

## Measuring Broadband

# New Zealand

Autumn Report, June 2021

In 2018, the Commerce Commission appointed SamKnows to measure New Zealand's internet performance. The programme, called Measuring Broadband New Zealand (MBNZ), gives internet users in New Zealand access to SamKnows Whiteboxes to measure the quality of their fixed-line internet. The aim of the programme is to increase transparency about actual in-home broadband performance and provide consumers with independent information about internet performance across 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.

This report provides an overview of the findings from data collected between 1 March and 31 March 2021.



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# Overview

This report presents the most recent key indicators of consumer internet performance in New Zealand.

## Highlights include:

1. Continued monitoring of the largest Fibre RSPs and plans.
2. An analysis of dropouts, or disconnections, which affect realtime application performance.

The last report, ([https://comcom.govt.nz/\\_data/assets/pdf\\_file/0027/252288/MBNZ-Summer-Report-2021-13-April-2021.pdf](https://comcom.govt.nz/_data/assets/pdf_file/0027/252288/MBNZ-Summer-Report-2021-13-April-2021.pdf)) published on 13th April 2021, compared the performance of the main RSPs' Fibre Max plans following the 2020 network improvements, and presented data on Cable for the first time.

Previous reports in this series have examined topics including internet performance during online broadcasts of the Rugby World Cup 2019, internet performance following New Zealand's Level 4 Alert in response to COVID-19, and how many people in a household can watch Netflix at the same time.

Other reports released by the MBNZ project can be found here: <https://comcom.govt.nz/regulated-industries/telecommunications/monitoring-the-telecommunications-market/monitoring-new-zealands-broadband/Reports-from-Measuring-Broadband-New-Zealand>

The Measuring Broadband New Zealand project has a code of conduct, the purpose of which is to ensure that parties involved in the MBNZ programme 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 signatories is included in the code, including the Commission and SamKnows. All tested RSPs complied with the code of conduct, including validation of data for this report. You can see the code of conduct on our website: <https://comcom.govt.nz/regulated-industries/telecommunications/monitoring-the-telecommunications-market/monitoring-new-zealands-broadband>

# Executive Summary

## Benchmarking

1. All main download/upload/latency results are stable against the previous reporting period.
2. Short dropouts, which affect the performance of realtime applications, are infrequent across all technologies. However, ADSL and Fixed Wireless connections are likely to experience more frequent dropouts than those on other technologies, and dropouts are more frequent for traffic going overseas.

## Application Performance

1. Online Gaming, Video Streaming and Social Media: Results were consistent with those seen in previous reports. Charts of the performance of gaming and social media applications have been omitted from this report.

# Package Comparison

## ADSL

Remains suitable for traditional services like web browsing, email, and basic video streaming, particularly when there's 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 most ADSL lines in New Zealand averaging under 8 Mbps download. Coupled with the higher latency inherent to the technology, this does make ADSL less suitable for upload-heavy applications and multi-user households.

## VDSL

There is a range in performance: some lines will achieve download/upload speeds indistinguishable from 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 which use a lot of data, such as video conferencing and Ultra High Definition streaming, whereas higher speed lines will generally support more data-heavy applications.

## Fibre 100

Supports latency-sensitive applications such as online gaming. Fibre 100 will also support data-heavy applications such as Ultra High Definition streaming with multiple concurrent users or video conferences with a large number of participants. Fibre 100 will cover most users' requirements.

## Fibre Max

Higher download and upload speeds than Fibre 100. The latency to internet applications, such as online games, through a Fibre Max line is the same as through any other Fibre package. Performance varies depending on RSP and is slightly lower in the South Island than in the North Island. Fibre 100 will support all modern internet applications and multi-user households, so Fibre Max is still only recommended in cases where there is a genuine need for more bandwidth e.g. frequently uploading or downloading large files.

## Cable

Available in some areas (Wellington, including Upper & Lower Hutt, the Kapiti Coast, and parts of Christchurch). Cable is also referred to as Hybrid Fibre-Coaxial (HFC) and DOCSIS. Vodafone is the only provider operating a Cable network in New Zealand. Two plans are available: UltraFast HFC Max and UltraFast HFC 200. Due to the limited number of subscribers MBNZ doesn't collect enough data to formally report on the performance of the HFC 200 plan.

# Package Comparison (continued)

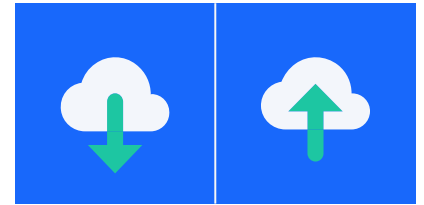
## Fixed Wireless (4G)

Can offer higher download speeds than ADSL, but with higher latencies due to the cellular technology underlying these plans. Fixed Wireless has the highest latency of all technologies apart from Satellite (not currently reported on by MBNZ). Fixed Wireless connections will be more likely to experience issues with latency-sensitive applications such as online gaming or video conferencing. Fixed Wireless connections can also be affected by congestion (for example average download speeds dropped by 25% in the March 2020 COVID-19 lockdown because of increased congestion). 5G Fixed Wireless plans (not currently reported on by MBNZ) are at present only available in limited areas, but would offer higher bandwidth than existing 4G plans.

## Other packages

There are other packages available, such as Fibre 30, Fibre 50, Fibre 200, HFC 200, and satellite packages. Since Measuring Broadband New Zealand collects less data on these packages it is not possible to give any firm advice around their suitability for different applications at this stage.

# Speed Tests

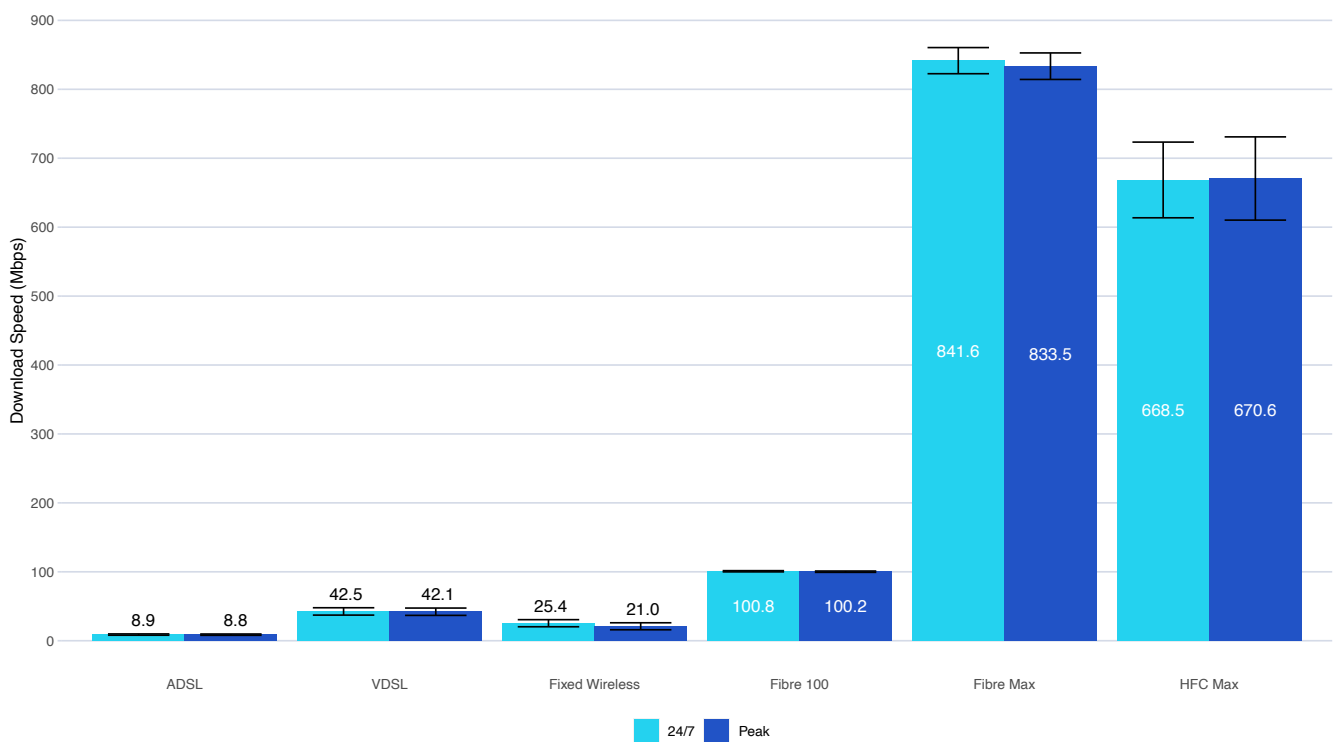


Figures 1 and 2 present an overview of download and upload speed across the country. These are included in every report in order to provide a benchmark that can be tracked over time. Peak hours are the times when people typically use the internet; in New Zealand this is 7pm to 11pm on Monday-Friday.

Figure 1

## Average Download Speeds by Plan.

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars show 95% confidence intervals.



These results are shown with error bars representing the 95% confidence interval for each plan's average speed. If we had repeated our measurements 100 times, we would expect average speeds to have fallen within the black bands in at least 95 cases. Other graphs throughout the report display similar confidence intervals, which carry the same interpretation.

### Key observations

- The average speeds of each plan are consistent with those seen in the previous report.

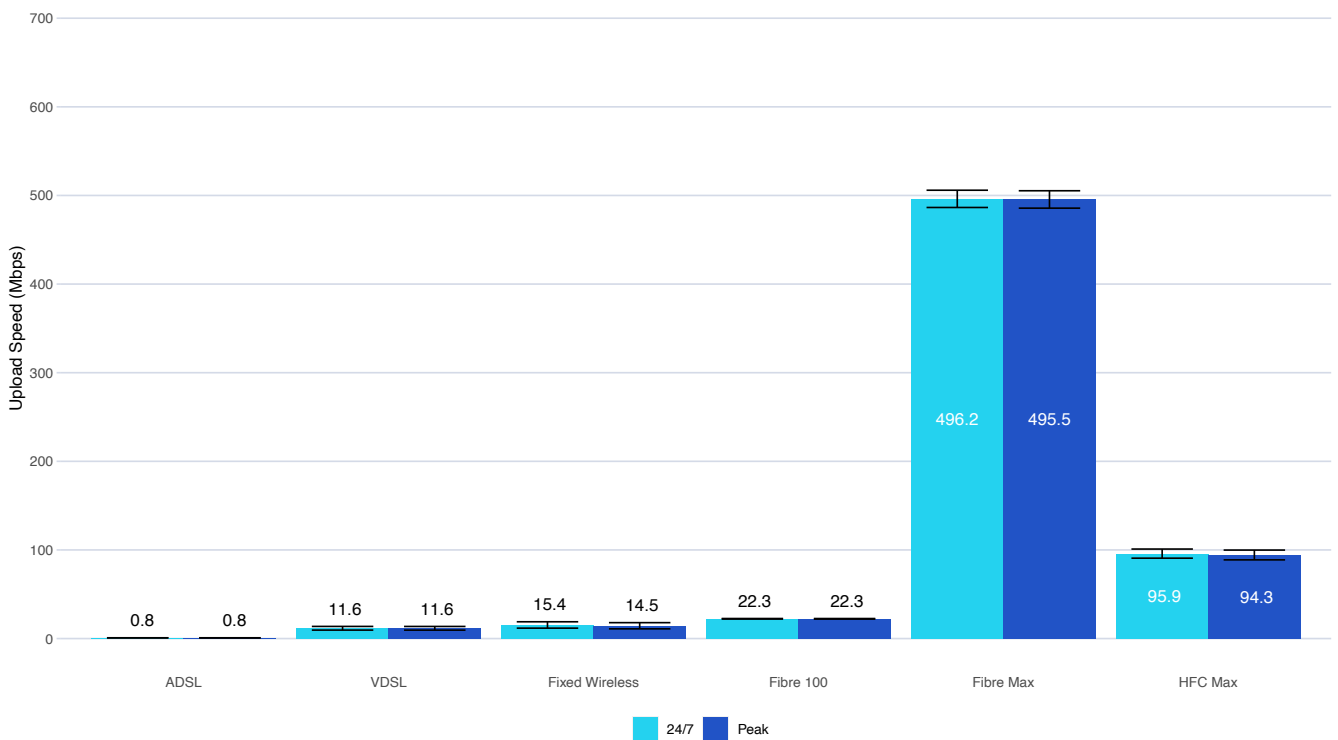
# Speed Tests (continued)

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

Figure 2

## Average Upload Speeds by Plan

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars show 95% confidence intervals.

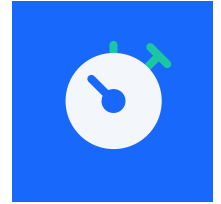


### Key observations

- The average speeds of each plan are consistent with those seen in the previous report.



# Latency

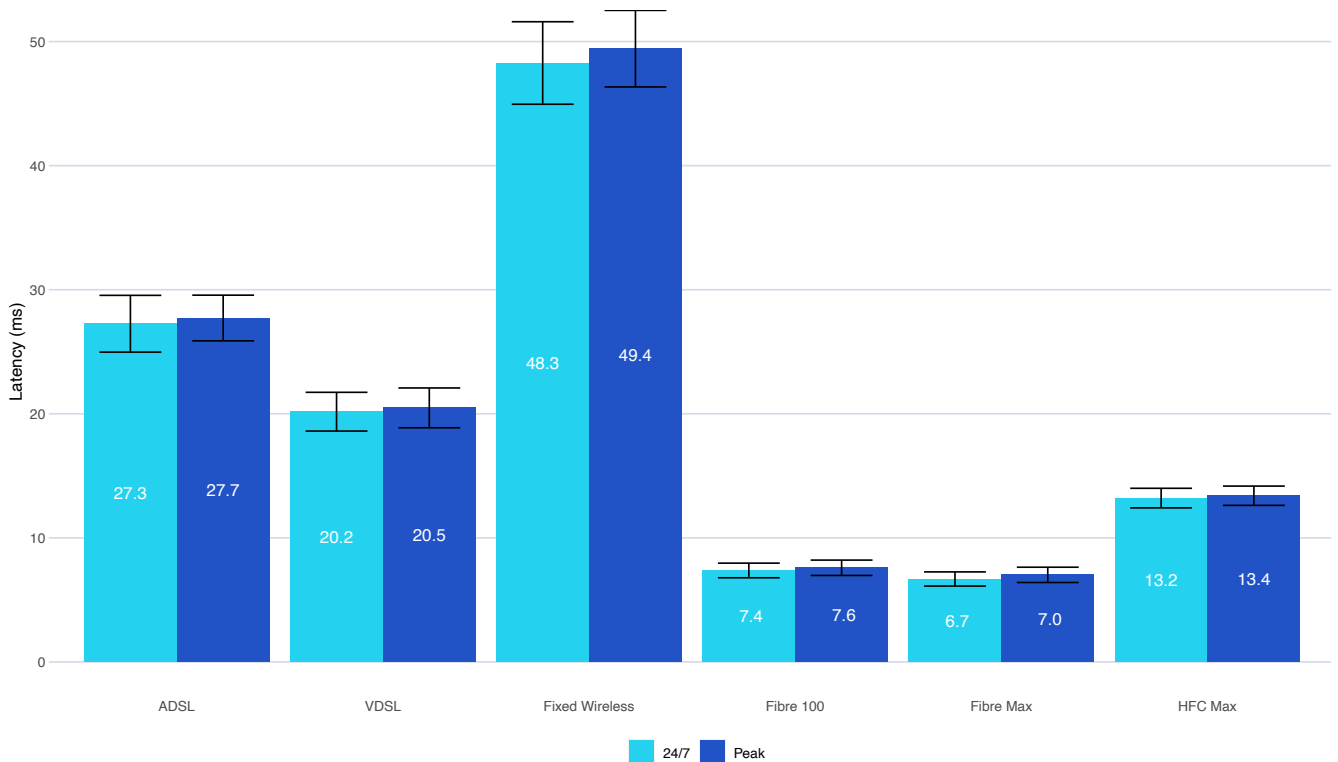


Latency is another key factor that should be considered when assessing broadband performance. The time it takes to transmit and receive messages between household and server limits the responsiveness of realtime applications such as interactive webpages or video calls. Higher baseline latency makes realtime applications more vulnerable to jitter (also known as packet delay variation) and dropouts.

Figure 3

## Average Latency to Test Servers by Plan. Lower is better.

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars show 95% confidence intervals.

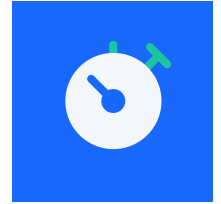


Some plans show a wider variation of latency than others: latency across a Fixed Wireless line will generally be more variable than over a Fibre line. These ranges have been reported explicitly in previous reports.

### Key observations

- Latency over Fixed Wireless is higher than over Copper, Cable, or Fibre. Fibre is faster due to both the lower latency over fibre optics and to the more recent infrastructure that underpins the Fibre network.
- HFC Max has an average latency between that of Fibre and that of Copper.
- There is no difference in latency across different Fibre plans, since latency is independent of bandwidth. A Fibre Max plan will not necessarily result in more responsive performance of interactive applications than a Fibre 100 plan.

# Disconnections

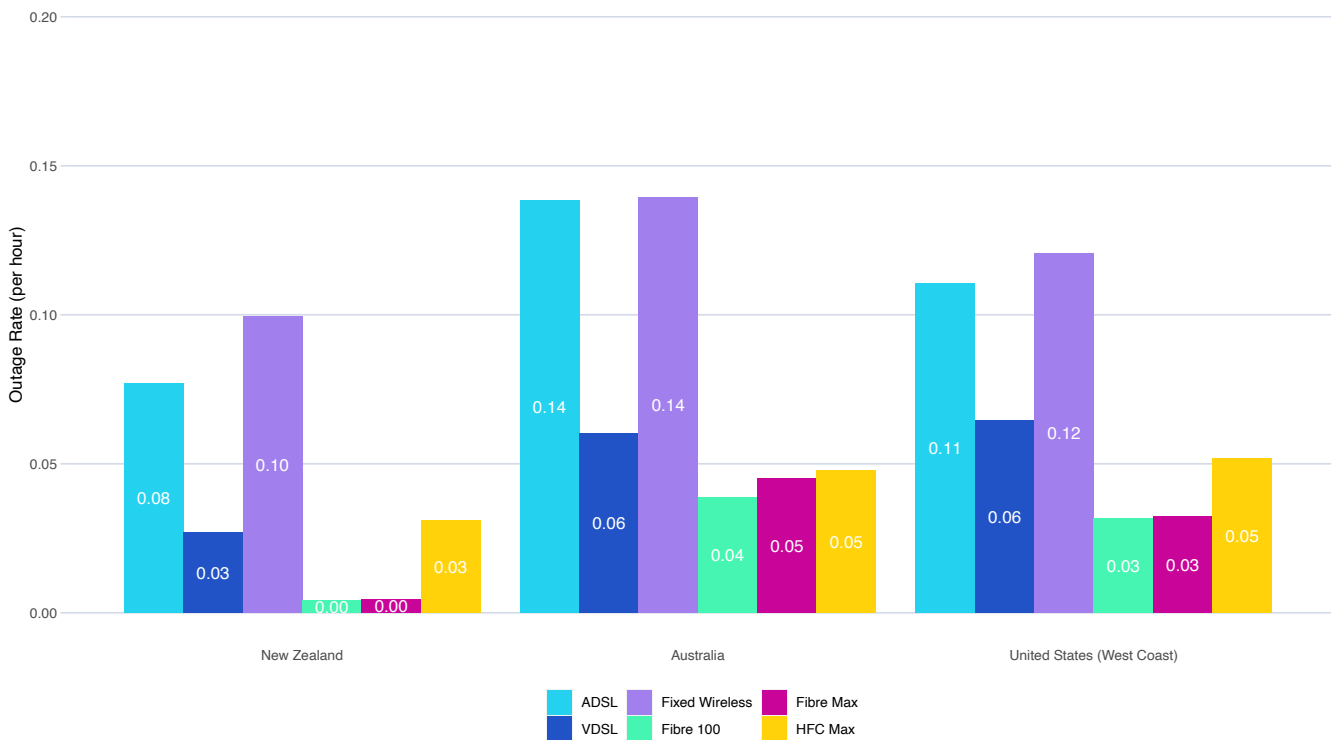


Realtime applications like video calls rely on a persistent connection between the home router and the target server. If the line drops, even for a few seconds, the application will exhibit some form of stuttering. In the worst instance, a user might be disconnected and have to reconnect or wait for their broadband line to come back online. A brief disconnection very rarely means that, for example, a physical cable has been cut; the main reasons for network dropouts relate to congestion and the configuration of network equipment. Many common applications, such as video conferencing applications or online gaming servers used by New Zealanders are served from overseas, mainly Australia, East Asia, and the USA. All New Zealand RSPs share capacity through the limited set of undersea cables which carry traffic across the Tasman and the Pacific.

The following graph compares disconnection rates across plans.

**Figure 4**  
**Median hourly outage rates. Lower is better.**

Medians of household hourly rates. A disconnection means that two or more latency measurement packets in a row were lost. Testing is run when the line is idle.



This graph shows medians across households. Taking Fixed Wireless as an example 50% of households will experience no more than 0.1 disconnections per hour 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. Disconnections vary by hour of the day, so the likelihood of 0.14 disconnection per hour when connected to an Australian server will not be consistent throughout all hours of the day.

This is the first time MBNZ has reported disconnections by technology, and the overarching findings indicate that there is only a small increase in the likelihood of disconnections for international traffic compared to domestic traffic. This is particularly important for New Zealanders as many application servers are hosted internationally.

We will be introducing a new test to the MBNZ program which will be included in reports from the Spring 2021 report onwards. This test, Latency under Load, will simulate the connection being in use before running the latency test. This should give an even more accurate picture of end users experience using applications like video conferencing and online gaming which can be compared with the disconnections tests carried out when the line is idle.

## Key observations

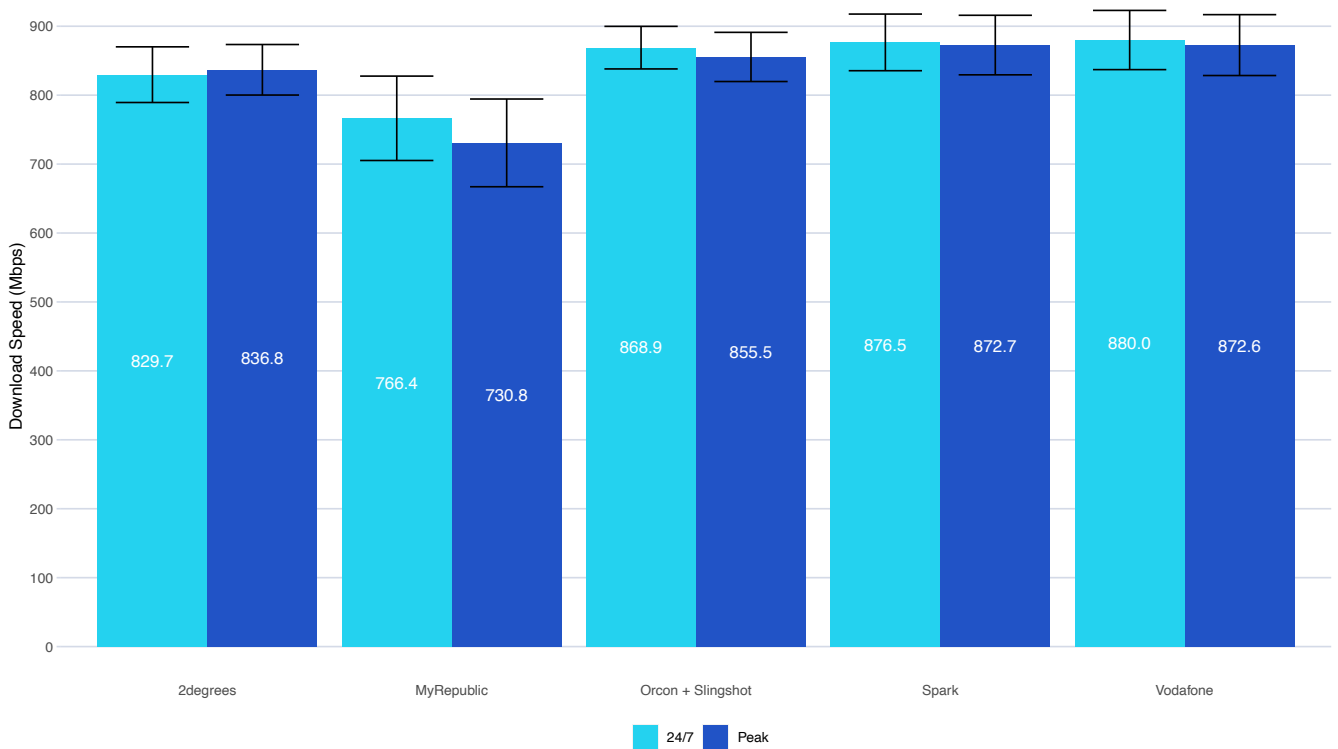
- Most households see a very low rate of disconnections, at least while the line is idle.
- Most ADSL and Fixed Wireless connections experience a higher rate of disconnections than most VDSL, Fibre, and Cable connections.
- Traffic going overseas is more likely to be lost than traffic remaining within New Zealand, though not to such an extent that most households would notice the difference.

# Fibre Max Breakdown by RSP

Fibre Max plans are generally advertised to the public with headline download speeds between 750 Mbps and 950 Mbps. 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 5**  
**Average Fibre Max Download Speed by RSP**

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars indicate 95% confidence intervals.



## Key observations

- All RSPs results are broadly in line with those seen in the previous report.

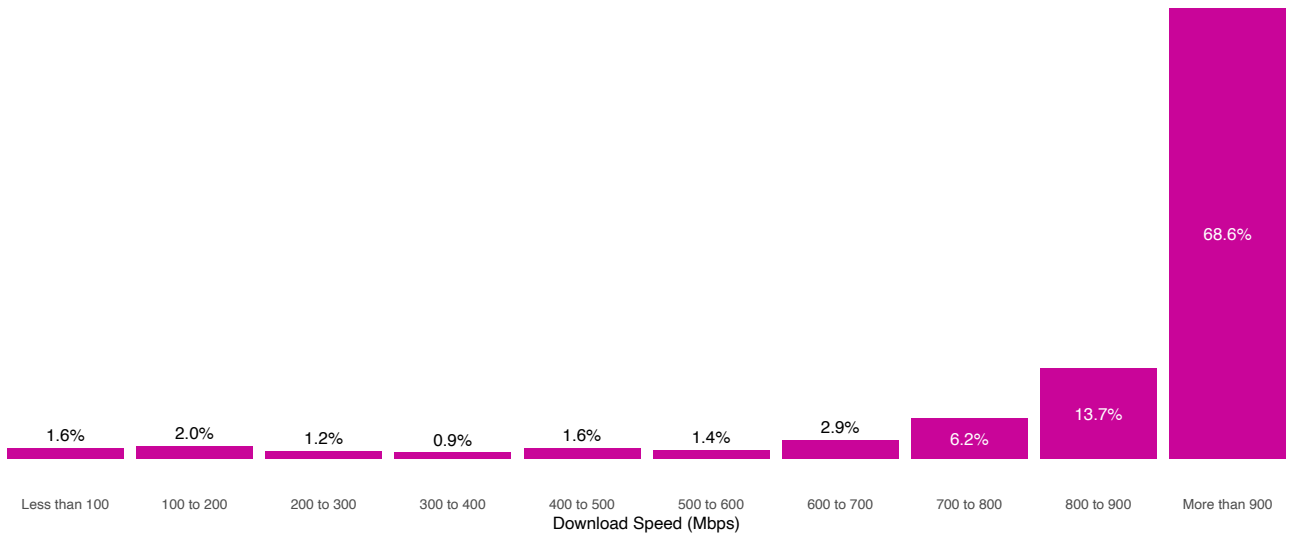
There were not enough Fibre Max volunteers connected to Trustpower during the measurement period to report results for those RSPs. All RSPs are included in the overall Fibre Max results shown in Figures 1-4.

# Distribution of Fibre Max Results

Figure 6

## Download speeds on Fibre Max plans.

Distribution of test results. Advertised average download speeds for Fibre Max plans range between 700Mbps and 950Mbps; this varies by RSP and over time.



### Key observations

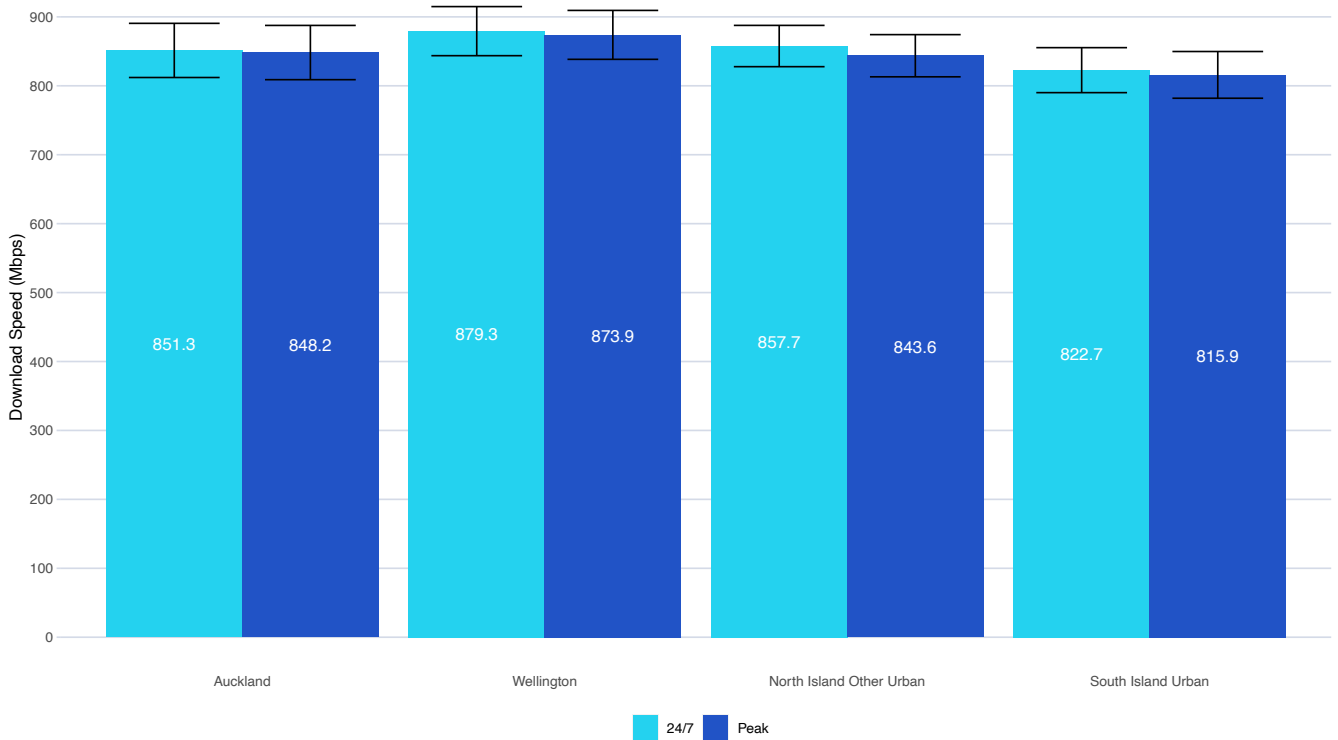
- 69% of speed tests run over Fibre Max lines now achieve download speeds above 900 Mbps, broadly in line with the 67% seen in the previous report.
- Within the range of test results, 82% of tested Fibre Max households had an average download speed higher than 800 Mbps, broadly in line with the 78% seen in the previous report.

# Fibre Max Breakdown by Region

Figure 7

## Average Fibre Max Download Speed by Region

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars indicate 95% confidence intervals.



### Key observations

- There remains a small difference in performance between islands, as has been noted in previous reports, but the difference is at a level which is unlikely to be noticed by end users.

The SamKnows test servers used for these speed tests are located in Auckland and Wellington. Since tests are run to the nearest server (in latency terms), tests originating in the South Island will generally use the Wellington server. Real internet traffic originating in the South Island will often remain within the South Island. To test whether this has an impact on speed test results, SamKnows are deploying a third test server located in Christchurch on behalf of the Commission. Results from this server will be reflected in the next report.

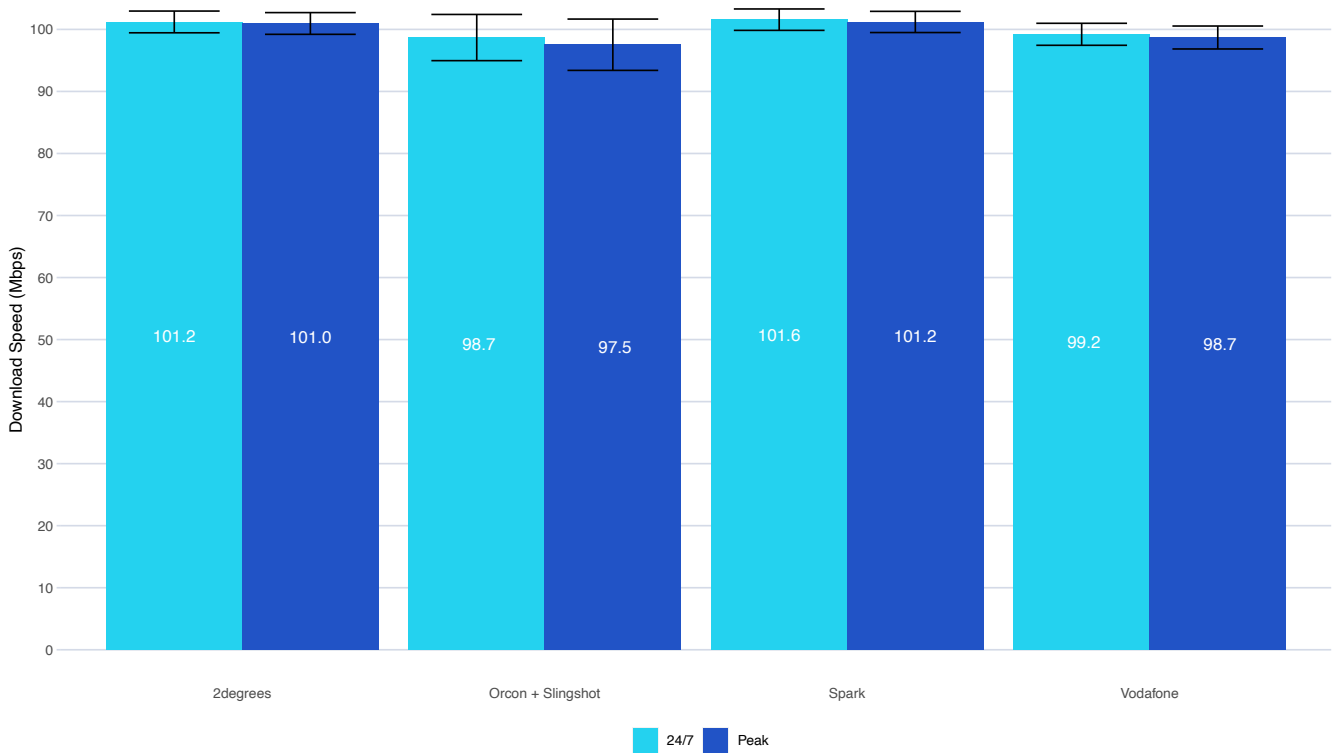
# Fibre 100 Breakdown by RSP

The speeds under which Fibre 100 is advertised to consumers are 100 Mbps download and 20 Mbps upload. In practice, since the provisioned speed is set slightly higher to allow for extra bandwidth used up by network protocol overhead, it's quite common to see measured speeds close to or slightly above 100 Mbps.

Figure 8

## Comparison of average Fibre 100 download speed across RSPs.

Average of monthly household averages. Peak hours are Monday - Friday 7pm - 11pm. Error bars indicate 95% confidence intervals.



### Key observations

- All RSPs average Fibre 100 download speeds are consistent with those seen in the previous report.

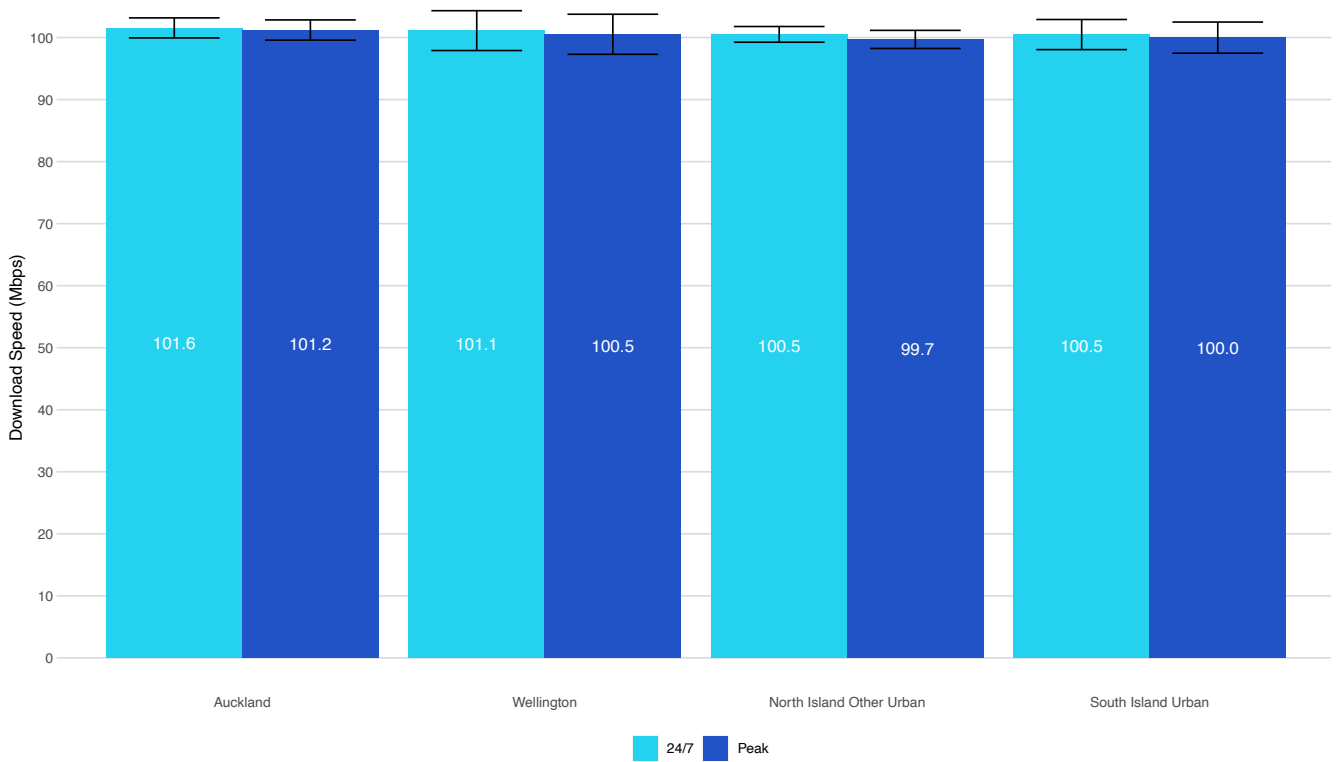
There were not enough volunteers connected to MyRepublic or Trustpower to report results for those RSPs. Those RSPs are included in the overall Fibre 100 results shown in Figures 1-4.

# Fibre 100 Breakdown by Region

Figure 9

## Comparison of average Fibre 100 download speeds for different parts of New Zealand.

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars indicate 95% confidence intervals.



### Key observations

- All areas of New Zealand see comparable download speeds through Fibre 100 plans, which are in line with the 100 Mbps headline download speed.



# How we test

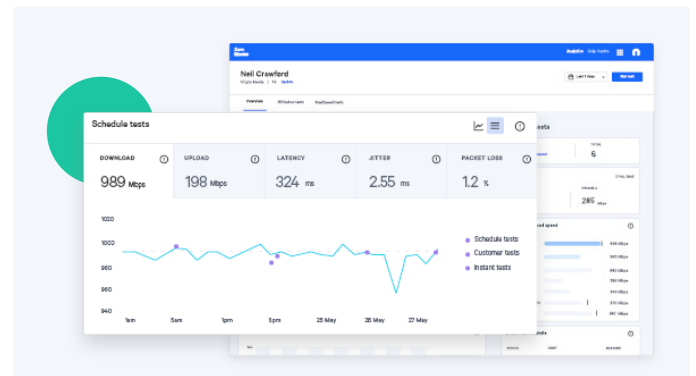


## Measuring home broadband across New Zealand

- The SamKnows Whitebox is a purpose-built testing agent that connects to your router.
- Measures every aspect of your internet service delivered to your home.
- Runs at regular intervals when you're not using the internet.

## SamKnows One analytics

- View all your data in one place.
- Create customised charts and save the results that mean the most to you.
- Track changes in your connection over time.















*SamKnows One stores all your home broadband performance data for easy analysis and detailed investigations*

## Sign up

Please participate by volunteering to receive a Whitebox. The more volunteers we have, the more information we can provide to consumers in New Zealand in future reports. [www.measuringbroadbandnewzealand.com/signup](http://www.measuringbroadbandnewzealand.com/signup)

## Our tests

Metric		Definition
	Download	The speed data travels from our test server to your device, measured in bits per second.
	Upload	The speed data travels from your device to our test server, measured in bits per second.
	Latency	How long it takes a data packet to go from your device to our test server and back to your device.
	Jitter	Measures the amount of difference between packet delays, or the stability of your latency.
	Packet Loss	When a packet of data becomes lost (does not arrive for two seconds) measured as a percentage of packets lost out of packets sent.
	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 you can reliably stream for the most popular video in your country.
	Web browsing	Measures how long it takes to fetch the HTML and referenced resources of a popular website.
	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”.
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.
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.
VDSL	Very high speed digital subscriber line. A broadband connection that allows higher speeds than ADSL technologies.
RSP	Retail Service Provider. A company that provides consumers with access to the internet.
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.
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.
SD	Standard definition. Resolution of video streaming between 640x480 pixels and 858x480 pixels. Often referred to as 480p.
HD	High definition. Resolution of video streaming between 1280x720 pixels and 1920x1080pixels. Often referred to as 720p or 1080p.
UHD	Ultra-high definition. The highest resolution for video streaming, this includes 4K UHD and 8K UHD. Minimum resolution of 3840x2160 pixels.
Upload speed	The speed that data travels from your router to our test server. Measured in Mbps (megabits per second); higher is better.