Report 16, March 2022

In 2017, the Australian Competition and Consumer Commission (ACCC) launched its project to measure internet performance. SamKnows was appointed to supply their Whiteboxes to internet users in Australia to measure the performance of NBN fixed-line internet. In 2021, the Measuring Broadband Australia program was renewed and has expanded to cover additional market segments, such as NBN fixed wireless services.

The goal of Measuring Broadband Australia is to increase transparency and encourage greater performance-based competition and better internet performance throughout the country.

SamKnows prepares these reports each quarter for publication by the ACCC. The metrics are also presented by the ACCC in a public dashboard available at https://www.accc.gov.au/consumers/internet-landline-services/broadband-performance-data. A data release containing the underlying summary data for this report can be found through https://data.gov.au/.

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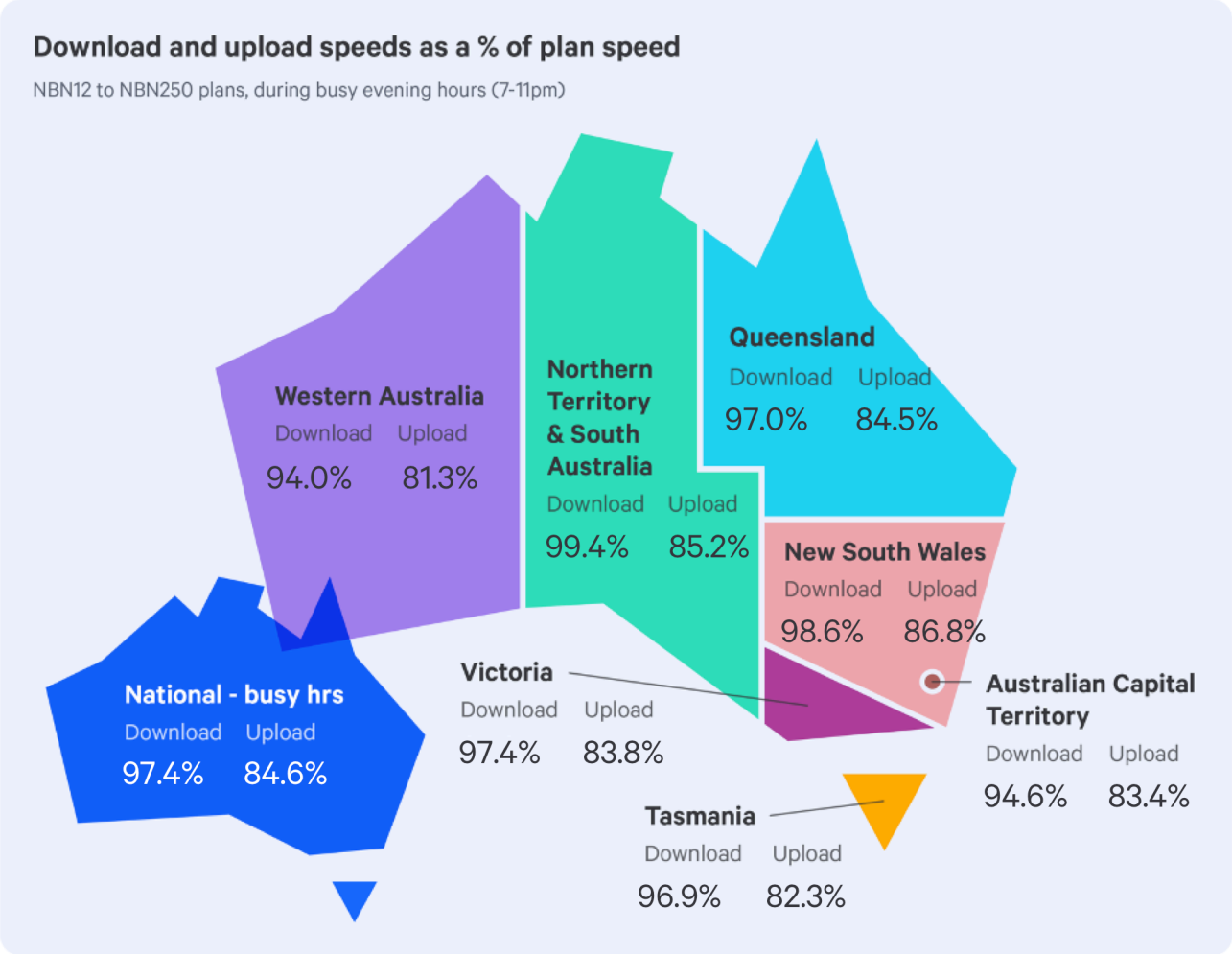
Measuring Broadband Australia Report 16 Key Results

Geographical

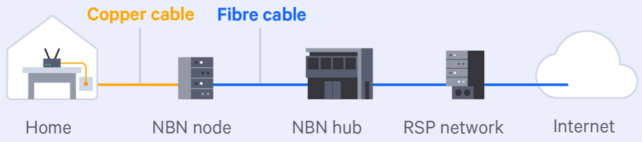
Average NBN fixed-line performance during busy hours by State/Territory, December 2021. Including underperforming and impaired services.



NBN access technology

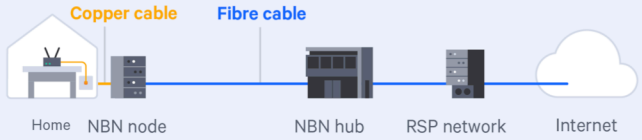
Download speeds during busy hours, December 2021.
Including underperforming and impaired services.

FTTN
Fibre to the Node



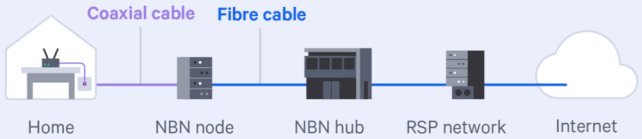
Plan	Avg download	% of plan
25	25.1 Mbps	100.6%
50	46.1 Mbps	92.2%
100	84.9 Mbps	92.2%

FTTC
Fibre to the Curb



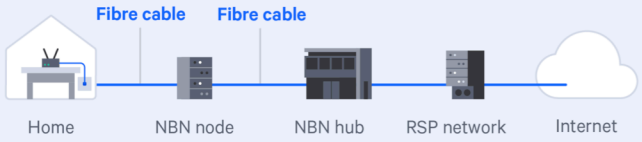
Plan	Avg download	% of plan
50	51.7 Mbps	103.5%
100	95.0 Mbps	95.0%

HFC
Hybrid Fibre Coaxial



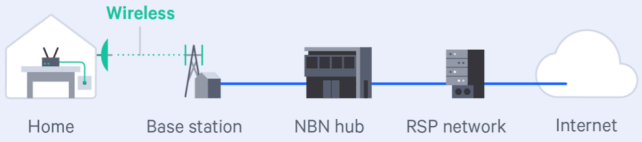
Plan	Avg download	% of plan
50	52.5 Mbps	105.0%
100	102.0 Mbps	102.0%
Very high speed services	725.9 Mbps	

FTTP
Fibre to the Premises



Plan	Avg download	% of plan
50	52.6 Mbps	105.1%
100	102.4 Mbps	102.4%
250	250.9 Mbps	100.4%
Very high speed services	733.7 Mbps	

Fixed wireless

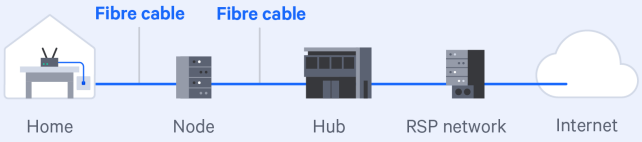


Plan	Avg download	% of plan
Fixed Wireless Plus	39.8 Mbps	79.6%

Other superfast access networks

Download speeds during busy hours, December 2021. Including underperforming and impaired services.

FTTP
Fibre to the Premises



Plan	% of plan
Uniti Group's FTTP networks	101.4%

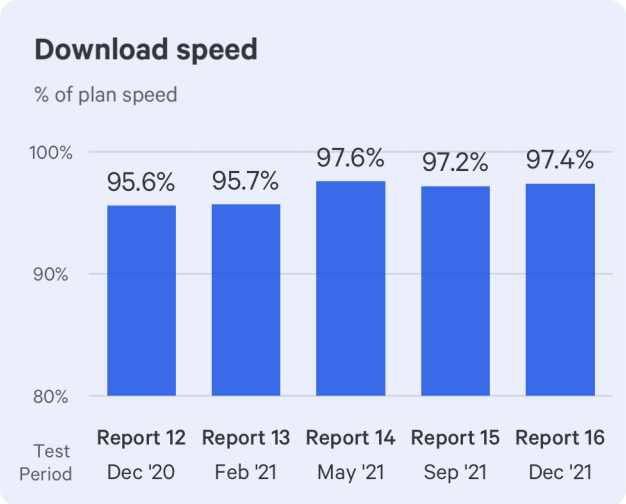
Quality of Experience

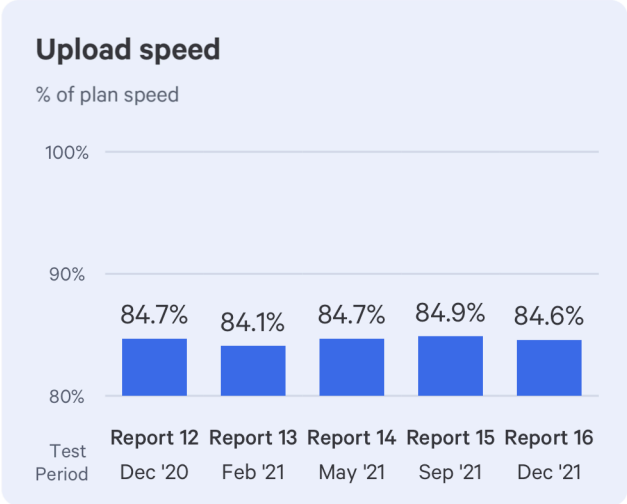
Streaming high definition (HD) and ultra-high definition (UHD) video during busy hours, December 2021. Including underperforming and impaired services.

NBN plan speed	% that can reliably stream HD & UHD videos from Netflix								
25	HD 100%	HD 100%	HD 100%	HD 100%	HD 100%	HD 98%	HD 95.9%	HD 92.9%	**7+** Concurrent **HD** video streams
	UHD 100%	UHD 79.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**1-2** Concurrent **UHD** video streams
50	UHD 99.7%	UHD 97.3%	UHD 87.1%	UHD 65.4%	0.0%	0.0%	0.0%	0.0%	**3-4** Concurrent **UHD** video streams
100	UHD 100%	UHD 100%	UHD 99.5%	UHD 96.7%	UHD 91.2%	UHD 84.7%	UHD 71.9%	41.2%	**6-7** Concurrent UHD video streams
250	UHD 100%	UHD 100%	UHD 100%	UHD 100%	UHD 100%	UHD 100%	UHD 97.6%	UHD 95.1%	**7+** Concurrent UHD video streams
Fixed Wireless Plus	UHD 98.2%	UHD 60.7%	41.1%	14.3%	8.9%	0.0%	0.0%	0.0%	**1-2** Concurrent UHD video streams

Long-term Trends

NBN fixed-line services[1], during busy hours.
Including underperforming and impaired services.





[1] Please note that the figures for December 2020 - September 2021 include only NBN12 to NBN250 plans, while the figure for December 2021 also includes data for plans with a retail download speed above 250 Mbps but under 1000 Mbps.

Overview

1 December 2021 to 31 December 2021

This is the sixteenth report issued as part of the Measuring Broadband Australia program. The main metrics of this report are based on measurements collected over the month of December 2021, a 31-day period.

Time series charts for download and upload performance

This report also presents the daily average download and upload performance of the major NBN fixed-line and NBN fixed wireless plans for the period November 2021 to January 2022.

Download performance between different RSPs

As a feature for this report, we have also included time series charts showing average daily download and upload speeds by retail service provider (RSP).

Other superfast access networks

As another feature, this report also provides the aggregated results of performance over other superfast access networks.

Volunteers using speed constrained in-home equipment

Similar to the September 2021 report (Report 15), this report will also include all services and plans that may be affected by a 100 Mbps link within their home. A common cause of this is Customer Premises Equipment (CPE) or other network devices that have Ethernet ports with a physical limit of 100 Mbps. Other potential sources of links constrained at 100 Mbps are damaged Ethernet cables, intermediate devices that only support 100 Mbps (such as old switches and hubs), and configuration of network equipment within the home. These consumers are unable to receive the full benefit of plans with download speeds above 100 Mbps when there is a 100 Mbps link in the path.The ACCC has engaged with RSPs to encourage them to reach out to their consumers who may be using a constrained network device.

For further information on what to do if you are experiencing reduced speeds, see https://www.accc.gov.au/consumers/internet-landline-services/home-broadband-for-consumers.

COVID-19 and broadband performance

During the period of November 2021 to January 2022, COVID-19 lockdowns no longer applied. To help RSPs accommodate increased network demand as a result of COVID-19 restrictions, in July 2021, NBN Co introduced a COVID-19 relief package that rebated some excess wholesale charge costs for RSPs. This form of relief continued until the end of December 2021.

NBN fixed-line services[2]

Download speed test results

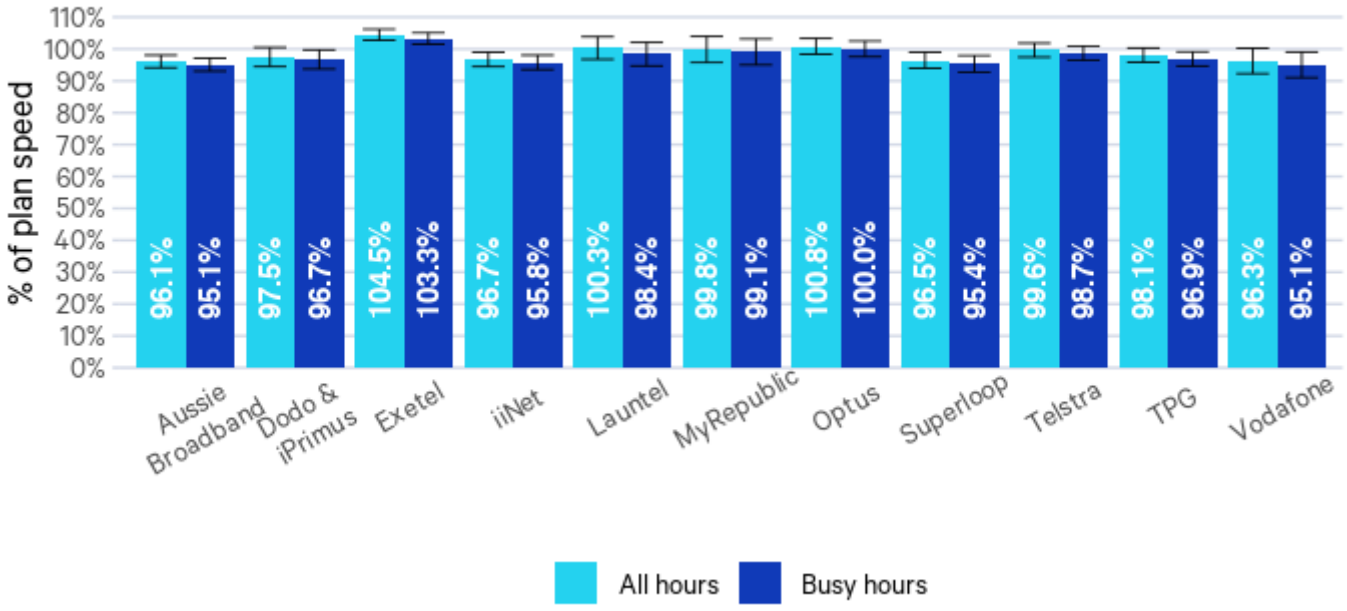
This report expresses results relating to download and upload speeds as a percentage of the service's plan speed.[3] Plan speed is not always the same as the speed advertised for a plan by RSPs. Hence, where the report outlines speed measures below 100 percent of plan speed, this should not be interpreted as the RSP having failed to provide the speed that it advertised.

[2] This section includes results for major NBN plans up to 600 Mbps. It excludes results from very high speed services as these are presented separately.

[3] Plan speed refers to the maximum download or upload speed associated with the relevant retail plan. For example, a 12/1 Mbps retail product has a maximum download speed of approximately 12 Mbps and 1 Mbps upload. A 100/20 Mbps retail product has a maximum download speed of approximately 100 Mbps and 20 Mbps upload. RSPs may advertise a maximum attainable speed and also state a different typical busy period speed that consumers are likely to experience, which may be the same or lower than the maximum attainable speed.

Figure 1: Average download speed by RSP

NBN fixed-line plans. Including underperforming services. Error bars indicate 95% confidence intervals of the mean.



During the December 2021 measurement period, users on NBN fixed-line services attained an average download performance of 98.4% of plan speed during all hours, decreasing to 97.4% during the busy hours (between 7pm and 11pm) which is when networks experience higher user activity.

These results are similar to the last (15th) Measuring Broadband Australia report. The corresponding figures in the last report were 98.3% of plan speed during all hours and 97.2% during busy hours.

As with previous reports, the 95% confidence intervals in Figure 1 above are a measure of how certain we are that the true average download speed lies between the upper and lower boundary indicated by the thin black lines. For example, Telstra had an average download performance of 99.6% with a 95% confidence interval of ±2.2%. This means that if we were to repeat our sampling 100 times, we expect that average performance would fall between 97.4% and 101.9% in at least 95 cases.

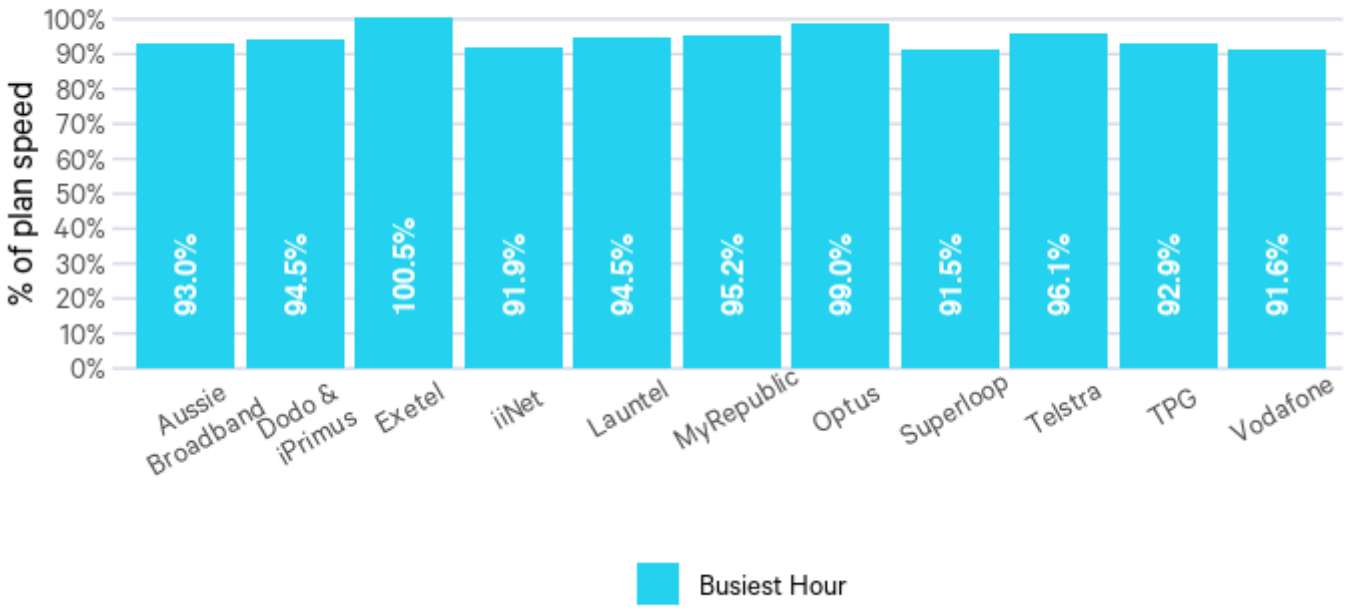
Figure 2 shows RSP results in the 'busiest hour', which is the fifth-lowest hourly average download speed across each busy hour by RSP in December 2021. The December 2021 measurement period had a total of 31 days with 4 busy hours each, totalling 124 busy hours

in the month. For each busy hour, we calculate the average download performance (download speed as a percentage of plan speed) for each RSP and use the fifth-lowest as the busiest hour.

The busiest hour gives an indication of the performance of each RSP when its network is under the highest levels of stress. The busiest hour download speed results in Figure 2 are lower than the busy hour download speeds shown in Figure 1. This indicates that there were periods of higher demand that affected consumers' performance on the NBN.

Figure 2: Busiest hour average download speed by RSP

NBN fixed-line plans. Including underperforming services.

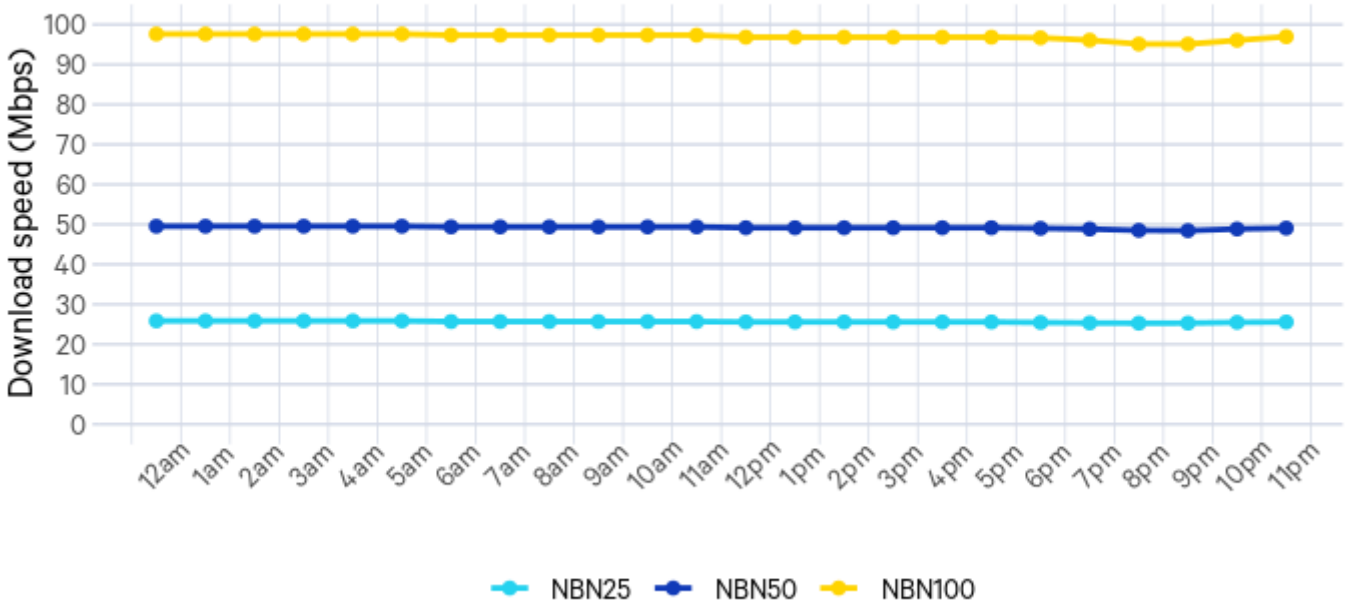


The range of speeds by RSP during the busiest hours varied from between 91.5% to 100.5% of plan speed. This is a wider range of results compared with the download metrics for all hours and busy hour metrics shown in Figure 1. Some RSPs were more affected by high demand peaks than other RSPs. All RSPs achieved busiest hour speeds above 90% of plan speed, which is an improvement from the previous report.

Figure 3 shows download speeds averaged across the month for each hour in the day.

Figure 3: Average hourly download speed by plan

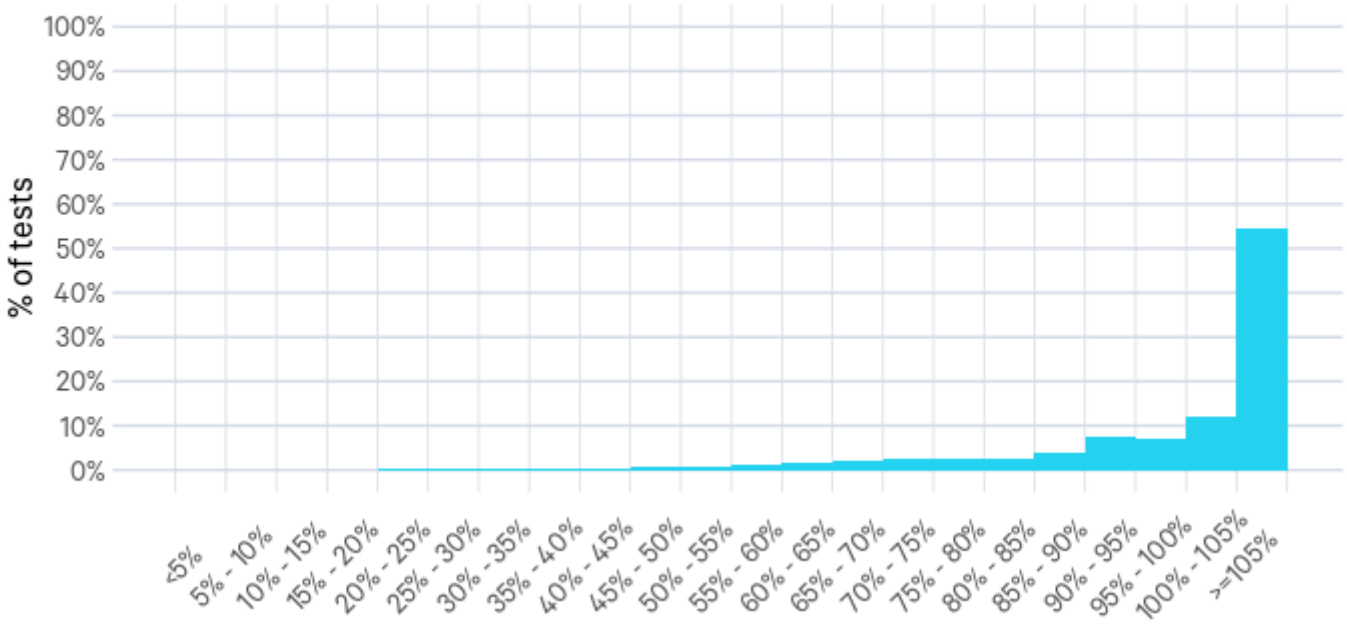
NBN fixed-line plans. Including underperforming services.



Average download speeds held steady throughout the day for users on most NBN plans. The 100 Mbps NBN plans remain the most affected by increased user activity in the evening hours, speeds typically started to decrease during the evening, dipping to 2.5 Mbps below the day's maximum by 9pm, and would recover to higher levels during the night. The average dip in NBN100 speeds is lower than that observed in the previous report (3.2 Mbps).

Figure 4: Frequency of download speeds attained during tests

NBN fixed-line plans. All hours. Including underperforming services.



During this reporting period, 262,983 download speed tests were performed across 1,266 Whiteboxes connected to fixed-line NBN infrastructure.

Of these tests, 66.5% achieved at least 100% of plan speed; for reference, 65.9% of tests in the previous report were at plan speed or higher.

The proportion of tests achieving less than 50% of plan speed was found to be 2.1% in this reporting period; for reference, 2.2% of tests failed to meet the 50% mark in the previous reporting period.

Daily average download speeds by plan

NBN fixed-line plans from 1 November 2021 to 31 January 2022

Figures 5 and 6 present average daily download speeds for the following NBN fixed-line plans:

- NBN100
- NBN50
- NBN25

The daily averages are calculated by aggregating raw test results by Whitebox, plan speed and day, with this then averaged across all Whiteboxes for each plan speed. For these time

series charts, calculations have been conducted for all hours and busy hours (7pm - 11pm) from Monday to Sunday. Our calculations exclude underperforming[4] and impaired[5] services. All charts use a consistent set of Whiteboxes across the entire reporting period. If a Whitebox changed plan during the period, it is excluded.

Figures 5 and 6 show the average download speed each day for the NBN25, NBN50, and NBN100 plans. Performance is broadly stable for all plan speeds during all hours. There is more variability in network performance during busy hours compared with all hours, particularly for NBN100 plans.

[4] We classify a service as 'underperforming' if no more than 5 percent of speed tests that we conducted over the service achieved a speed that was above 75 percent of maximum plan speed. This test effectively identifies those services with maximum attainable speeds that fall closer to the maximum speed of a lower plan than to the maximum speed of the consumer's current plan.
[5] Impaired services are those where NBN Co provides us with the information that the maximum plan speed cannot be attained due to physical limitations.

Figure 5: Average daily download speeds during all hours by plan

NBN fixed-line plans. Excluding underperforming and impaired services.

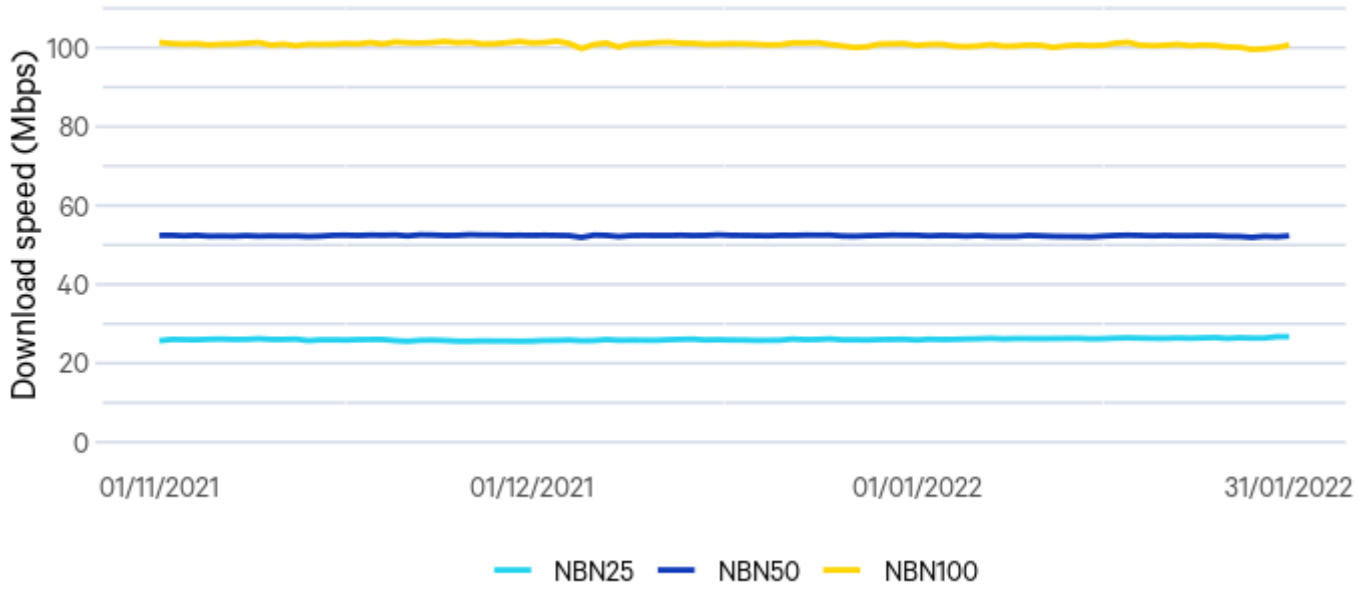
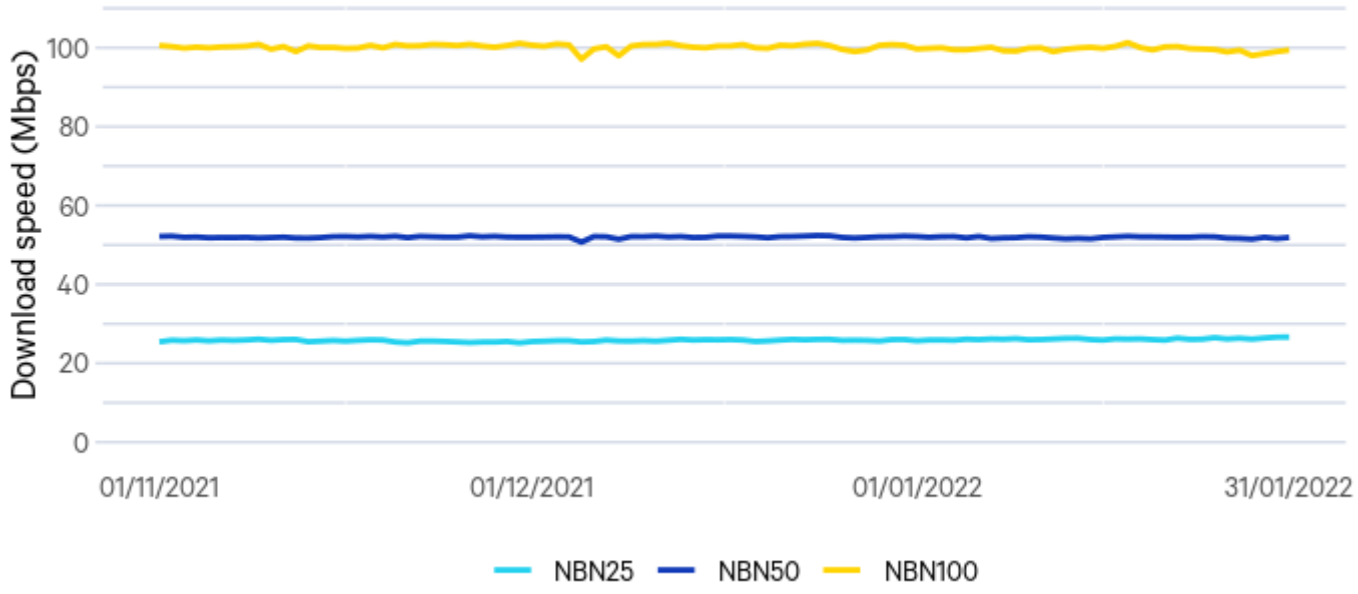


Figure 6: Average daily download speeds during busy hours by plan

NBN fixed-line plans. Excluding underperforming and impaired services.



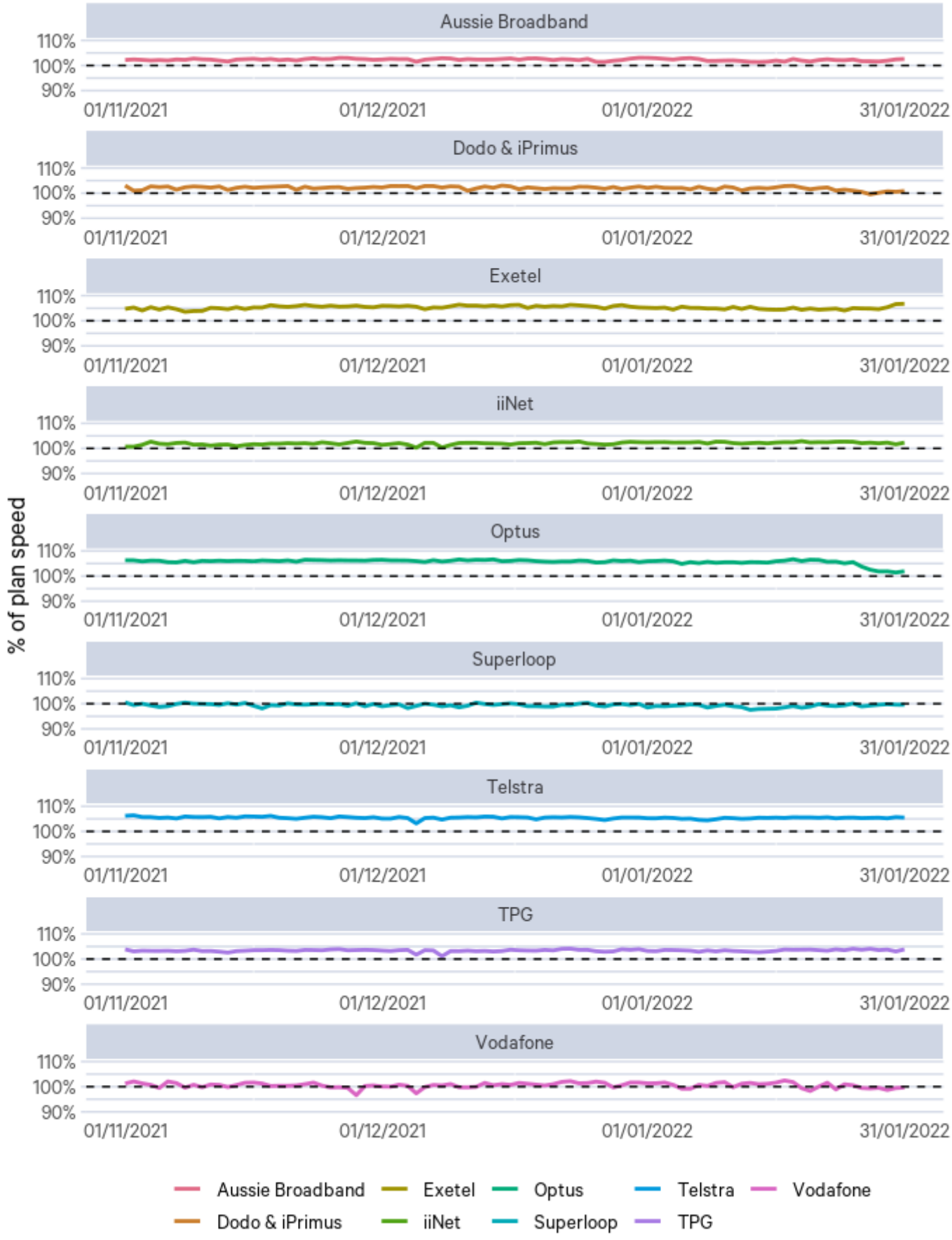
Daily average download speeds by RSP

NBN fixed-line plans from 1 November 2021 to 31 January 2022

Figure 7 presents average daily download speeds as a percentage of plan download speed for all NBN fixed-line plans. The daily averages are calculated as explained in the previous section. This figure only includes data from RSPs that had more than 40 units reporting consistently across the entire reporting period.

Figure 7: Average daily download speeds during all hours by RSP

NBN fixed-line plans. Excluding underperforming and impaired services.

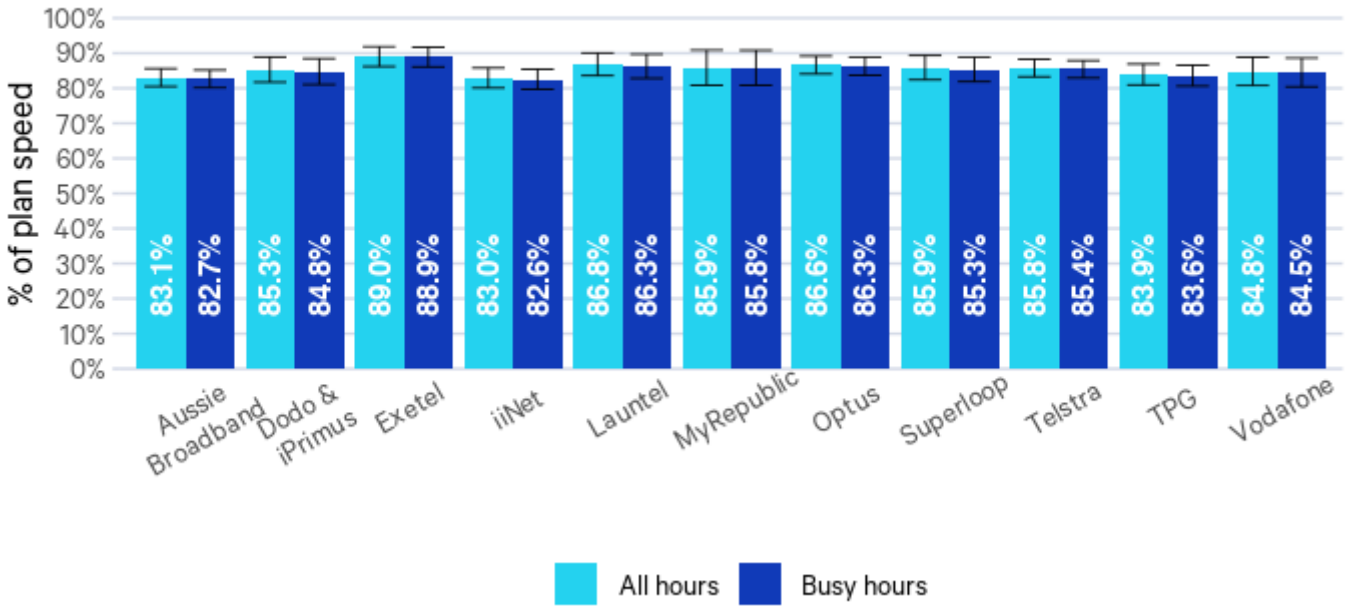


Upload speed test results

Figures 8 and 9 show upload speeds for the main NBN fixed-line RSPs and plans. Upload speed is especially relevant for applications where a user sends significant amounts of data to the internet, for example uploading files to cloud storage or running multiple simultaneous video conferencing sessions. Unlike download speeds, the upload component of NBN speed tiers is not overprovisioned.

Figure 8: Average upload speed by RSP

NBN fixed-line plans. Including underperforming services. Error bars indicate 95% confidence intervals of the mean.

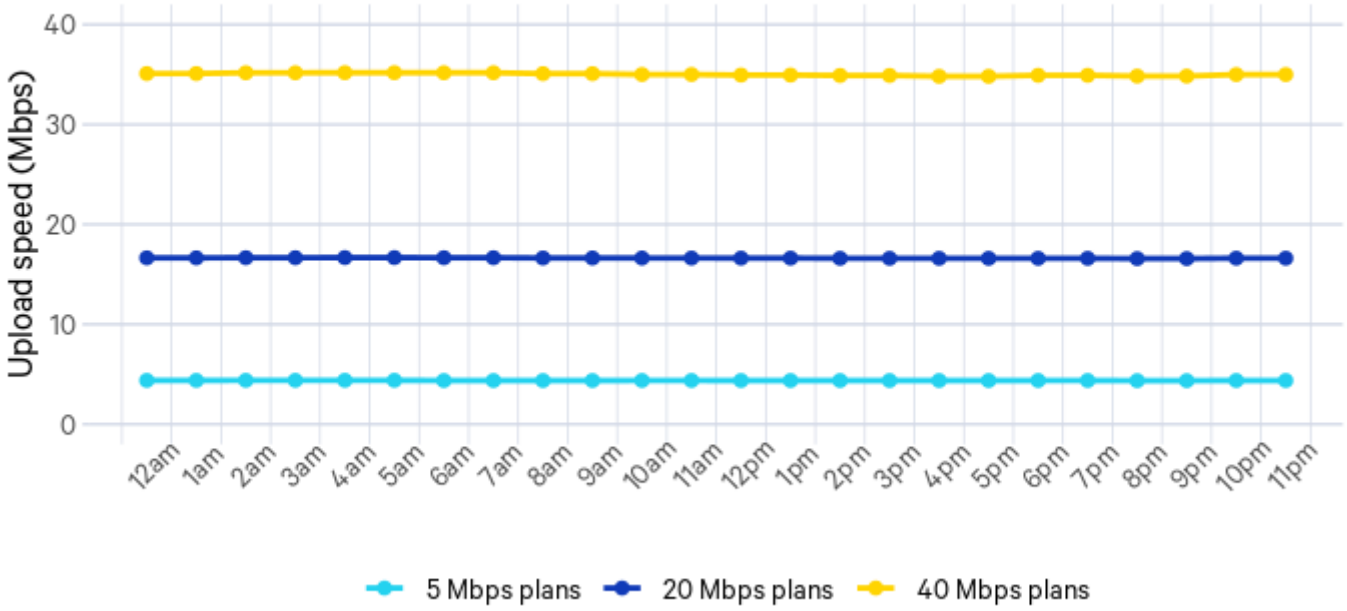


Upload performance remained similar when compared to the previous report - September 2021: NBN services achieved an overall average upload performance of 85.0% during all hours, as against 85.1% in the previous report. During busy hours, NBN fixed-line services achieved an average upload performance of 84.6%, as against 84.9% in the previous report. As the upload is not overprovisioned, upload results are lower than download results relative to plan speed.

Average upload performance ranged between 83.0% and 89.0% during all hours across RSPs.

Figure 9: Average hourly upload speed by plan

NBN fixed-line plans. Including underperforming services.



Average hourly upload speeds were steady throughout the day, with negligible change during busy evening hours.

Daily average upload speeds by plan

NBN fixed-line plans from 1 November 2021 to 31 January 2022

Figures 10 and 11 present average daily upload speeds for the following NBN fixed-line upload speed plans:

- 20 Mbps
- 40 Mbps

The daily averages are calculated by aggregating raw test results by Whitebox, plan speed and day, with this then averaged across all Whiteboxes for each plan speed. For these time series charts, calculations have been conducted for all hours and busy hours (7pm - 11pm) from Monday to Sunday. Our calculations exclude underperforming and impaired services. All charts use a consistent set of Whiteboxes across the entire reporting period. If a Whitebox changed plan during the period, it is excluded.

Figure 10: Average daily upload speeds during all hours by plan

NBN fixed-line plans. Excluding underperforming and impaired services.

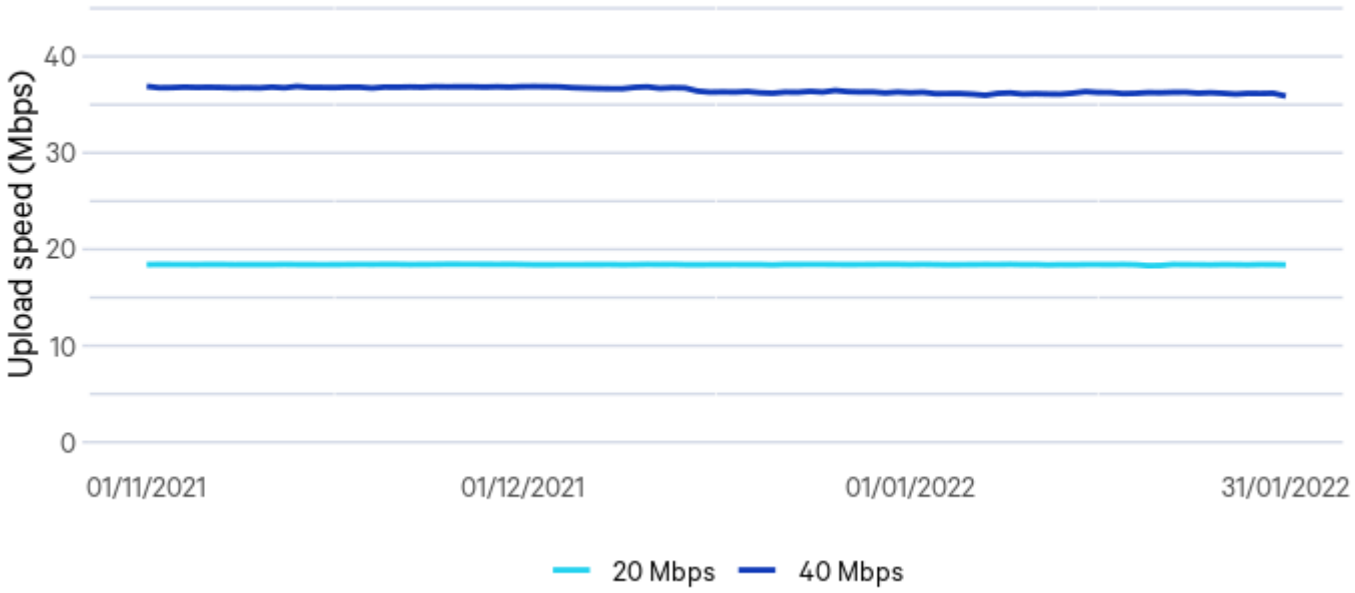
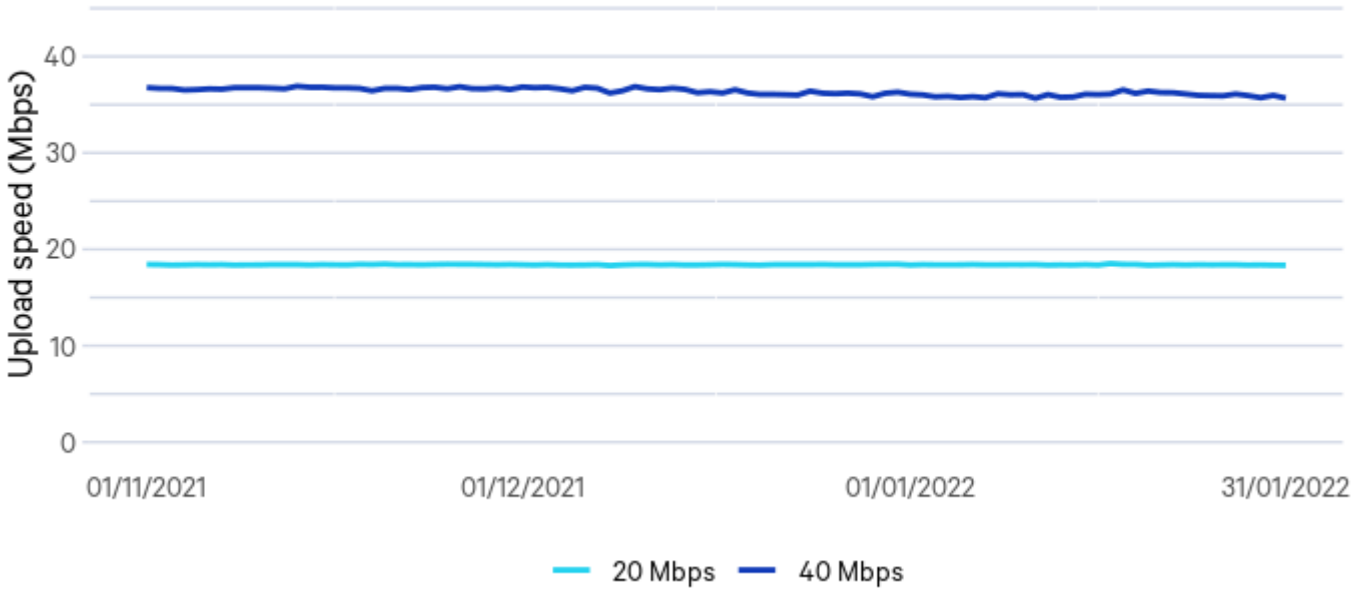


Figure 11: Average daily upload speeds during busy hours by plan

NBN fixed-line plans. Excluding underperforming and impaired services.



Figures 10 and 11 show that the daily average upload speed for plans with 20 Mbps and 40 Mbps upload speeds did not experience much variation between November 2021 and January 2022. There is also no noticeable difference in upload speeds during all hours and busy hours.

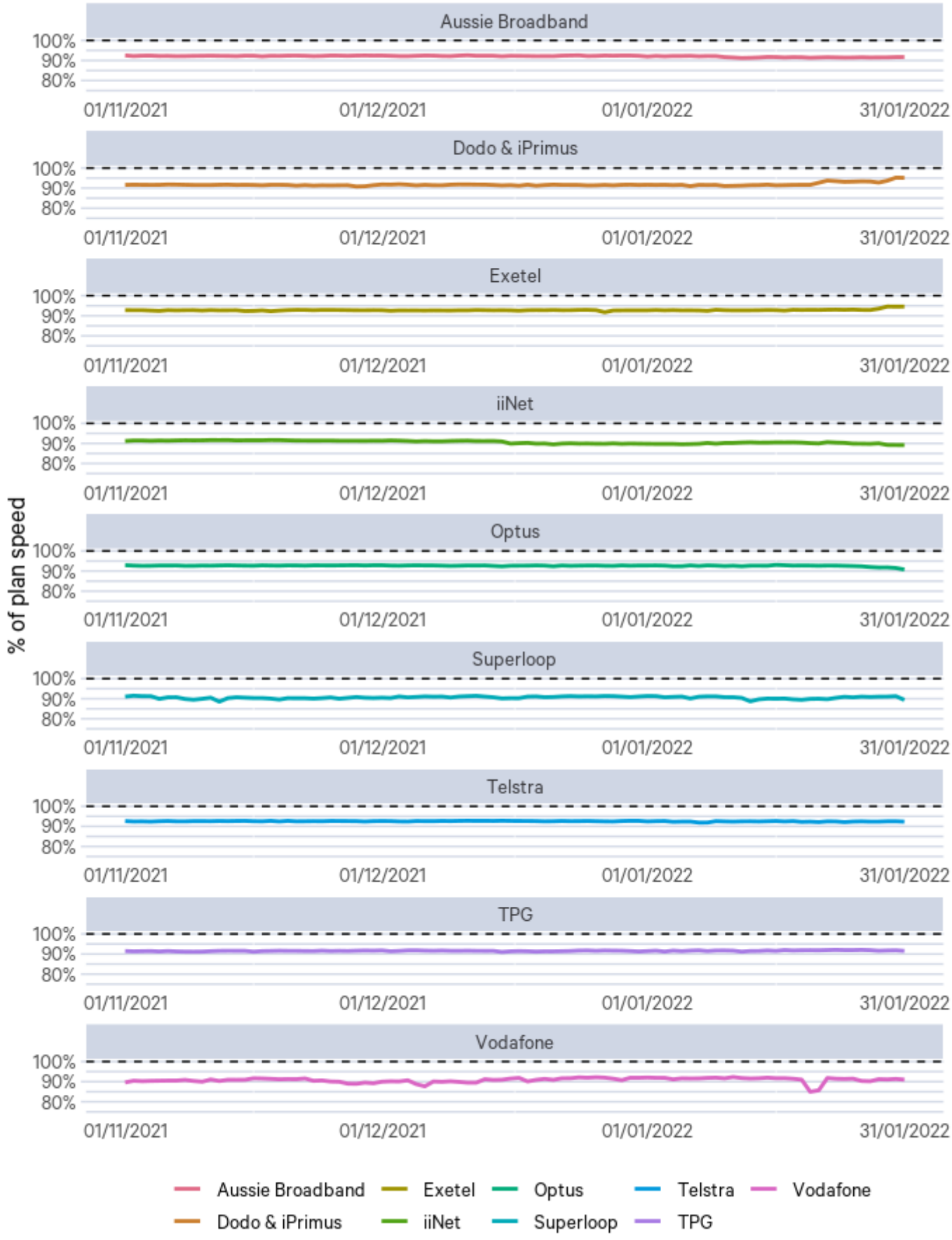
Daily average upload speeds by RSP

NBN fixed-line plans from 1 November 2021 to 31 January 2022

Figure 12 presents average daily upload speeds as a percentage of plan upload speed for all NBN fixed-line plans. The daily averages are calculated as explained in the previous section. These figures only include data from RSPs that had more than 40 units reporting consistently across the entire reporting period.

Figure 12: Average daily upload speeds during all hours by RSP

NBN fixed-line plans. Excluding underperforming and impaired services.



Impact of underperforming services on download speed

As in previous reports, we present separate measures of download performance exclusive of underperforming services. These are services that do not achieve speeds that approach plan speeds at any time of the day. They are essentially services that the RSP supplies to a consumer with a plan speed that cannot be attained due to specific physical limitations affecting the service.

This information allows consumers to better understand the reported download and upload speed measures by removing the effect of services which, due to physical limitations, would be better assigned to another plan. At the same time, this comparison provides stronger incentives for service providers to improve service quality for customers on underperforming services; a small number of underperforming services can have an appreciable effect on an RSP's overall performance metrics.

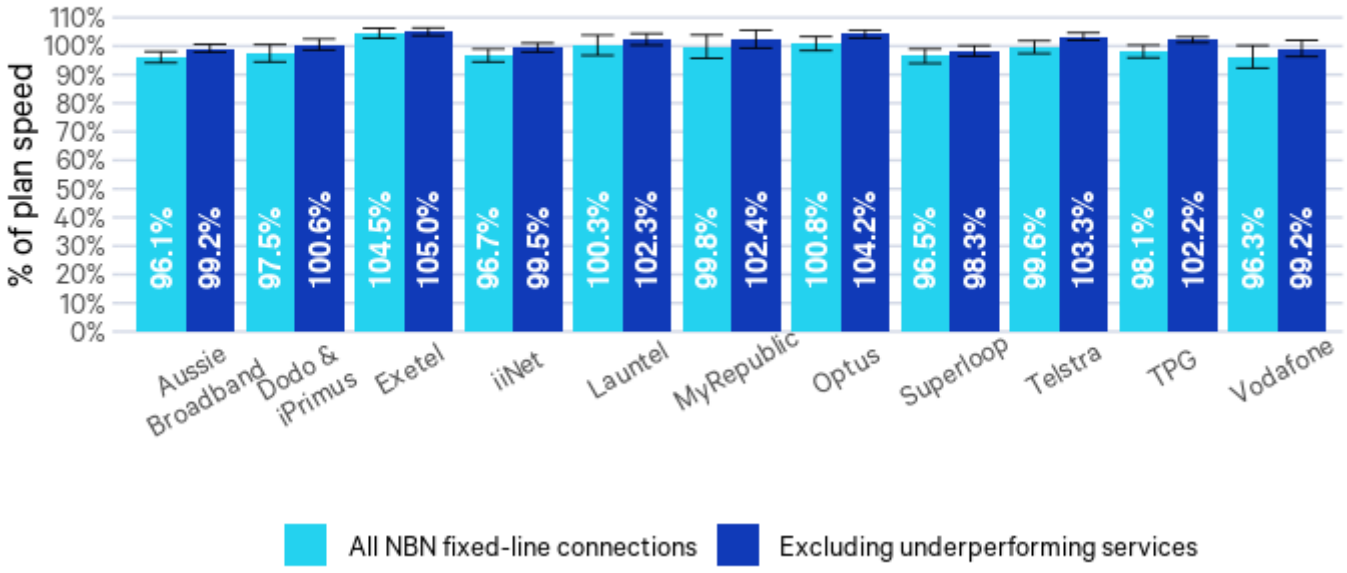
- Underperforming services represented 7.0% of the 1,266 NBN services that were tested for this report.
- Fibre to the node services make up 89% of underperforming NBN services in our sample.
- The NBN50 and NBN100 plans account for 93% of the underperforming NBN services in our sample.

Once underperforming services are excluded, the average download performance during all hours is 101.4% as against the 98.4% figure quoted earlier for all services. This means that if underperforming services had been remediated before the measurements were collected, then overall download performance would have been 3.0 percentage points higher than was actually observed during the period.

As in previous reports, all RSPs' performance were impacted to some extent by underperforming services during the period.

Figure 13: Average download speed by RSP - inclusive and exclusive of underperforming services

NBN fixed-line plans. All hours. Error bars indicate 95% confidence intervals of the mean.

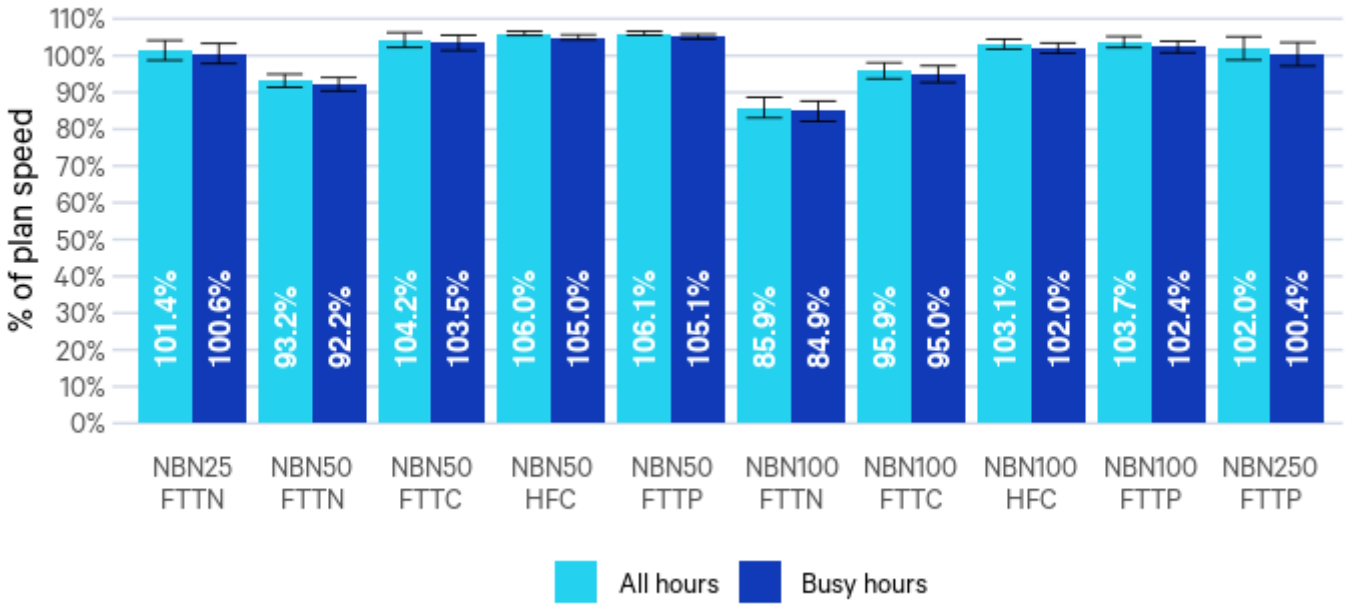


Download speed by NBN plan and access technology

Figure 14 shows average download speed for different access technologies for different NBN plans:

Figure 14: Average download speed by plan and technology

NBN fixed-line plans. Including underperforming services. Error bars indicate 95% confidence intervals of the mean.



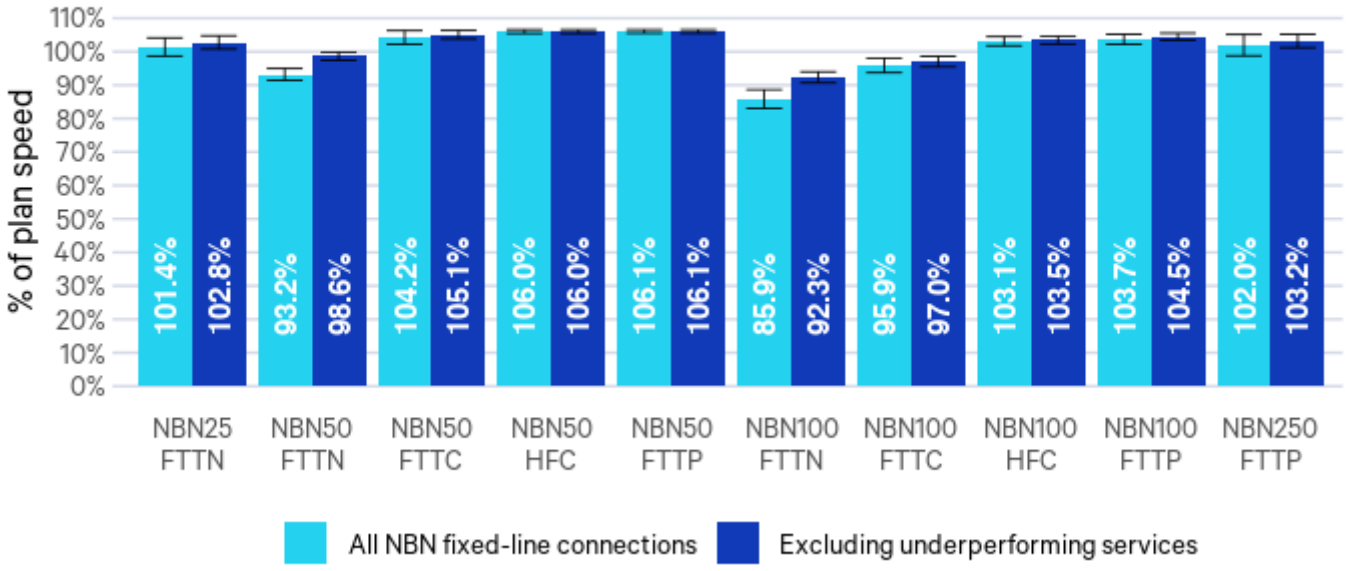
Within the NBN50 plan, fibre to the node services had an average download speed around 6 Mbps lower than other technologies, a difference of 12% when comparing in percentage terms as shown in Figure 14. Within the NBN100 plans, fibre to the node services had an average download speed around 16 Mbps lower than other technologies.

The pattern of results is similar to that seen in previous reports, with fibre to the node performing significantly below other access technologies for the 50 and 100 plans.

Figure 15 shows the impact of underperforming services on average download speed across different plans and technologies.

Figure 15: Average download speed by plan and technology - inclusive and exclusive of underperforming services

NBN fixed-line plans. All hours. Error bars indicate 95% confidence intervals of the mean.



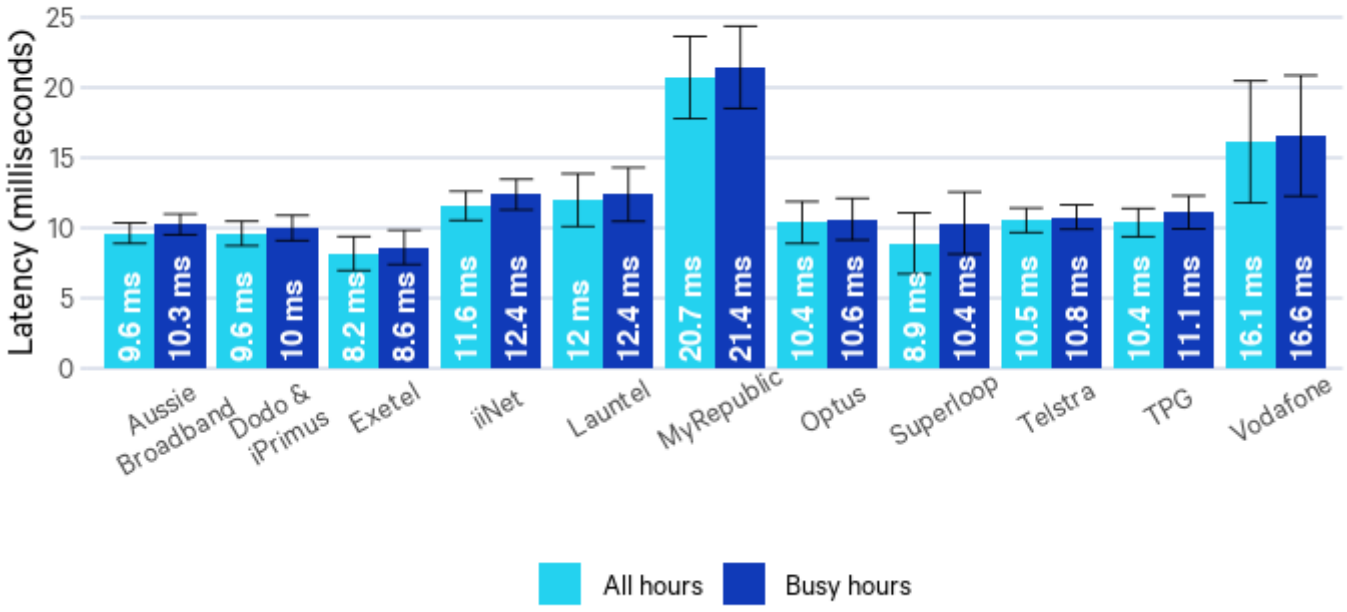
Fibre to the node services continue to account for the bulk of the impact from underperforming services across both the NBN50 and NBN100 plans.

Latency, webpage loading time, and packet loss by plan

Figure 16 shows average round trip latency, which is the average time required to send a packet of data to the test server and back. Lower latency will result in more responsive behaviour from real-time applications such as video conferencing and online gaming.

Figure 16: Average latency by RSP

NBN fixed-line plans. Including underperforming services. Error bars indicate 95% confidence intervals of the mean.



Latency results from this period remained roughly in line with previous reports, except for Vodafone.

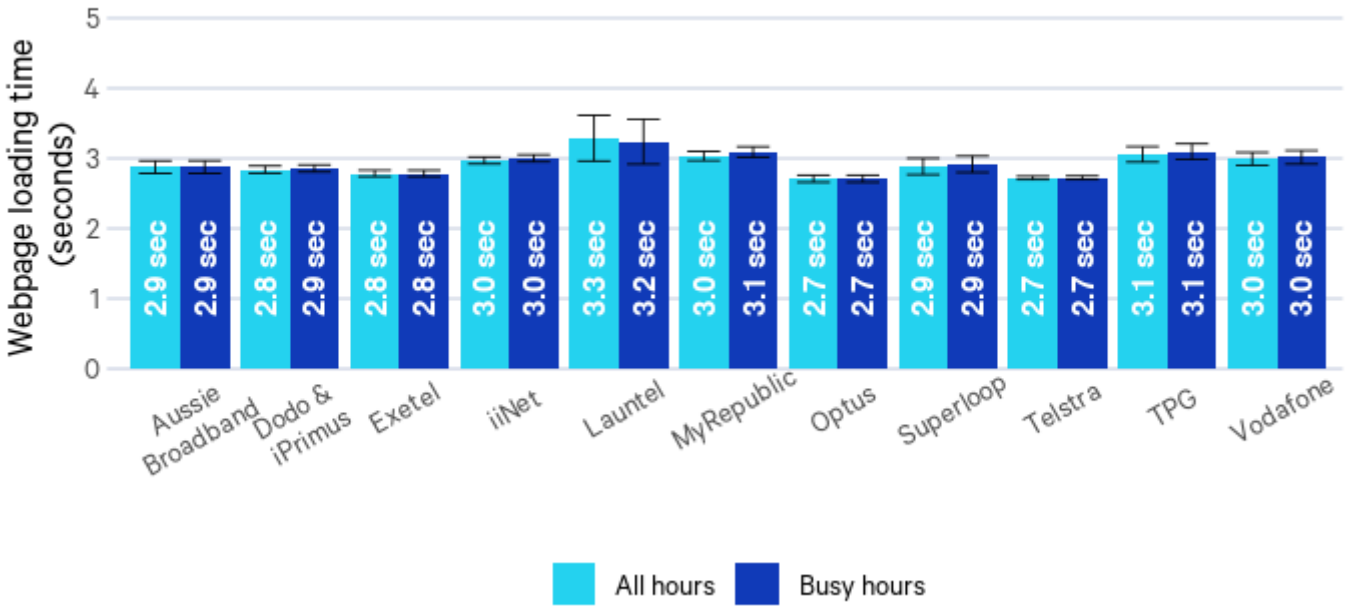
Vodafone services in Western Australia experienced an increased average latency of 51.3 ms during all hours, while Vodafone services in other parts of the country continued to have an average latency of 9.1 ms during all hours, in line with the average latencies for Vodafone services quoted in the previous report (Report 15). On average, services with other providers did not measure higher average latencies in Western Australia compared to other parts of the country.

It should be noted that these latency values are still so low that their effect is unlikely to be noticed by a typical end user, even when using more latency-sensitive applications (such as videoconferencing services or online gaming).

Figure 17 shows the average time required to fully load eight popular webpages for Australian users across all NBN plans, per RSP.

Figure 17: Average webpage loading time by RSP

NBN fixed-line plans. Including underperforming services. Error bars indicate 95% confidence intervals of the mean.

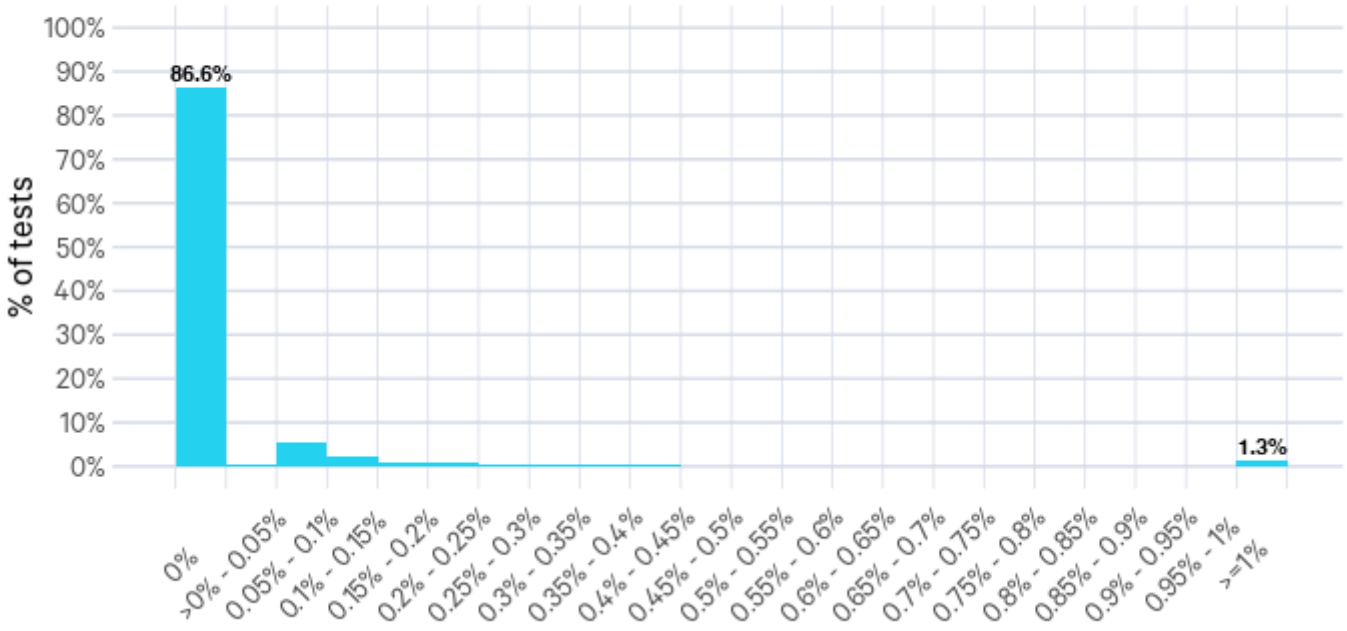


The average time needed to load a website for each RSP remained similar to the values cited in the previous report. More information on the factors that impact web browsing experience can be found in the Web performance test report at https://www.accc.gov.au/regulated-infrastructure/communications/monitoring-reporting/measuring-broadband-australia-program/web-performance-test-report.

Figure 18 shows the frequency at which different levels of packet loss occurred during tests. Packet loss measures the percentage of packets that were lost somewhere between the router and the test server, often due to network congestion. Packet loss is expressed as a percentage of all packets sent.

Figure 18: Frequency of packet loss rates observed during tests

NBN fixed-line plans. All hours. Including underperforming services.



A total of 840,272 packet loss tests were conducted over the measurement period. 86.8% of these tests had packet loss of either zero or less than 0.05%. For reference, in the previous report 87.5% of tests had packet loss below 0.05%.

At the other end of the scale, 1.3% of tests had packet loss greater than 1% as against 1.3% in the previous report. At levels above 1%, packet loss can cause issues which are detrimental to user experience, such as webpages failing to load and unstable video calls.

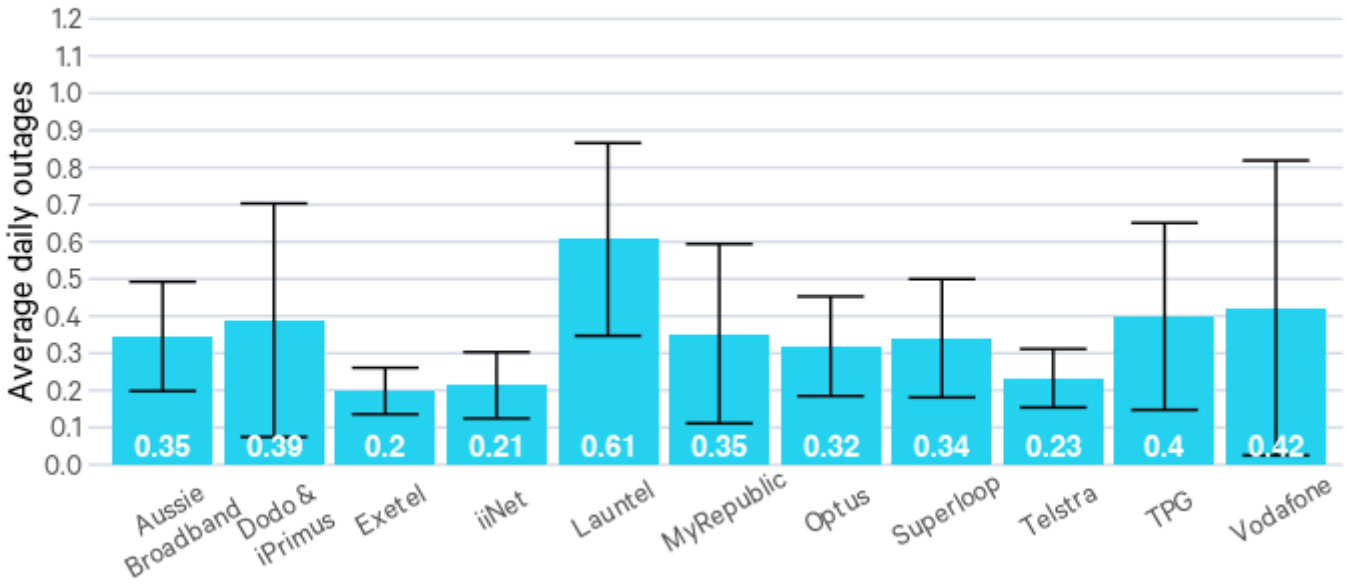
Outages

Figures 19 and 20 show, for each RSP:

- the average rate of daily outages for a service, indicating how often outages occurred
- the distribution of outage duration, indicating the severity of outages' impact on user experience.

Figure 19: Average daily outages lasting over 30 seconds by RSP

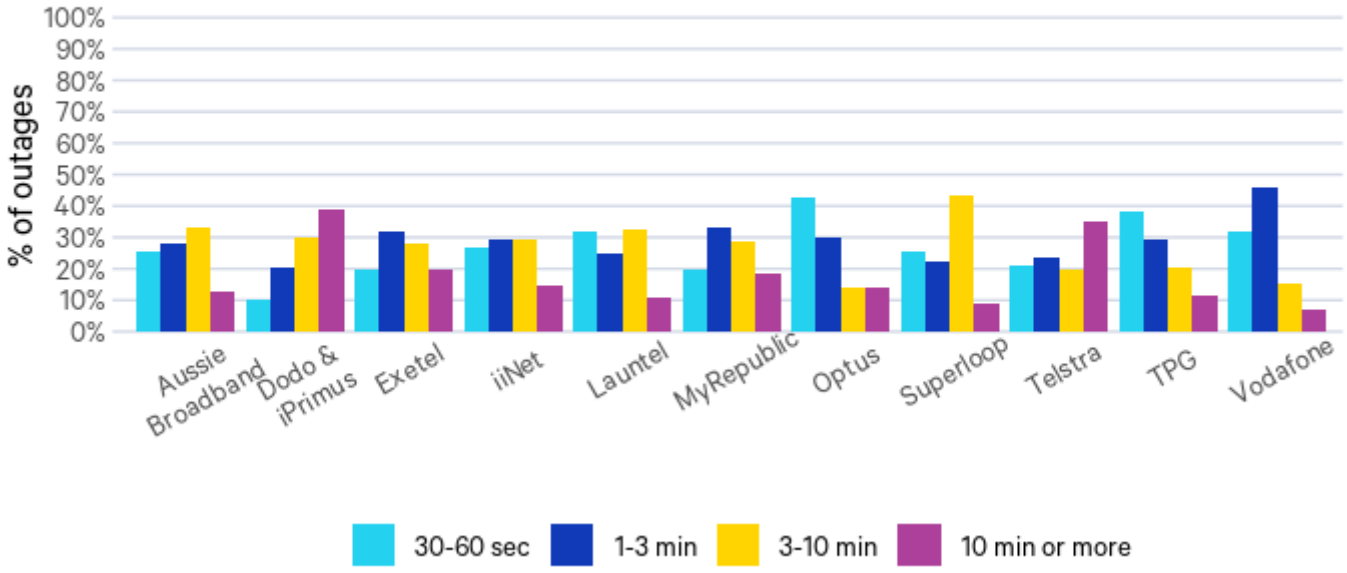
NBN fixed-line plans. All hours. Including underperforming services.



All RSPs' rates of outages were relatively low. Across all RSPs, the average rate of outages per day on NBN plans was an average of 0.32 ± 0.06 outages per day.

Figure 20: Distribution of outage duration by RSP - NBN plans including underperforming services - all hours

NBN fixed-line plans. All hours. Including underperforming services.



As the majority of outages last for no more than 3 minutes, outages are likely to have little material impact on end user experience.

Download speed during the busiest hour

In this report, the busiest hour speed is the fifth-lowest average hourly download speed across each busy hour within the month. A result in which the busiest hour speed is relatively close to the average busy hour speed indicates that a plan is relatively unaffected by higher demand especially at busy times. Results in which busiest hour speeds are further below the average busy hour speeds indicates that a plan is more affected by particularly high demand peaks.

During the measurement period, RSPs advertised download speeds for their NBN50 and NBN100 products that were between 90% and 100% of the maximum achievable by the products. Aussie Broadband[6] and Superloop advertised the lowest speed for NBN50 at 48 Mbps and iiNet, TPG and Vodafone advertised the lowest speeds for NBN100 at 90 Mbps. Exetel, Optus and Telstra were advertising the highest speeds, offering the nominal 50 Mbps for their NBN50 plan and 100 Mbps for their NBN100 plan.

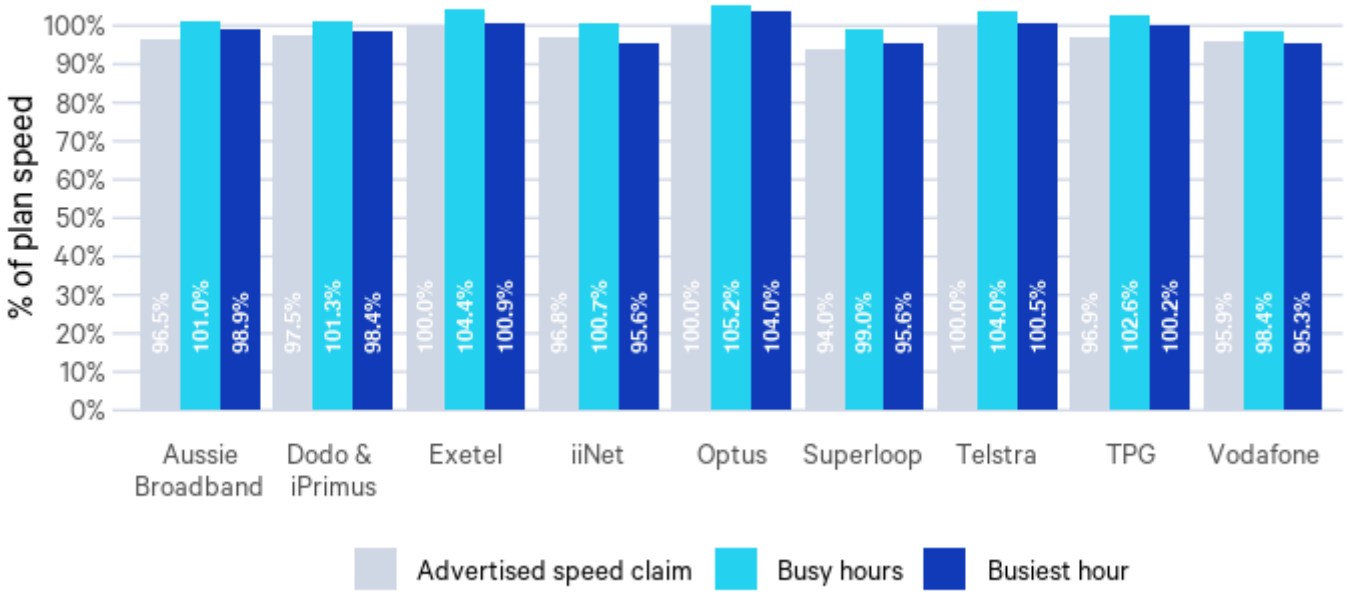
[6] Aussie Broadband's speed claims were 50 Mbps for the NBN50 plan and 99 Mbps for the NBN100 plan at the beginning of December, these were then lowered to 48 Mbps and 97 Mbps respectively towards the middle of December.

Figure 21 shows the typical evening hour speeds that were the predominant speed advertised by RSPs during the measurement period, as well as the busy hour and busiest hour download performance by RSP excluding underperforming and impaired services. The busy hour and busiest hour download performance is calculated against the nominal plan download speed (50 Mbps and 100 Mbps respectively), rather than the advertised speed claim.

Figures 21 and 22 show performance by RSP for NBN50 and NBN100 plans across all NBN fixed-line technologies.

Figure 21: Advertised speeds and average download speeds by RSP

50 Mbps and 100 Mbps NBN fixed-line plans. Excluding underperforming and impaired services.

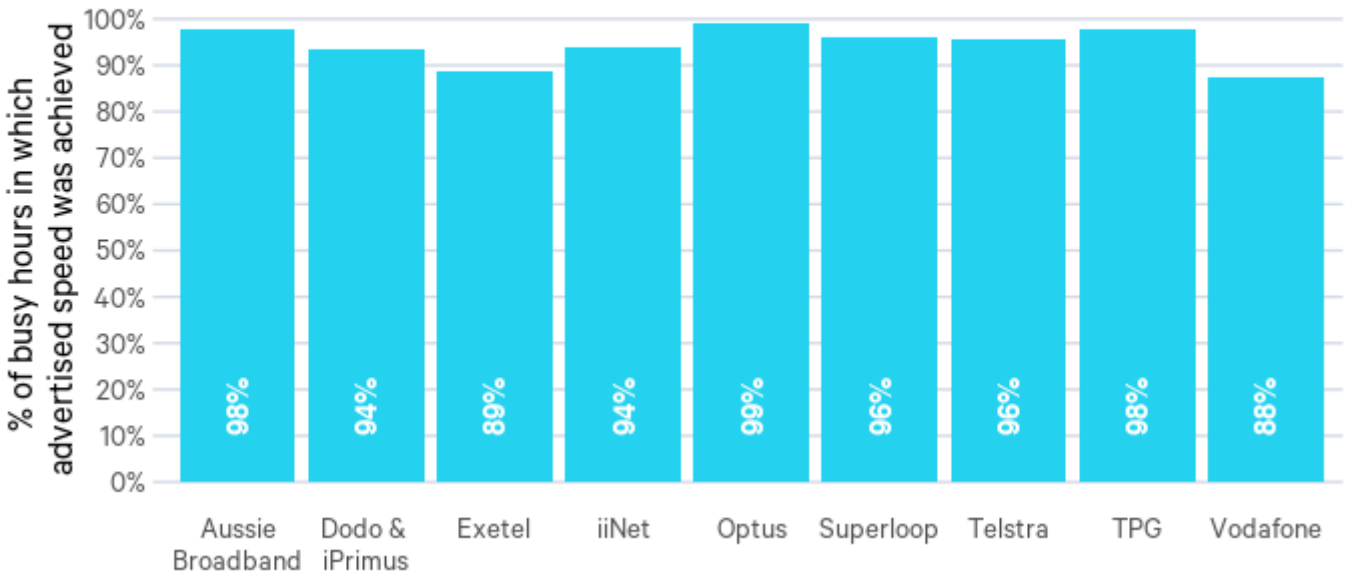


From these results we can see that if all underperforming services and impaired services had been remediated – or moved to a more appropriate plan - then the majority of RSPs would have average speeds that met or exceeded advertised speed claims during their busy hours.

Figure 22 shows the percentage of busy hours during the period in which test speeds for NBN50 and NBN100 products met or exceeded the speeds advertised by RSPs.

Figure 22: Proportion of busy hours where advertised speed was achieved - by RSP

50 Mbps and 100 Mbps NBN fixed-line plans. Excluding underperforming and impaired services.



If all underperforming services and impaired services had been remediated – or moved to a more appropriate plan - then the proportion of busy hours when RSPs met their advertised speed claims would have been no lower than 88% for the majority of providers[7].

Note that Figure 22 shows the proportion of busy hours where the advertised speed claim was achieved, rather than the proportion of busy hours where the nominal plan download speed was achieved. This means that an RSP advertising lower speed claims may achieve their advertised speed claim in a greater proportion of busy hours even when their busy hour download performance is lower. Conversely, another RSP advertising higher speed claims may only achieve their advertised speed claims in a lower proportion of busy hours even when their busy hour download performance is higher. For example, in December 2021 Exetel's advertised speed claims were 50 Mbps and 100 Mbps respectively for the NBN50 and NBN100 plans, and Exetel achieved a download performance of 104.4% during busy hours (see Figure 21), however the advertised speed claims were only achieved in 89% of busy hours (see Figure 22).

[7] Aussie Broadband had lowered its advertised NBN50 speed claim from 50 Mbps to 48 Mbps and its NBN100 speed claim down from 99 Mbps to 97 Mbps between 13-17 December 2021. The reported 98% is calculated using Aussie Broadband's lowered speed claims valid in the second half of December; when assessed against speed claims valid at the beginning of December, Aussie Broadband's download speed exceeded advertised claims in 75.4% of December busy hours.

Other superfast access networks

This section of the report presents data on 40 services on other superfast access networks on a variety of plans: 25/5 Mbps (4 units), 50/20 Mbps (10 units), 100/20 Mbps (7 units), 100/40 Mbps (14 units), 250/25 Mbps (2 units) and 250/100 Mbps (3 units). The results presented are aggregated across the Uniti Group's LBNCo and OptiComm fixed-line networks. Download and upload speeds are expressed as a percentage of the nominal plan speed.

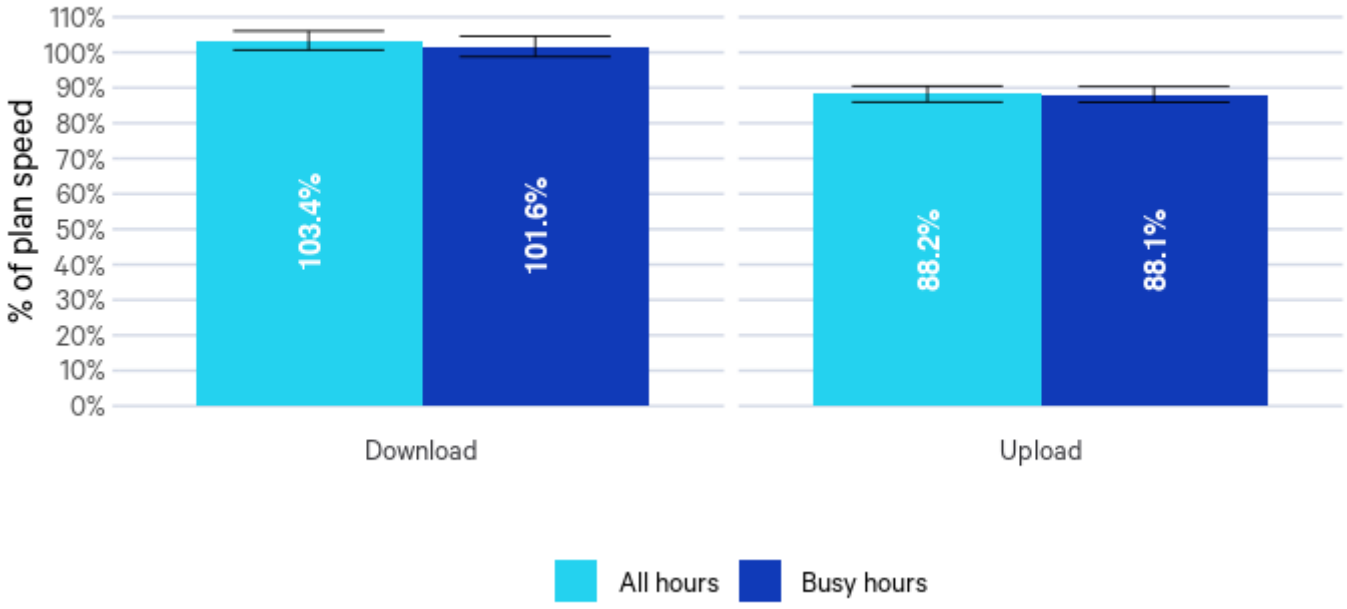
Speed test results

During this period, the sampled households on other superfast access networks attained an average download performance of 103.4% of plan speeds during all hours, decreasing to 101.6% during the busy hours (between 7pm and 11pm), which is when networks experience higher user activity.

The results presented here are indicative only, and firm inferences about the performance of other superfast access networks should not be made from these results.

Figure 23: Average download and upload speeds

Other superfast access networks. Error bars indicate 95% confidence intervals of the mean.



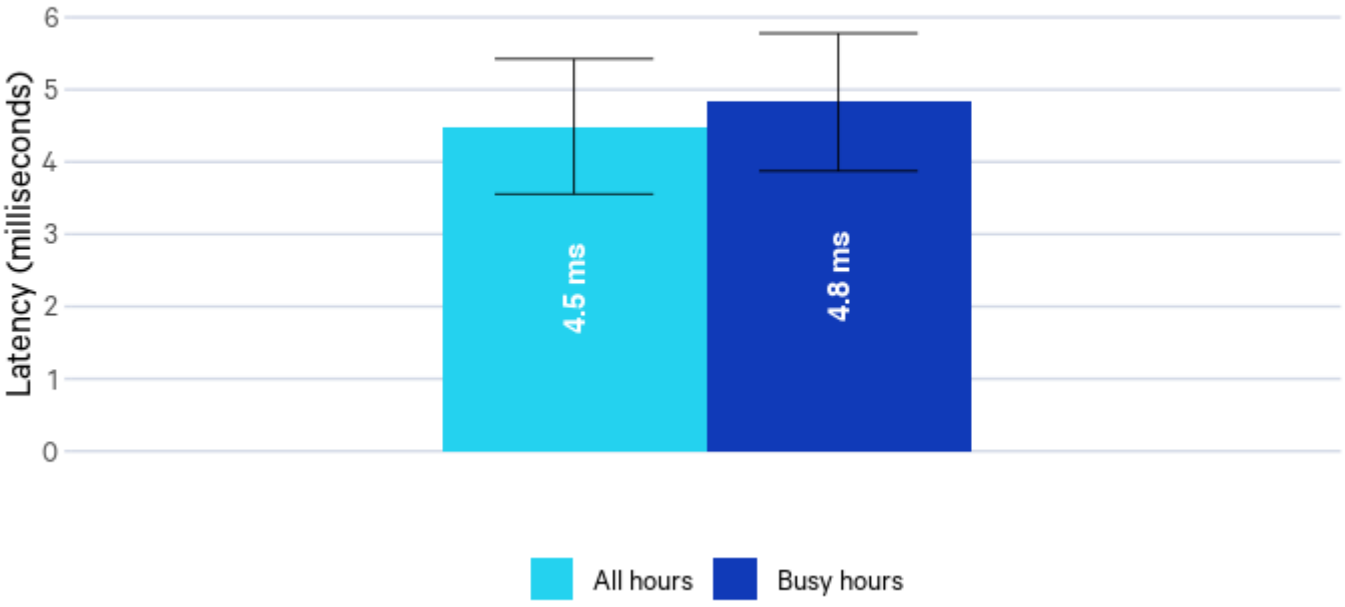
The sampled services on other superfast access networks attained an average upload performance of 88.2% of plan speeds during all hours, decreasing to 88.1% during the busy hours (between 7pm and 11pm).

Latency, packet loss and outages

The following section provides a brief overview of latency, packet loss and outages for services on other superfast access networks.

Figure 24: Average latency

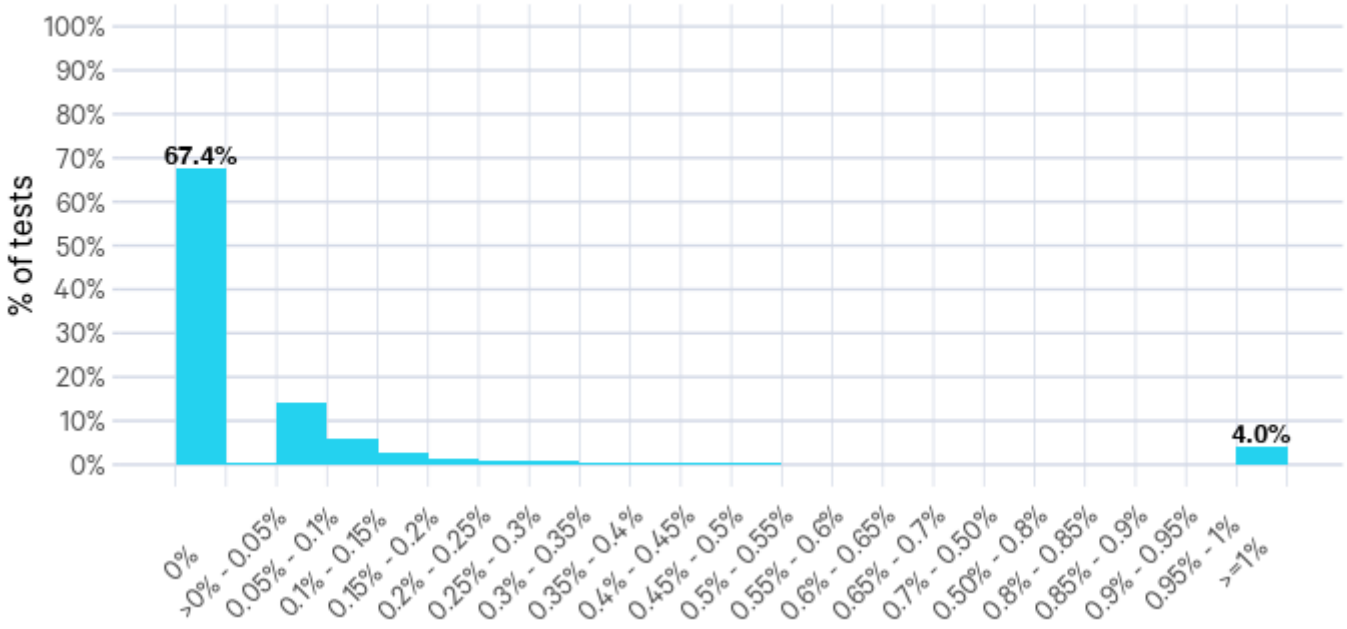
Other superfast access networks. Error bars indicate 95% confidence intervals of the mean.



The average latency for services on other superfast access networks was recorded as 4.5 milliseconds during all hours, rising slightly to 4.8 milliseconds during busy hours. Although this is lower than the latency measured for NBN fixed-line services over FTTP connections (9 ms during all hours and 9.6 ms during busy hours), both results are so low that the difference would not be noticeable to a typical end-user.

Figure 25: Frequency of packet loss rates observed during tests

Other superfast access networks. All hours.



During this measurement period, 25,061 packet loss tests were conducted through services on other superfast access networks. Of these tests, 68.0% had packet loss of either zero or less than 0.05%.

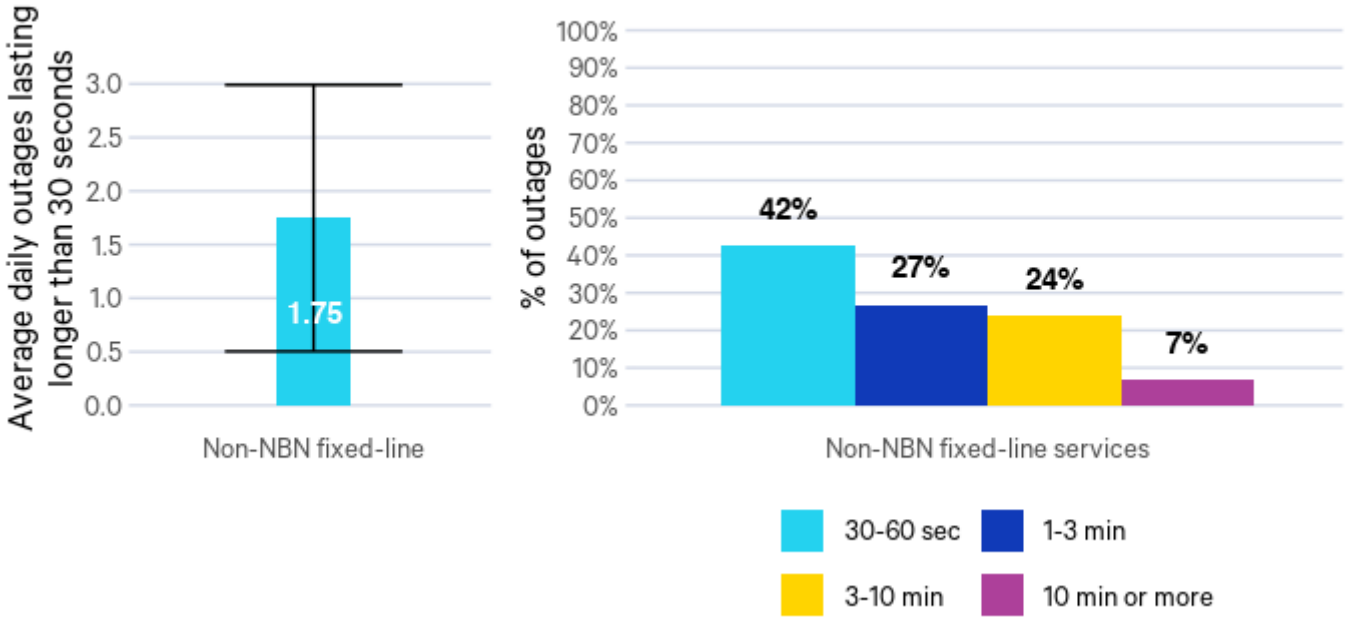
At the other end of the scale, 4.0% of tests had packet loss greater than 1%.

Figure 26 shows, for other superfast access networks, during all hours:

- the average rate of daily outages for a service, indicating how often outages occurred; and
- the distribution of outage duration, indicating the severity of outages' impact on user experience.

Figure 26: Outage characteristics

Other superfast access networks. All hours.



During December 2021, there was an average of around 1.75 outages per day on other superfast access networks.

The daily rate of outages varies strongly between households, from units experiencing no such event during the whole measurement month to units experiencing multiple outages per day on average. As a result of this, the uncertainty with which the average daily rate of outages can be determined for such a small sample set remains large (see Figure 26). The relatively high average daily rate of outages for other superfast access networks can largely be attributed to two units experiencing a higher (but not unusually high) number of outages.

NBN very high speed services

This section presents results for NBN fixed-line very high speed services for the same period, December 2021, as for other fixed-line results. Very high speed services refers to plans where the underlying wholesale product sold by NBN Co has a download/upload speed range of 500-990/50 Mbps (referred to by NBN Co as “Ultrafast”). This section is based on a total of 139 monitored very high speed services, across both fibre to the premises (FTTP) and hybrid fibre-coaxial (HFC) technologies.

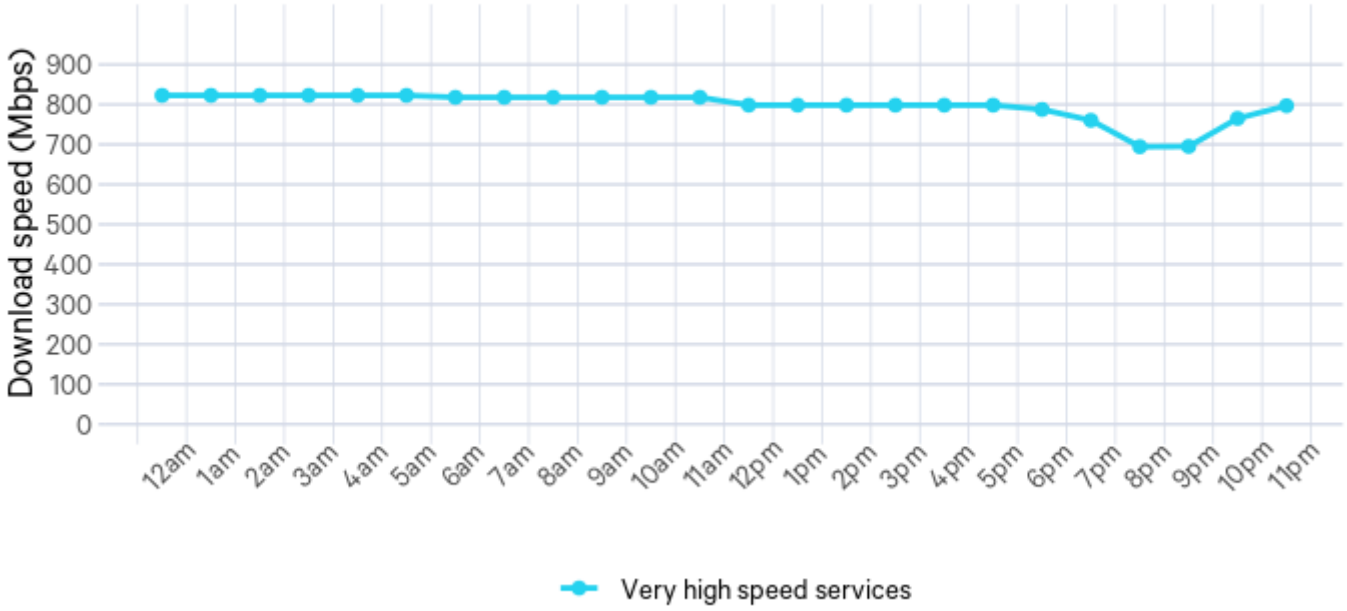
We note that currently, unlike other NBN plans, NBN Co does not overprovision on the download component of very high speed services. Coupled with the fact that the Whitebox connects via gigabit Ethernet to the home gateway, this means that the end-to-end link is limited to 1 Gbps. After network/transport protocol overheads are deducted from this, the fastest speed we expect to observe on these plans is around 940 Mbps.

The hourly average download speeds attained by NBN very high speed services ranged across the day between 694 Mbps and 823 Mbps. Performance varied more during the busy hours (between 7pm and 11pm) and wider evening peak period, which is when networks experience higher user activity.

The measured download speeds show an improvement over the previous results.

Figure 27: Average hourly download speed for very high speed services

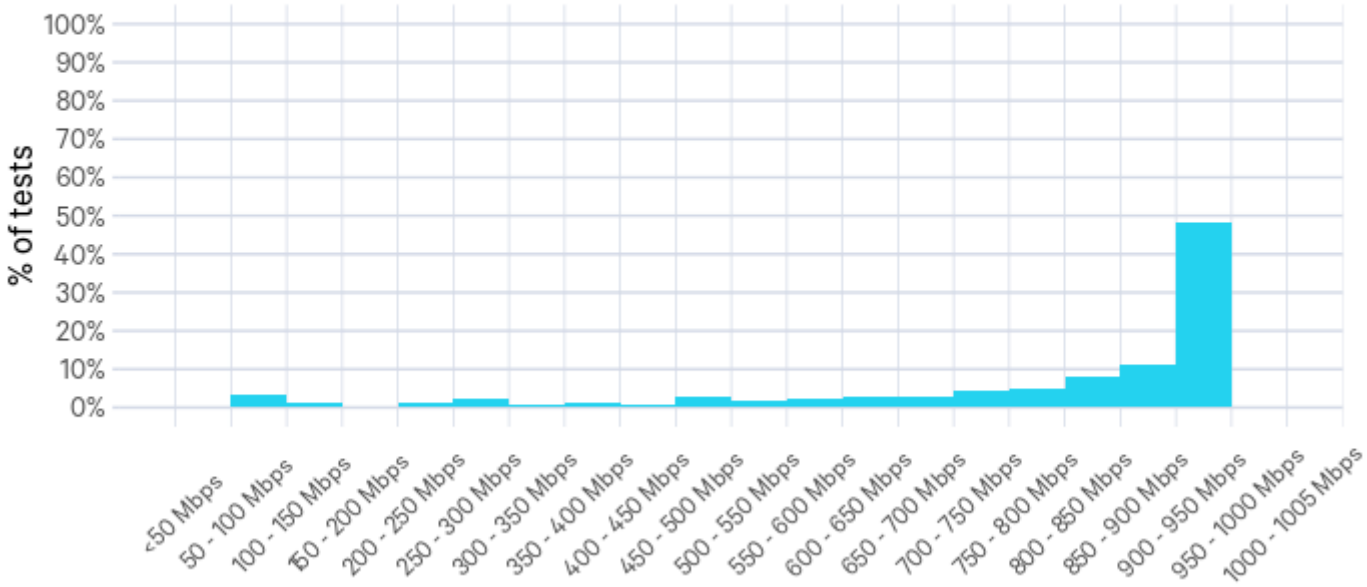
NBN very high speed services.



Average download speeds showed considerable variation throughout the day for very high speed services: speeds typically started to decrease during the evening, dipping to 128 Mbps below the day's maximum speed by 8pm, and would recover to higher levels later at night. This dip in speeds for very high speed services is greater than for the other major NBN plans considered earlier in this report, including NBN100 plans. This shows that NBN very high speed plans are more affected by congestion during busy periods than lower speed plans.

Figure 28: Frequency of download speeds attained during tests of very high speed services

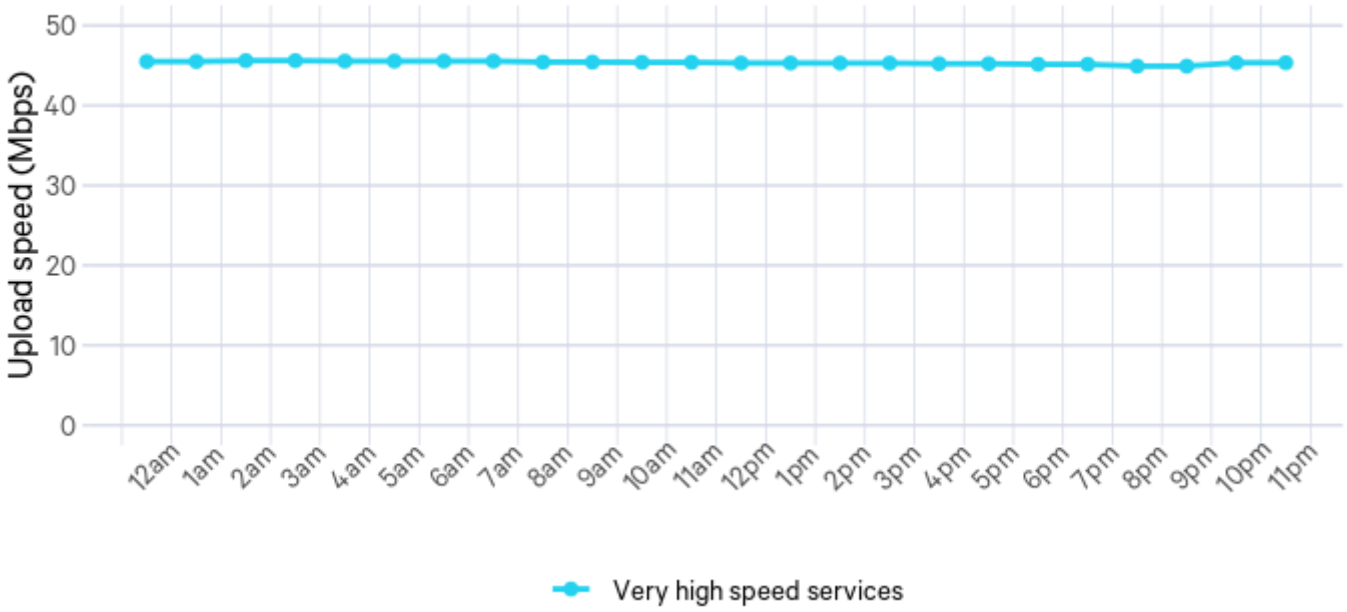
NBN very high speed services. All hours.



During this reporting period 26,902 download speed tests were performed across 139 Whiteboxes connected to fixed-line NBN infrastructure. Of these tests, 48.4% of tests conducted achieved a download speed of at least 900 Mbps.

Figure 29: Average hourly upload speed for very high speed services

NBN very high speed services.



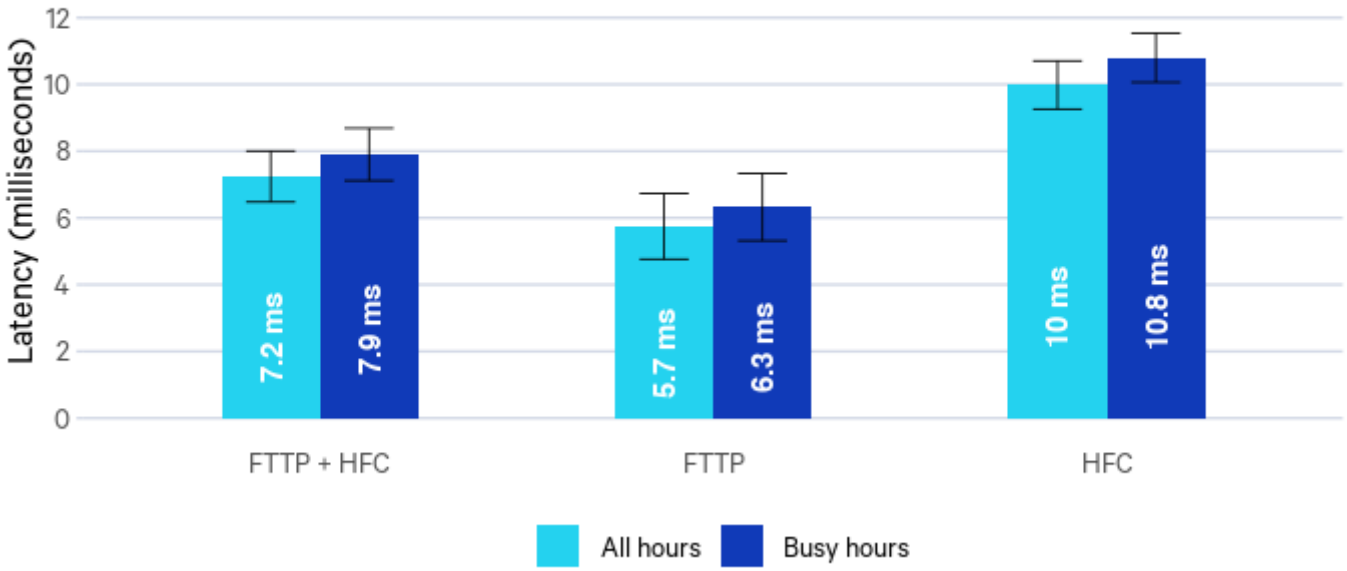
Upload speeds for very high speed services show little variation throughout the day.

Latency, packet loss and outages

The following section provides a brief overview of latency, packet loss and outages for very high speed services.

Figure 30: Average latency for very high speed services

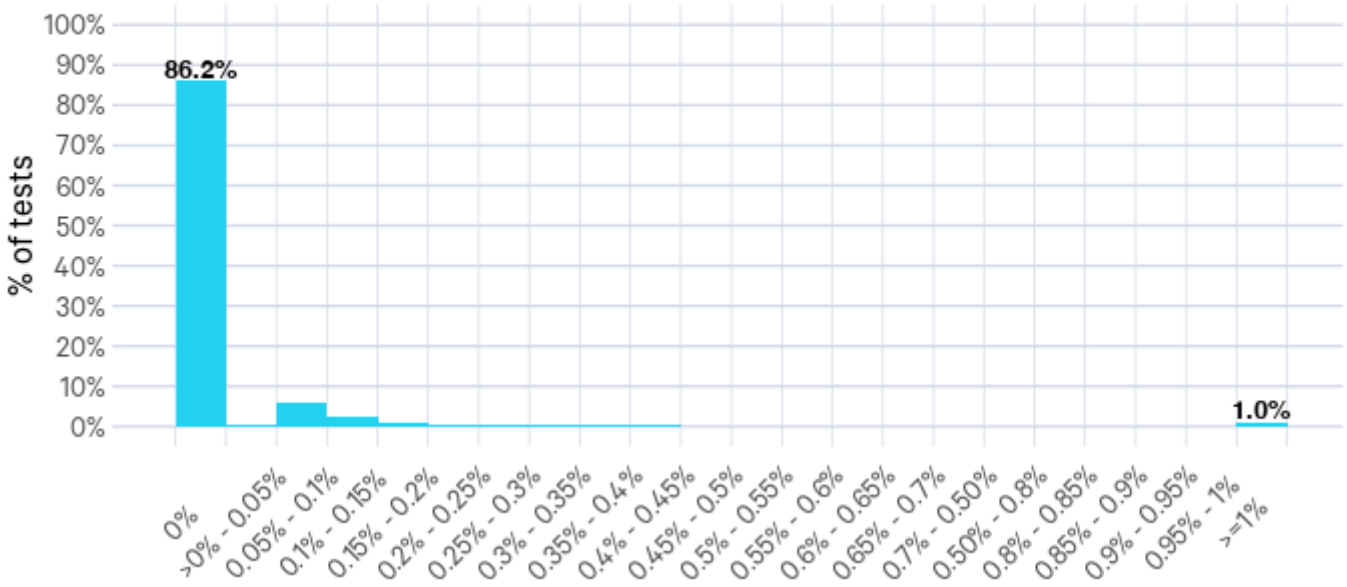
NBN very high speed services. Error bars indicate 95% confidence intervals of the mean.



Average latency for very high speed plans was recorded as 7.2 milliseconds during all hours, rising slightly to 7.9 milliseconds during busy hours. Although the average latency for very high speed services over HFC was almost twice as high as the average latency through FTTP services, both latency values are so low that their effect is unlikely to be noticed by a typical end user.

Figure 31: Frequency of packet loss rates observed during tests of very high speed services

NBN very high speed services. All hours.



During this measurement period, 88,955 packet loss tests were conducted through very high speed NBN services. Of these tests, 86.6% had packet loss of either zero or less than 0.05%.

At the other end of the scale, 1.0% of tests had packet loss greater than 1%.

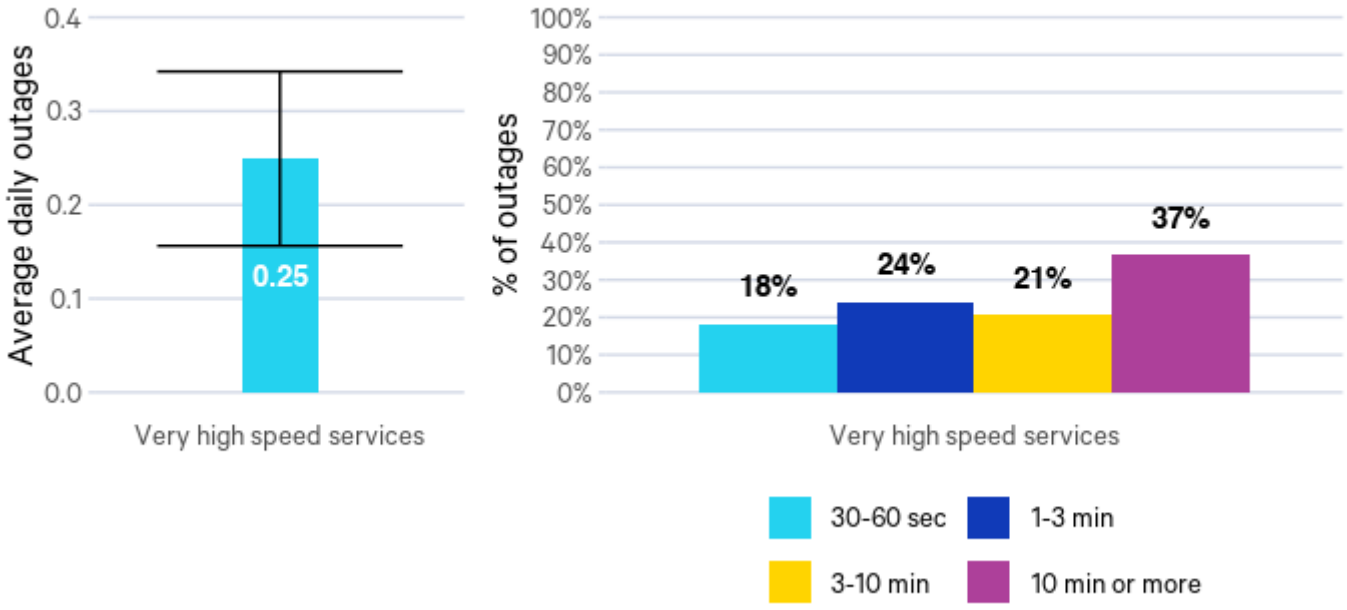
These results are broadly in line with those recorded for other fixed-line services.

Figure 32 shows, for very high speed services, during all hours:

- the average rate of daily outages for a service, indicating how often outages occurred; and
- the distribution of outage duration, indicating the severity of outages' impact on user experience.

Figure 32: Outage characteristics

NBN very high speed services. All hours.



The rate of outages was low and compared favourably to other fixed-line plans.

We note that these results include services where we identified that the volunteer had a 100 Mbps link within the home and were unable to receive the full benefit of their high speed plans. The ACCC has engaged with RSPs to encourage them to reach out to their consumers who may be using a constrained network device.

For further information on what to do if you are experiencing reduced speeds, see https://www.accc.gov.au/consumers/internet-landline-services/home-broadband-for-consumers#factors-that-may-affect-your-broadband-quality

This is the end of the report on NBN fixed-line services.

NBN fixed wireless services

Results for NBN fixed wireless services in this section cover the same period, December 2021, as for fixed-line results.

Fixed wireless performance is measured in much the same way as the fixed-line program, with SamKnows supplying its Whiteboxes to NBN fixed wireless internet users in Australia to measure the performance of their internet connection.

The goal of reporting on fixed wireless performance is to increase transparency and encourage greater performance-based competition and better internet performance throughout outer metropolitan, regional, rural and remote areas of Australia.

The following sections present a brief summary of key metrics from our NBN fixed wireless sample, for both the 25/5 Mbps (14 units) and Fixed Wireless Plus plans (56 units). As the sample number for the 25/5 Mbps plan is very low, all results for this plan should be considered indicative only.

Differences between NBN fixed-line and NBN fixed wireless services

NBN fixed-line services and NBN fixed wireless services utilise different technologies that are not directly comparable in terms of performance. An NBN fixed-line connection utilises a physical line running to the household to connect it to the NBN. There are a number of fixed-line technologies: fibre to the premises, fibre to the building, fibre to the curb, fibre to the node and hybrid fibre-coaxial cable.

An NBN fixed wireless connection transmits data over radio signals to connect a household to the NBN and uses similar technology to mobile networks. NBN typically uses this type of service in regional and remote areas, where the distance between households can be many kilometres, but outer metropolitan centres may also use NBN fixed wireless. Data travels from a transmission tower to an outdoor antenna fitted at each household. Each fixed wireless tower has one or more 'cells' containing the equipment that transmits signals to a dish or the outdoor antenna at a customer's home or other premise, allowing them to connect to the internet. NBN fixed wireless serves around 4% of NBN consumers, typically in rural and regional areas, but it may also be used in outer metropolitan centres.

The quality and maximum speed of a fixed wireless connection is often more variable than fixed-line technology.

The following environmental factors may affect fixed wireless:

- the distance of the consumer's premises to the fixed wireless tower
- whether there is a clear line of sight between the antenna on the roof of the premises and the fixed wireless tower, or if there is an obstruction, such as foliage
- weather conditions such as extreme heat or heavy rain.

Another factor that may affect fixed wireless performance is network congestion. Each fixed wireless cell has a finite amount of capacity (e.g. a certain number of megabits per second, or Mbps), which is shared between the households connected to that cell. Where more households in an area connect to a particular cell and/or those households increase their usage towards the limit of the cell, this can cause the cell to become congested. The impact

of network congestion on the fixed wireless network is typically most noticeable during busy hours (between 7pm and 11pm).

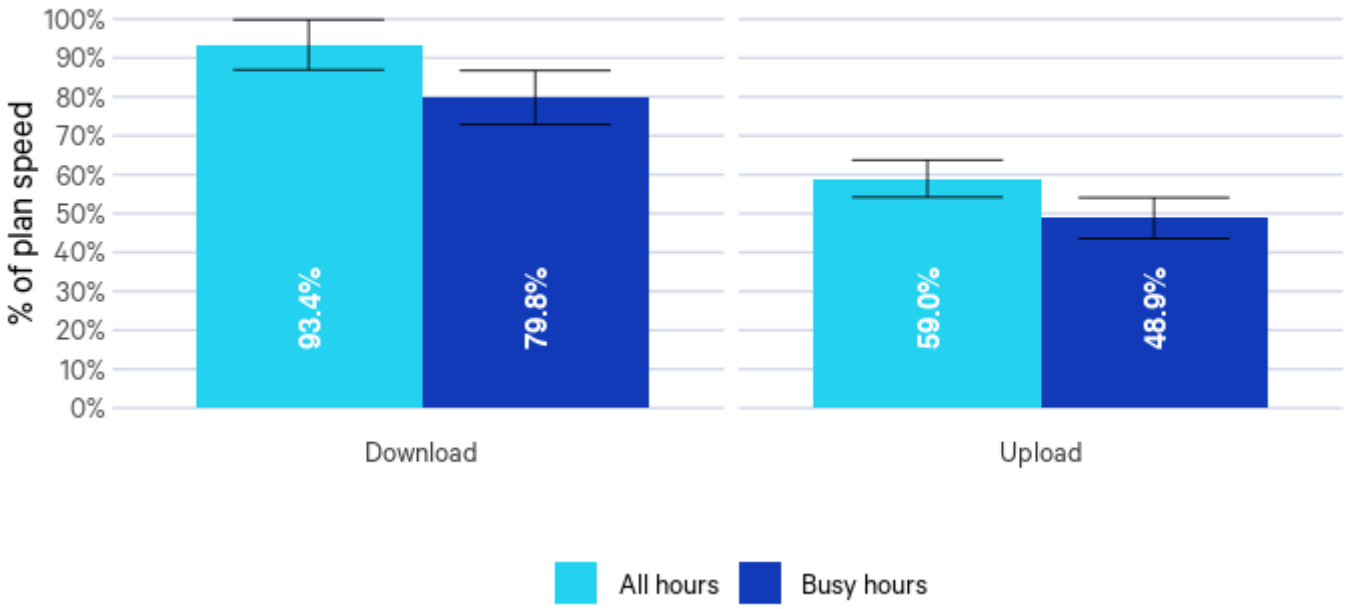
For further information on using NBN fixed wireless, see https://www.accc.gov.au/consumers/internetlandline-services/broadband-speeds/using-nbn-fixed-wireless.

Speed test results

In this section, we use download/upload speed benchmarks of 50/10 Mbps for the Fixed Wireless Plus plan. We express the results of the Fixed Wireless Plus plan along with the 25/5 Mbps fixed wireless plan as a percentage of the service's plan speed.

Figure 33: Average download and upload speeds for fixed wireless

NBN fixed wireless plans. Error bars indicate 95% confidence intervals of the mean.



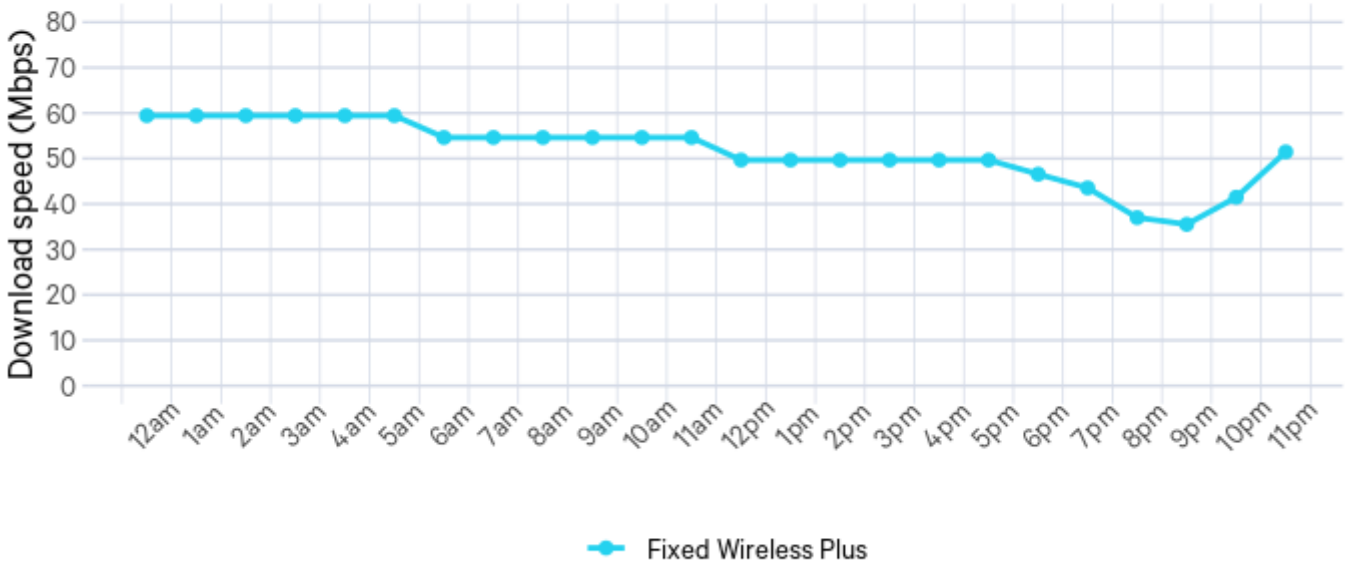
During this period, users on NBN fixed wireless services attained an average download performance of 93.4% of plan speeds during all hours, decreasing to 79.8% during the busy hours (between 7pm and 11pm), which is when networks typically experience higher user activity. This is an improvement compared to the previous report which tested September 2021. In the previous report, concerning September 2021, average download performance was 88.5% of plan speeds during all hours and 73.9% during the busy hours. The December

2021 results are based on a total of 71 NBN fixed wireless services across both the 25/5 Mbps and Fixed Wireless Plus plans.

In December 2021, NBN fixed wireless services attained an average upload performance of 59.0% of plan speeds during all hours, decreasing to 48.9% during the busy hours (between 7pm and 11pm). In the previous report, concerning September 2021, average upload performance during all hours was 56.2% of plan speeds decreasing to 44.8% during busy hours.

Figure 34: Average hourly download speed for the Fixed Wireless Plus plan

NBN fixed wireless plans.



Average download speeds for the Fixed Wireless Plus plan showed considerable variation throughout the day: speeds typically started to decrease during the evening, dipping to 24 Mbps below the day's maximum speed by 9pm, and would recover to higher levels later at night. The average download speed for the Fixed Wireless Plus plan was 47.4 Mbps during all hours, decreasing to an average of 39.8 Mbps in the busy hours. During September 2021, the average download speed for the Fixed Wireless Plus plan was 44.4 Mbps during all hours, and 36.4 Mbps during busy hours.

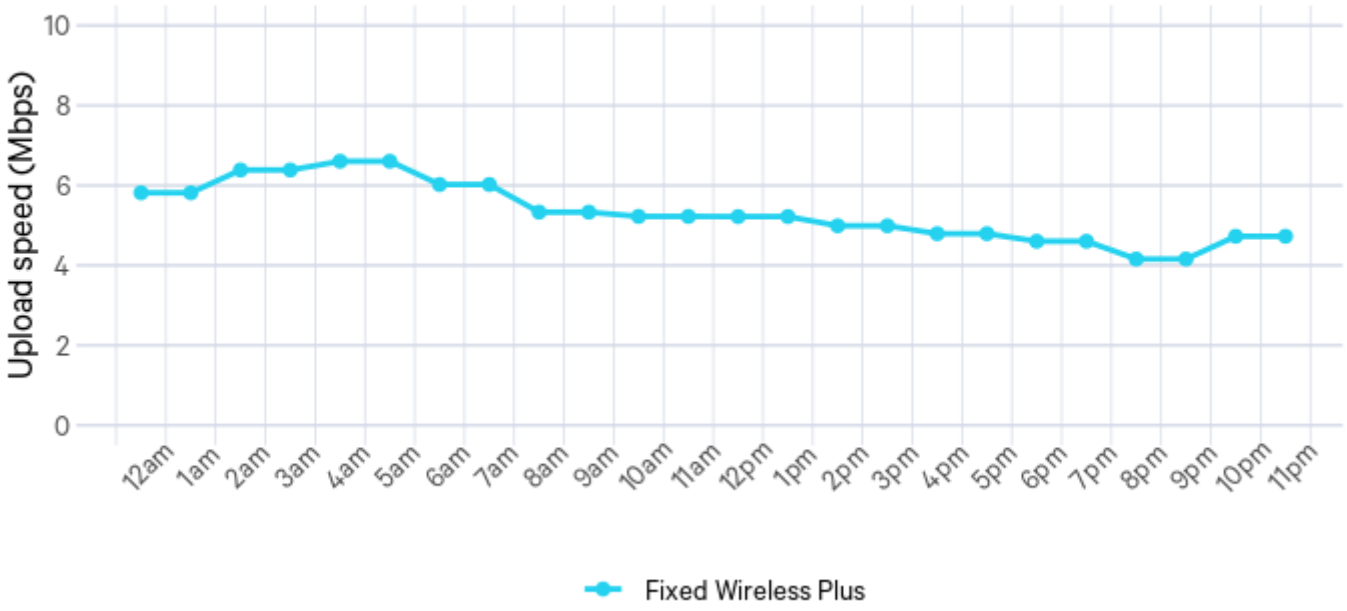
Upload speeds showed a similar pattern to download speeds and recorded lower values both during the busy hours and during the afternoon. The average upload speed for the

Fixed Wireless Plus plan was 5.4 Mbps during all hours, decreasing to an average of 4.3 Mbps in the busy hours. During September 2021, the average upload speed for the Fixed Wireless Plus plan was 5.2 Mbps during all hours, and 4.0 Mbps during busy hours.

Both download and upload speeds showed considerable daily variation for fixed wireless products as can be expected with this technology. Network congestion can affect the fixed wireless network, particularly during the busy hours (between 7pm and 11pm).

Figure 35: Average hourly upload speed for the Fixed Wireless Plus plan

NBN fixed wireless plans.



Fixed Wireless Plus results are based on a total of 56 NBN fixed wireless services on the Fixed Wireless Plus plan.

Daily average download speeds by plan

The following two graphs track the average daily download speeds for 14 fixed wireless services on the 25/5 Mbps plan and 56 services on the Fixed Wireless Plus plan for the period of November 2021 to January 2022.

The results presented here are indicative only, and firm inferences about the performance of fixed wireless products should not be made from these results.

Figure 36: Average daily download speeds during all hours

NBN Fixed Wireless Plus. November 2021 to January 2022.

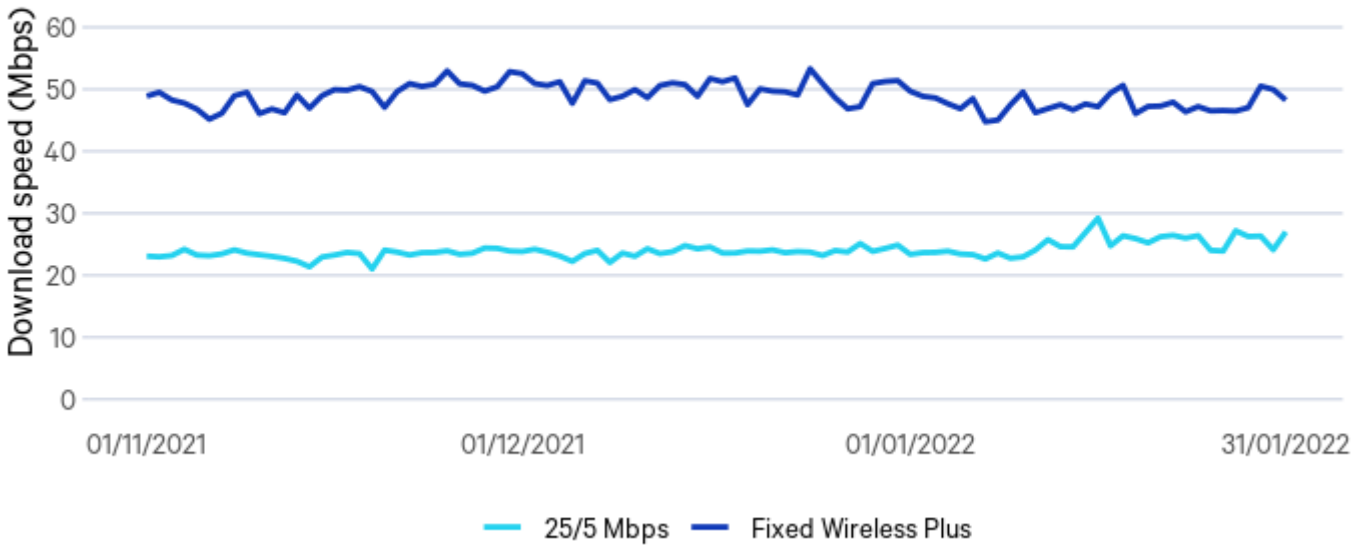
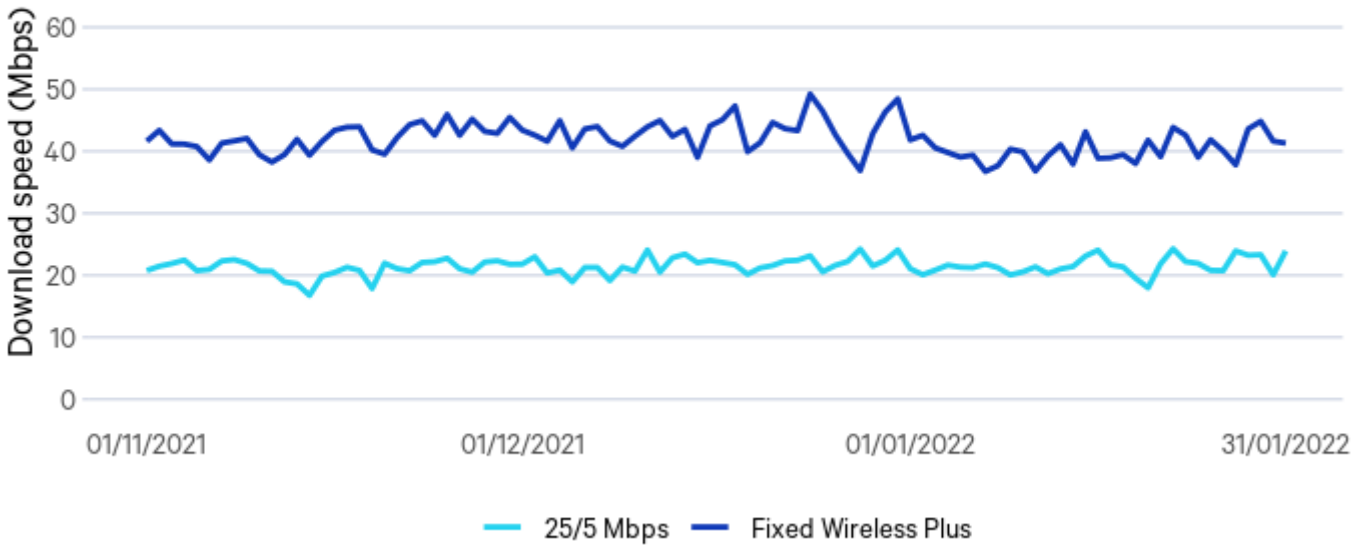


Figure 37: Average daily download speeds during busy hours

NBN Fixed Wireless Plus. November 2021 to January 2022.



Daily average upload speeds by plan

Figures 38 and 39 track the average daily upload speeds for 14 fixed wireless services on the 25/5 Mbps plan and 56 services on the Fixed Wireless Plus plan for the period of November 2021 to January 2022. For these time series charts, calculations have been conducted for all hours and busy hours (7pm - 11pm) from Monday to Sunday.

The results presented here are indicative only, and firm inferences about the performance of fixed wireless products should not be made from these results.

Figure 38: Average daily upload speeds during all hours

NBN Fixed Wireless Plus. November 2021 to January 2022.

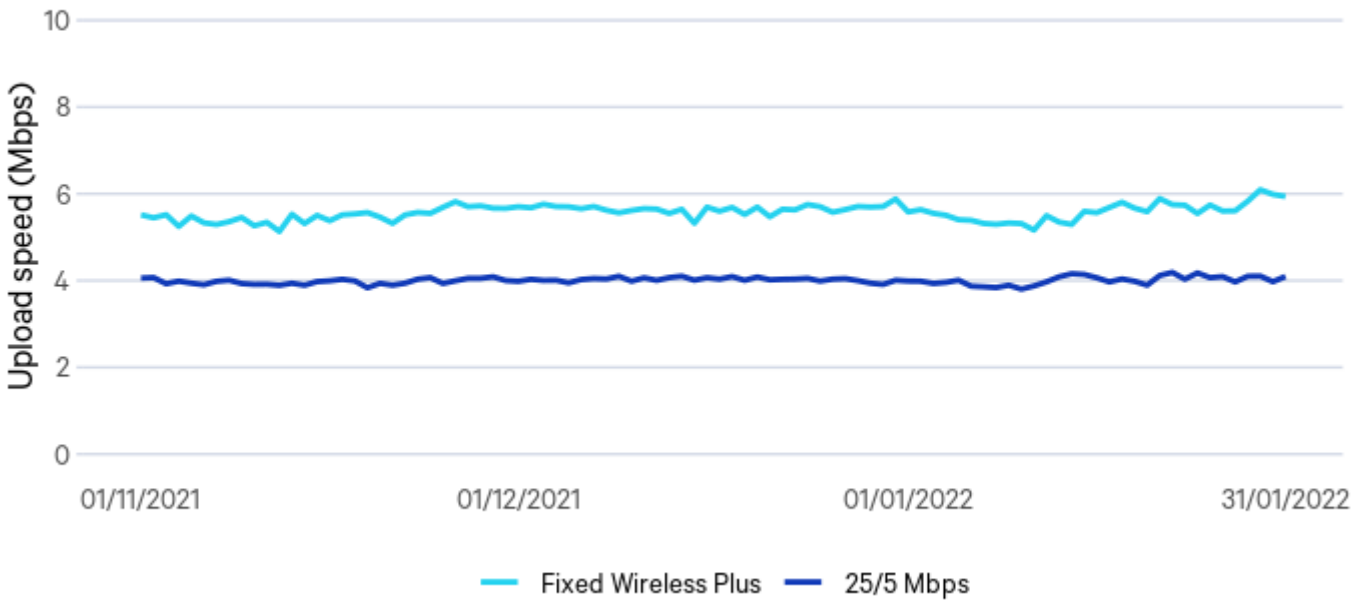
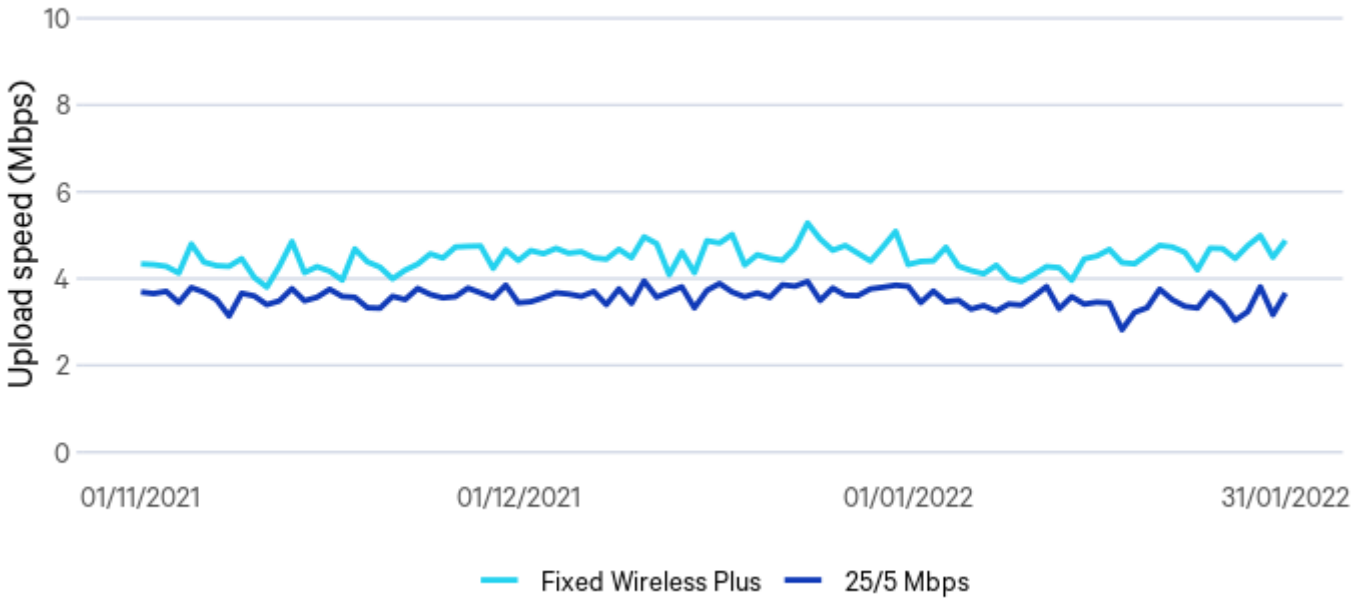


Figure 39: Average daily upload speeds during busy hours by plan

NBN Fixed Wireless Plus. November 2021 to January 2022.



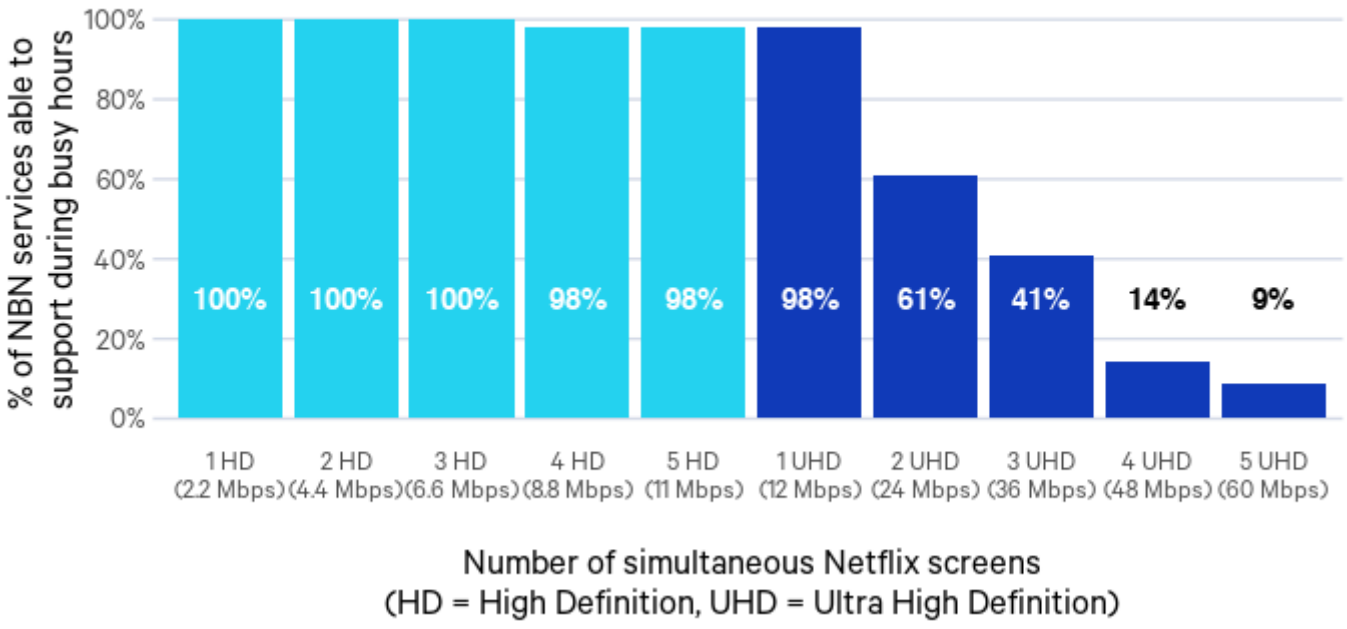
Video streaming

Figure 40 shows the proportion of services on the NBN Fixed Wireless Plus plan which would be able to reliably stream (with a low chance of stopping and starting) a varying number of videos at High Definition and Ultra High Definition from Netflix simultaneously.

We present results for Netflix as it is one of the dominant streaming providers in the Australian market. Netflix has significant traffic over Australian networks and supports our testing of its services. We welcome interest from other streaming providers if they wish to participate in the program.

Figure 40: Netflix streaming for the Fixed Wireless Plus plan

Busy hours. Including underperforming and impaired services.



Please note: the results are not cumulative and should be read separately for High Definition and Ultra High Definition streaming.

The results show that during the busy hours (7-11pm):

- Most Fixed Wireless Plus plans can support five High Definition, or one Ultra High Definition video stream.
- More than half (61%) of Fixed Wireless Plus plans can support two Ultra High Definition streams. This is an improvement over the September 2021 measurement

period, when less than half (41%) of services on the Fixed Wireless Plus plan was found to be able to support two UHD streams.

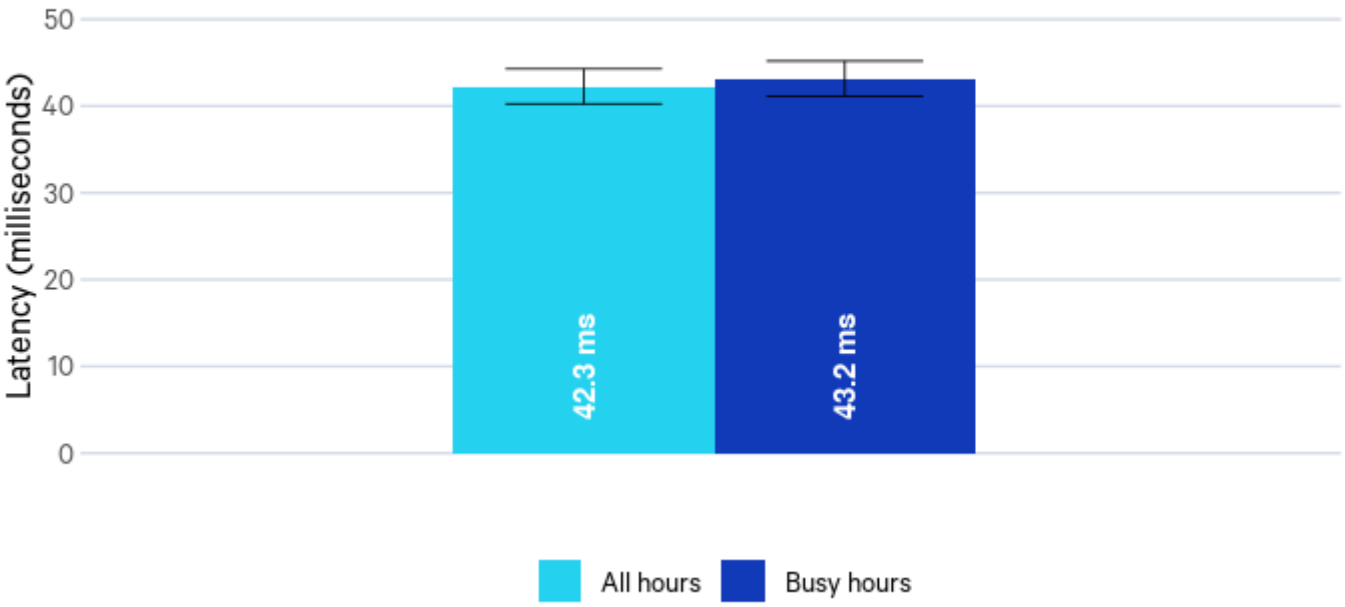
Please note: fixed-line video streaming analysis is detailed in the appendix due to results being relatively unchanged over recent quarters. For example, NBN50 plans continued to be able to stream over 5 HD Netflix streams simultaneously in line with results from our September report.

Latency, packet loss and outages

The following section provides a brief overview of latency, packet loss and outages for fixed wireless plans.

Figure 41: Average latency for fixed wireless

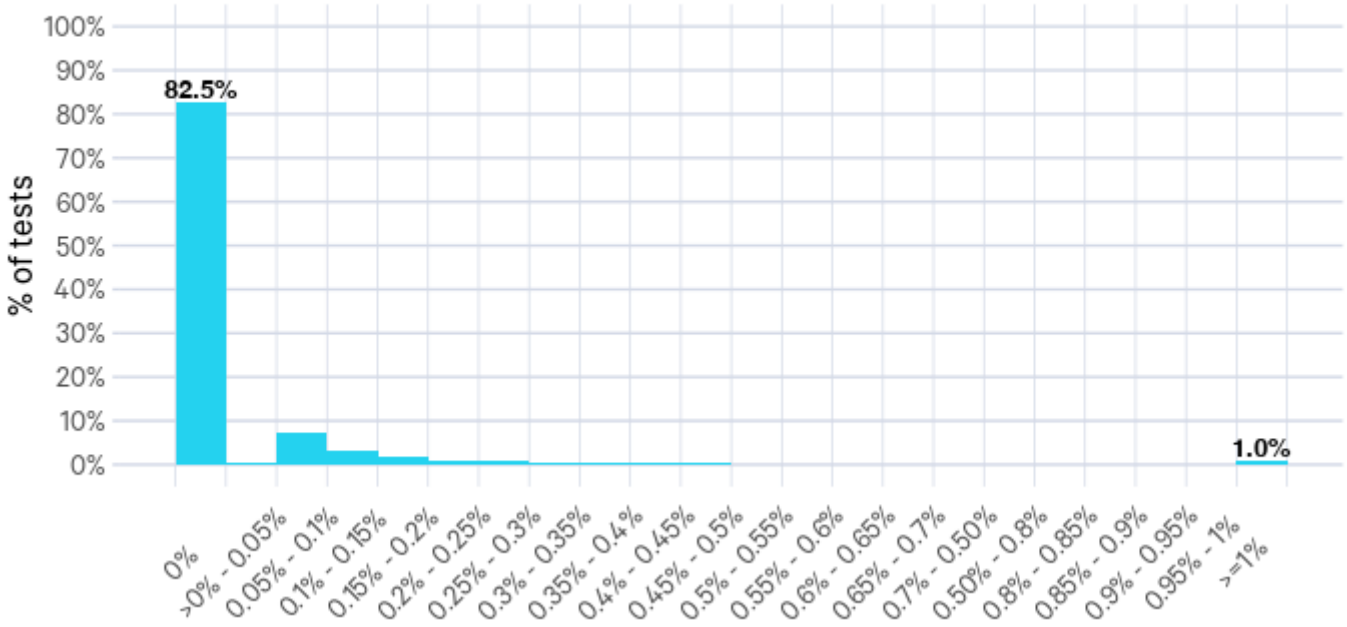
NBN fixed wireless plans. Error bars indicate 95% confidence intervals of the mean.



Average latency for fixed wireless plans was recorded as 42.3 milliseconds during all hours, rising slightly to 43.2 milliseconds during busy hours, broadly in line with the previous report.

Figure 42: Frequency of packet loss rates observed during tests

NBN fixed wireless plans. All hours.



During this measurement period, 46,924 packet loss tests were conducted through fixed wireless services. Of these tests, 82.8% had packet loss of either zero or less than 0.05%.

At the other end of the scale, 1.0% of tests had packet loss greater than 1%.

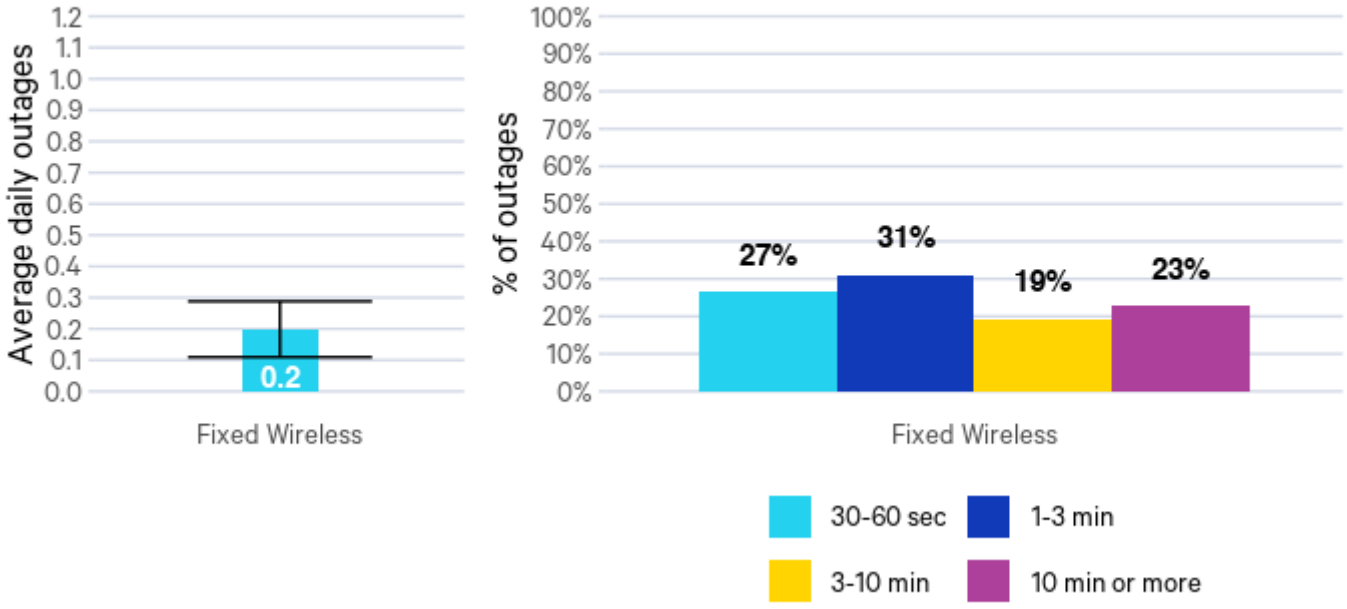
These results are broadly in line with those recorded for fixed-line services.

Figure 43 shows, for fixed wireless services, during all hours:

- the average rate of daily outages for a service, indicating how often outages occurred; and
- the distribution of outage duration, indicating the severity of outages' impact on user experience.

Figure 43: Outage characteristics

NBN Fixed Wireless. All hours.



Test Definitions

	Test	Definition
	Download	The speed at which data can be transferred from the SamKnows test server to your computer, measured in megabits per second (Mbps).
	Upload	The speed at which information is transferred from your computer 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.
	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 don't make it to their destination, measured as a percentage of packets lost out of all packets sent.
	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.
	Outages	The outages metric tracks how many times per day your broadband connection goes offline for at least 30 seconds. Outages between 12am and 6am are excluded from this metric as this is when network maintenance typically occurs.
	Video streaming	Measures the highest bitrate (in Mbps), and therefore quality level, you can reliably stream from real content servers.

Glossary

Term	Definition
SamKnows	The independent testing provider appointed to conduct testing for Measuring Broadband Australia. https://samknows.com/
Whitebox	A purpose-built hardware measurement agent manufactured by SamKnows, installed in volunteers' homes.
Testing Infrastructure	SamKnows-maintained test servers hosted within Australia.
Customer-Premises Equipment (CPE)	Network equipment provided by an RSP (generally including a home router/gateway).
NBN service	A proxy for a single household which accesses the internet through the NBN.
Very High Speed service	Services where the underlying wholesale product sold by NBN Co has a download/upload speed range of 500-990/50 Mbps (referred to by NBN Co as 'Home Ultrafast').
Underperforming service	Services which reach above 75% of plan speed in no more than 5% of download tests. These are services which rarely or never attain plan speed.
Impaired service	FTTN / Fibre to the Node services where the maximum attainable line speed measured by NBN Co is below plan speed.
Plan / Plan	A retail product, for example 50/20 Mbps or 100/40 Mbps.
Plan speed	The download and upload speeds associated the relevant retail plan. For example, plan speeds for NBN50 are 50 Mbps down and 20 Mbps up.
Advertised speed	The speed claim made by an RSP for a given plan during a Measuring Broadband Australia reporting period. May be the same as or lower than plan speed.
Download performance	Measured download speed expressed as a percentage of plan speed. e.g. for an NBN50 service, 100% download performance would be 50 Mbps. Prior to overprovisioning this was capped at 100%. Since NBN has begun overprovisioning services, results above 100% are common.
All hours	Refers to tests conducted at any time of the day.

Term	Definition
Busy hours	Refers to tests conducted between 19:00:00 and 22:59:59, Monday to Friday.
Busiest hour	Fifth lowest hourly average speed out of all busy hours in the month (including weekends cf. 'busy hours').
Fixed-Line	For reporting, fixed-line encompasses the FTTP (Fibre to the Premises), FTTB (Fibre to the Building), HFC (Hybrid Fibre-Coaxial), FTTC (Fibre to the Curb), and FTTN (Fibre to the Node) access technologies.
FTTN / Fibre to the Node	Measuring Broadband Australia treats the FTTN / Fibre to the Node and FTTB / Fibre to the Building access technologies as identical for reporting.
Other superfast access networks	A proxy for a single household which accesses the internet through a (non-NBN) superfast access network.