Measuring Broadband New Zealand

Report 20, June 2024

The Measuring Broadband New Zealand programme measures the quality of New Zealand's fixed line, fixed wireless, and satellite internet. The aim of the programme is to independently measure and report on the actual in-home broadband performance so consumers can assess different providers, plans, and technologies to help them choose the best broadband for their homes. It will also encourage providers to improve and compete on their performance.

Please refer to page 21 for speed test results. The report also includes summary tables at the back that show the results for easy reference.

This report provides an overview of the findings from data collected between 1st April and 30th April 2024.

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Overview

This report presents the key indicators of consumer internet performance in New Zealand from testing during April 2024.

Highlights include:

1. **For the first time, reporting download and upload speed results of two of Spark's 4G Fixed Wireless plans using embedded technology.**
2. **Reporting on average download and upload speeds for Spark's 5G Fixed Wireless plan. This marks the first-ever inclusion of 5G Fixed Wireless results in MBNZ.**
3. **Continuing to compare results from previous MBNZ reports across the past year for quality of service metrics (download, upload and latency).**

This report draws on testing from a wide range of providers, and a full list of RSPs included in this MBNZ report can be found in Table 2. There are a range of other RSPs to choose from who are not currently included in the testing, and we encourage Kiwis to shop around. Previous reports released by the MBNZ programme can be found here[1].

The MBNZ programme has a code of conduct to ensure that the parties involved act in good faith and in accordance with principles relating to data validation, 'gaming' of results, and appropriate public usage of the MBNZ results. A list of the signatories is included in the code, including the Commission and SamKnows. All tested RSPs complied with the current code of conduct, including validation of the data used in this report. You can see the code of conduct on our website here.[2]

[1] https://comcom.govt.nz/regulated-industries/telecommunications/monitoring-the-telecommunications-market/monitoring-new-zealands-broadband/Reports-from-Measuring-Broadband-New-Zealand
[2] https://comcom.govt.nz/__data/assets/pdf_file/0026/334871/Measuring-Broadband-NZ-Code-of-Conduct-October-2023.pdf

Executive Summary

Application Performance

1. Over 99% of Fibre 300, Fibre Max and HFC households were able to support 4 simultaneous UHD Netflix Streams. 78% of LEO Satellite households were able to support 4 simultaneous streams, and 98% could support 3 simultaneous streams.

2. Online gaming shows consistent results for the games included in the previous report, with LEO Satellite results sitting between VDSL and 4G Fixed Wireless. The three games testing to servers in North America showed much higher latencies across all technologies compared to games with gaming servers located in Australia. This increased latency could negatively impact the user experience for latency sensitive games.

3. Latency to most social media platforms and video conferencing services remained fairly consistent compared to the previous report, with Snapchat seeing a small increase in latency for users receiving images.

Benchmarking

1. All plans saw stable download, upload and latency results compared to the previous reporting month.

Broadband Plan Comparison

This report includes broadband plans across a range of technologies and areas. The report shows performance comparison split across areas where Fibre broadband is available (urban areas), and where Fibre is not an option (rural areas). This comparison refines and expands our previous urban and rural view to better allow consumers to see how different technologies such as 4G Fixed Wireless perform in different areas. Areas with access to Fibre plans (Specified Fibre Areas) are the locations where Chorus will eventually be able to stop providing copper-based internet services (ADSL & VDSL plans), because Fibre is available. These are typically in more urban areas of New Zealand. More information on the withdrawal of copper-based internet services is available on the Commerce Commission website here[1].

ADSL - Remains suitable for traditional services like web browsing, email, and basic video streaming, particularly when there is only one person using the connection. Due to physical limitations, the highest-performing ADSL lines will never achieve download speeds higher than ~25 Mbps. The distance from house to exchange has a big effect on attainable speeds, with many ADSL lines averaging under 8 Mbps download. The higher latency, more frequent dropouts, and lower upload speeds make ADSL less suitable for video calls and multi-user households.

VDSL - There is a range in performance, some lines will achieve similar download/upload speeds to ADSL, whereas a small proportion of lines will achieve speeds comparable with Fibre 100, and certainly with lower speed Fibre plans. Lower speed lines will be less suitable for applications that use a lot of data, such as video conferencing and Ultra High Definition (UHD) streaming, whereas higher speed lines will generally support more data-heavy applications.

Fibre 50 - Supports latency-sensitive applications such as online gaming. Fibre 50 will also support applications such as UHD streaming and video conferencing. Fibre 50 may be unsuitable for data-heavy households with multiple simultaneous users.

Fibre 300 - Supports latency-sensitive applications such as online gaming. Fibre 300 will also support data-heavy applications such as UHD streaming with multiple simultaneous users or video conferences with a large number of participants. Fibre 300 will cover most users' requirements.

Fibre Max - Higher download and upload speeds than Fibre 300. The idle latency to internet applications, such as online games, through a Fibre Max line is the same as through any other Fibre

[1] https://comcom.govt.nz/regulated-industries/telecommunications/regulated-services/consumer-protections-for-copper-withdrawal

plan. Latency under load is lower for Fibre Max plans than for Fibre 300. Performance can vary depending on RSP, and Fibre 300 will support most modern internet applications and multi-user households. Fibre Max might be needed in cases where there is a genuine need for more bandwidth (e.g. frequently uploading or downloading large files) or when using extremely latency sensitive applications on a busy connection.

HFC (Cable) - Available in some areas (Wellington, Upper & Lower Hutt, the Kapiti Coast, and parts of Christchurch). HFC is also referred to as Cable and DOCSIS. One New Zealand is the only provider operating an HFC network in New Zealand. HFC lines achieve similar download/upload performance to Fibre Max, however latency can be higher due to the difference between Cable and Fibre technologies.

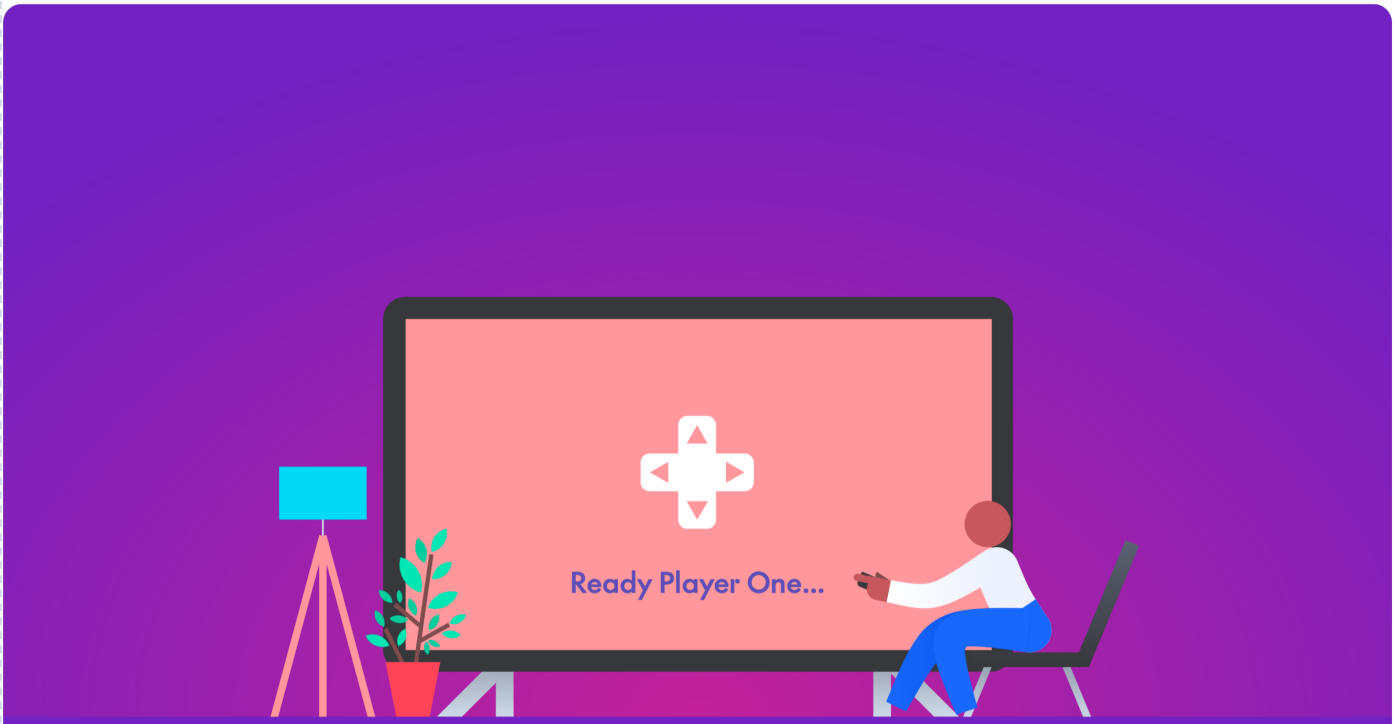
4G Fixed Wireless - Can offer higher download speeds than ADSL, and on average similar speeds to VDSL. Users will experience higher latencies due to the cellular technology underlying these plans. 4G Fixed Wireless has the highest latency of all technologies, and also delivers lower download/upload speeds and more frequent dropouts than Fibre. This range of performance factors means 4G Fixed Wireless should not necessarily be preferred to Fibre on performance grounds, however in some areas 4G Fixed Wireless is the only option for consumers, and even in areas where Fibre is available there are other reasons consumers might choose this option (ease of installation for example).

5G Fixed Wireless - Expected to support data-heavy applications, such as UHD streaming with multiple simultaneous users. Being a Fixed Wireless technology, users will likely experience higher latencies due to the nature of cellular technology. The 5G Fixed Wireless results presented in this report are specific to Spark. As each RSP has different fixed wireless infrastructure, these results should not be directly compared between RSPs.

LEO Satellite - Available in both rural and urban areas and is transmitted wirelessly using a satellite and ground based satellite dish. Typically higher download speeds than a Fibre 100 plan, but this can vary with location. While speeds can be expected to handle most applications, including video conferencing and streaming, it is not as consistent as fixed line broadband due to factors such as congestion and bad weather. Starlink is currently the only LEO Satellite provider included in the MBNZ report.

Other Broadband Plans - There are other plans available that are not currently reported on by MBNZ. Fibre 30, 100 and 200 plans should be broadly consistent with results measured for Fibre 50, 300 and Fibre Max for latency and reliability metrics. The main differences for these lower speed

Fibre plans would be lower download and upload speeds, meaning it would take longer to download and upload larger files, and they would be able to support fewer users at the same time when using video streaming services. For WISP Fixed Wireless plans it is not possible to give any firm advice around their suitability for different applications at this stage due to the variety of implementations and low sample size.



Application Performance

In this section we report on the performance of a number of common applications that consumers in New Zealand use on a regular basis. Results for YouTube are not included in this report due to recent configuration updates but will be included in the next MBNZ report.

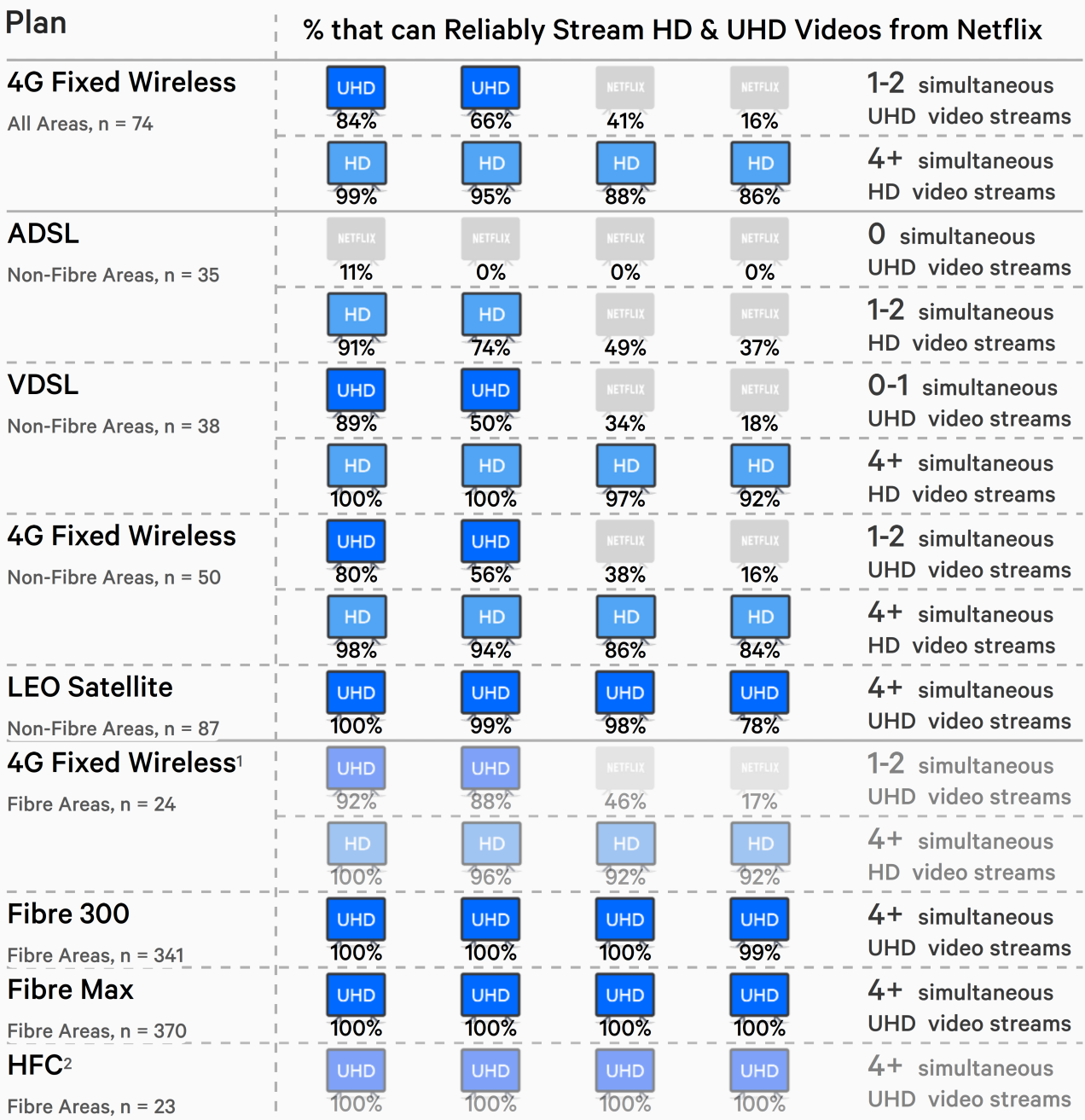
Some results in this section are shown with error bars representing the 95% confidence interval for each plan. This means that if we had repeated our measurements 100 times, we would expect the result to have fallen within the black bands in at least 95 cases.

The transparent bars show plans with a sample size lower than we would typically include within reporting. These plans have larger error bars due to the smaller sample size and care should be taken when comparing these plans against others. We recommend consumers factor in the error bars when comparing plan averages, especially those with smaller sample sizes.

Netflix

Video streaming is a good example of an application where the quality of a user's experience is more affected by bandwidth (capacity) than by latency (lag). The Netflix measurement streams real video from the live Netflix service [1]. Traffic for this service is often delivered from within broadband provider's network to improve performance. The transparent screens show plans with a sample size lower than we would typically include within reporting.

Figure 1:



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[1] This test runs on an idle connection, results may be affected with simultaneous usage. Results are also collected across all hours of the day, and peak hour performance may vary. HD is measured at 3 Mbps, and UHD at 15 Mbps in accordance with Netflix guidelines.

Key Observations

- 78% of LEO Satellite plans were able to stream 4 simultaneous UHD Netflix streams, an increase compared to the previous 60%.
- 84% of households on Fixed Wireless across all areas of New Zealand were able to support a single UHD stream, and 86% of households could support at least 4 simultaneous HD streams.
- In non-Fibre areas, 80% of 4G Fixed Wireless households were able to support a single UHD stream, and 84% of households could support at least 4 simultaneous HD streams.
- In Fibre areas[1], 92% of 4G Fixed Wireless households were able to support a single UHD stream, and 92% of households could support at least 4 simultaneous HD streams.
- At least 99% of households on Fibre 300, Fibre Max or HFC[2] plans were able to support 4 simultaneous UHD Netflix streams.
- 89% of households on VDSL plans in non-Fibre areas were able to support a single UHD stream, and 92% could support 4 simultaneous HD streams. For ADSL households in non-Fibre areas, only 11% were able to support a single UHD stream, while 49% could support 3 simultaneous HD streams.

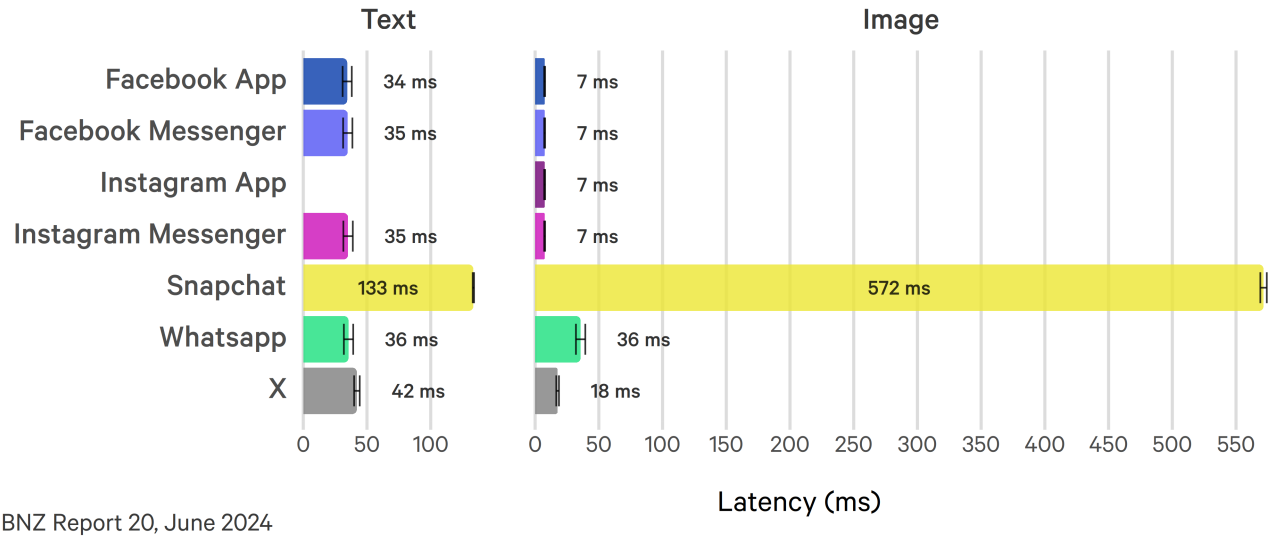
[1] Results for 4G Fixed Wireless in Fibre areas are based on a sample size of 24 Whiteboxes. The lower sample size can be attributed to Fixed Wireless being a new area of focus for the MBNZ programme and we hope to increase this number for subsequent reports.
[2] Results for HFC are based on a sample size of 23 Whiteboxes. The low sample size can be attributed to the relatively small coverage area of One New Zealand's Cable network and the competing influence of Copper, Fibre and Fixed Wireless in those areas.

Social Media

Social media applications generally involve fetching a large number of relatively small pieces of information (single images, short pieces of text, and so on). Applications such as Facebook serve different types of content from different servers - for example, an image will come from one server while its caption will come from a different server. Due to this, latency to the server will be a large factor of how responsive social media applications will be, however there are other factors that can also influence performance.

Figure 2: The Latency to Servers of Different Social Media Platforms.

Average of household average latency to content servers, lower is better.
Fibre plans only.



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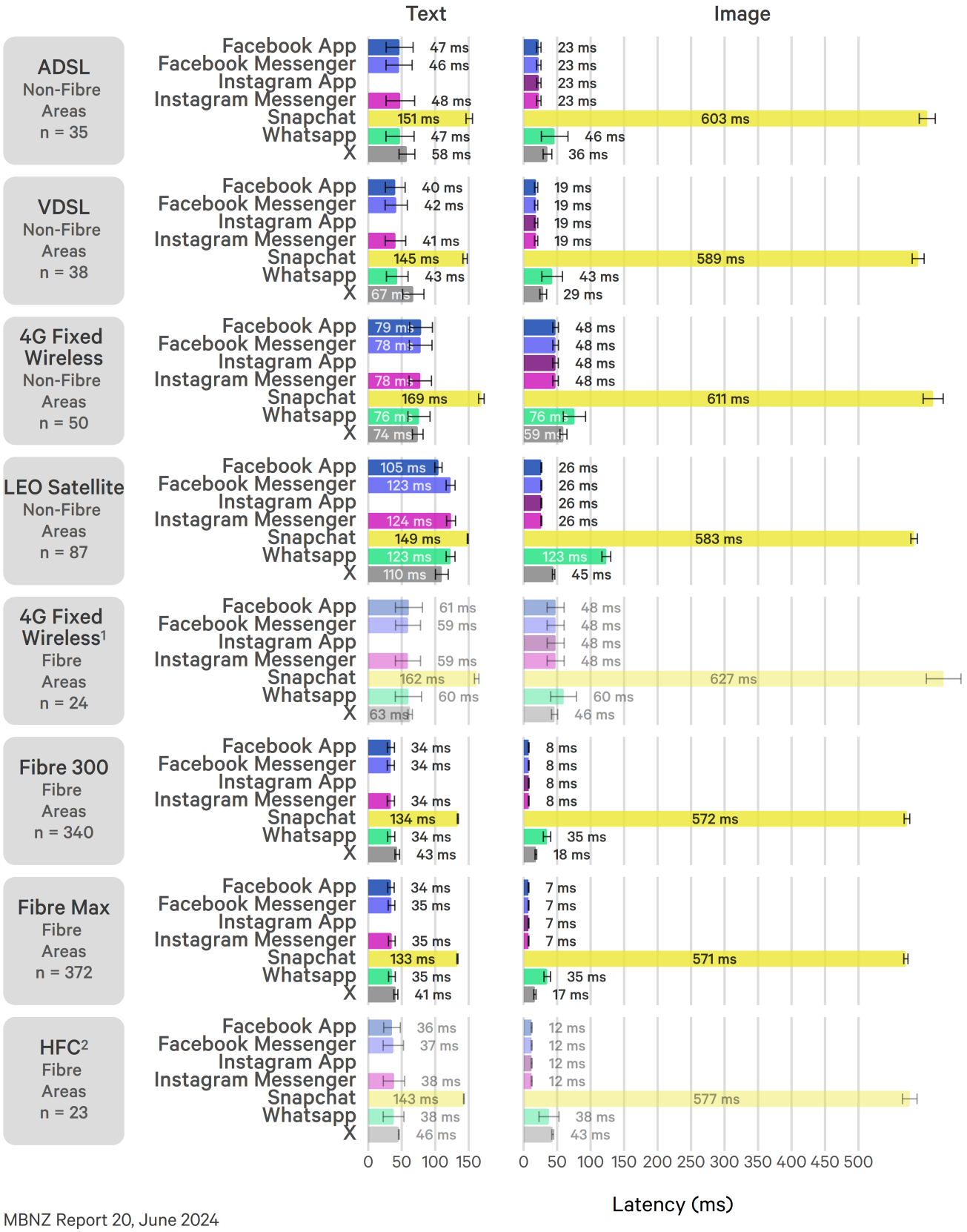
Key Observations

- Latency values for all social media services remained consistent for Fibre plans compared to the previous report.
- Snapchat image latencies increased compared to the previous report and remain higher than all other social media platforms tested for both Image and Text downlink. Consumers may notice a several second delay when using Snapchat, to download an image for example, compared to other social media platforms due to Snapchat's hosting location. This is outside the control of RSPs.
- Latency results are shown for Fibre plans only. Results for social media split by individual plans can be seen in the figure below, and results for all RSPs can be seen in Table 5.

Figure 3: The Latency to Servers of Different Social Media Platforms by Plan.

Average of household average latency to content servers, lower is better.

The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 35).



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[1]Results for 4G Fixed Wireless are based on a sample size of 24 Whiteboxes in Fibre areas. The lower sample size can be attributed to Fixed Wireless being a new area of focus for the MBNZ programme and we hope to increase this number for subsequent reports.

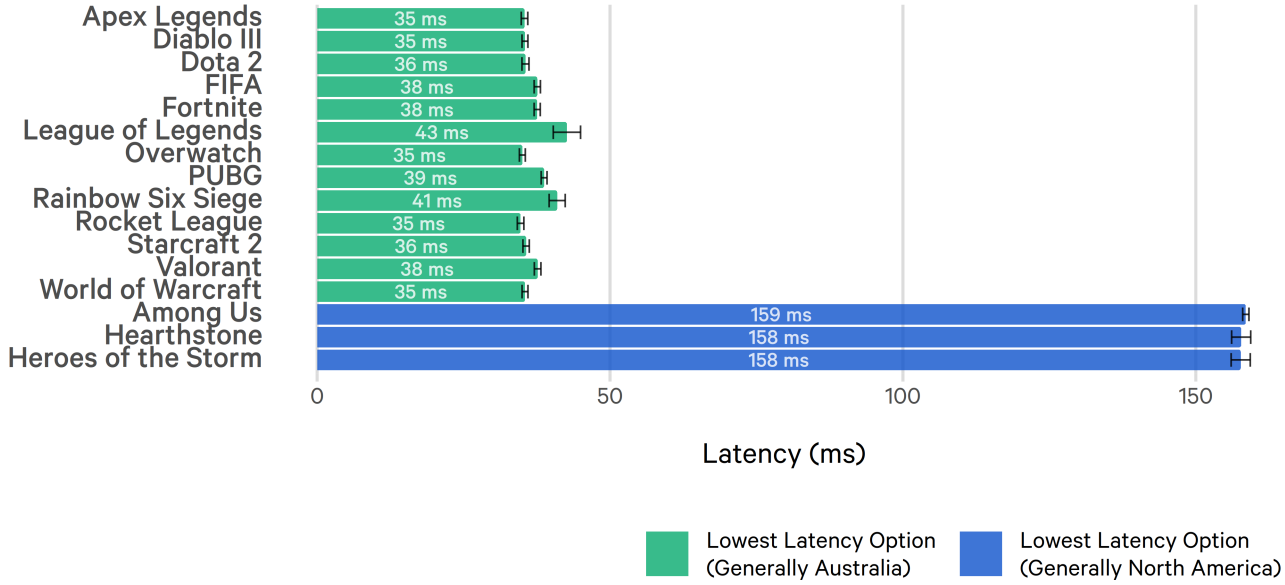
[2]Results for HFC are based on a sample size of 23 Whiteboxes. The low sample size can be attributed to the relatively small coverage area of One New Zealand's Cable network and the competing influence of Copper, Fibre and Fixed Wireless in those areas.

Online Gaming

Online gaming applications require low latency between users' machines and the central host server. If it takes a long time to pass messages between the users' device and the server where the game is hosted, then disruptive stuttering or lag will result. This is usually when latency increases beyond 50 or 100ms – some game servers will simply refuse to admit players who have triple-figure latency because this will ruin the game for everyone else.

Figure 4: The Latency to Various Online Gaming Servers.

Average of household average latency to gaming servers, lower is better.
Fibre Plans Only. Lower latency means that lag is less likely.



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Key Observations

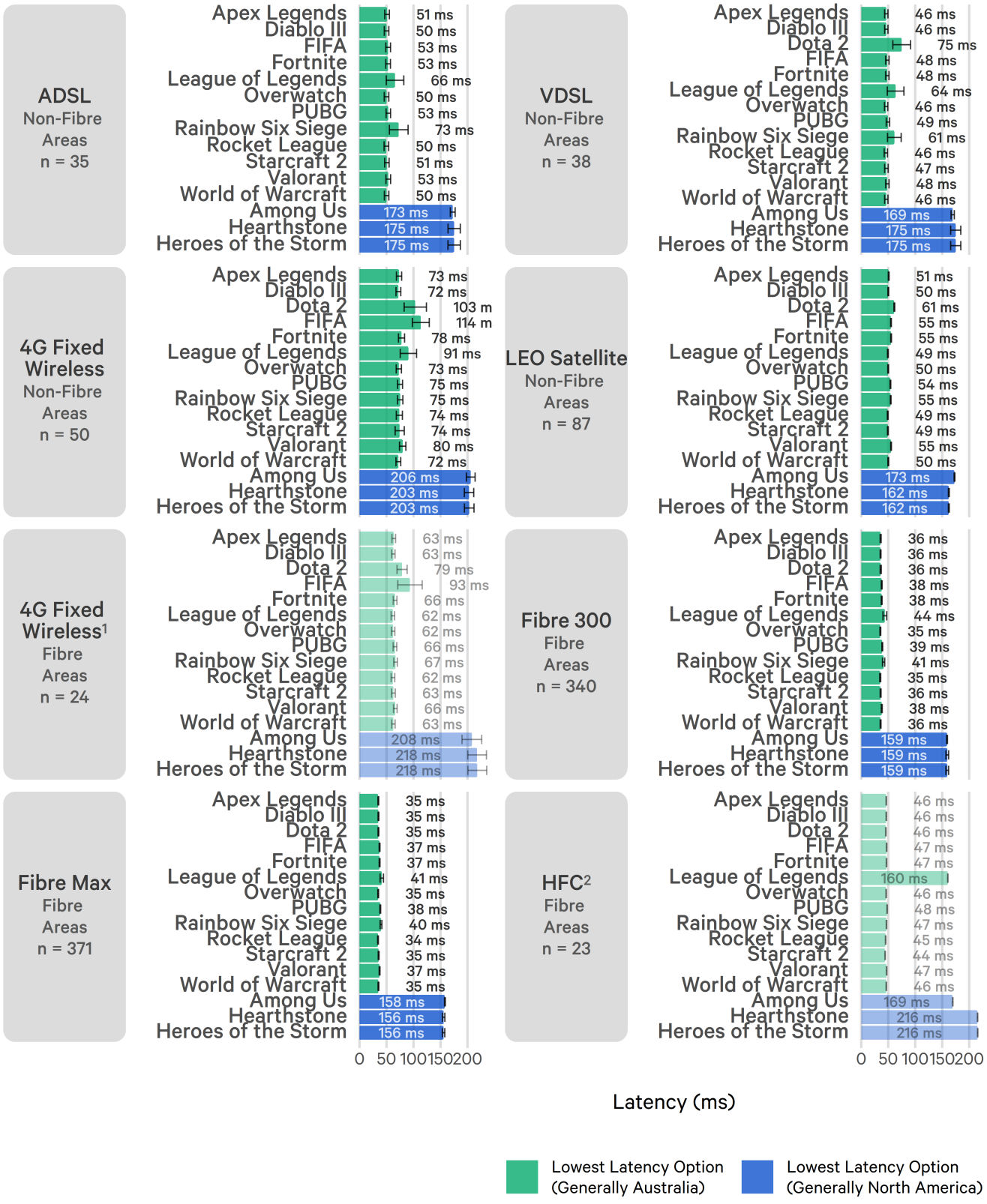
- Among Us, Hearthstone and Heroes of the Storm all tested to servers in North America. These games show average latencies around 150 ms, much higher than the remaining games which tested to servers located in Australia.
- The impact of latency on consumers also depends on the type of game being played. For example, high latency would be noticed more by consumers playing first person shooter games than turn based strategy games, and could have a negative impact on game play experience if it was too high.
- The latency results above are shown for Fibre plans only. Results for latency split by individual plans can be seen in the figure below, and results for all RSPs can be seen in Table 6.

Figure 6: The Latency to Various Online Gaming Servers by Plan.

Average of household average latency to gaming servers, lower is better

The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 35).

Lower latency means that lag is less likely.



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[1]Results for 4G Fixed Wireless are based on a sample size of 24 Whiteboxes in Fibre areas. The lower sample size can be attributed to Fixed Wireless being a new area of focus for the MBNZ programme and we hope to increase this number for subsequent reports.

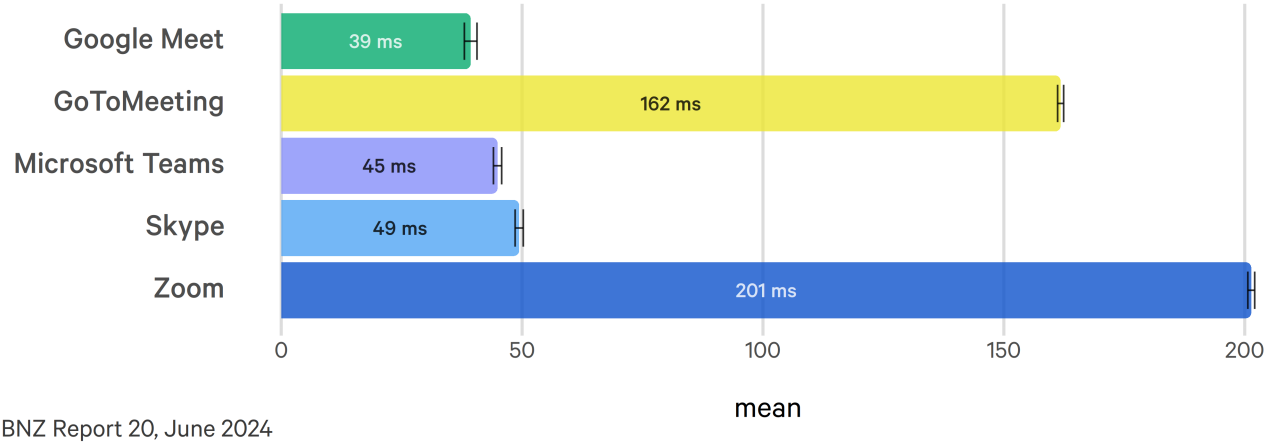
[2]Results for HFC are based on a sample size of 23 Whiteboxes. The low sample size can be attributed to the relatively small coverage area of One New Zealand's Cable network and the competing influence of Copper, Fibre and Fixed Wireless in those areas.

Video Conferencing

Latency is not the only factor impacting on the quality of a video call. Packet loss and jitter can result in stuttering and dropouts, and these are not captured in the round-trip times measured here. Application specific attributes such as audio/video encoding and proprietary communication protocols can lead to different performance characteristics for different services.

Figure 6: The Latency to Servers of Different Video Conferencing Services.

Results are using free accounts only.
Average of household average latency, lower is better. Fibre plans only.



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Key Observations

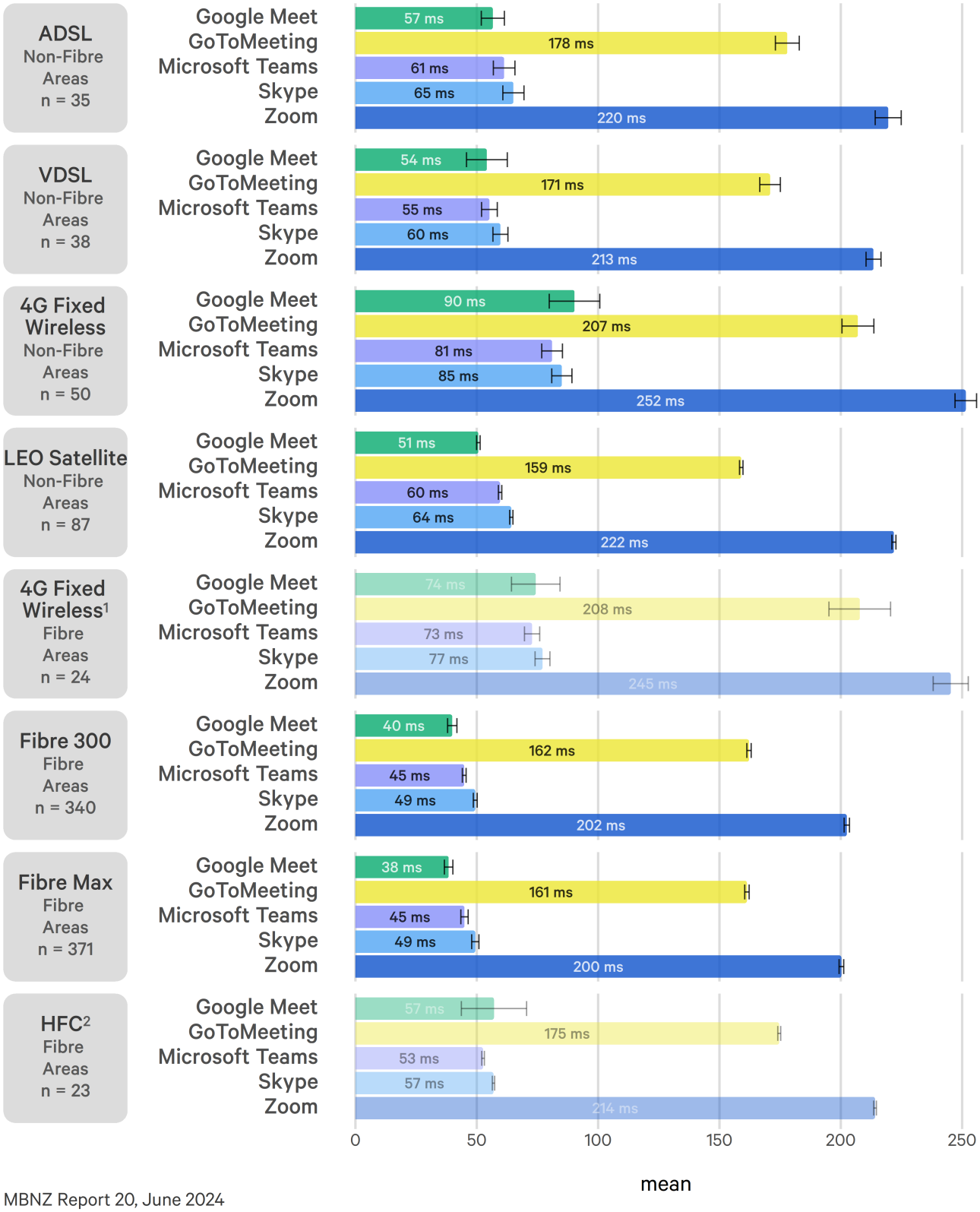
- Since the last report, there has been an update to the configuration of the video conferencing test. Since the majority of users of these services utilise basic accounts, the test now solely targets free accounts.
- Video conferencing services that use international servers usually see similar performance, however as the traffic is travelling further and subject to international routing, this could account for small differences in consumer experience like users talking over one another more frequently when using these unpaid services.
- The latency results above are shown for Fibre plans only. Results for all video conferencing split by individual plans can be seen in the figure below, and results for all RSPs can be seen in Table 7.

Figure 7: The Latency to Servers of Different Video Conferencing Services by Plan.

Results are using free accounts only.

Average of household average latency, lower is better.

The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 35).



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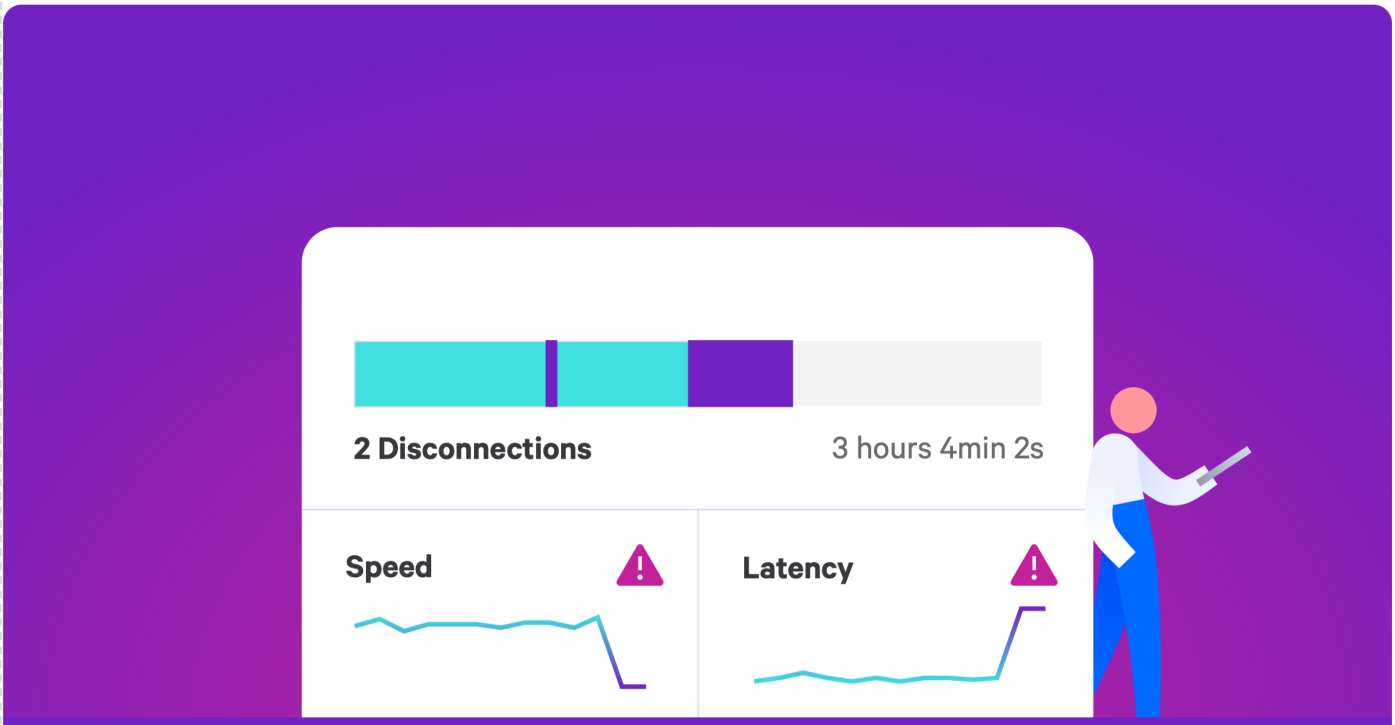
[1]Results for 4G Fixed Wireless are based on a sample size of 24 Whiteboxes in Fibre areas. The lower sample size can be attributed to Fixed Wireless being a new area of focus for the MBNZ programme and we hope to increase this number for subsequent reports.

[2]Results for HFC are based on a sample size of 23 Whiteboxes. The low sample size can be attributed to the relatively small coverage area of One New Zealand's Cable network and the competing influence of Copper, Fibre and Fixed Wireless in those areas.



Quality of Service & Reliability

In this section we report on the performance of a number of popular plans across New Zealand for quality of service metrics.

Some results in this section are shown with error bars representing the 95% confidence interval for each plan. This means that if we had repeated our measurements 100 times, we would expect the result to have fallen within the black bands in at least 95 cases.

The transparent bars show plans with a sample size lower than we would typically include within reporting. These plans have larger error bars due to the smaller sample size and care should be taken when comparing these plans against others. We recommend consumers factor in the error bars when comparing plan averages, especially those with smaller sample sizes.

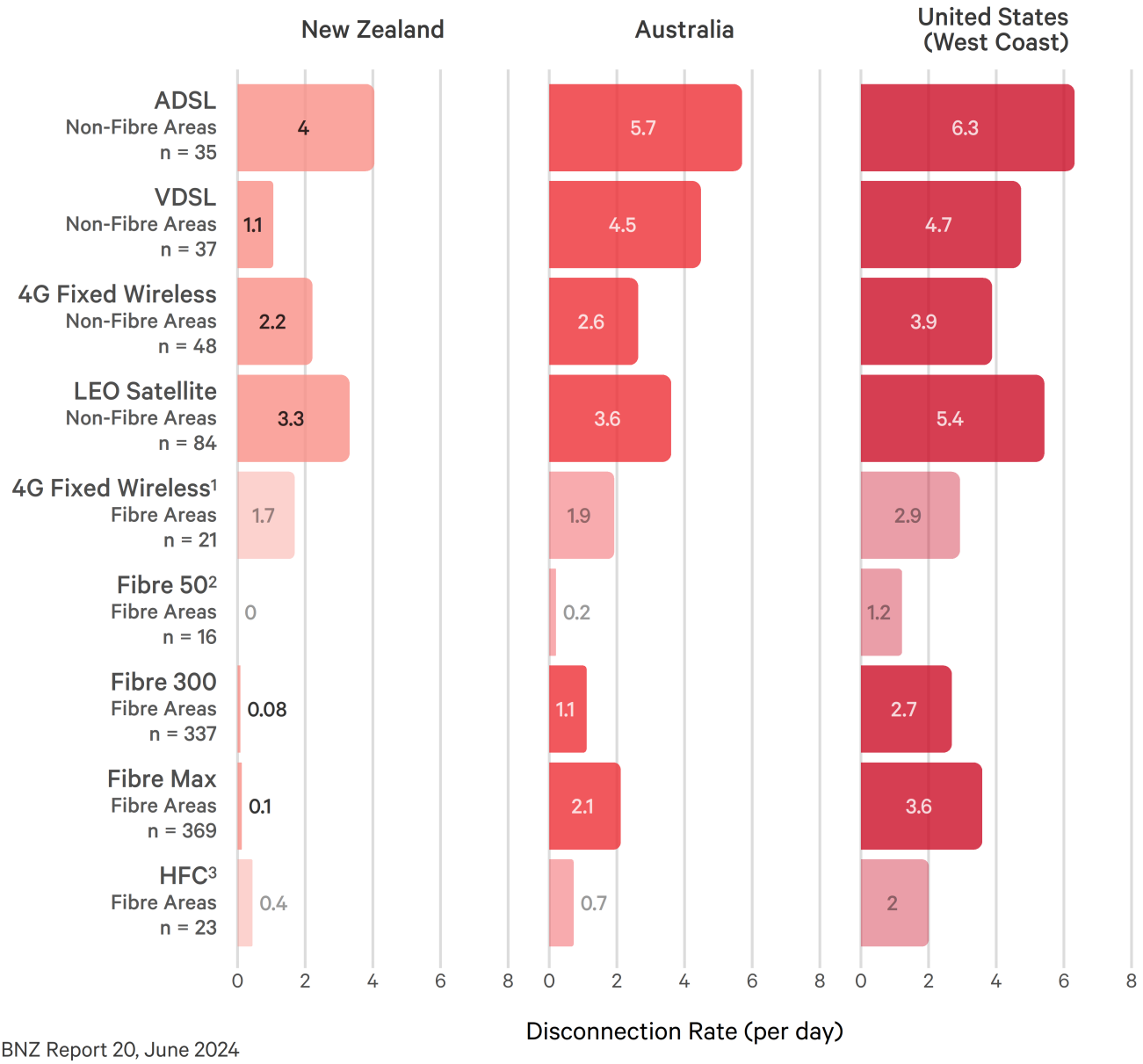
Disconnections

Realtime applications like video calls rely on a consistent connection between the home router and the target server. If the connection drops, even for a few seconds, the application will exhibit some form of stuttering. In the worst instance, a user might be disconnected and have to reconnect or wait for their broadband connection to come back online.

A brief disconnection very rarely means that, for example, a physical cable has been cut. Instead, the main reasons for network dropouts relate to congestion and the configuration of network equipment. The following graph compares daily disconnection rates across plans.

Figure 8: Median Daily Disconnection Rates. Lower is Better.

Medians of household daily rates. A disconnection means that two or more packets in a row don't complete a full round trip. Testing only covers periods where the line is idle.



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This graph shows medians across households. Taking VDSL as an example 50% of households will experience no more than 1 disconnections per day for traffic remaining within New Zealand. This obscures the extremes of performance for each plan. While the median ADSL and Fixed Wireless results are comparable, ADSL connections are more likely than others to have disconnection rates far above the median, whereas Fixed Wireless plans are more likely to have results close to the median.

Many common applications, such as video conferencing applications or online gaming used by New Zealanders are served from overseas, mainly Australia, East Asia, and the USA. All New Zealand RSPs share capacity through four undersea cable networks which carry traffic to and from New Zealand across the Tasman Sea and the Pacific.

Key Observations

- Most households see a very low rate of disconnections, at least while the line is idle.
- The results for disconnections remain broadly consistent when compared to the previous report, and the level of disconnections is at a level whereby user experience will not be unduly affected. The median number of disconnections across ADSL plans has increased slightly compared to the previous report.
- In the previous report, several RSPs using Telstra showed a large increase in disconnections to our USA target. Results in this report have decreased back to levels consistent with previous reports.
- LEO Satellite plans have seen the median number of disconnections fall compared to the previous report. This has brought the rate of disconnections that Satellite experienced to a similar rate to that of most ADSL, VDSL and Fixed Wireless[1] Connections. LEO Satellite customers will often see a small increase in packet loss when connecting to moving satellites, however this is not at a level that would unduly affect user experience. Disconnections for Fibre[2] plans and HFC[3] remain low.
- Traffic going overseas is more likely to be lost than traffic remaining within New Zealand.

[1] Results for 4G Fixed Wireless are based on a sample size of 21 Whiteboxes in Fibre areas. The lower sample size can be attributed to Fixed Wireless being a new area of focus for the MBNZ programme and we hope to increase this number for subsequent reports.
[2] Results for Fibre 50 are based on a sample size of 16 Whiteboxes.
[3] Results for HFC are based on a sample size of 23 Whiteboxes. The low sample size can be attributed to the relatively small coverage area of One New Zealand's Cable network and the competing influence of Copper, Fibre and Fixed Wireless in those areas.

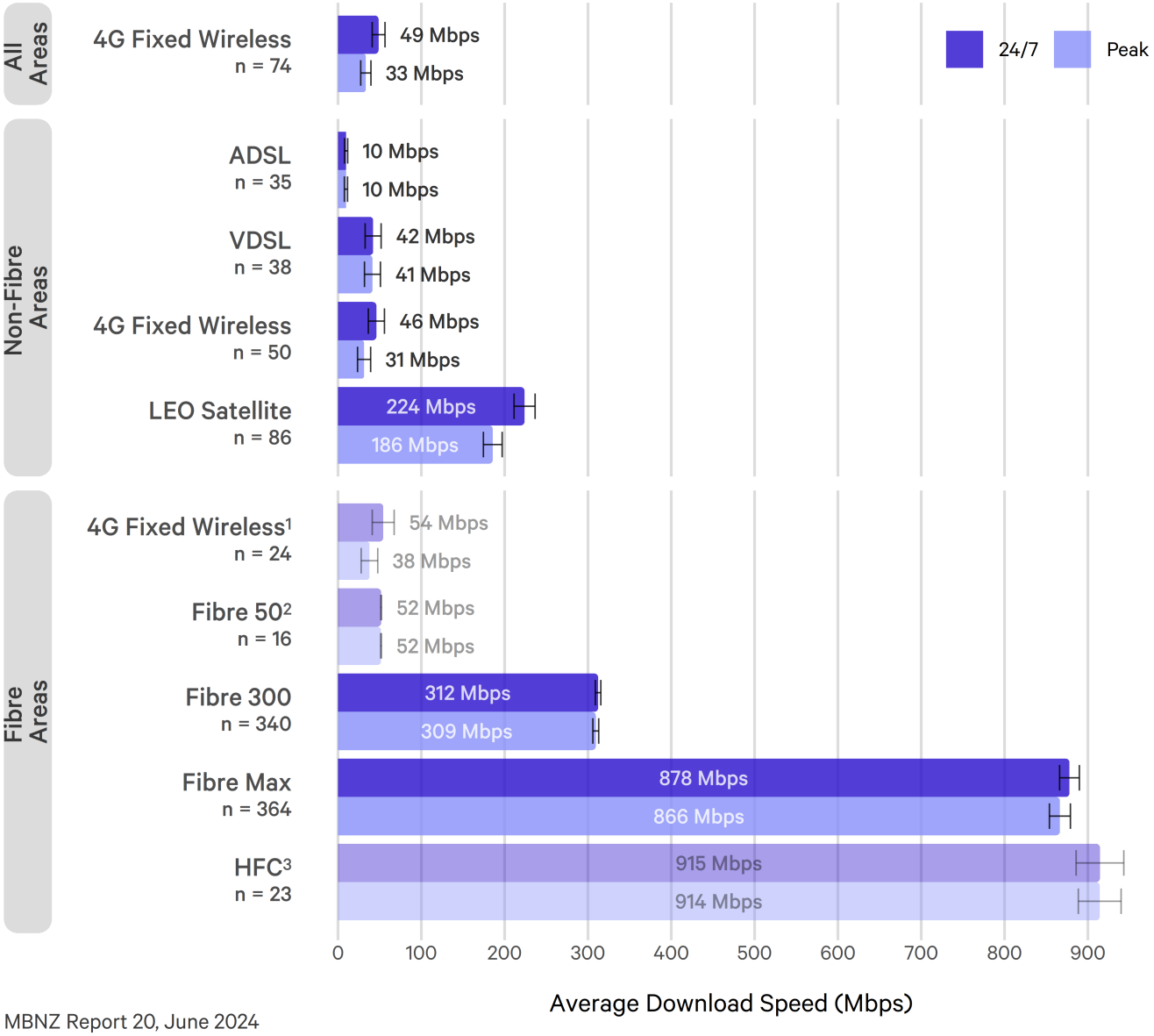
Speed Tests - Download

Figures 9 and 18 give an overview of download and upload speed across the country. These are included in every report to provide a benchmark that can be tracked over time. These results are split across Fibre areas, where Fibre is available to consumers and non-Fibre areas where Fibre is not available. There were not enough Whiteboxes to report ADSL and VDSL results in Fibre areas.

Peak hours are the times when people typically use the internet; in New Zealand this is 7pm to 11pm on Monday-Friday.

Figure 9: Average Download Speeds by Plan

Average of monthly household weighted averages. Peak hours are Monday - Friday, 7pm - 11pm. The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 74). Error bars show 95% confidence intervals of the mean.



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Key Observations

- ADSL and VDSL results are consistent with those seen in the previous report, showing similar results during peak hours.
- LEO Satellite results have increased during all hours compared to the previous report. Any volunteers on Starlink's deprioritized plan are not included in these results. We are building the sample and intend to report these separately to the standard plan in upcoming MBNZ reports.
- LEO Satellite and 4G Fixed Wireless show a larger variation between peak hour download speeds and all hour download speeds compared to fixed line plans. This could be due to these technologies being more sensitive to congestion during peak hours. 4G Fixed Wireless results in Fibre areas[1] achieved similar speeds with non-Fibre areas during peak hours, and slightly higher results during all hours.
- Fibre 50[2], Fibre 300 and Fibre Max results are also broadly similar to the previous report, with Fibre 300 seeing average speeds above 300 Mbps, including during peak hours. Fibre Max average download speeds are consistent with previous results. RSP specific results for Fibre Max and Fibre 300 can be found in Figures 10 and 11.
- Results for HFC[3] are broadly consistent with the previous report.

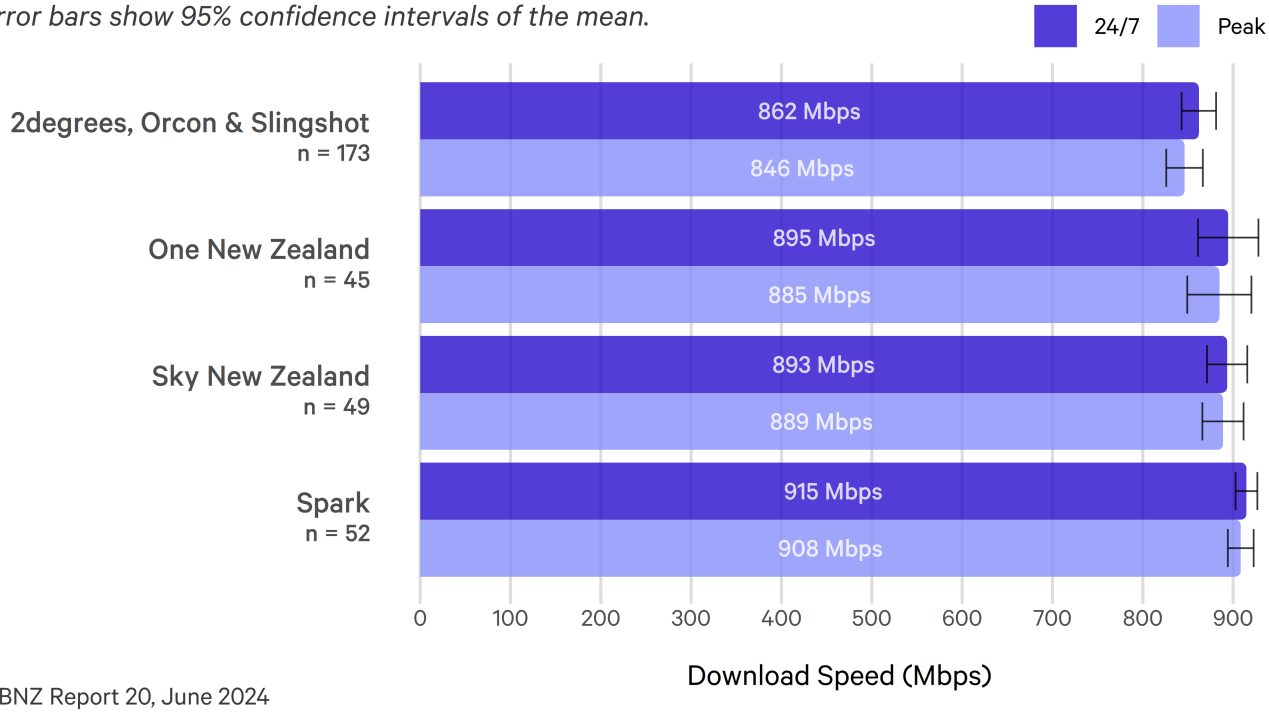
[1] Results for 4G Fixed Wireless are based on a sample size of 24 Whiteboxes in Fibre areas. The lower sample size can be attributed to Fixed Wireless being a new area of focus for the MBNZ programme and we hope to increase this number for subsequent reports.
[2] Results for Fibre 50 are based on a sample size of 16 Whiteboxes in Fibre areas.
[3] Results for HFC are based on a sample size of 23 Whiteboxes. The low sample size can be attributed to the relatively small coverage area of One New Zealand's Cable network and the competing influence of Copper, Fibre and Fixed Wireless in those areas.

Fibre Max Breakdown by RSP

Fibre Max plans are derived from 'gigabit' wholesale products but, since around 6% of the data in HTTP traffic is given over to protocol overhead (IP packet headers etc), the highest speed test result that can theoretically be achieved by a Fibre Max line is around 940 Mbps.

Figure 10: Average Fibre Max Download Speed by RSP

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm.
The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 173).
Error bars show 95% confidence intervals of the mean.



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Key Observations

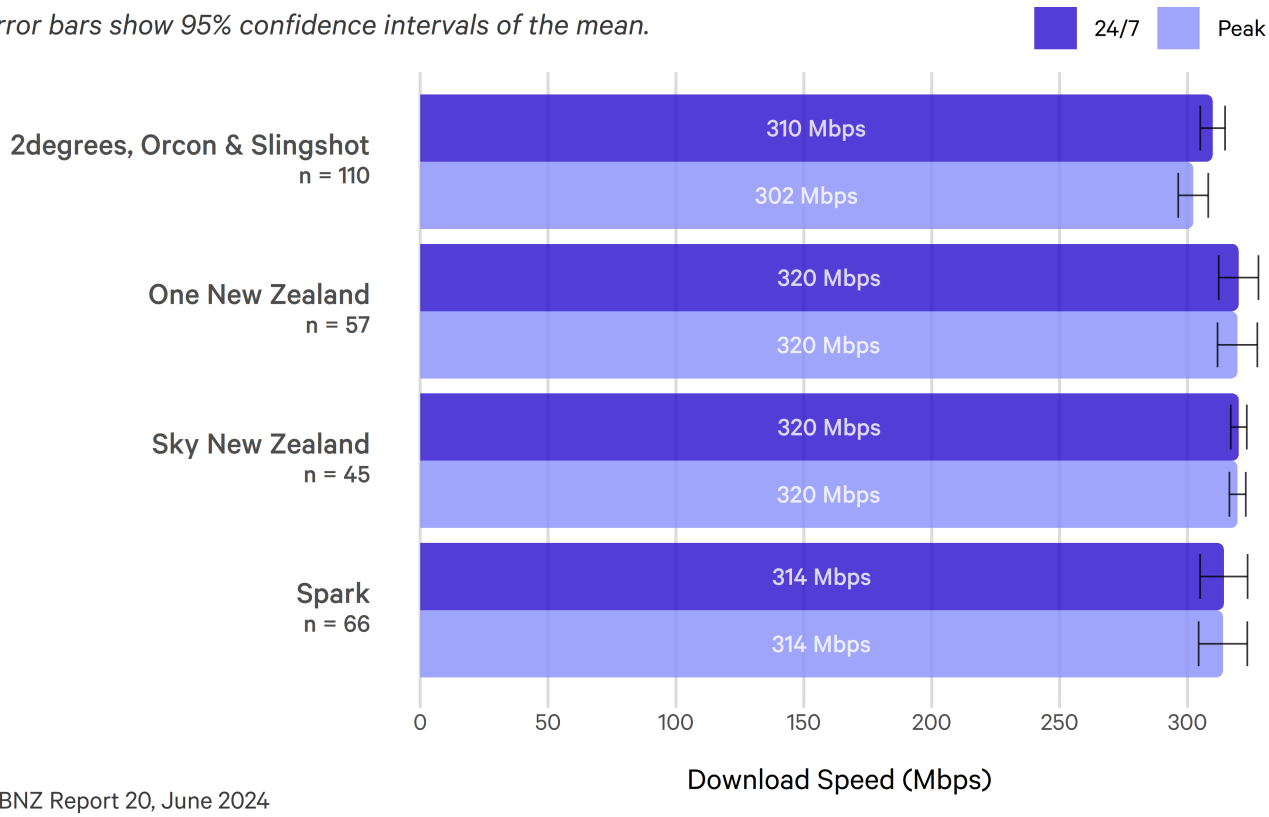
- All RSPs, the results are broadly in line with those seen in the previous report, showing a small decrease in average download speeds across all hours and peak hours.
- There were not enough Fibre Max volunteers on Contact Energy, Electric Kiwi, Mercury, NOW NZ, PureLink or Voyager during the measurement period to report results for these RSP. All tested RSPs are included in the overall Fibre Max results shown in Figure 9.

Fibre 300 Breakdown by RSP

The speeds Fibre 300 is typically advertised to consumers are 300 Mbps download and 100 Mbps upload. In practice, since the provisioned speed is set slightly higher to allow for extra bandwidth used up by the network protocol overhead, it is quite common to see measured download speeds close to or slightly above 300 Mbps.

Figure 11: Comparison of Average Fibre 300 Download Speeds across RSPs.

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm.
The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 110)
Error bars show 95% confidence intervals of the mean.



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Key Observations

- All RSPs tested previously continued to perform consistently in April, with all RSPs shown in the chart achieving average download speeds above 300 Mbps, including during peak hours.
- There were not enough volunteers on Contact Energy, Electric Kiwi, Inspire, Mercury, NOW NZ, Voyager or Wireless Nation to report results. All tested RSPs are included in the overall Fibre 300 results shown in Figure 9.

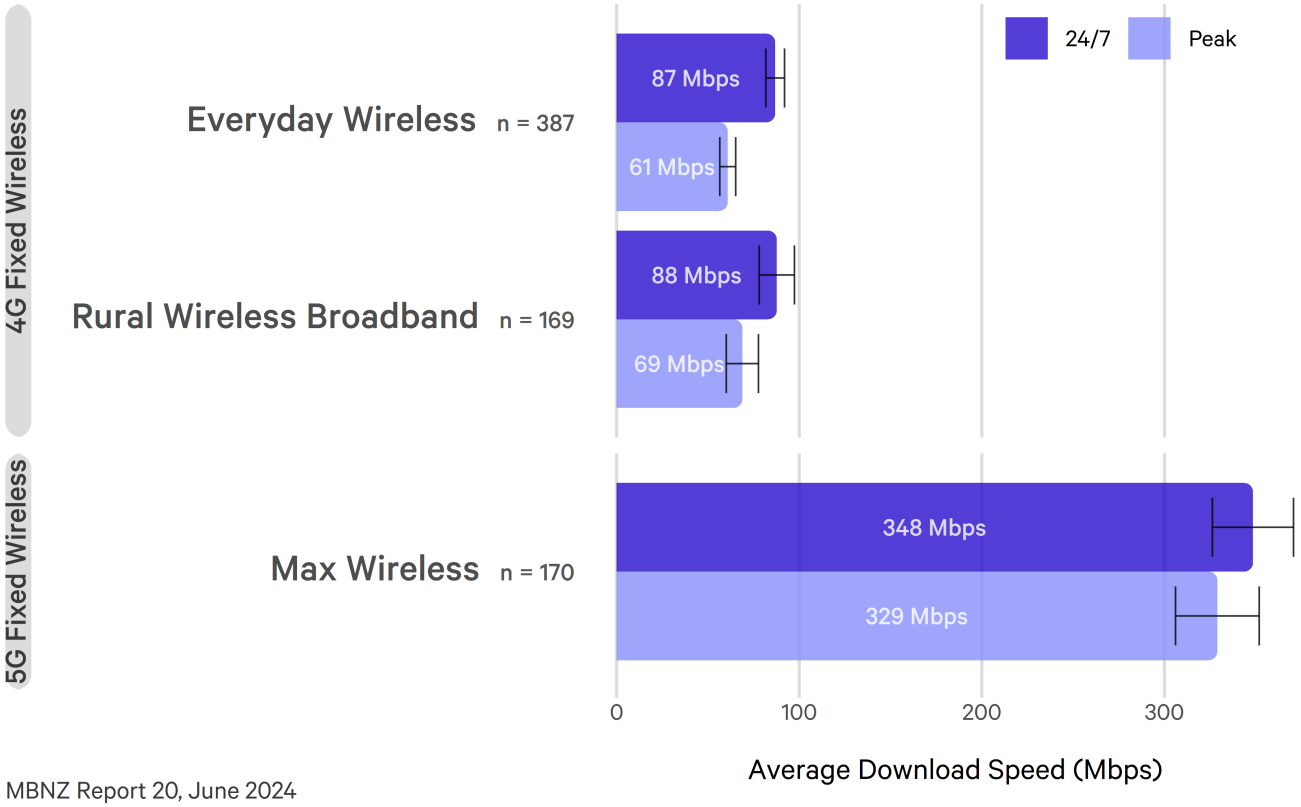
Spark Fixed Wireless Embedded Download Speeds

For the first time, this report includes results from embedded agent testing, with SamKnows (part of Cisco) embedding its software directly into the modems of customers of an RSP. The embedded agent uses the same methodology as the Whitebox. Any customer with a modem that has the embedded software can become part of an RSP's test population. More details on this testing can be found in the technical FAQs on the Commerce Commission's website here.

Spark is the first RSP to submit results of embedded agent testing for inclusion in the MBNZ report. To do so, Spark randomly selected around 800 customers across their Everyday Wireless, Max Wireless, and Rural Wireless Broadband plans with Spark's latest Wireless Broadband modems (Spark Smart Modem 2 or a 5G Smart Modem), to be part of the sample group. We have ensured that this has resulted in a geographically representative sample of the plans being tested. The Spark modems with the embedded agent ran a comparable test schedule to the Whitebox agents used in the MBNZ project using the same off-net test servers, located in Auckland, Wellington, and Christchurch. This report currently contains only download and upload results, but we hope to include additional metrics in future reports.

Figure 12: Average Download Speeds for Spark Fixed Wireless Plans.

Average of monthly household weighted averages. Peak hours are Monday - Friday, 7pm - 11pm. The number of embedded agents contributing to each result is shown under each plan name (eg n = 387). Error bars show 95% confidence intervals of the mean.



MBNZ Report 20, June 2024

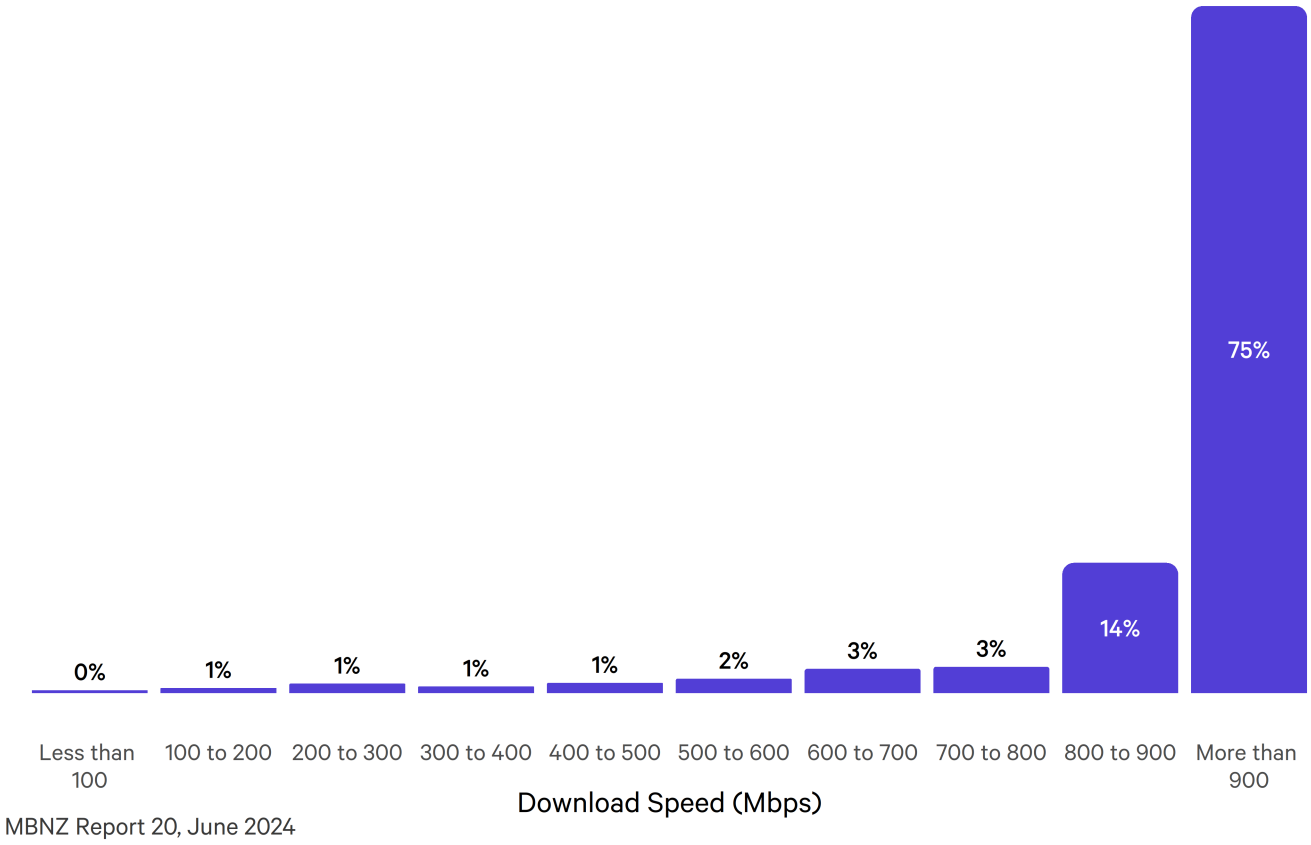
Key Observations

- There is minimal difference in average download speeds between Spark 4G Everyday Wireless and Rural Wireless Broadband, with both plans seeing slightly lower download speeds during peak hours.
- The average download speeds across all 4G Fixed Wireless plans and RSPs in NZ is 49 Mbps during all hours, and 33 Mbps during peak hours. All results for the Spark 4G plans measured are higher than the average download speed of all 4G Fixed Wireless results.
- There are a number of factors that influence Fixed Wireless broadband performance including distance, and number of customers connected to the nearest cell tower. During peak hours, the number of customers connected to a cell tower in an urban area can be much higher than in a rural area, which could be one explanation for higher average peak hour speeds in rural areas.
- This is the first time reporting an average download speed for any 5G Fixed Wireless plan in an MBNZ report. The average download speed measured for Spark's Max Wireless 5G Plan was 348 Mbps during all hours, and 329 Mbps during peak hours.

Distribution of Fibre Max Results

Figure 13: Download Speeds on Fibre Max Plans.

Distribution of test results across 364 Fibre Max units.
Average (24/7) download speeds for Fibre Max plans is 878 Mbps; this varies by RSP and over time.



MBNZ Report 20, June 2024

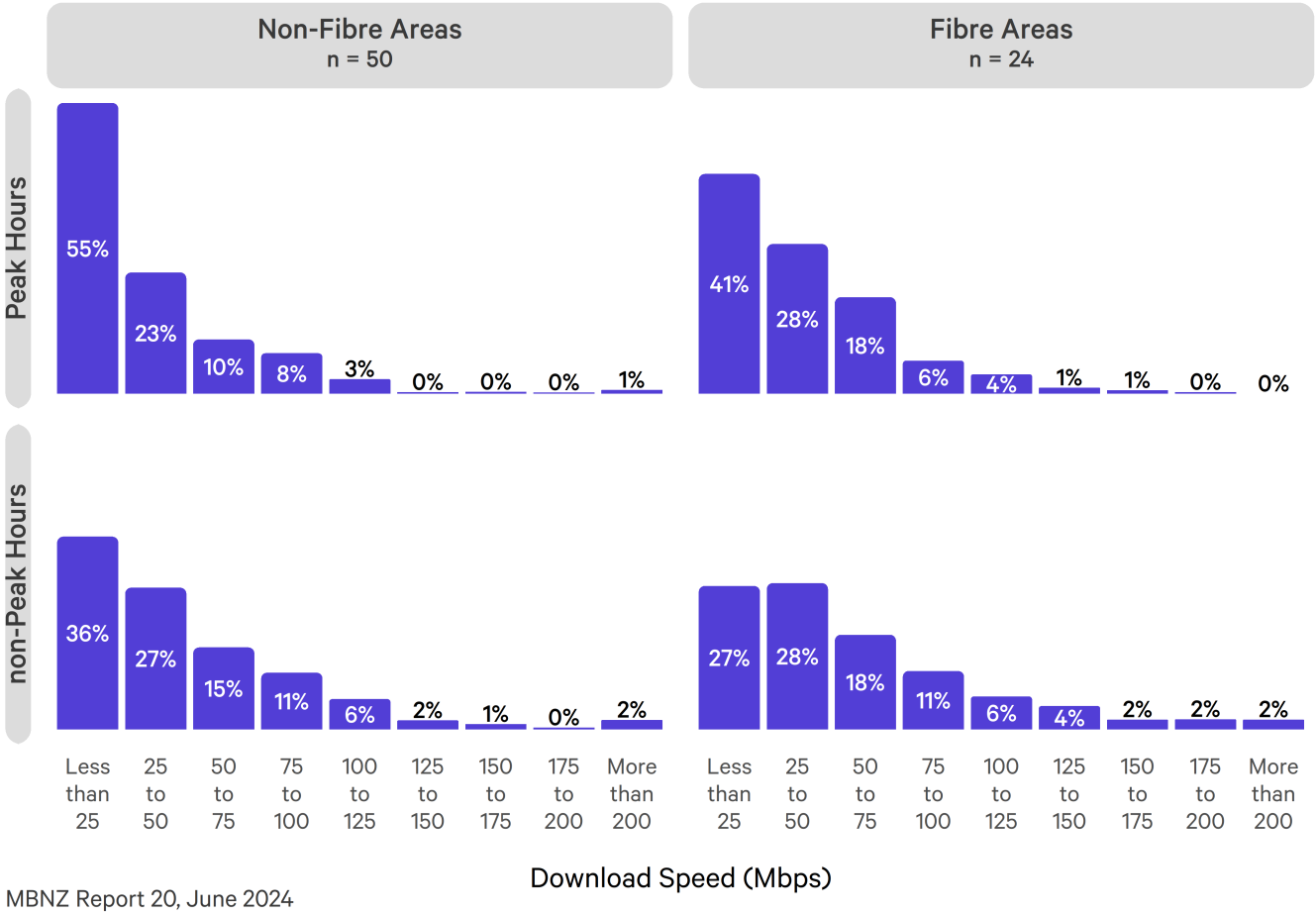
Key Observations

- 75% of speed tests run over Fibre Max lines achieved download speeds above 900 Mbps, a small decrease compared to the previous report.

Distribution of 4G Fixed Wireless Results

Figure 14: Download Speeds on 4G Fixed Wireless Plans.

Distribution of test results. Average (24/7) download speeds for 4G Fixed Wireless plans is 46 Mbps in non-Fibre areas and 54 Mbps in Fibre areas; this varies by RSP and over time.



MBNZ Report 20, June 2024

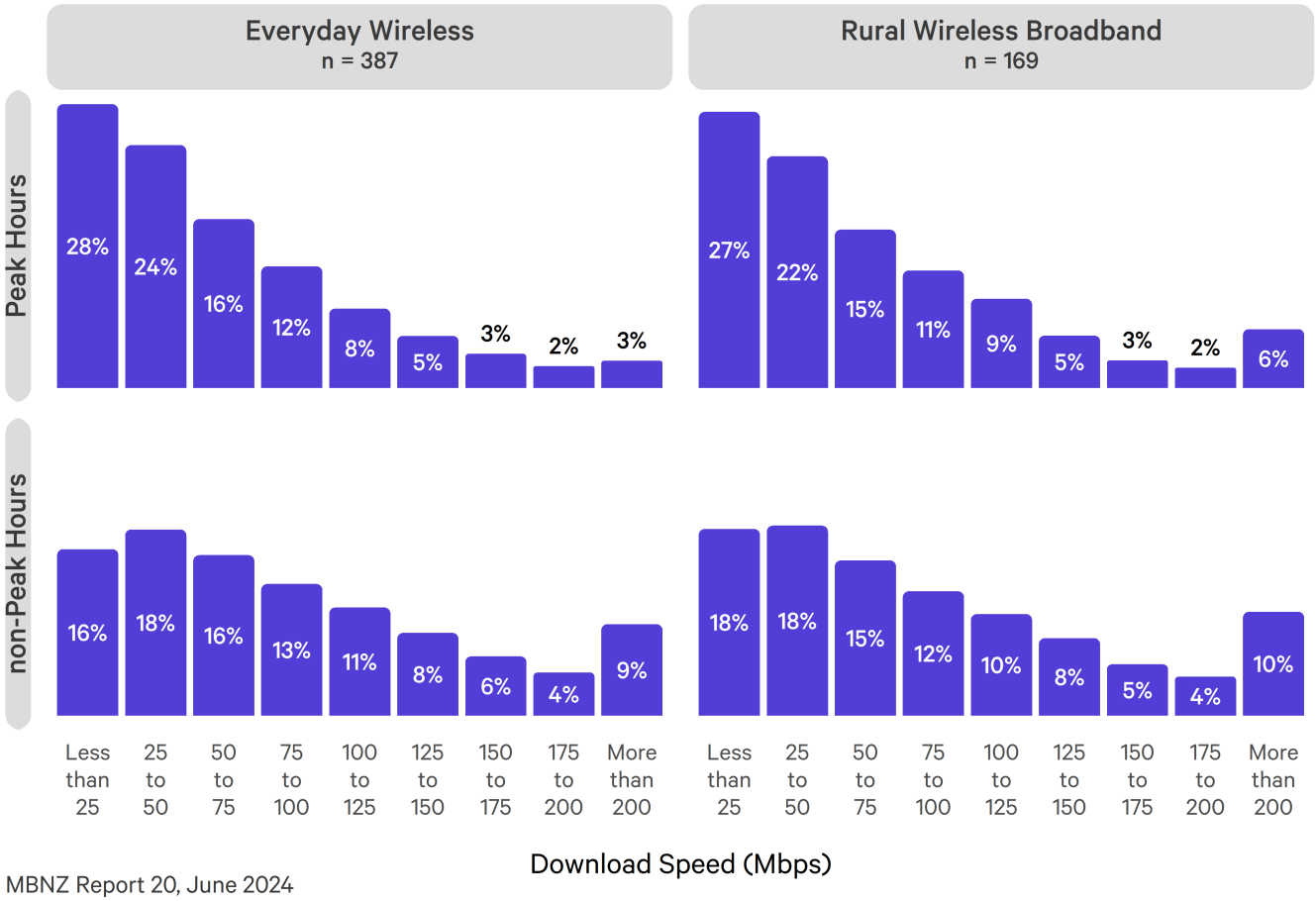
Key Observations

- 36% of speed tests run over Fixed Wireless lines achieve download speeds of less than 25 Mbps in non-Fibre areas during non-peak hours, compared to 27% in Fibre areas.
- 16% of download speed tests in Fibre areas achieved speeds of 100 Mbps or higher during non-peak hours, compared to just 6% during peak hours.

Distribution of Spark Embedded Fixed Wireless Results

Figure 15: Download Speeds on Spark Embedded 4G Fixed Wireless Plans.

Distribution of test results.



MBNZ Report 20, June 2024

Key Observations

- During non-peak hours, 38% of Everyday Wireless download tests achieved speeds above 100 Mbps, compared to 37% for Rural Wireless Broadband. During peak hours, the percentage of tests over 100 Mbps for Everyday Wireless fell to 21%, compared to 25% for Rural Wireless Broadband.
- For both plans, the percentage of tests below 25 Mbps increased during peak hours compared to non-peak hours. For Everyday Wireless plans, the percentage rose from 16% to 28%, and for Rural Wireless plans, it increased from 18% to 27%.
- For both plans, saw similar percentages of tests achieve speeds over 200 Mbps during non-peak hours, at 9% and 10% for Everyday Wireless and Rural Wireless respectively. However, during peak hours, the percentage of tests fell to only 3% for Everyday Wireless, and 6% for Rural Wireless.

Figure 16: Download Speeds on Spark Embedded 5G Fixed Wireless Plan.

Distribution of download test results.

MBNZ Report 20, June 2024

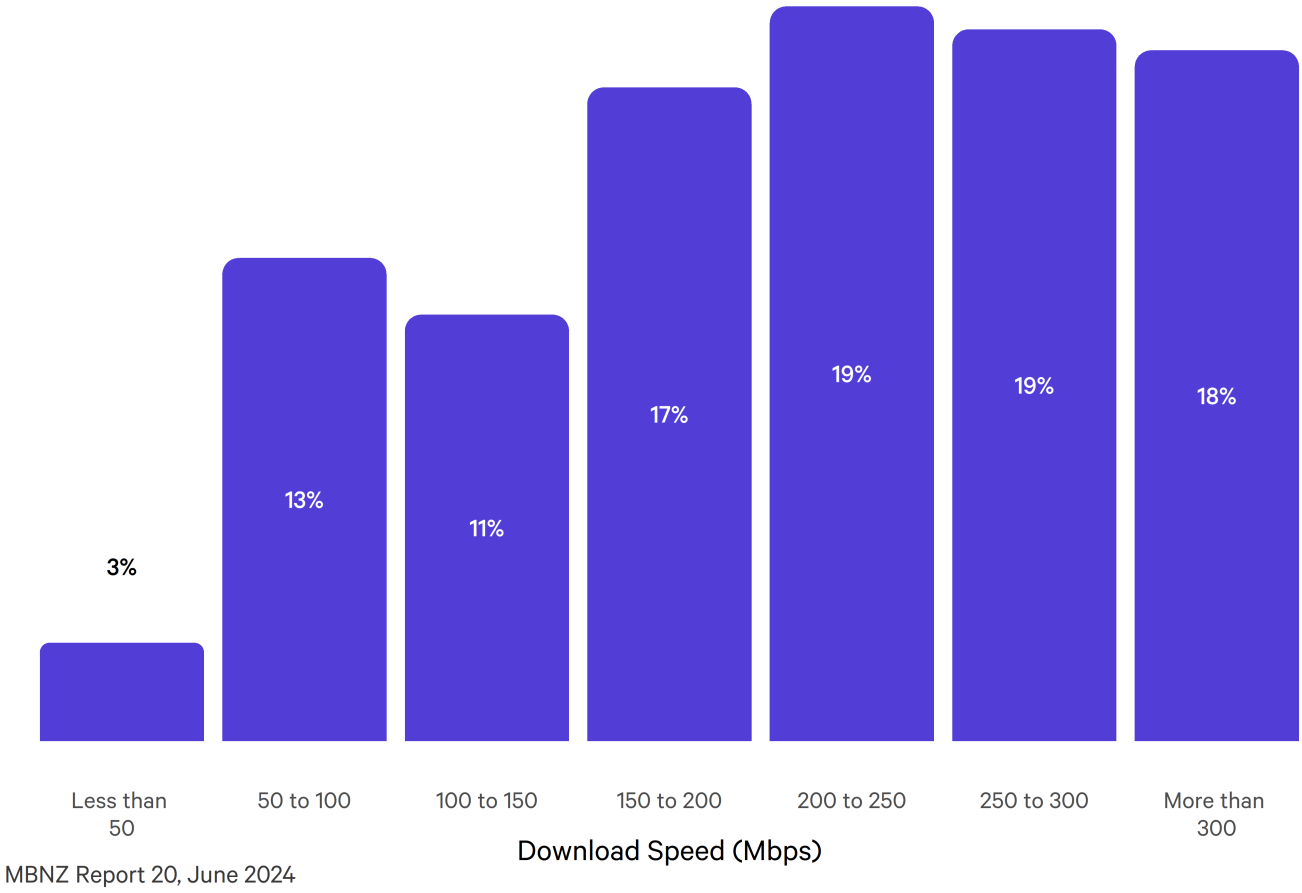
Key Observations

- The distribution of download tests for Spark 5G Max Wireless was broadly similar during peak hours compared to non-peak hours.
- During non-Peak hours, 25% of all embedded download speed tests run on Max Wireless plans achieved speeds greater than 500 Mbps.

Distribution of LEO Satellite Results

Figure 17: Download Speeds on LEO Satellite Plans.

Distribution of test results across 86 Satellite units. Average (24/7) download speeds for LEO Satellite plans is 224 Mbps in non-Fibre areas; this varies over time.



MBNZ Report 20, June 2024

Key Observations

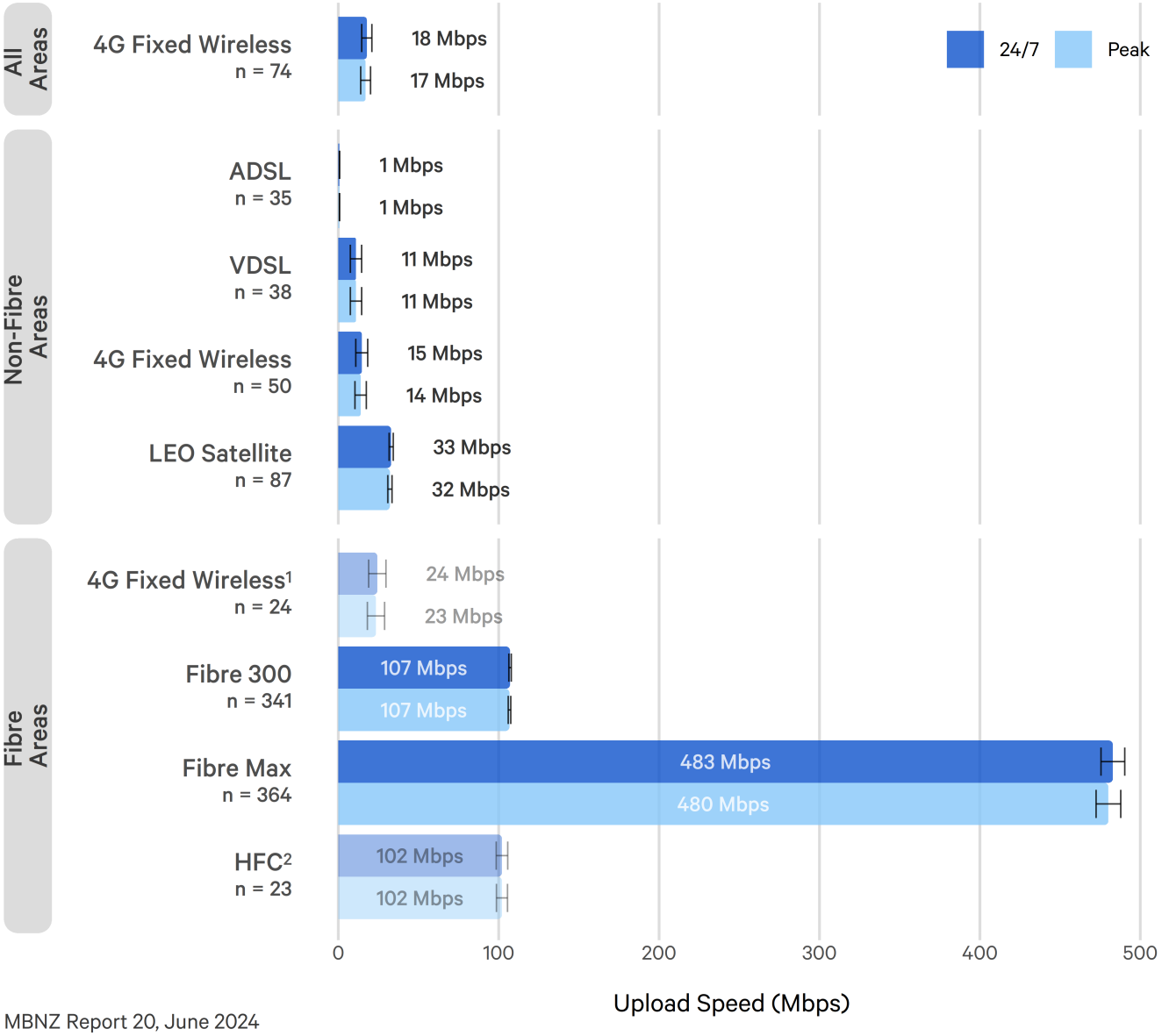
- Only 3% of speed tests run over LEO Satellite achieve download speeds of less than 50 Mbps in non-Fibre areas.
- Over 80% of download tests in non-Fibre areas achieved speeds of 100 Mbps or higher.
- 18% of download speed tests in non-Fibre areas achieved speeds of 300 Mbps or higher, an increase on 10% previously.

Speed Tests - Upload

Upload speeds should be considered alongside download speeds. The main applications where the impact of upload speed is apparent are file transfers and video conferencing. For example, a lower upload speed will mean that it takes longer for files to sync or email attachments to be applied.

Figure 18: Average Upload Speeds by Plan

Average (24/7) of monthly household weighted averages. Peak hours are Monday - Friday, 7pm - 11pm. The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 74). Error bars show 95% confidence intervals of the mean.



MBNZ Report 20, June 2024

Key Observations

- The average upload speeds are consistent with those seen in the previous report.
- Average upload speeds for Fibre 50 are not included in this report due to different upload allocations across local fibre companies. There were not enough Whiteboxes on Fibre 50 to split upload results by local fibre company.
- 4G Fixed Wireless results in Fibre areas[1] and HFC[2] results are based on a smaller sample size than we would typically include within reporting.

[1] Results for 4G Fixed Wireless are based on a sample size of 24 Whiteboxes in Fibre areas. The lower sample size can be attributed to Fixed Wireless being a new area of focus for the MBNZ programme and we hope to increase this number for the Summer Report

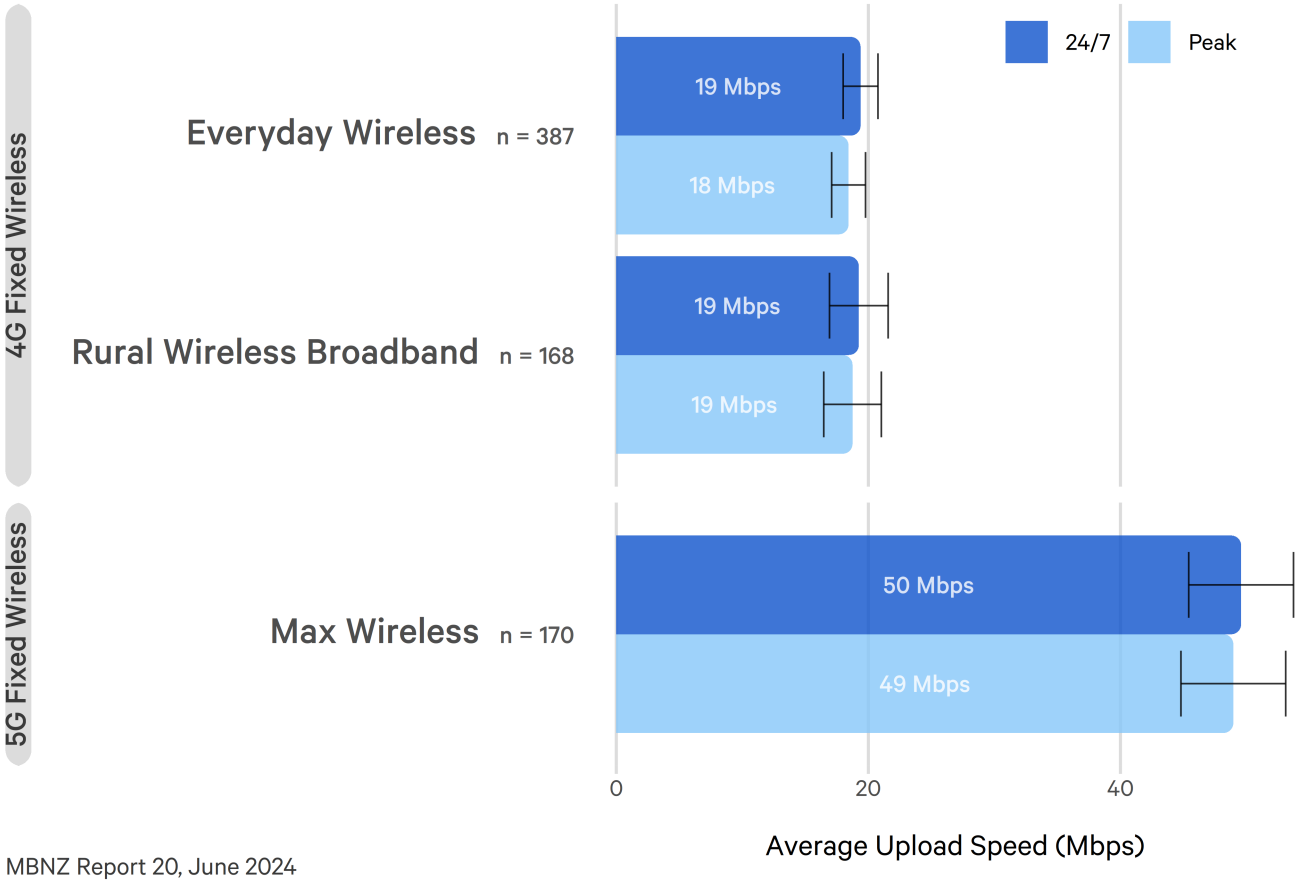
[2] Results for HFC are based on a sample size of 23 Whiteboxes. The low sample size can be attributed to the relatively small coverage area of One New Zealand's Cable network and the competing influence of Copper, Fibre and Fixed Wireless in those areas.

Spark Fixed Wireless Embedded Upload Speeds

The results below are for some of Spark's 4G Fixed Wireless and 5G Fixed Wireless plans. More information on Spark's embedded testing can be found on page 25.

Figure 19: Average Upload Speeds for Spark Fixed Wireless Plans.

Average of monthly household weighted averages. Peak hours are Monday - Friday, 7pm - 11pm.
The number of embedded agents contributing to each result is shown under each plan name (eg n = 387).
Error bars show 95% confidence intervals of the mean.



MBNZ Report 20, June 2024

Key Observations

- There is minimal difference in average upload speeds between Spark 4G Everyday Wireless and Rural Wireless Broadband, with both plans seeing no noticeable decrease in upload speeds during peak hours
- This is the first time reporting an average upload speed for any 5G Fixed Wireless plan in an MBNZ report. The average upload speed measured for Spark's Max Wireless 5G Plan was 50 Mbps during all hours, and 49 Mbps during peak hours.

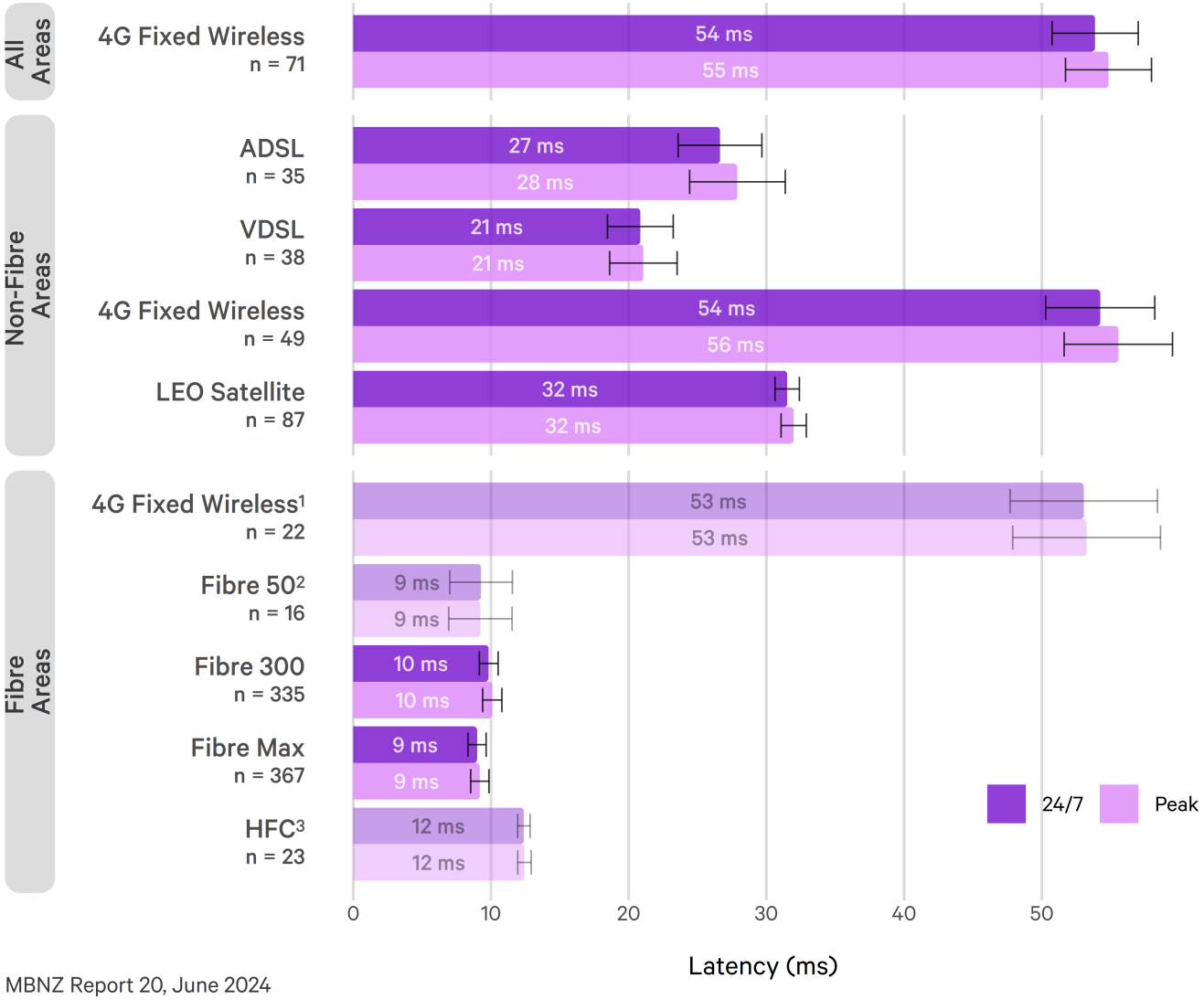
Latency

Latency is another key factor that should be considered when assessing broadband performance. The time it takes to transmit and receive messages between households and servers limits the responsiveness of realtime applications such as interactive webpages or video calls. Higher baseline latency makes realtime applications more vulnerable to jitter (also known as packet delay variation) and dropouts. Figure 20 only includes results relating to servers hosted in New Zealand.

Some plans show a wider variation of latency than others: latency across a Fixed Wireless connection will generally be more variable than over a Fibre line. The impact of latency on user experience relating to specific applications is discussed earlier in the report (Social Media, Online Gaming, Video Conferencing).

Figure 20: Average Latency to Test Servers by Plan. Lower is Better.

Average of monthly household weighted averages. Peak hours are Monday - Friday, 7pm - 11pm. The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 71). Error bars show 95% confidence intervals of the mean.



MBNZ Report 20, June 2024

Latency Under Load

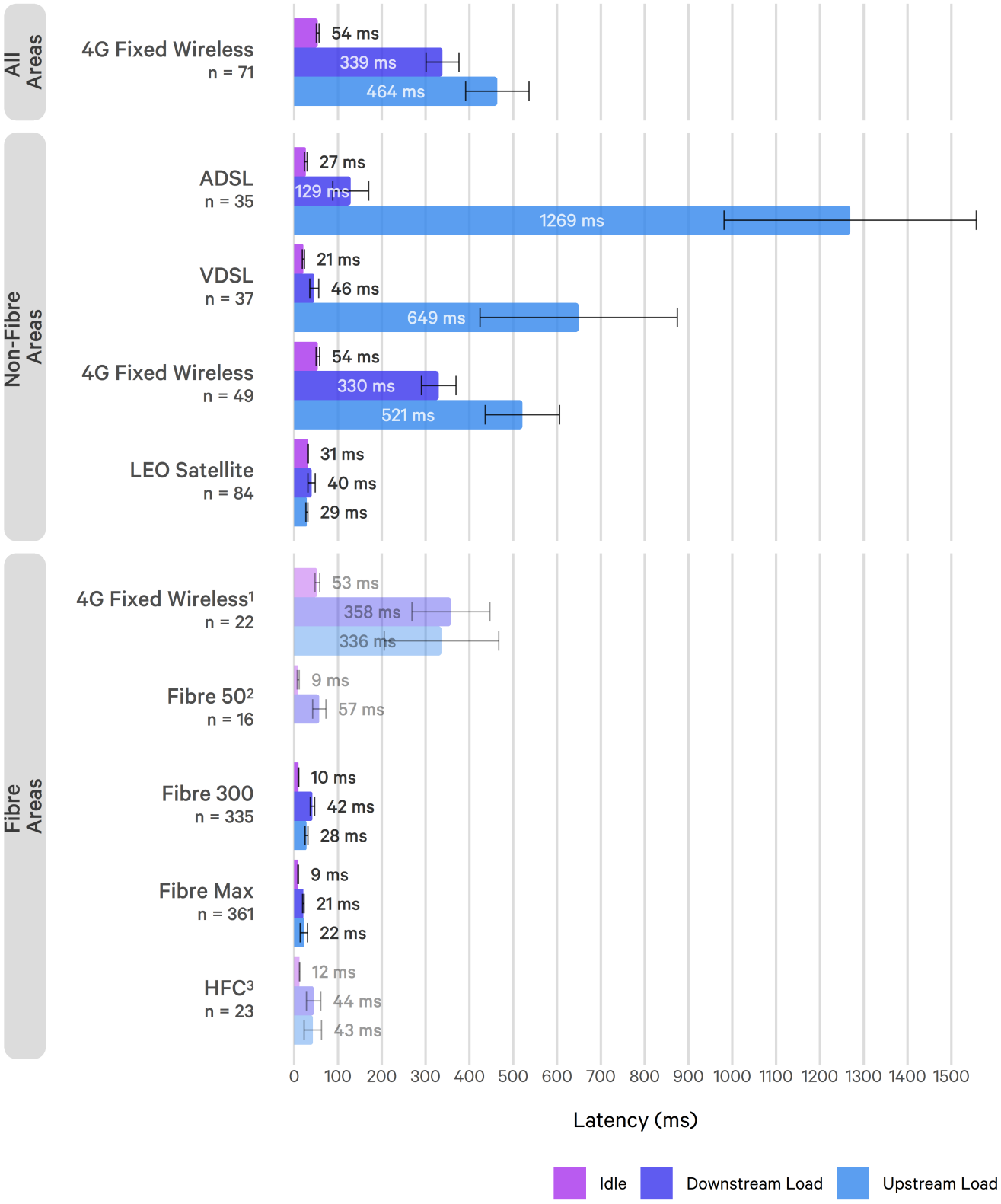
The latency under load test measures the latency when the broadband connection is heavily utilised (by the way of a speed test run in parallel). This is more representative of user experience than idle latency as it shows the impact of downloading or uploading data to the internet (e.g. watching Netflix or uploading a file) on latency (e.g. how long a webpage takes to load). The results are particularly illustrative of real-world experience for people who are using latency-sensitive applications like video conferencing or some video games.

The graph shows latency values while the connection is idle, compared with latency values while the connection under either downstream or upstream load. The latency under load test is performed while the download (or upload) speed tests are running, and this is compared to the idle latency measurement which is calculated when the line is idle. Differences in access technology and router models will result in different results for the user.

It is expected that the router model will be a factor in any latency rise, as the test is measuring what is known as bufferbloat, which is where the router or other network devices on the path are buffering large amounts of data. As such, differences in technology and router models will result in different results for the user.

Figure 21: Average Latency Under Load to Test Servers by Plan. Lower is Better.

Averages of monthly household averages.The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 71).



MBNZ Report 20, June 2024

Key Observations

- Idle latency over Fixed Wireless is higher than over Copper (ADSL, VDSL), Cable (HFC), or Fibre (Fibre 50, Fibre 300, Fibre Max). Fibre is faster due to both the lower latency over Fibre optics and the more recent infrastructure that underpins the Fibre network.

- All plans see latency increase when the line is running upload or download tests compared to when the line is idle. ADSL and 4G Fixed Wireless[1] plans see a large increase in latency under load while both download and upload tests are running. VDSL shows a high latency when upload tests are running. These latency values are high enough to be noticeable to the user if multiple devices are used simultaneously, with one device heavily using the connection.

- Average latency under upload results for Fibre 50 are not included in this report due to different upload allocations across local fibre companies. There were not enough Whiteboxes on Fibre 50 to split upload results by local fibre company.

- Latency under downstream and upstream load is higher for the Fibre 300 plan compared to Fibre Max results. Fibre Max plans have lower latency results for latency under downstream and upstream load than HFC[2].

- LEO Satellite plans see a small increase in latency under load when download tests are running. Latency under upload shows a smaller increase on idle latency for satellite plans. While idle latency for satellite is higher than Copper (ADSL and VDSL), latency under downstream load is significantly lower for LEO Satellite than ADSL, and latency under upstream load is also lower for LEO Satellite than both ADSL and VDSL.

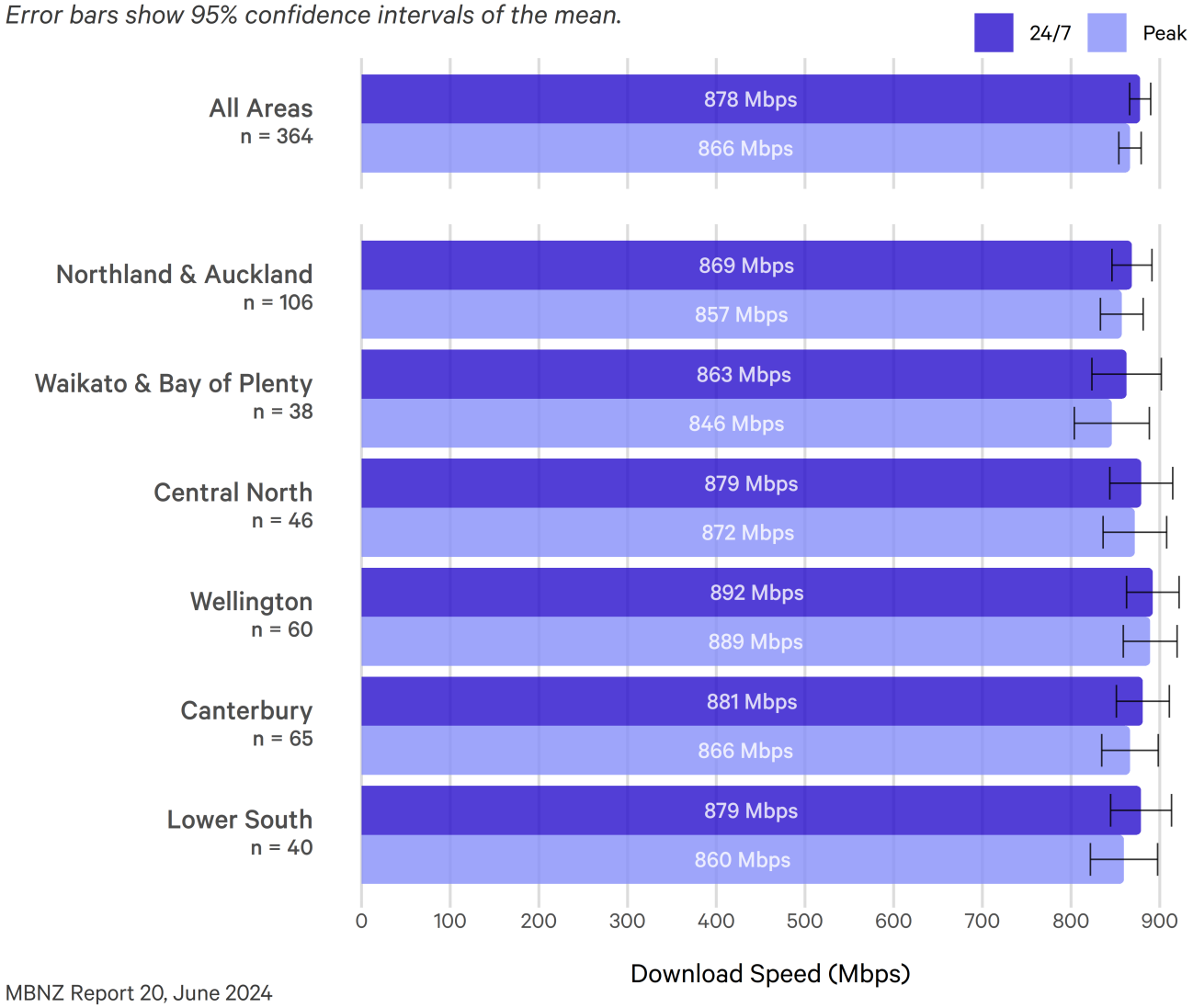
[1] Results for 4G Fixed Wireless are based on a sample size of 22 Whiteboxes in Fibre areas. The lower sample size can be attributed to Fixed Wireless being a new area of focus for the MBNZ programme and we hope to increase this number for the Summer Report

[2] Results for HFC are based on a sample size of 23 Whiteboxes. The low sample size can be attributed to the relatively small coverage area of One New Zealand's Cable network and the competing influence of Copper, Fibre and Fixed Wireless in those areas.

Fibre Max Breakdown by Region

Figure 22: Average Fibre Max Download Speeds by Region

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm.
The number of Whiteboxes contributing to each result is shown under each geographical area (eg n = 364)
Error bars show 95% confidence intervals of the mean.



MBNZ Report 20, June 2024

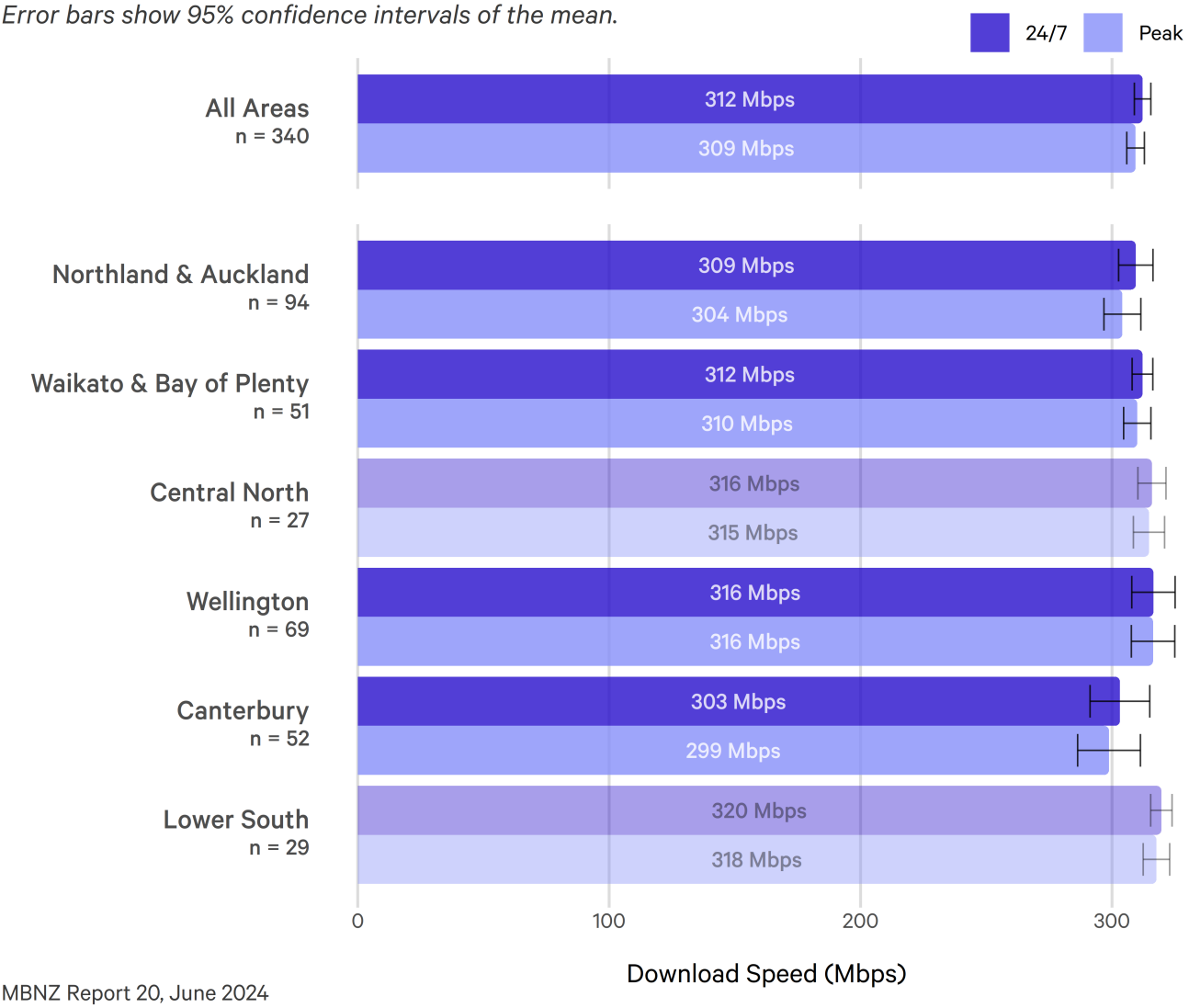
Key Observations

- Across all areas of New Zealand, there is very little difference between average Fibre Max performance.
- Results for the Upper South (Tasman, Nelson & Marlborough) are unable to be reported due to a low sample size.

Fibre 300 Breakdown by Region

Figure 23: Average Fibre 300 Download Speeds by Region

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm.
The number of Whiteboxes contributing to each result is shown under each geographical area (eg n = 340)
Error bars show 95% confidence intervals of the mean.



MBNZ Report 20, June 2024

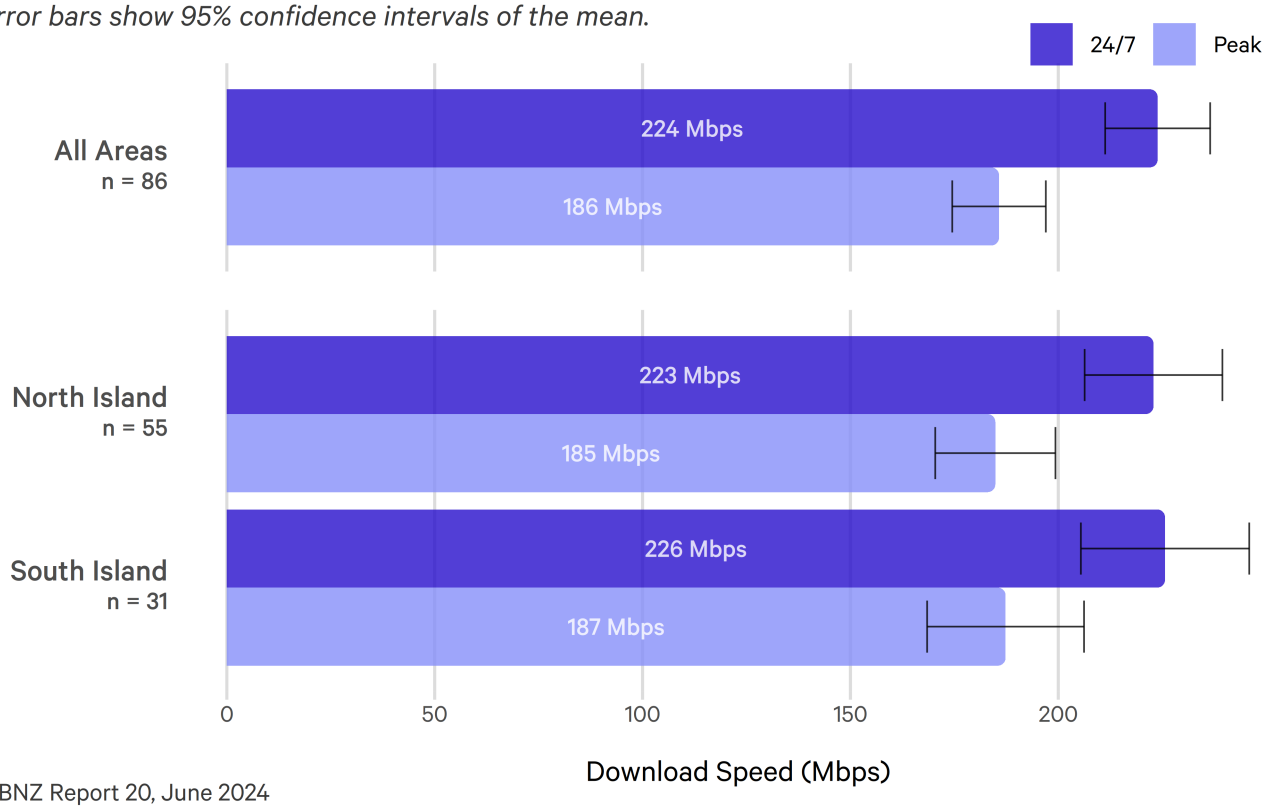
Key Observations

- Across all areas of New Zealand, there is very little difference between average Fibre 300 performance. All regions shown achieve average download speeds around 300 Mbps or higher.
- Results for the Upper South (Tasman, Nelson & Marlborough) are unable to be reported due to a low sample size.

LEO Satellite Breakdown by Island

Figure 24: Average LEO Satellite Download Speeds by Island

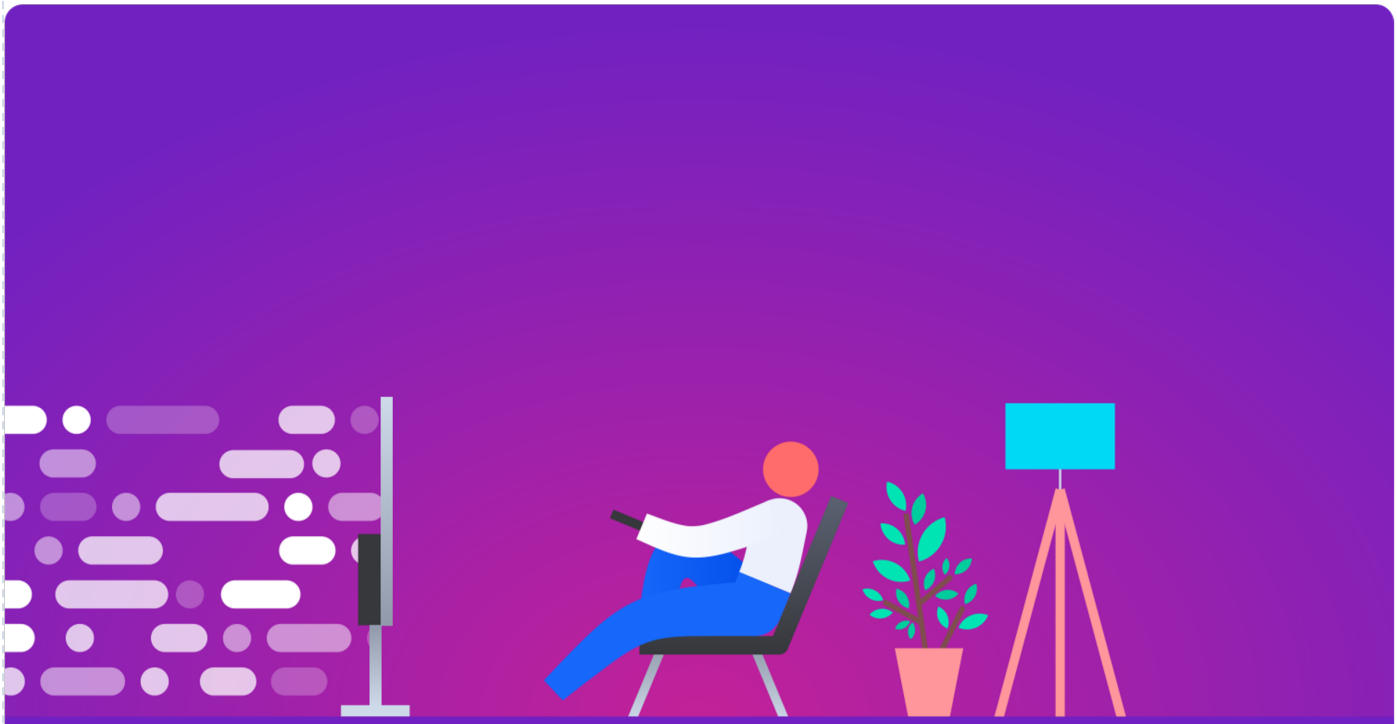
Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm.
The number of Whiteboxes contributing to each result is shown under each geographical area (eg n = 86)
Error bars show 95% confidence intervals of the mean.



MBNZ Report 20, June 2024

Key Observations

- There is very little difference between North and South Island results for LEO Satellite.



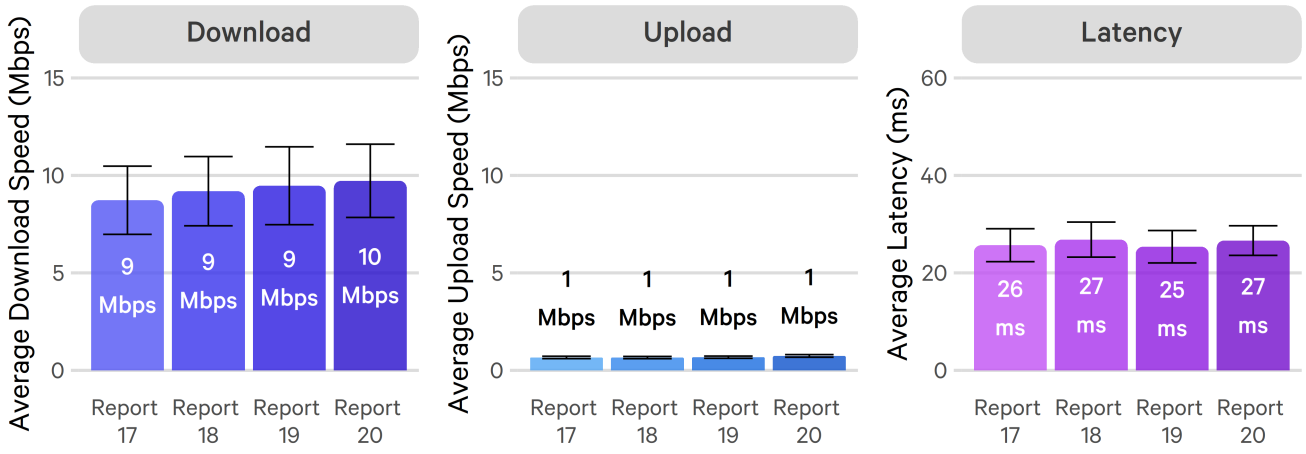
Previous Report Comparison

The following charts compare results from previous MBNZ reports across the past year for popular plans in New Zealand for quality of service metrics (download, upload and latency). ADSL, VDSL, Fibre 300 and Fibre Max plans have all seen consistent performance across reports. 4G Fixed Wireless and LEO Satellite plans have seen increases in average download speeds across the past year, with consistent upload and latency performance.

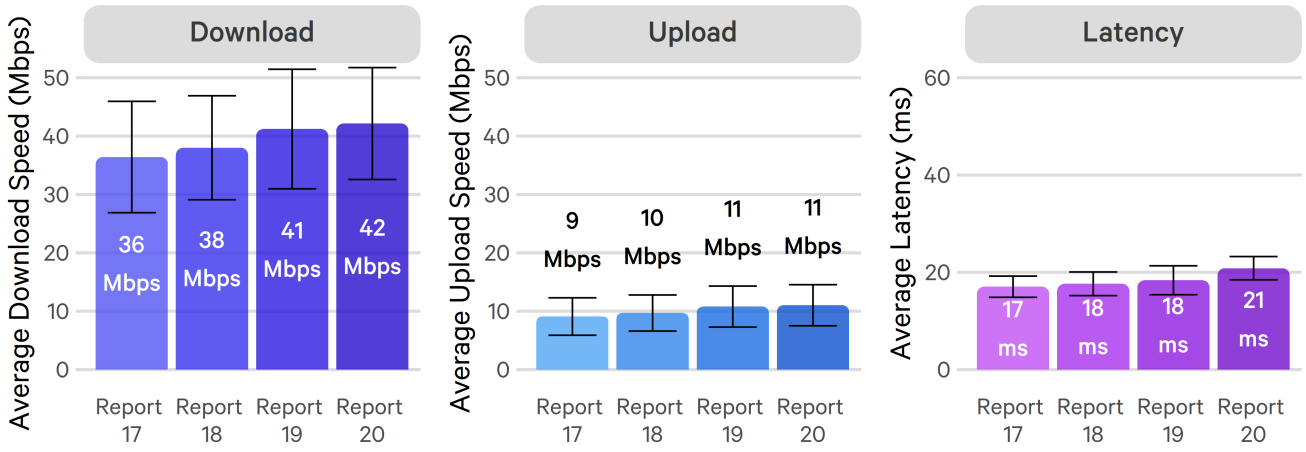
Table 1: Previous MBNZ Reports

MBNZ Report	Measurement Month	Publication Month
Report 17	July 2023	September 2023
Report 18	October 2023	January 2024
Report 19	January 2024	April 2024
Report 20	April 2024	July 2024

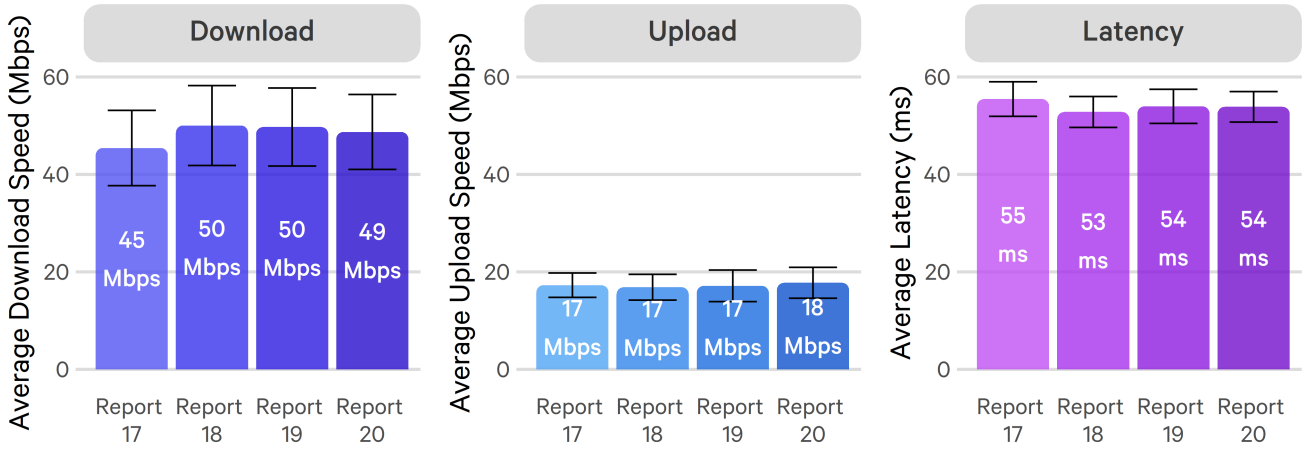
ADSL Performance across Reports



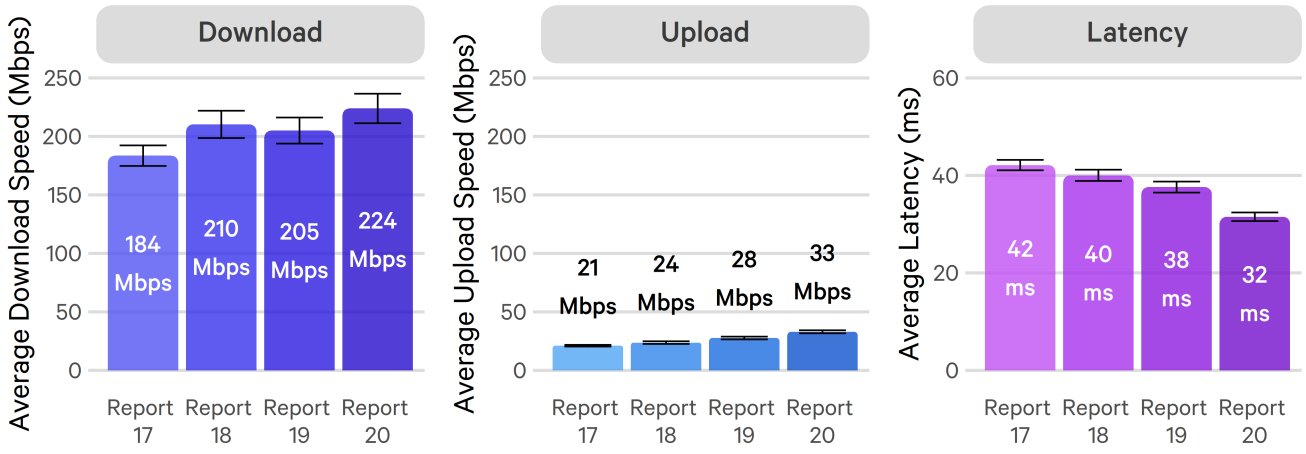
VDSL Performance across Reports



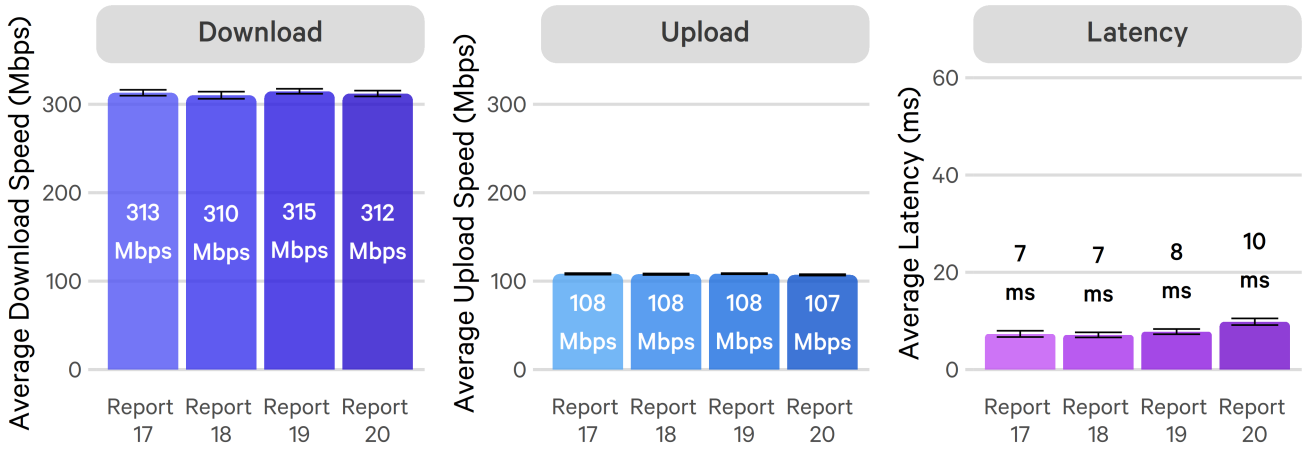
4G Fixed Wireless Performance across Reports



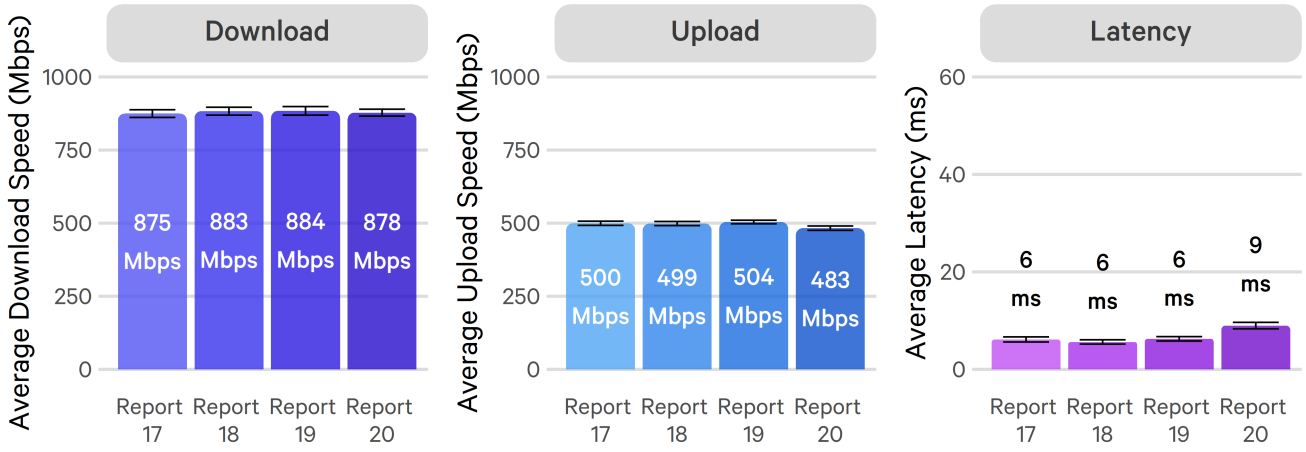
LEO Satellite Performance across Reports



Fibre 300 Performance across Reports



Fibre Max Performance across Reports



How we test

Measuring home broadband across New Zealand

- The SamKnows Whitebox is a purpose-built testing agent that connects to your router.
- It runs regular, automated performance tests to record the quality and performance of your internet connection without interfering with your network.
- The Whitebox does not record any personal information or browsing history.

Join the MBNZ Programme!

We are always on the hunt for more volunteers to help us expand on the technologies reported on in the MBNZ programme. Joining our awesome volunteer network enables us to gather even more data so we can continue shining a light on different technologies, RSPs and regions in New Zealand! Sign up at the following link[1], and if you're already a volunteer, encourage your friends and family to join too!

- Have 24/7 access to your own data.
- View all your data in one place via the SamKnows One platform.
- Create customised charts and save the results that mean the most to you.
- Track changes in your connection over time.

[1] https://www.measuringbroadbandnewzealand.com/sign-up

Our tests

	Test	Definition
	Download	The speed at which data can be transferred from the SamKnows test server to your device, measured in megabits per second (Mbps).
	Upload	The speed at which information is transferred from your device to the SamKnows test server, measured in megabits per second (Mbps).
	Latency	How long it takes a data packet to go from your device to our test server and back to your device, measured in milliseconds (ms). The shorter the latency, the better.
	Latency Under Load	How long it takes a data packet to go from your device to our test server and back to your device while a download/upload test is running, measured in milliseconds (ms). The shorter the latency, the better.
	Jitter	The variation in the delay of received packets, measured in milliseconds (ms). Essentially it is a measure of the stability of latency.
	Packet Loss	Packet loss counts packets that are sent over a network and do not make it to their destination, measured as a percentage of packets lost out of all packets sent.
	Disconnection	A disconnection means that two or more latency measurement packets in a row were lost. Measured as the median of household hourly rates.
	Video Conferencing	Measures round-trip latency and reachability of a selection of video conferencing services.
	Social Media	Measures round-trip latency and reachability of a selection of major social media services.
	Online Gaming	Measures performance for a number of major games and supporting services, such as game distribution platforms.
	Video Streaming	Measures the highest bitrate, and therefore quality level, you can reliably stream from real content servers.
	Webpage Loading Time	The time it takes for a specific webpage to fully load. This is a combination test that includes download, latency and DNS in one test that accurately mimics real-world usage.
	CDN Measurements	Measures download performance for the same (or very similar) object from a variety of popular Content Delivery Networks over HTTP.
	Voice over IP	Measures the suitability of a broadband connection for VoIP calls.

Glossary

Term	Definition
ADSL	Asymmetric digital subscriber line. A broadband connection that uses existing telephone lines to send data.
Advertised speed	The speed at which broadband services are typically advertised or marketed, usually described in Mbps (megabits per second). On some networks like ADSL or Fixed Wireless, these are not given as a general maximum but vary from line to line as they do not transmit data without depreciation across distance.
Broadband	A network service or connection which is defined as “always on”, as opposed to historical dial-up internet.
Broadband speed	The speed at which data is transmitted over a broadband connection, usually measured in megabits per second (Mbps).
Disconnection	A disconnection means that two or more latency measurement packets in a row were lost, resulting in stuttering broadband performance.
Download speed	The speed that data travels from our test server to your router. Measured in megabits per second (Mbps); higher is better.
HFC	Hybrid Fibre-Coaxial. A broadband connection that uses coaxial cables to send data.
Fibre	A broadband connection that uses Fibre-Optic cables to send data to and from a property directly. Sometimes referred to as FTTH (Fibre-to-the-home) or FTTP (Fibre-to-the-premises).
Fixed Wireless	A broadband connection that uses radio waves to provide internet access to a premises.
Latency	The time it takes for a data packet to travel from your router to our test server and back. Measured in milliseconds (ms); lower is better.
Latency under load	The time it takes for a data packet to travel from your router to our test server and back while a download/upload speed test is running. Measured in milliseconds (ms); lower is better.
LEO Satellite	Low Earth Orbit Satellite. A broadband connection that is transmitted wirelessly using a satellite and ground based satellite dish.
Mbps	Megabits per second. A unit measuring broadband speed. Mbps is the equivalent of 1,000 kilobits per second.
Packet loss	The percentage of packets that were lost somewhere between your router and our test server. Measured as a percentage of all packets sent; lower is better.
Peak hours	The time of day when people are typically using their internet connection, defined in New Zealand as between 7pm and 11pm.
RSP	Retail Service Provider. A company that provides consumers with access to the internet.
Upload speed	The speed that data travels from your router to our test server. Measured in Mbps (megabits per second); higher is better.
VDSL	Very high speed digital subscriber line. A broadband connection that allows higher speeds than ADSL technologies.

Summary Tables

Table 2: All RSPs Included in MBNZ Programme

All RSPs Included in MBNZ
2degrees, Stuff Fibre, Orcon & Slingshot
Spark (Including Skinny & Bigpipe)
One New Zealand (Including Farmside)
Starlink
Sky New Zealand
Mercury
Voyager
Contact Energy
NOW NZ
Netspeed
Inspire
Electric Kiwi
Ultimate Broadband
WIZwireless
Wireless Nation
Yrless
AirFibre
Evolution Networks
PureLink
UniFone

Table 3: Download, Upload and Latency Performance by Plan

Plan	SFA Area	Peak or Off-Peak	Number of Units	Average Download (Mbps)	Average Upload (Mbps)	Average Latency (ms)
ADSL	All Areas	24/7	38	10 Mbps	1 Mbps	26 ms
		Peak	38	10 Mbps	1 Mbps	27 ms
	Non-Fibre Areas	24/7	35	10 Mbps	1 Mbps	27 ms
		Peak	35	10 Mbps	1 Mbps	28 ms
VDSL	All Areas	24/7	43	43 Mbps	11 Mbps	21 ms
		Peak	43	43 Mbps	11 Mbps	21 ms
	Non-Fibre Areas	24/7	38	42 Mbps	11 Mbps	21 ms
		Peak	38	41 Mbps	11 Mbps	21 ms
LEO Satellite	All Areas	24/7	90	224 Mbps	33 Mbps	32 ms
		Peak	90	185 Mbps	32 Mbps	32 ms
	Non-Fibre Areas	24/7	86	224 Mbps	33 Mbps	32 ms
		Peak	86	186 Mbps	32 Mbps	32 ms
4G Fixed Wireless	All Areas	24/7	71	49 Mbps	18 Mbps	54 ms
		Peak	71	33 Mbps	17 Mbps	55 ms
	Fibre Areas	*24/7*	*22*	*54 Mbps*	*24 Mbps*	*53 ms*
		Peak	*22*	*38 Mbps*	*23 Mbps*	*53 ms*
	Non-Fibre Areas	24/7	49	46 Mbps	15 Mbps	54 ms
		Peak	49	31 Mbps	14 Mbps	56 ms
Fibre 300	Fibre Areas	24/7	335	312 Mbps	107 Mbps	10 ms
		Peak	335	309 Mbps	107 Mbps	10 ms
Fibre Max		24/7	364	878 Mbps	483 Mbps	9 ms
		Peak	364	866 Mbps	480 Mbps	9 ms
HFC		*24/7*	*23*	*915 Mbps*	*102 Mbps*	*12 ms*
		Peak	*23*	*914 Mbps*	*102 Mbps*	*12 ms*
Fibre 50		*24/7*	*16*	*52 Mbps*		*9 ms*
		Peak	*16*	*52 Mbps*		*9 ms*
5G Fixed Wireless	All Areas		*11*			

Plan	SFA Area	Peak or Off-Peak	Number of Units	Average Download (Mbps)	Average Upload (Mbps)	Average Latency (ms)
WISP Fixed Wireless			*18*			

Table 4: Fibre 300 and Fibre Max Download, Upload and Latency Summary by RSP

Plan	RSP	Peak or Off-Peak	Number of Units	Average Download (Mbps)	Average Upload (Mbps)	Average Latency (ms)
Fibre 300	2degrees, Orcon & Slingshot	24/7	110	310 Mbps	105 Mbps	12 ms
		Peak	110	302 Mbps	105 Mbps	13 ms
	One New Zealand	24/7	57	320 Mbps	110 Mbps	11 ms
		Peak	57	320 Mbps	110 Mbps	11 ms
	Sky New Zealand	24/7	45	320 Mbps	107 Mbps	10 ms
		Peak	45	320 Mbps	107 Mbps	10 ms
	Spark	24/7	66	314 Mbps	109 Mbps	6 ms
		Peak	66	314 Mbps	109 Mbps	6 ms
Fibre Max	2degrees, Orcon & Slingshot	24/7	173	862 Mbps	478 Mbps	10 ms
		Peak	173	846 Mbps	478 Mbps	11 ms
	One New Zealand	24/7	45	895 Mbps	469 Mbps	9 ms
		Peak	45	885 Mbps	469 Mbps	9 ms
	Sky New Zealand	24/7	49	893 Mbps	476 Mbps	12 ms
		Peak	49	889 Mbps	477 Mbps	12 ms
	Spark	24/7	52	915 Mbps	518 Mbps	3 ms
		Peak	52	908 Mbps	518 Mbps	3 ms

Table 5: Downlink Latency to Popular Social Media Platforms by RSP, Fibre Plans Only

Social Media Platform	Media Type	RSP	Number of Units	Average Latency
Instagram App	Image	2degrees, Orcon & Slingshot	295	8 ms
		Spark	127	5 ms
		One New Zealand	119	6 ms
		Sky New Zealand	94	8 ms
Instagram Messenger	Text	2degrees, Orcon & Slingshot	295	27 ms
		Spark	127	81 ms
		One New Zealand	119	19 ms
		Sky New Zealand	94	15 ms
	Image	2degrees, Orcon & Slingshot	295	8 ms
		Spark	127	5 ms
		One New Zealand	119	6 ms
		Sky New Zealand	94	8 ms
Facebook App	Text	2degrees, Orcon & Slingshot	295	26 ms
		Spark	127	81 ms
		One New Zealand	119	17 ms
		Sky New Zealand	94	15 ms
	Image	2degrees, Orcon & Slingshot	295	8 ms
		Spark	127	5 ms
		One New Zealand	119	6 ms
		Sky New Zealand	94	8 ms
Facebook Messenger	Text	2degrees, Orcon & Slingshot	295	27 ms
		Spark	127	80 ms
		One New Zealand	119	18 ms
		Sky New Zealand	94	15 ms
	Image	2degrees, Orcon & Slingshot	295	8 ms
		Spark	127	5 ms
		One New Zealand	119	6 ms
		Sky New Zealand	94	8 ms

Social Media Platform	Media Type	RSP	Number of Units	Average Latency
Snapchat	Text	2degrees, Orcon & Slingshot	294	134 ms
		Spark	127	133 ms
		One New Zealand	119	133 ms
		Sky New Zealand	94	135 ms
	Image	2degrees, Orcon & Slingshot	294	572 ms
		Spark	127	586 ms
		One New Zealand	119	561 ms
		Sky New Zealand	94	573 ms
Whatsapp	Text	2degrees, Orcon & Slingshot	295	29 ms
		Spark	127	80 ms
		One New Zealand	119	18 ms
		Sky New Zealand	94	15 ms
	Image	2degrees, Orcon & Slingshot	295	28 ms
		Spark	127	81 ms
		One New Zealand	119	18 ms
		Sky New Zealand	94	15 ms
X (formally Twitter)	Text	2degrees, Orcon & Slingshot	295	35 ms
		Spark	127	35 ms
		One New Zealand	119	35 ms
		Sky New Zealand	94	38 ms
	Image	2degrees, Orcon & Slingshot	295	14 ms
		Spark	127	28 ms
		One New Zealand	119	21 ms
		Sky New Zealand	94	13 ms

Table 6: Latency to Various Online Gaming Servers by RSP, Fibre plans only

Game	RSP	Number of Units	Average Latency
Among Us	2degrees, Orcon & Slingshot	294	159 ms
	Spark	127	156 ms
	One New Zealand	119	159 ms
	Sky New Zealand	94	161 ms
Apex Legends	2degrees, Orcon & Slingshot	294	35 ms
	Spark	127	36 ms
	One New Zealand	119	36 ms
	Sky New Zealand	94	36 ms
Diablo III	2degrees, Orcon & Slingshot	294	35 ms
	Spark	127	36 ms
	One New Zealand	119	36 ms
	Sky New Zealand	94	36 ms
Dota 2	2degrees, Orcon & Slingshot	294	36 ms
	Spark	127	35 ms
	One New Zealand	119	35 ms
	Sky New Zealand	94	37 ms
FIFA	2degrees, Orcon & Slingshot	294	37 ms
	Spark	127	40 ms
	One New Zealand	119	36 ms
	Sky New Zealand	94	38 ms
Fortnite	2degrees, Orcon & Slingshot	294	37 ms
	Spark	127	40 ms
	One New Zealand	119	36 ms
	Sky New Zealand	94	38 ms
Hearthstone	2degrees, Orcon & Slingshot	294	149 ms
	Spark	127	145 ms
	One New Zealand	119	205 ms
	Sky New Zealand	94	152 ms
Heroes of the Storm	2degrees, Orcon & Slingshot	294	148 ms

Game	RSP	Number of Units	Average Latency
	Spark	127	145 ms
	One New Zealand	119	205 ms
	Sky New Zealand	94	152 ms
Overwatch	2degrees, Orcon & Slingshot	294	35 ms
	Spark	127	35 ms
	One New Zealand	119	36 ms
	Sky New Zealand	94	36 ms
PUBG	2degrees, Orcon & Slingshot	294	39 ms
	Spark	127	39 ms
	One New Zealand	119	37 ms
	Sky New Zealand	94	40 ms
Rainbow Six Siege	2degrees, Orcon & Slingshot	293	39 ms
	Spark	127	53 ms
	One New Zealand	119	37 ms
	Sky New Zealand	94	40 ms
Rocket League	2degrees, Orcon & Slingshot	294	35 ms
	Spark	127	34 ms
	One New Zealand	119	35 ms
	Sky New Zealand	94	36 ms
Valorant	2degrees, Orcon & Slingshot	294	37 ms
	Spark	127	40 ms
	One New Zealand	119	36 ms
	Sky New Zealand	94	38 ms
World of Warcraft	2degrees, Orcon & Slingshot	293	35 ms
	Spark	127	36 ms
	One New Zealand	119	36 ms
	Sky New Zealand	94	36 ms

Table 7: Latency to Various Video Conferencing Services by RSP, Fibre Plans Only

Video Conferencing Service	Free or Paid	RSP	Number of Units	Average Latency
GoToMeeting	Free	2degrees, Orcon & Slingshot	293	162 ms
		Spark	127	161 ms
		One New Zealand	119	164 ms
		Sky New Zealand	94	163 ms
	Paid	2degrees, Orcon & Slingshot	293	203 ms
		Spark	127	192 ms
		One New Zealand	119	195 ms
		Sky New Zealand	94	188 ms
Google Meet	Free	2degrees, Orcon & Slingshot	293	36 ms
		Spark	127	36 ms
		One New Zealand	119	55 ms
		Sky New Zealand	94	37 ms
	Paid	2degrees, Orcon & Slingshot	293	36 ms
		Spark	127	36 ms
		One New Zealand	119	55 ms
		Sky New Zealand	94	37 ms
Microsoft Teams	Free	2degrees, Orcon & Slingshot	293	46 ms
		Spark	127	44 ms
		One New Zealand	119	43 ms
		Sky New Zealand	94	46 ms
	Paid	2degrees, Orcon & Slingshot	293	46 ms
		Spark	127	44 ms
		One New Zealand	119	43 ms
		Sky New Zealand	94	46 ms
Skype	Free	2degrees, Orcon & Slingshot	293	51 ms
		Spark	127	49 ms
		One New Zealand	119	47 ms
		Sky New Zealand	94	51 ms

Video Conferencing Service	Free or Paid	RSP	Number of Units	Average Latency
Zoom		2degrees, Orcon & Slingshot	293	198 ms
		Spark	127	202 ms
		One New Zealand	119	204 ms
		Sky New Zealand	94	199 ms
	Paid	2degrees, Orcon & Slingshot	293	52 ms
		Spark	127	50 ms
		One New Zealand	119	48 ms
		Sky New Zealand	94	54 ms