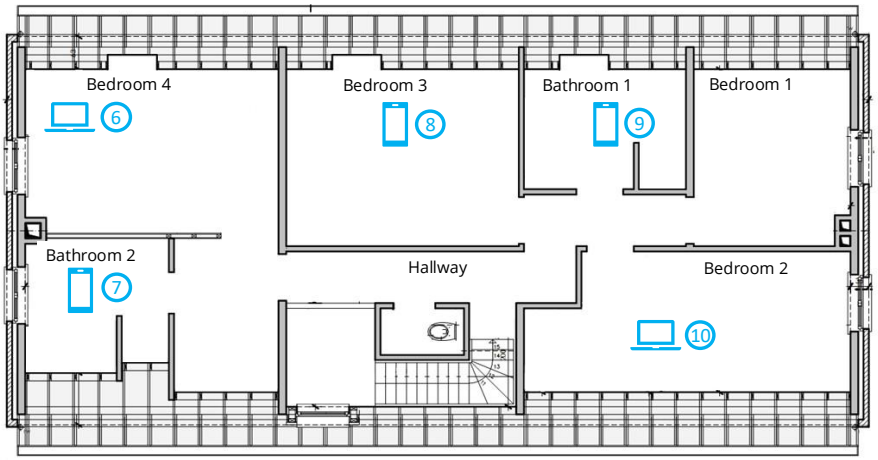
6.2 Test setup

Ten wireless clients were distributed over both floors of the house as shown below.



1. OnePlus 15 (Wi-Fi 7)
2. MacBook Air M1 (Wi-Fi 6)
3. Samsung S25 (Wi-Fi 7)
4. Samsung S20 (Wi-Fi 6)
5. Samsung S22 Ultra (Wi-Fi 6E)

Figure 16 Device locations on the ground floor



6. Windows 10 laptop (Wi-Fi 5)
7. iPhone 16 (Wi-Fi 7)
8. iPhone 15 Pro (Wi-Fi 6)
9. Google Pixel 6 (Wi-Fi 6E)
10. MacBook Pro (Wi-Fi 5)

Figure 17 Device locations on the top floor

6.3 Test method

When each client is the only one active on the network, it gets 100 % of the airtime and a throughput test will show the full single-client rate for this client. This is used as the benchmark to assess the airtime fairness and further referenced to as “its benchmark throughput”.

When all clients are active at the same time and airtime distribution is perfect, each client gets an equal percentage of the available airtime on the Wi-Fi band where its traffic is active. Hence it gets the same percentage of its benchmark throughput. In practice, this does not happen because of collisions, the medium access delay inherent to transmissions over a shared medium and specific device behaviour.

The first part of the test is the establishment of the benchmark. Each client is tested individually, and the respective benchmark throughput rates are logged.

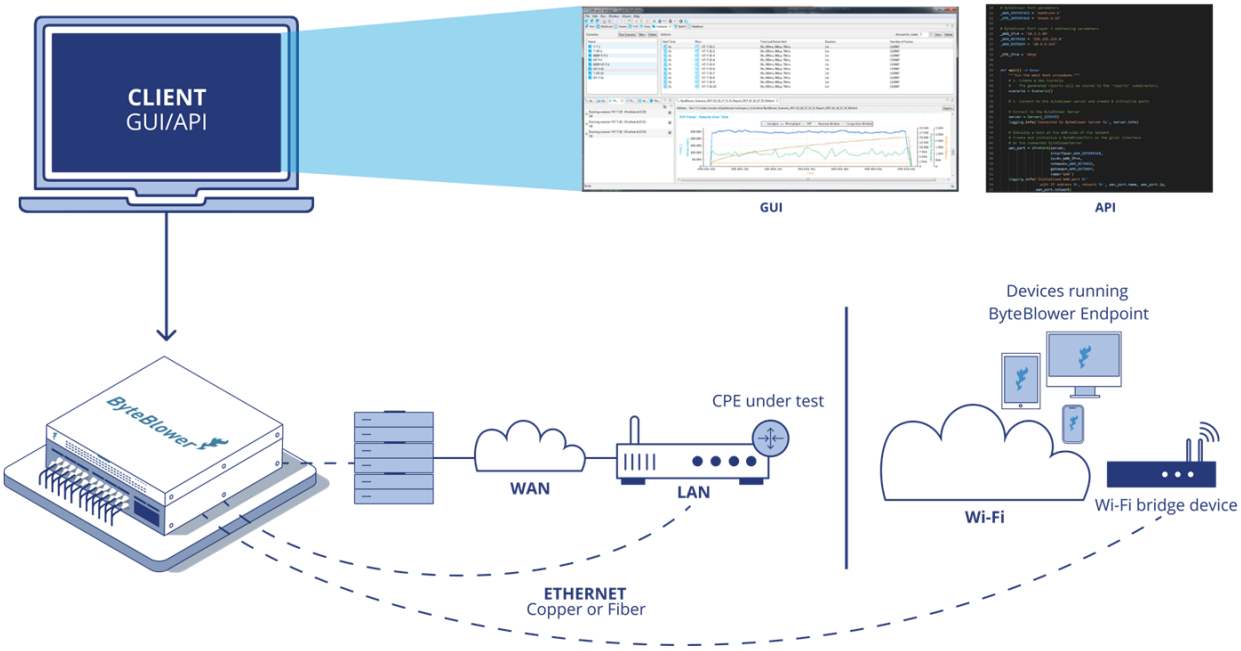
The second part has all clients active at the same time. The simultaneous throughput rates are then checked.

1. Is the throughput with all clients active around the expected percentage of the benchmark throughput for each client?
2. Does any client drop down to unusable levels (< 5 Mbps)?
3. Compare the aggregate throughput rate over all ten clients between the different access points.

7 Traffic generation

All traffic needed for execution of this test plan was generated using Excentis ByteBlower® ecosystem.

Visit the [ByteBlower website] for more information.



8 About Excentis

Excentis provides **independent, operator-grade testing and validation** for broadband and Wi-Fi performance — helping ISPs translate technology into **measurable customer experience gains**.

What this means for operators

For Commercial Strategy

- **Differentiate with Wi-Fi 7**
- Position premium tiers around **multi-Gbps in-home experience**
- Use test-backed results in **marketing & lead generation**

For Customer Experience

- Ensure consistent performance across **multi-device households**
- Avoid congestion issues in busy homes
- Deliver reliable gigabit Wi-Fi beyond the access link

For Product Strategy

Invest in:

- Wi-Fi 7 gateways
- Multi-band optimization
- Spectrum utilization (incl. 6 GHz)

Interested? Feel free to reach out to us!

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