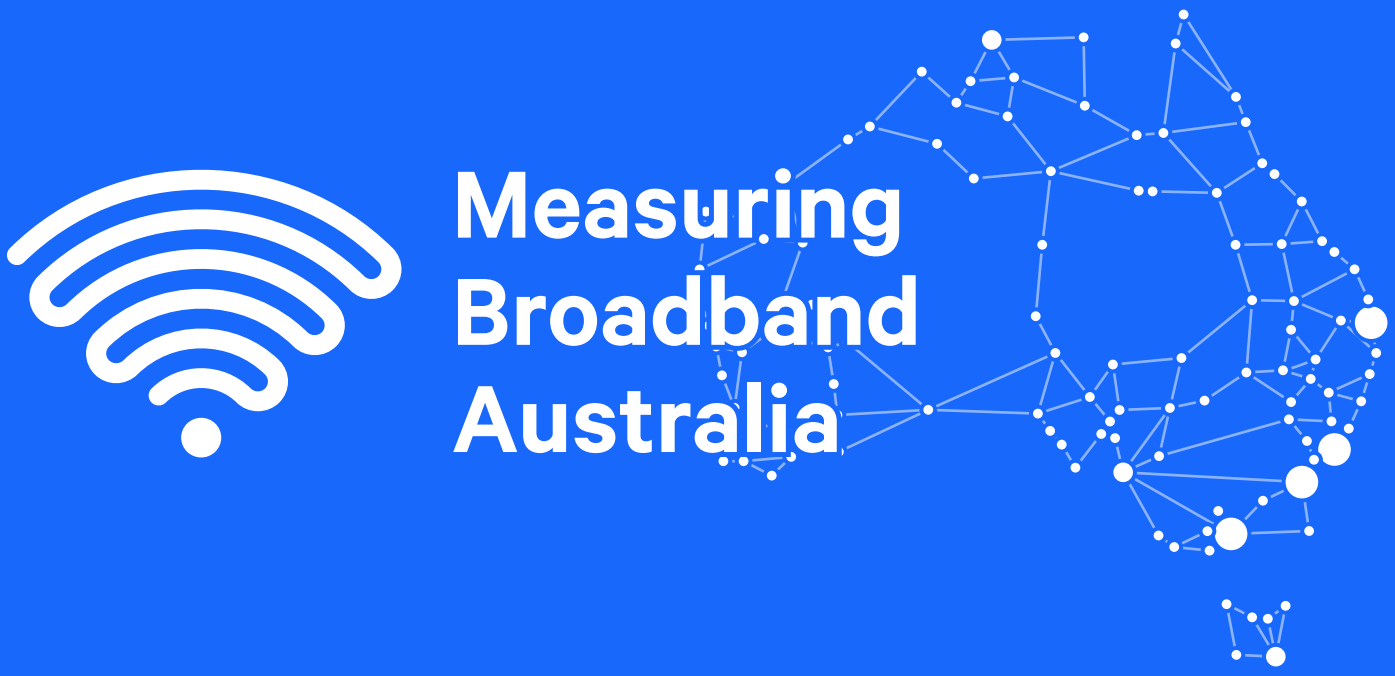


Measuring Broadband Australia

Report 13, June 2021

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 quality of experience for fixed-line internet.

The goal of the Measuring Broadband Australia program 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 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/

The program originally tested NBN fixed-line services as a main focus, but now includes a section on fixed wireless services. In this report we have also included for the first time a section showing results from consumers on very high speed services, where the underlying wholesale product sold by NBN Co has a download/upload speed range of 500-990/50 Mbps.

Contents

Overview

1 February 2021 to 28 February 2021

This is the thirteenth report issued as part of the Measuring Broadband Australia project. This reporting period, includes measurements collected over the month of February 2021, a 28 day period.

Moving on from COVID-19 mitigation measures

COVID-19 has led to a major switch in home internet usage patterns. More people are working and learning from home, increasing pressure on telecommunications networks.

As covered in the previous reports, NBN Co introduced two measures to respond to the challenges presented by COVID-19. Both measures have caused an uplift in results in our reports in late 2020.

NBN Co introduced the following measures:

- provisioned 40 per cent more connectivity virtual circuit (CVC) capacity for retail service providers (RSPs) free of charge; and
- over-provisioned the download component of some NBN speed tiers by around 10 – 15 per cent, where possible.

CVC is one of the essential elements of NBN performance. It is used to aggregate the traffic of an RSP's consumers. Where consumers are doing a lot of things on the internet at once, this will fill up a CVC and cause congestion. If an RSP's network is under-provisioned relative to consumer requirements, then consumers will likely be impacted and speeds will slow, particularly during the busy hours.

NBN Co implemented a 40 per cent CVC boost in late March 2020, and the full amount of this additional capacity was available to RSPs until 30 November 2020. As this was a temporary measure, the boost was then gradually removed over a three month transition period, and was fully withdrawn on 1 February 2021. Therefore results in this report are not impacted by this measure.

Between June and August 2020 NBN Co also started to over-provision the download component of some speed tiers by around 10 – 15 per cent, where possible. A certain proportion of a customer's plan speed is given over to protocol overhead, which is key to ensuring that communications are delivered to the right place. The over-provisioning of the download component now means that consumers can more reliably experience speeds that are closer to the maximum set download speed of their chosen retail plan speed. This is a measure that is continuing, but is reliant on there being sufficient CVC capacity for consumers to continue to experience speeds closer to the maximum set download speed of their plan.

Inclusion of very high speed services

This report includes a section covering the results of very high speed services. These are services where the underlying wholesale product sold by NBN Co has a download/upload speed range of 500-990/50Mbps (referred to by NBN Co as 'Home Ultrafast').

Some of the test results for very high speed services on the NBN panel showed that a small number of our volunteers were always achieving below 100Mbps. We have assessed that most of these volunteers have a 100Mbps Ethernet link within their home that is the bottleneck. A common cause of this is a Customer Premises Equipment (CPE) or other networking equipment that has 100Mbps ports. These consumers are unable to receive the full benefit of their very high speed plans when there is a 100Mbps link in the path. We have excluded these services from our results.

The ACCC has engaged with RSPs to encourage them to reach out to their consumers who may be using a constrained gateway device.

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

Addition of time series charts for download performance

The report now includes time series charts that were formerly presented in the Monthly Key Indicators Report of the Measuring Broadband Australia Program. These show the daily average performance of the major NBN fixed line and NBN fixed wireless plans and will continue to be incorporated within the quarterly reports.

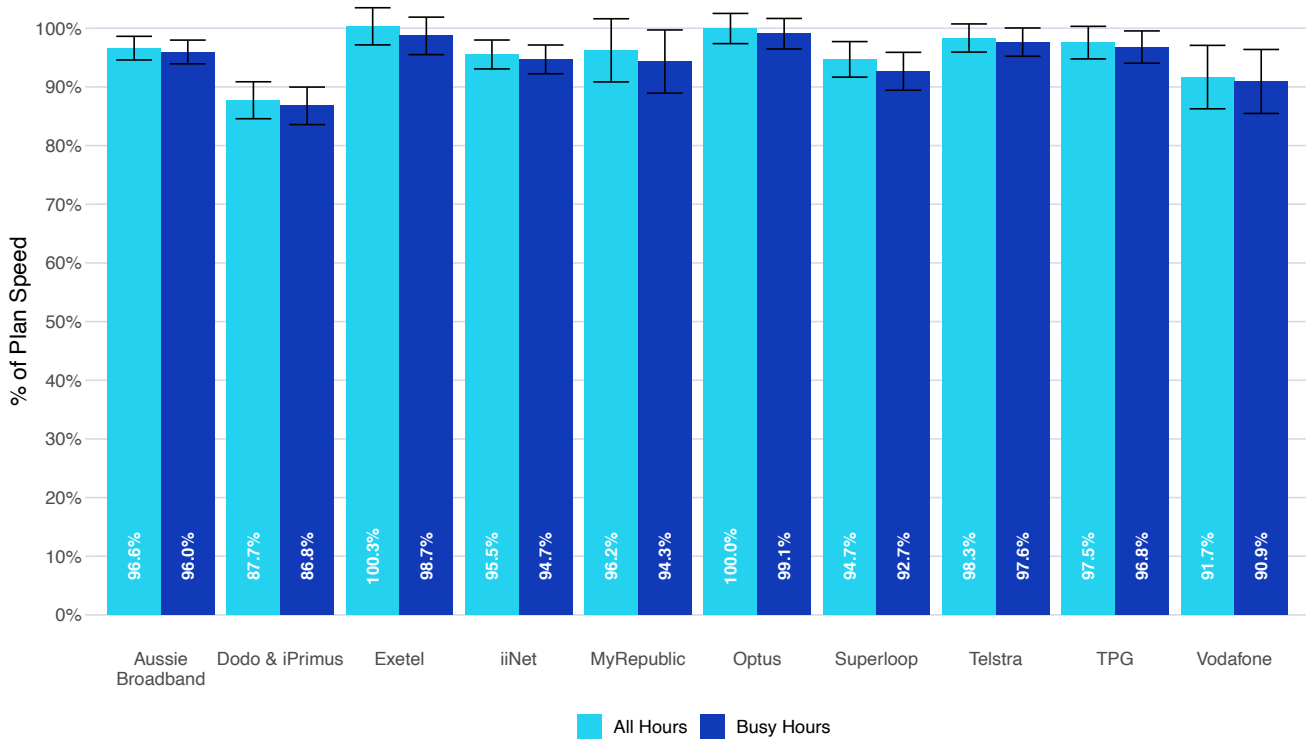
NBN fixed-line services[1]

Download Speed Test Results

This report expresses results relating to download and upload speed as a percentage of the service's plan speed.[2] 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.

Figure 1: Average download speed by RSP

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



1 This section includes results from all major NBN fixed-line download speed plans, from NBN12 to NBN250. It excludes results from very high speed services as these are presented separately.

2 Plan speed refers to the maximum download or upload speed associated with the relevant retail plan. For example, a 12/1Mbps retail product has a maximum download speed of approximately 12Mbps and 1Mbps upload. A 100/20Mbps retail product has a maximum download speed of approximately 100Mbps and 20Mbps 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.

During this period, users on NBN connections attained an average download performance of 96.7% of plan speeds during all hours, decreasing to 95.7% during the busy hours (between 7pm and 11pm) which is when networks experience higher user activity.

These results are a slight increase compared with those measured in the last (12th) Measuring Broadband Australia report, but continue to show the impact that over-provisioning has had on speed results. As explained in the previous report: prior to this change, an NBN100 service would have been provisioned at 100Mbps plan speed; after protocol overhead, the highest speed test result which we could have measured might have been around 94Mbps. After the change, the same service might have been provisioned at above 100Mbps plan speed, meaning that even after protocol overheads we might still measure speeds around or slightly above 100Mbps. As NBN Co is no longer offering CVC capacity free of charge, RSPs must ensure that they have sufficient capacity to deliver speeds that they advertise.

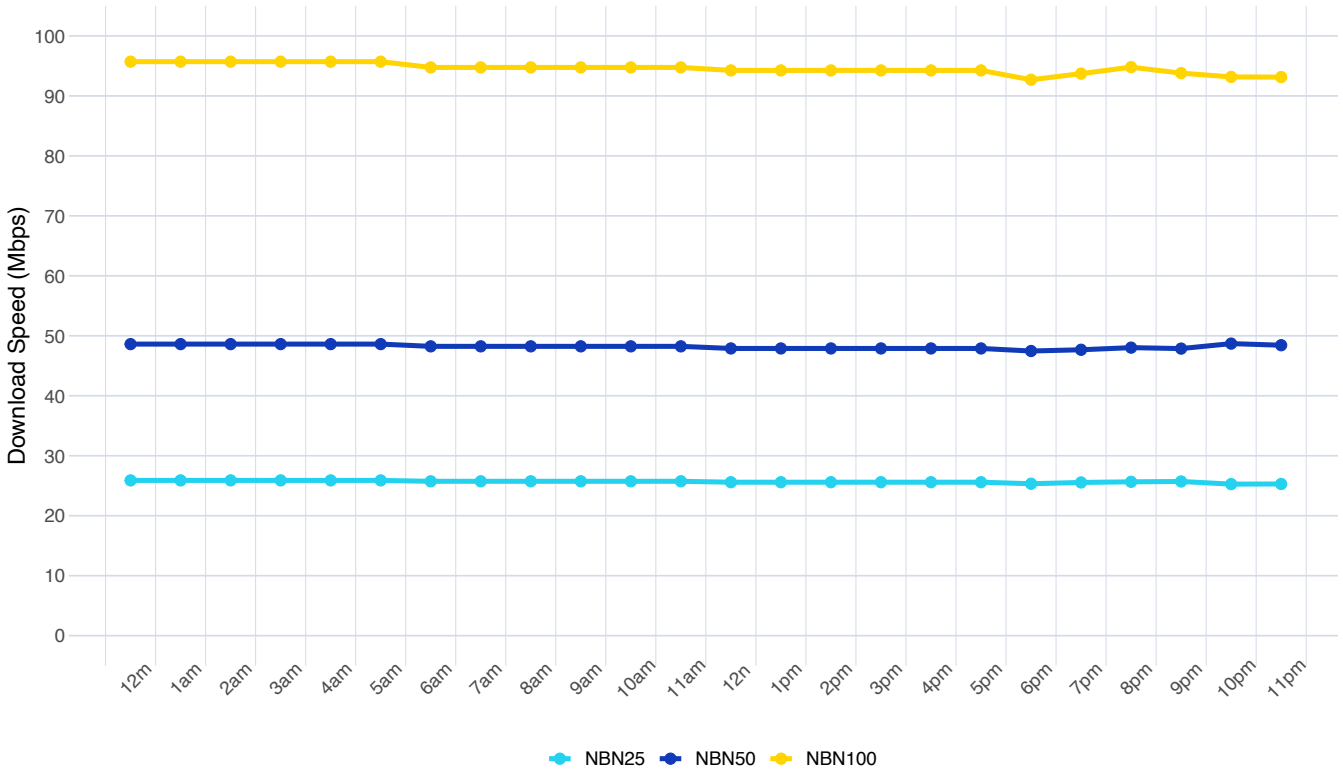
To give an indication of the impact of this change in provisioning, the set of results in the 10th report which tested May-June 2020 showed an all hours average download performance of 88.5% of plan speed, decreasing to 86.7% during busy hours. This implies that all hours download performance in February 2021 has increased by 8.2 percentage points, and busy hour download performance by 9.0 percentage points, since the May-June 2020 test period. Since the 12th report, which had a test period of December 2020, results have increased by 0.3% and 0.1% for all hours and busy hours respectively.

The impact is clear in the number of services which have higher average values than their plan speed. In February 2021, 59.6% of NBN services we monitored reported a higher average speed than plan speed. In comparison in February 2020, there were no monitored NBN services that reported a higher than average plan speed.

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, Exetel had an average download performance of 100.3% with a 95% confidence interval of ±3.2%. This means that if we were to repeat our sampling 100 times, we expect that average performance would range between 97.2% and 103.5% in at least 95 cases.

Figure 2: Average hourly download speed by plan

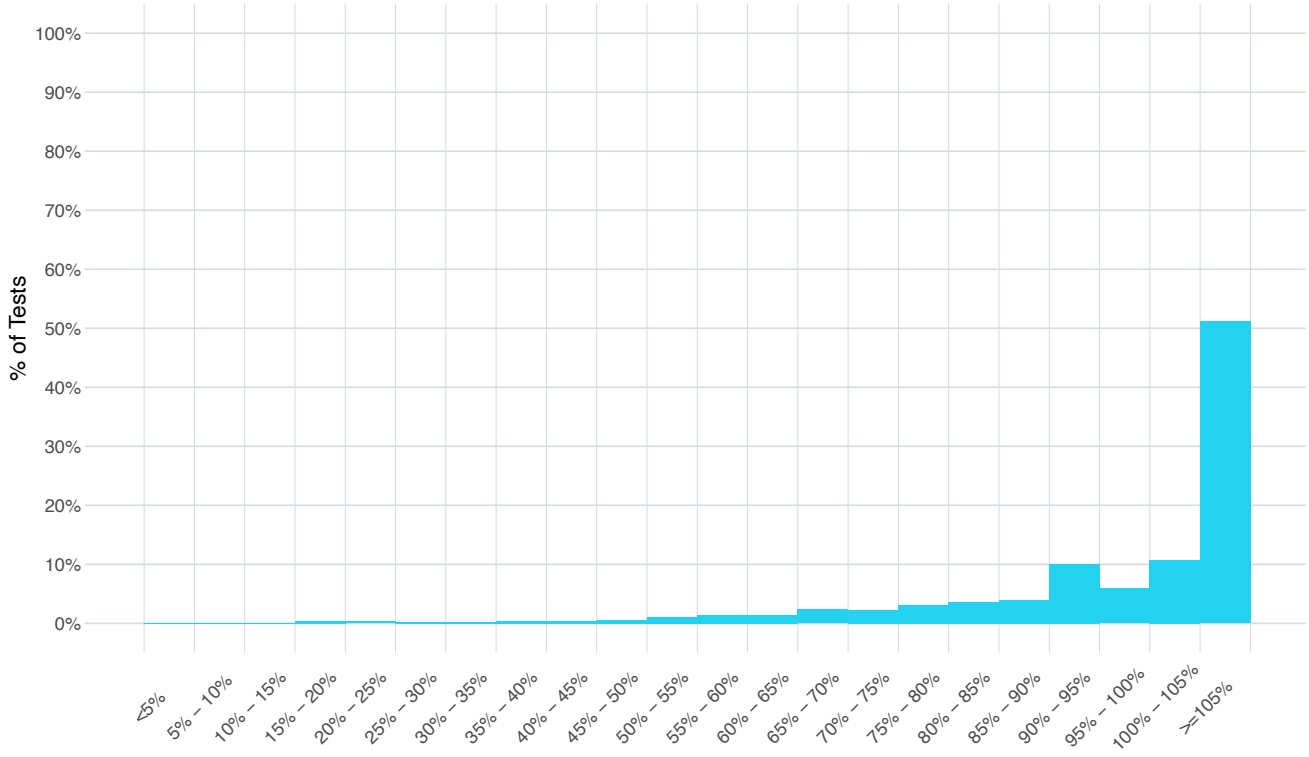
NBN fixed-line plans. Including underperforming services.



Average download speeds held steady throughout the day for users on most NBN speed tiers. The 100Mbps NBN tiers remain the most affected by increased user activity in the evening hours: speeds typically started to decrease during the evening, dipping to 3Mbps below the day's maximum by 6pm, and would recover to higher levels during the night. The average dip in NBN100 speeds is larger than what was observed in our previous report.

Figure 3: Average hourly download speed by plan

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



198,168 download speed tests were performed across 1,117 Whiteboxes connected to fixed-line NBN infrastructure during the period. 77.9% of tests conducted achieved a download speed of at least 90% of the plan's download speed – this is a decrease from 79.0% in the previous report.

Another impact of the over-provisioning of NBN services is the increase in the proportion of tests achieving speeds above 100% of their plan speed. 61.9% of tests in this reporting period achieved speeds above 100% of their plan speed.

2.8% of tests achieved less than 50% of plan speed; for reference, in the previous report 3.0% of tests also failed to meet the 50% mark.

Time Series of Average Daily Download Speeds

This section presents average daily performance for the three most popular NBN download plans for the period from February 2021 to April 2021. It incorporates the information formerly presented in the Monthly Key Indicators Report of the Measuring Broadband Australia Program.

The following four charts present performance of NBN fixed-line services from February to April 2021 for the following NBN fixed-line download speed plans:

- NBN100
- NBN50
- NBN25

The daily averages are calculated by aggregating raw test results by Whitebox, plan speed and day, with this then being averaged across all Whiteboxes for each plan speed. Additionally, we have presented the percentage change in average daily download speeds for each fixed-line plan against a pre-COVID-19 February 2020 average baseline. 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[3] and impaired[4] units. All charts use a consistent set of Whiteboxes across the entire reporting period. If a Whitebox changed speed plan during the period, it is excluded.

3 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 speed tier than to the maximum speed of the consumer's current plan.

4 Impaired services are those where NBN Co provides us with the information that the maximum plan speed cannot be attained due to physical limitations.

In figures 4 and 5, it can be seen that network performance is broadly stable for all plan speeds, during all hours, while during busy hours there is more variability.

Figure 4: Average daily download speeds during all hours by plan

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

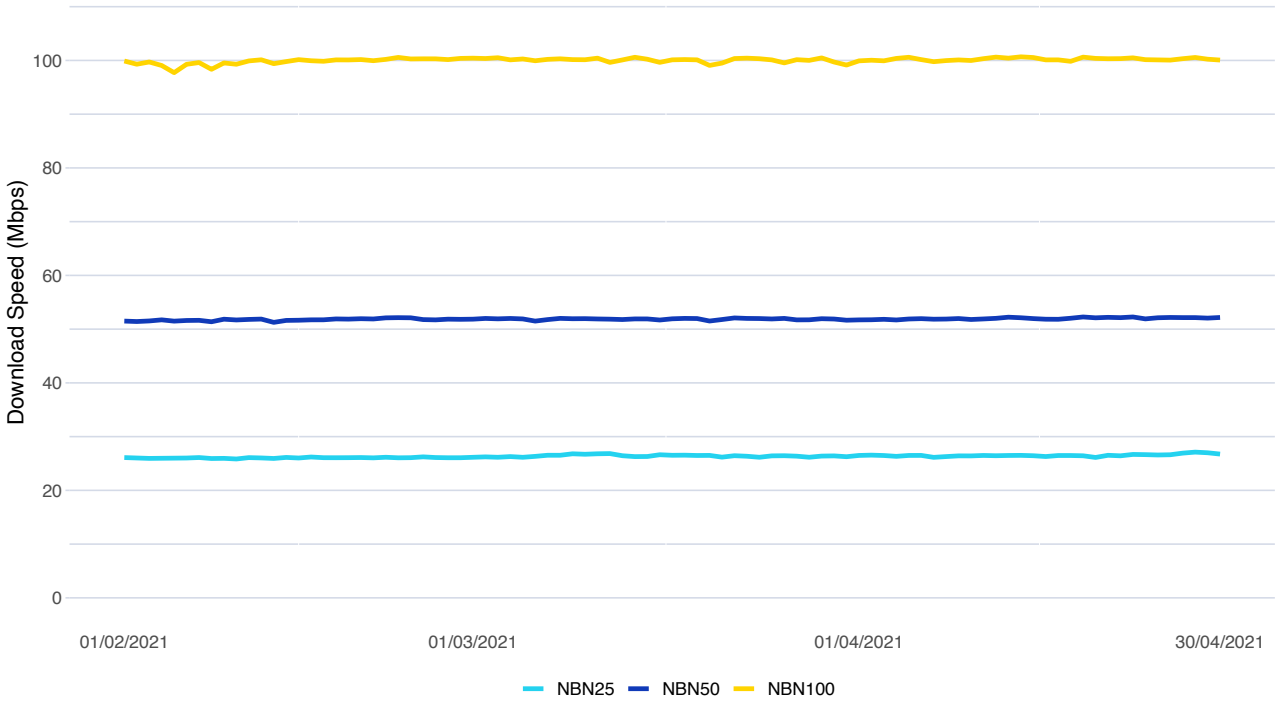
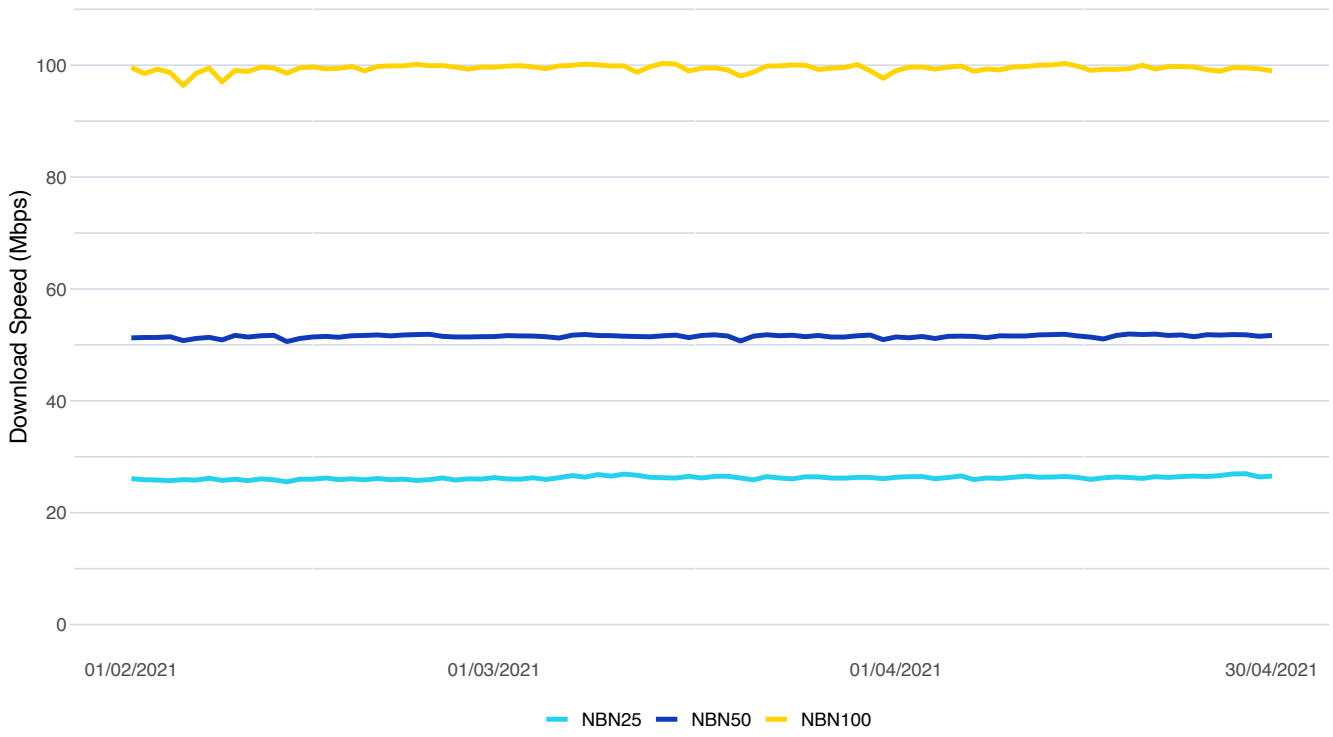


Figure 5: Average daily download speeds during busy hours by plan

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



The next two figures track the percentage change in download speed recorded each day over the period by plan speed, as compared against a pre-COVID baseline of February 2020. Both figures exclude impaired and underperforming units.

During all hours (figure 6 below), download speeds for the period were consistently above the February 2020 pre-COVID baseline, due to the over-provisioning which was implemented between June and August 2020. Performance was broadly stable over the period, although the 25Mbps and 50Mbps plans both finished the period higher. Network download speed performance during busy hours follows a similar pattern to that of all hours (refer to figure 7 below).

The NBN100 plan has higher performance compared to its February 2020 baseline in the busy hours than in the all hours for this period. All plans were consistently above their baselines (between 8% and 17%) during all hours and busy hours.

Figure 6: Change in average daily NBN fixed-line download speeds as compared to February 2020 baseline, during all hours by plan

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

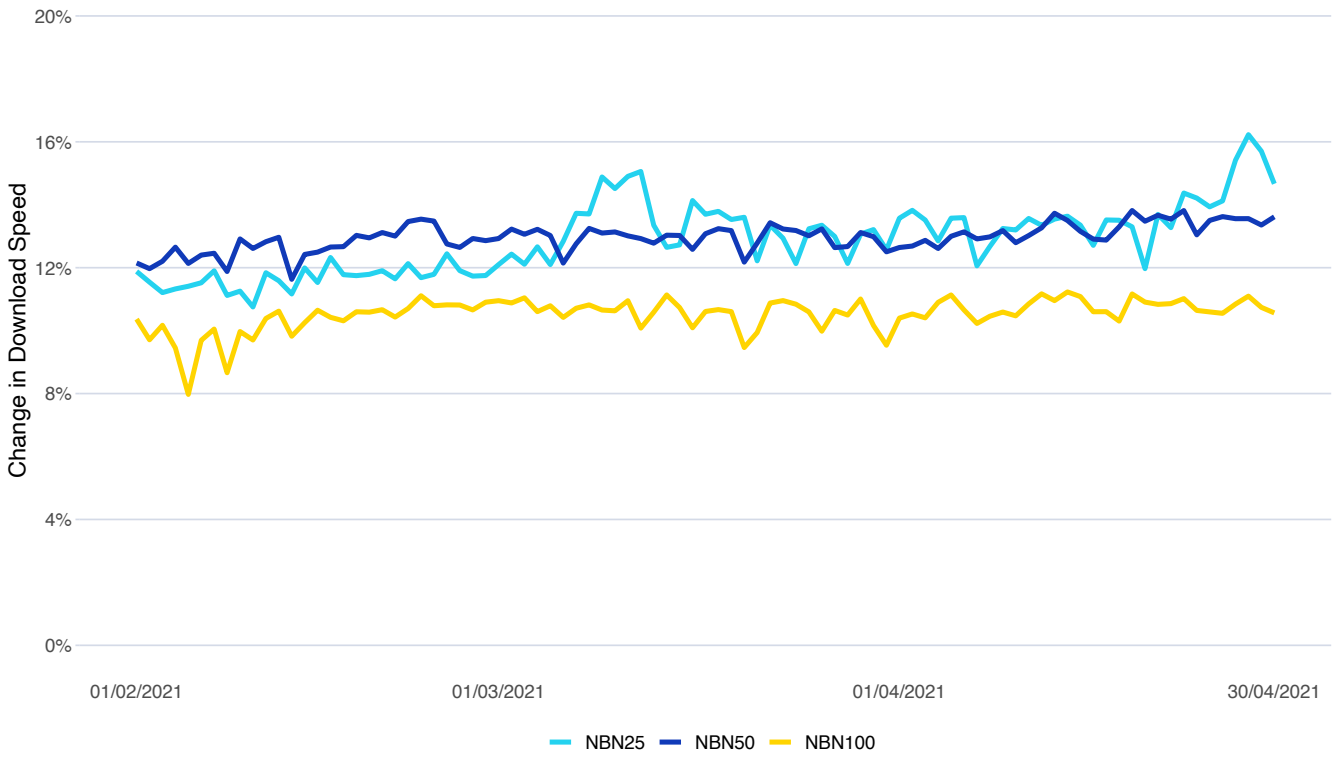
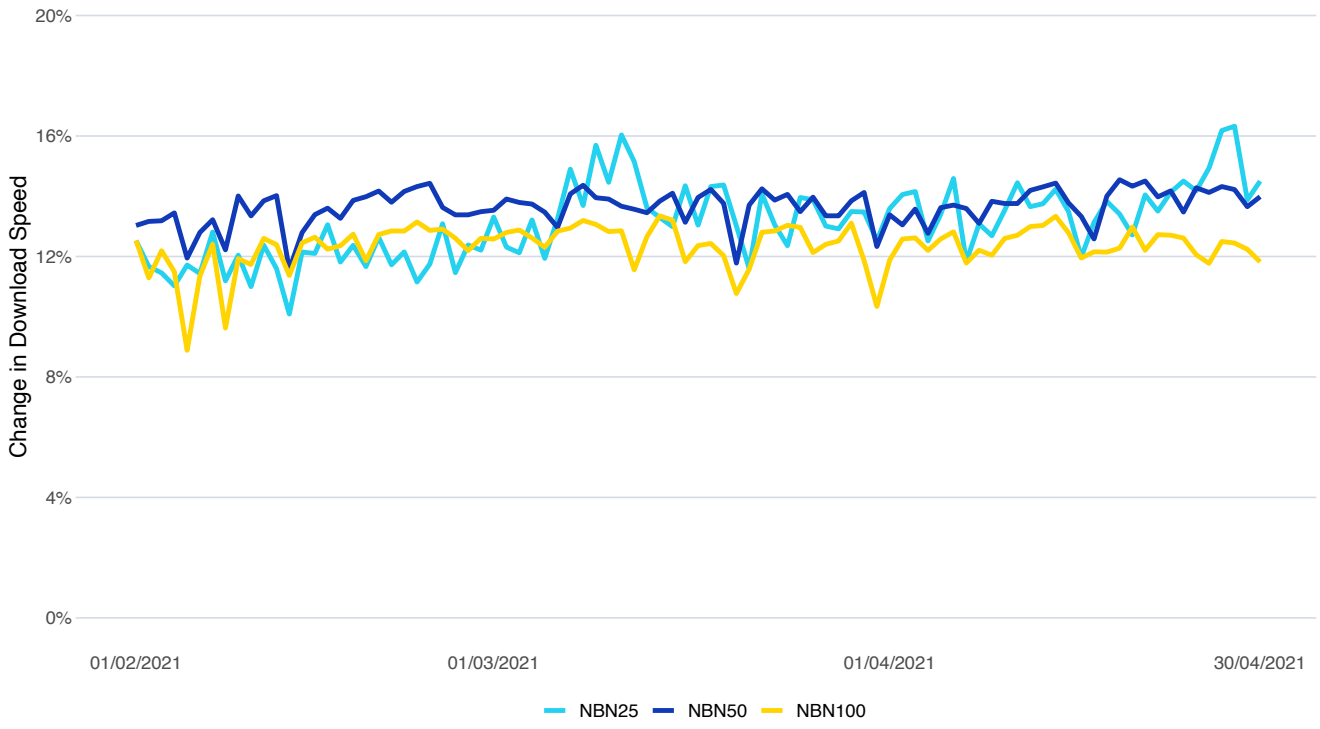


Figure 7: Change in average daily NBN fixed-line download speeds as compared to February 2020 baseline, during busy hours by plan

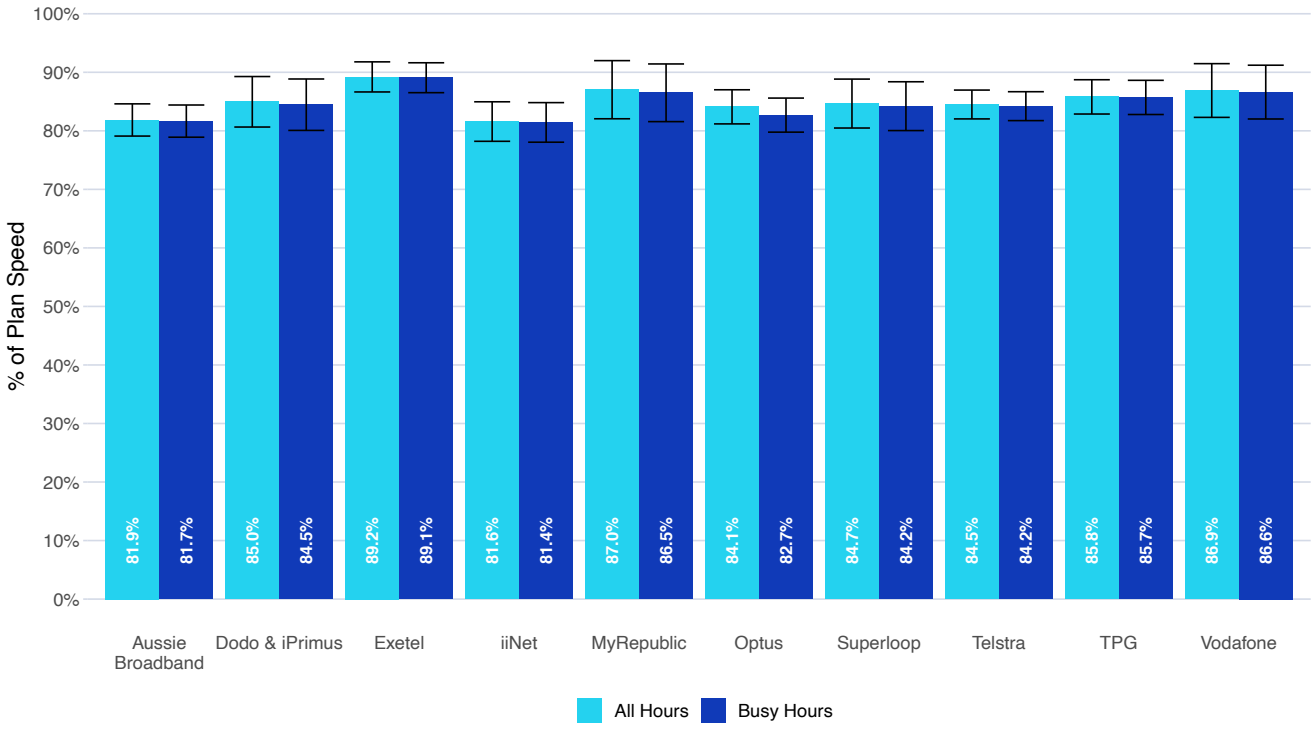
NBN fixed-line plans. Excluding underperforming and impaired services.



Upload Speed Test Results

Figure 8: Average upload speed by RSP

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



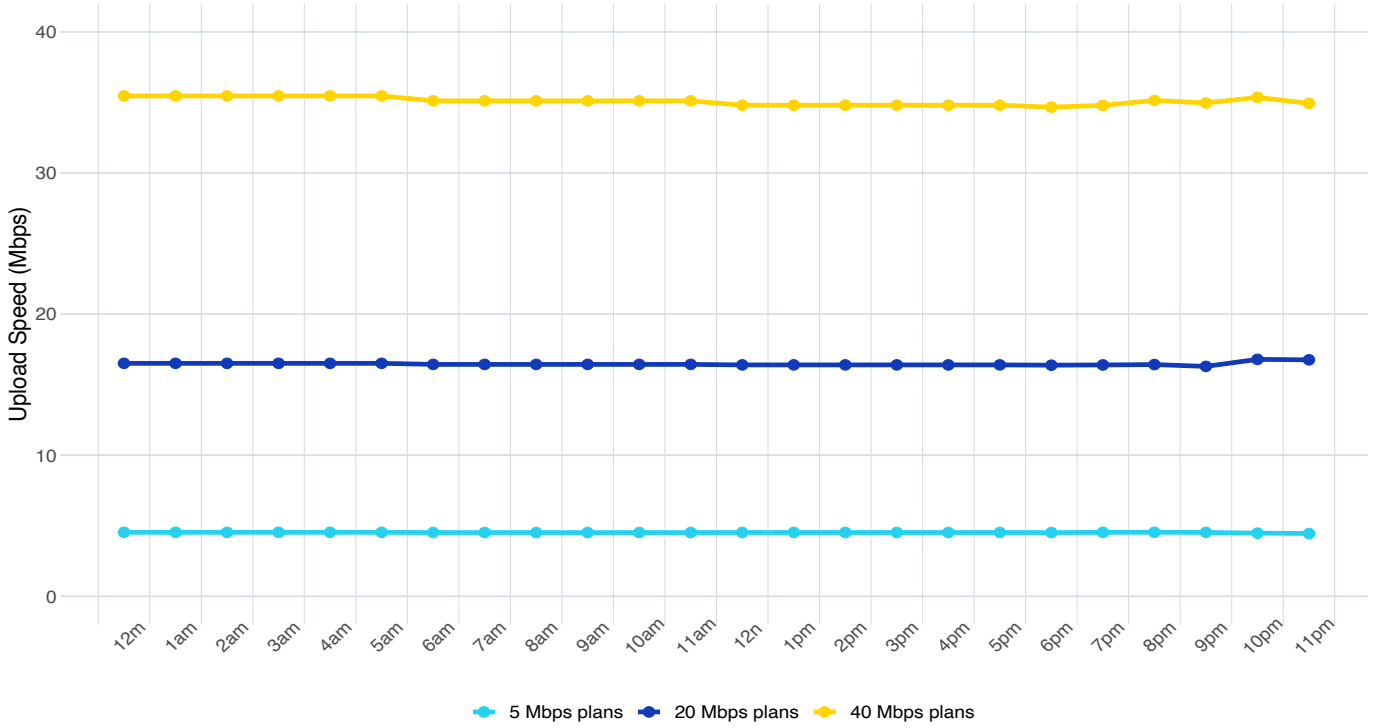
Upload performance was similar when compared to the previous report: NBN services achieved an overall average upload performance of 84.5% during all hours, as against 85.3% in the previous report. In contrast to download speeds, the upstream side of NBN services has not been over-provisioned, and so these upload speed test results do not show a substantial change on previous reports.

Average upload performance ranged between 81.6% and 89.2% during all hours across RSPs as shown in figure 8 above.

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

Figure 9: Average hourly upload speed by plan

NBN fixed-line plans. Including underperforming services.



Video Streaming

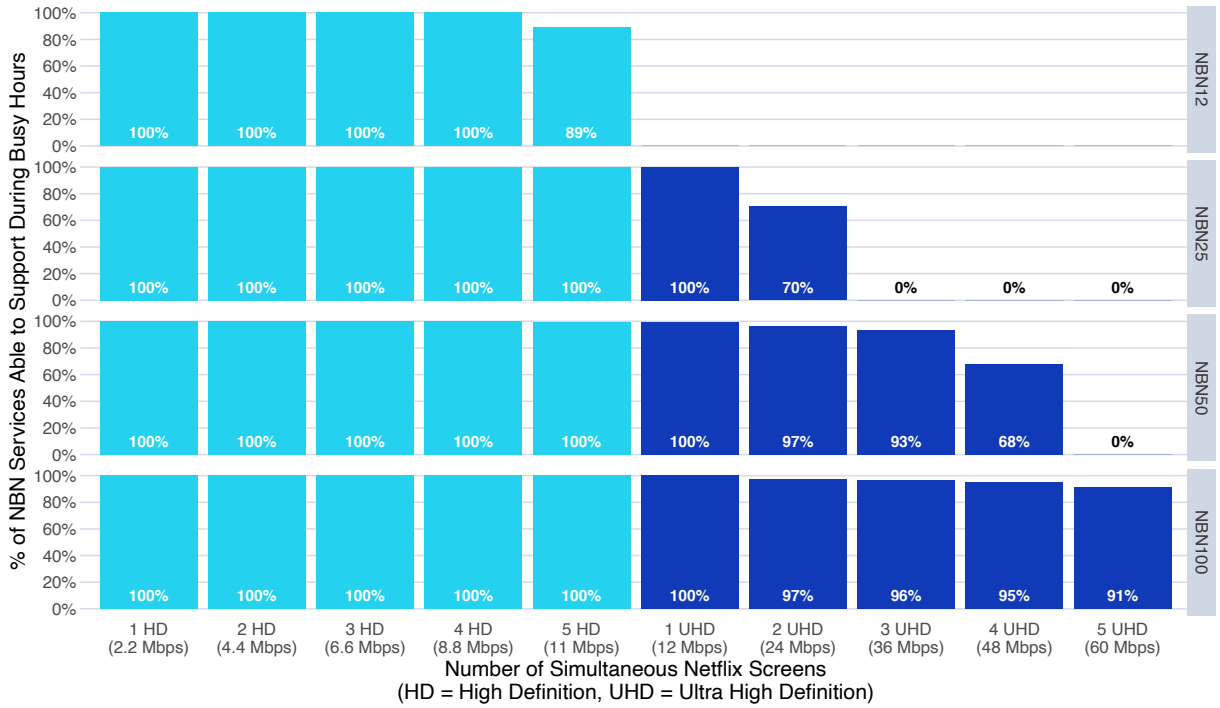
The following chart shows the proportion of NBN services on the main NBN plans which would be able to reliably stream (without stopping and starting) a varying number of videos at High Definition and Ultra High Definition from Netflix simultaneously during busy hours. We present results for Netflix as reports indicate that it has the largest volume of traffic over Australian networks and Netflix supports our testing of its services. We welcome interest from other streaming providers if they wish to participate in the program.

In this report, the calculations used to estimate the number of videos which could simultaneously be streamed have been updated to take into account improvements that Netflix have recently made to their service. These improvements aim to allow users to stream videos at lower bitrates than previously. Due to these updates the following results for Netflix performance have increased from reports 11 and earlier.

Consumers using the popular High Definition video streams from Netflix will see improvements, as a High Definition stream now takes up around 2.2Mbps (previously 6 Mbps) data rate on average. Even those consumers with premium Ultra High Definition (4K) video stream also see improvements, as an Ultra High Definition stream now takes up 12Mbps (previously 15.6Mbps) data rate on average. The actual data rate will vary during video streaming: for example Netflix would use a higher data rate during a fast-paced action scene. The actual data rate will also depend on how many other users are using Netflix. The Whitebox measures the total downstream data rate available from Netflix's servers. Therefore, by using multiples of 2.2Mbps (for High Definition) and 12Mbps (for Ultra High Definition) it allows us to infer whether a NBN fixed-line service would be able to support different numbers of simultaneous streams. This assumes no other use of the connection at the time i.e. that Netflix is the only application running.

Figure 10: Netflix streaming by plan

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



Note: The results are not cumulative and should be read separately for HD and UHD streaming.

Netflix's upgrades and the subsequent changes to the methodology for calculating the number of theoretical simultaneous screens have had a significant impact on the number of simultaneous screens which can theoretically be streamed.

- All major plan speeds can now theoretically support up to 4 simultaneous High Definition streams during busy hours.
- Almost three quarters of NBN25 services during busy hours would support two simultaneous Ultra High Definition streams, and all can manage a single Ultra High Definition stream.
- Almost all NBN50 plans would be able to handle three Ultra High Definition videos. 68% of NBN50 services can handle four Ultra High Definition streams during busy hours.
- NBN100 plans will generally allow up to five Netflix videos to be watched with the highest quality settings available, the percentage that can manage 5 simultaneous Ultra High Definition streams in the busy hours remained steady at just over 90%.

We have not fully tested NBN12 services for Ultra High Definition Streams.

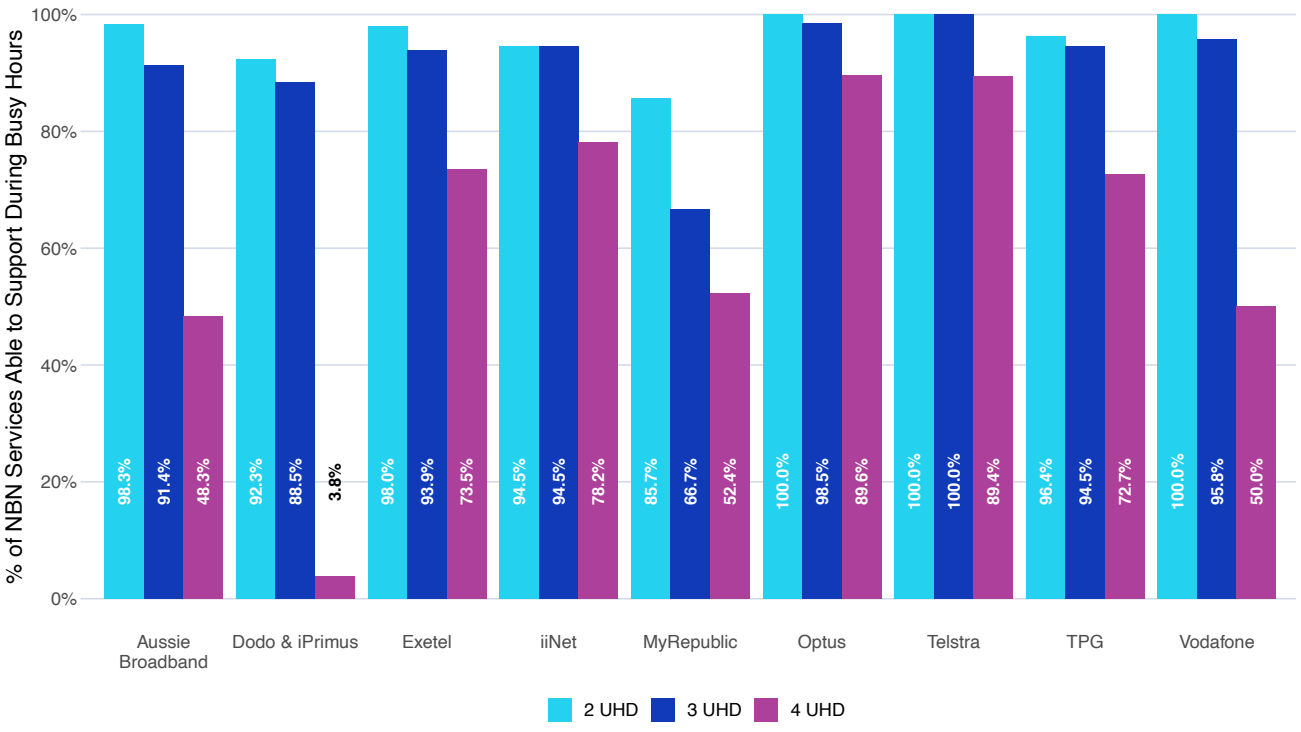
Similar tests were run to YouTube. Since YouTube caps the data rate at which it serves video, test results could not be used to infer whether a service would be able to handle multiple concurrent streams. Nevertheless, nearly all tests from all NBN plans were able to stream YouTube reliably in Ultra High Definition.

Netflix content is served by 'Open Connect Appliance' content delivery network (CDN) caches embedded within RSPs' networks. Since the endpoints tested for each RSP are different, Netflix performance can vary across RSPs.

The following chart shows the proportion of NBN50 services which would be able to reliably stream two, three, or four simultaneous Netflix videos in Ultra High Definition, split by RSP during busy hours. Results for Superloop have been excluded due to low sample size.

Figure 11: Netflix streaming for NBN50 plans

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



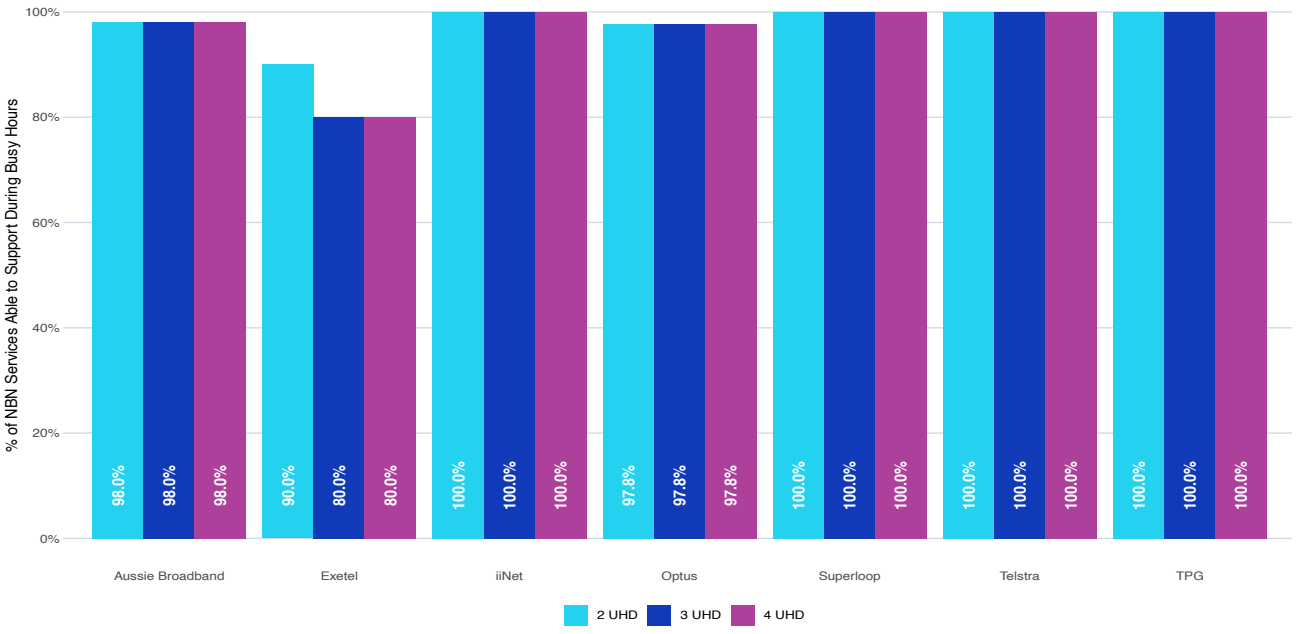
In previous reports, NBN50 performance for High Definition streams have been presented, but given the significant improvements caused by Netflix's bitrate changes, Ultra High Definition results have been presented here to be more informative. While most providers are able to stream 2 and 3 simultaneous Ultra High Definition streams there is more variation

in performance for 4 Ultra High Definition streams. Performance for 4 simultaneous Ultra High Definition streams is linked to the RSP's download speed claim, with higher speed claims linked with a higher proportion of services able to support 4 simultaneous Ultra High Definition streams. It should be noted that the results for Dodo & iPrimus, MyRepublic and Vodafone are based on data from 26, 22 and 24 Whiteboxes respectively, and so the results for those RSPs should be considered as indicative only.

The following chart shows the proportion of NBN100 services which would be able to reliably stream two, three, or four simultaneous Netflix videos in Ultra High Definition, split by RSP. Results from Dodo & iPrimus, MyRepublic and Vodafone are excluded due to low sample sizes.

Figure 12: Netflix streaming by RSP - NBN100 services

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



As expected the NBN100 plans do better than the NBN50 plans at being able to stream multiple Ultra High Definition streams during the busy hours. In fact, all bar one provider are able to reliably stream 4 simultaneous Ultra High Definition videos. It should be noted that the results for Exetel, iiNet and TPG are based on data from 20, 25 and 24 Whiteboxes respectively, and so the results for those RSPs should be considered as indicative only.

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. These 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.

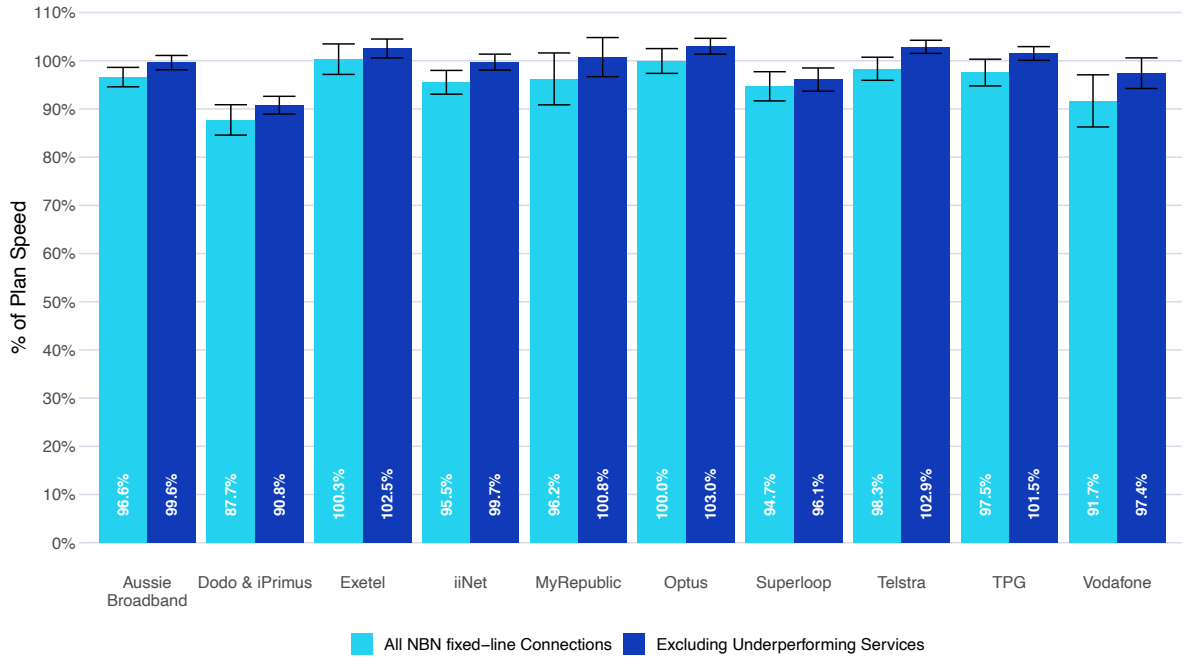
This information allows consumers to better understand the reported download and upload speed measures by removing the effect of services which, due to physical limitations, would be better assigned to another plan. At the same time, this comparison provides stronger incentives for service providers 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 8.1% of the 1,117 NBN services that were tested for this report. 90% of underperforming NBN services are fibre to the node connections. 98% of underperforming NBN services are on NBN50 and NBN100 plans. The average download performance once underperforming services are excluded is 100.3% as against the 96.7% 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 3.6 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

NBN fixed-line plans. All hours. Inclusive and exclusive of underperforming services.

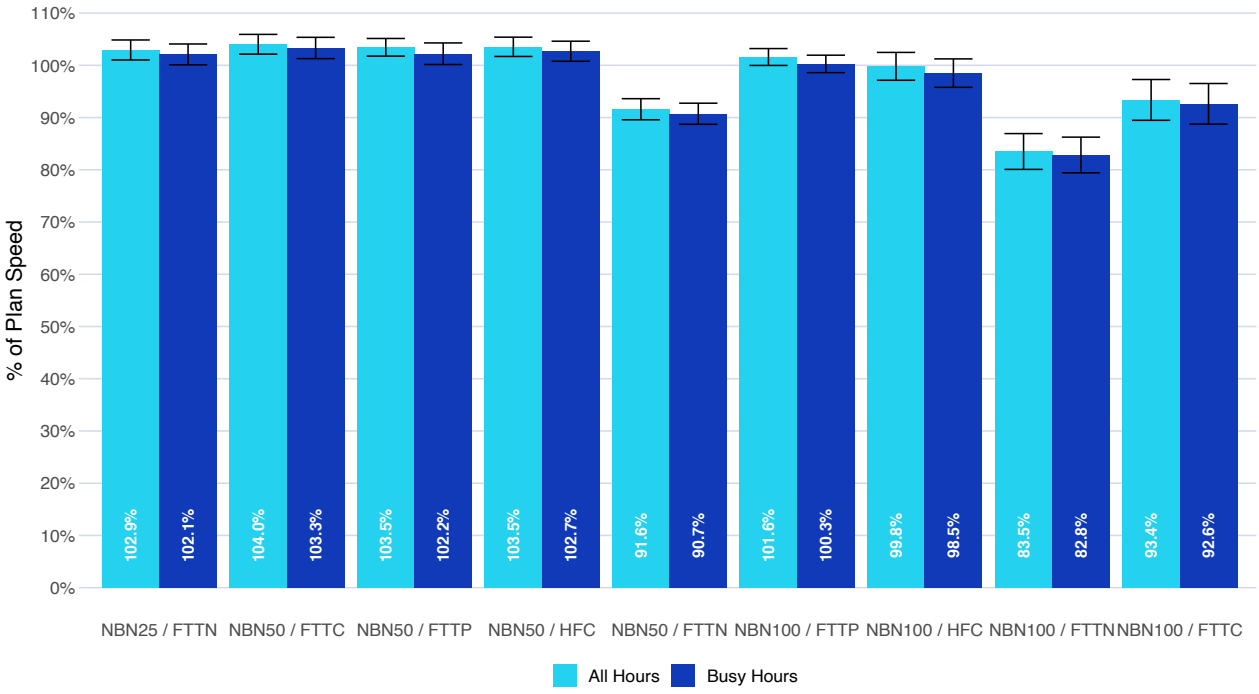


Download Speed by NBN Plan and Access Technology

The following chart shows average download speed for different access technologies for different NBN speed tiers.

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 speed tier, fibre to the node services had an average download speed

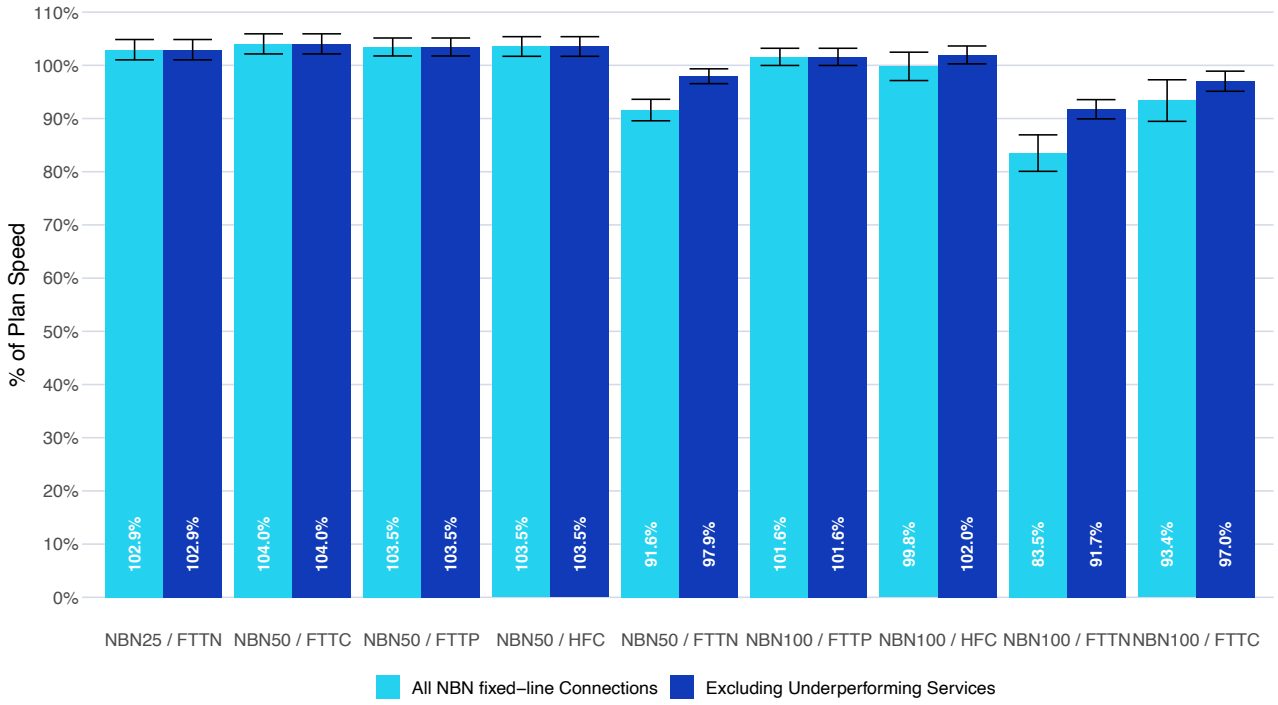
around 6Mbps lower than other technologies, a difference of 12% when comparing in percentage terms, as shown in the chart above. Within the NBN100 speed tiers, fibre to the node services had an average download speed around 16Mbps lower than other technologies.

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

The following chart shows the impact of underperforming services on average download speed across different plans and technologies.

Figure 15: Average download speed by plan and technology

NBN fixed-line plans. All hours. Inclusive and exclusive of underperforming services. Error bars indicate 95% confidence intervals of the mean.



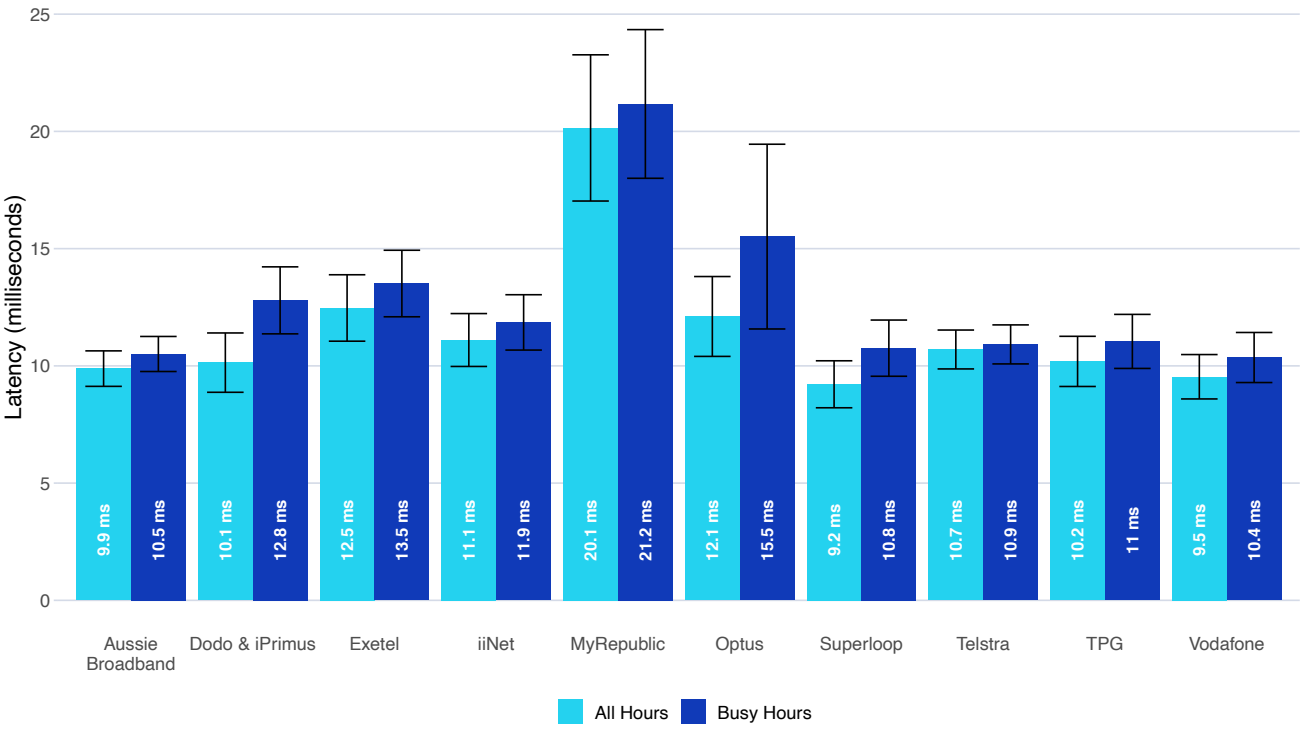
Fibre to the node continues to account for the bulk of the impact from underperforming services across both the NBN50 and NBN100 speed tiers.

Latency, Webpage Loading Time, and Packet Loss by Plan

The following chart 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.



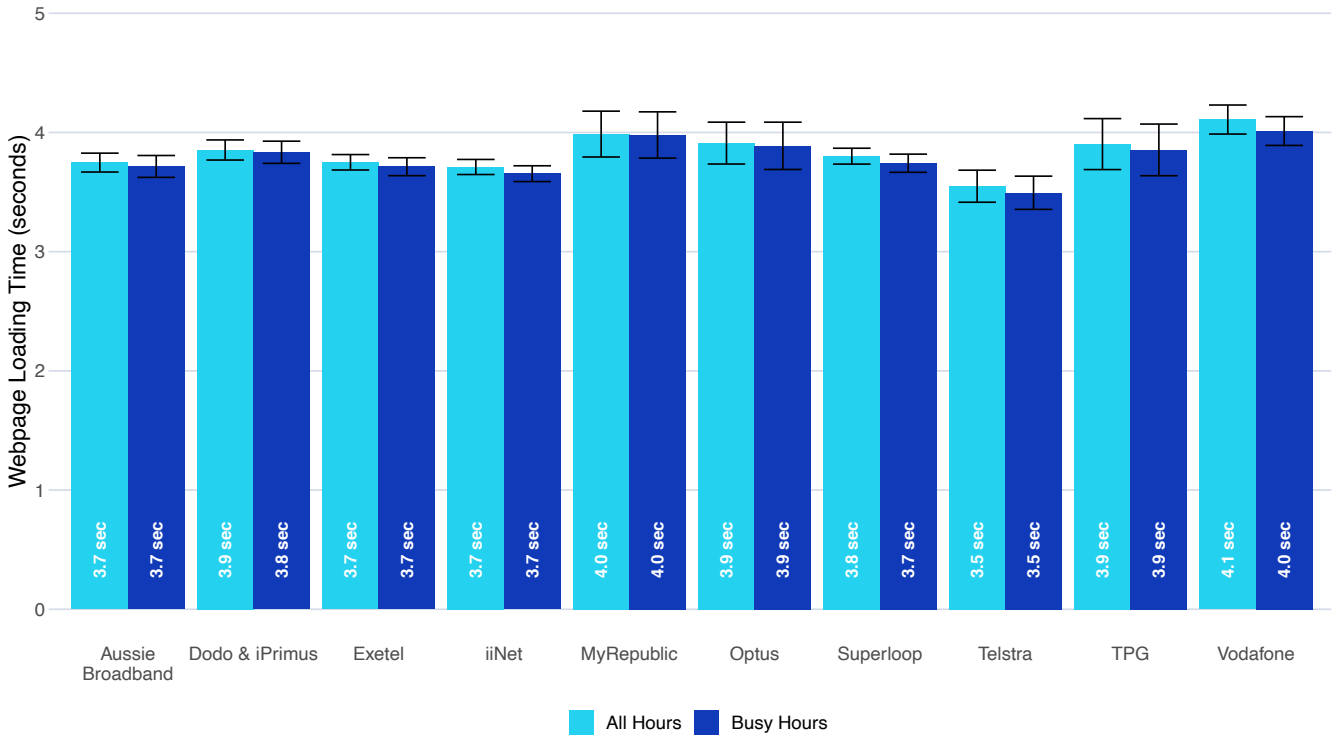
Latency results from this period are in line with the previous report: average latency was generally below 13 milliseconds during all hours across RSPs with the exception of MyRepublic.

MyRepublic services had higher average latency than connections served by other RSPs, although MyRepublic's average latency did remain at a similar level during busy hours. It should be noted that latency at even 30 milliseconds would have a detrimental effect on only the most latency-sensitive applications and would be unlikely to be noticed by an end user.

The following chart shows the average time required to fully load eight popular webpages for Australian users across all NBN speed tiers, 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.



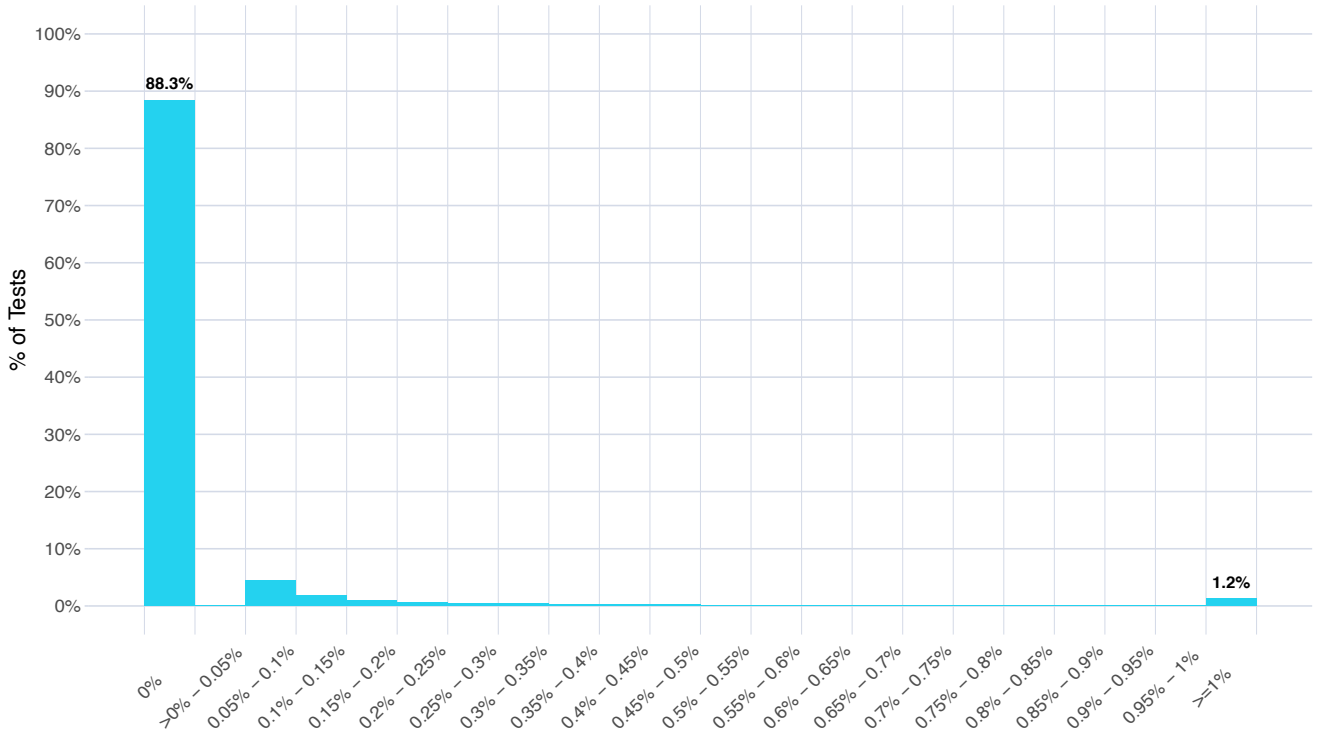
The average time needed to load a website decreased since the previous reporting period by approximately 0.3 seconds for each RSP. This is mainly due to the average time to load one monitored website falling by around a third (to an average of around 8 seconds) since the previous report. This increase affected the webpage loading time metric for all RSPs and so there are no material differences between RSPs by this metric. Even an increase of a few seconds may not have a huge visual impact to an end user. This is because websites[5] are often designed so that the main elements of a page load first. The elements which come through in the final few seconds generally involve small visual changes. These are unlikely to have much impact on user experience.

The following chart 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 your router and the test server, often due to network congestion. Measured as a percentage of all packets sent.

5 The web performance test report prepared for the ACCC provides further information about webpage loading and other factors that may affect web browsing performance.

Figure 18: Frequency of packet loss rates observed during tests

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



A total of nearly 668,221 packet loss tests were conducted over the measurement period. 88.3% of these tests had packet loss of either zero or less than 0.05%. For reference, in the previous report 89% of tests had packet loss below 0.05%.

At the other end of the scale, 1.2% of tests had packet loss greater than 1% as against 1.0% 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.

Outages

The following charts show, for each RSP:

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

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

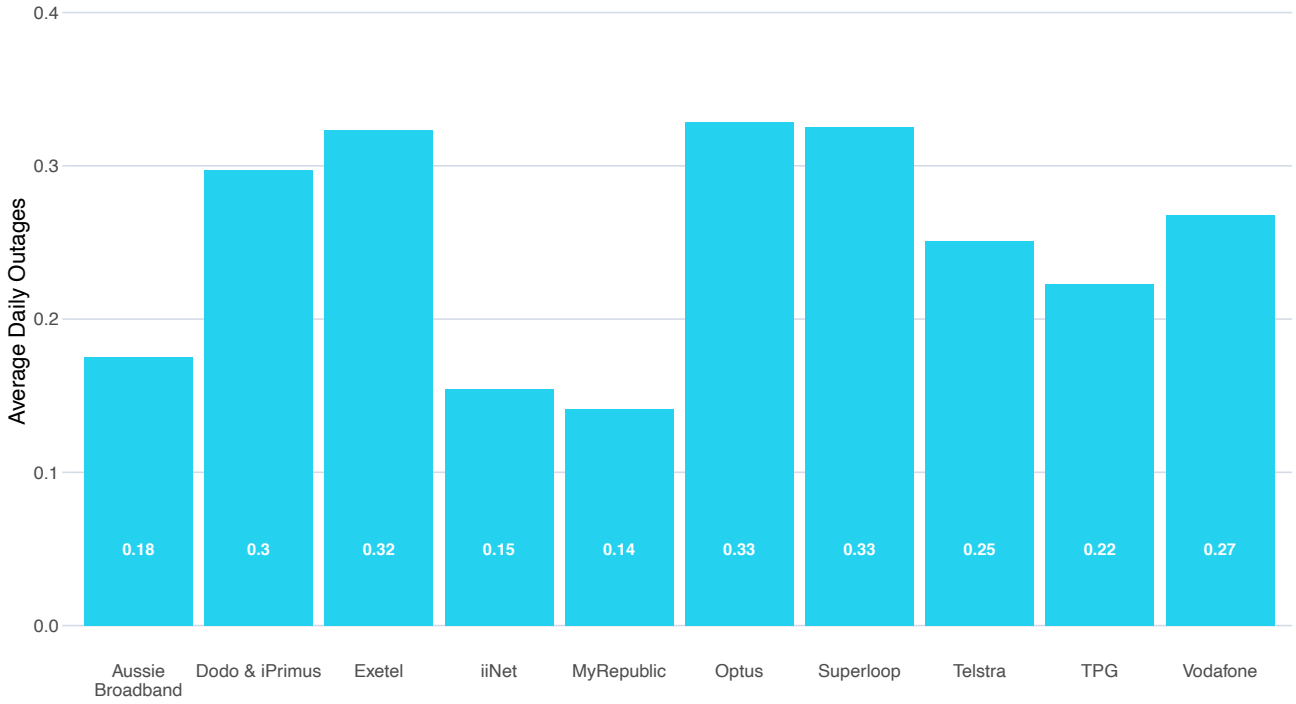
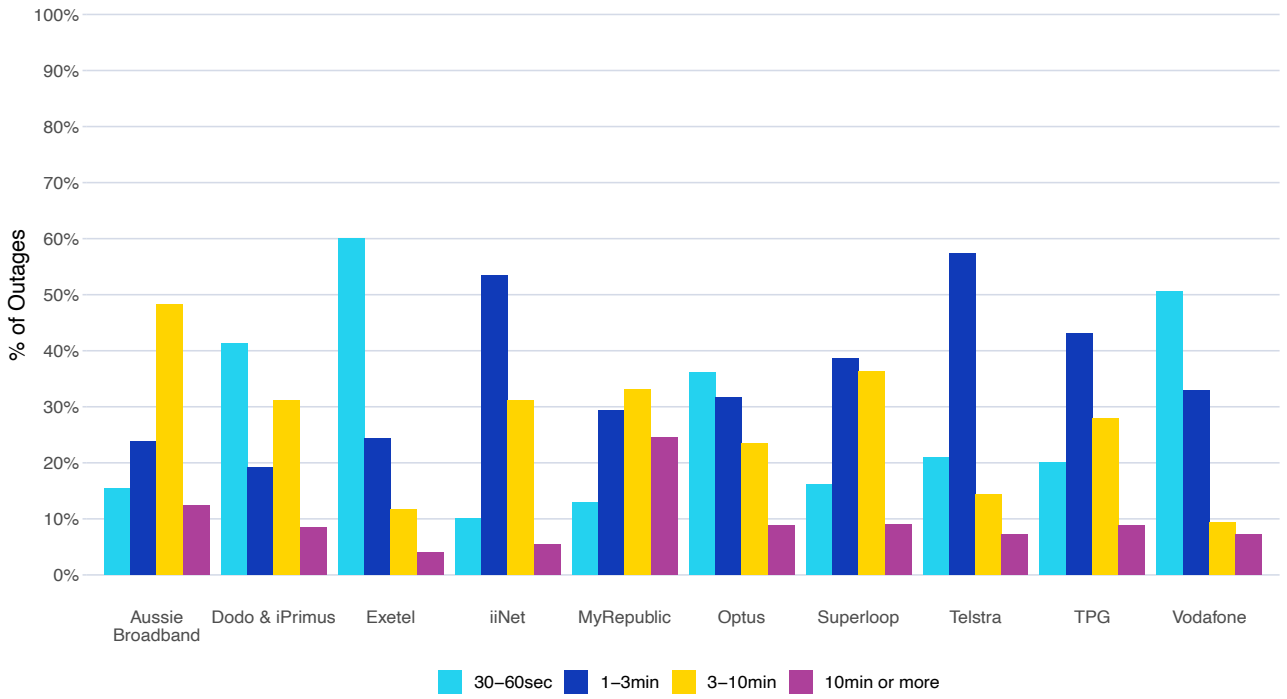


Figure 20: Distribution of outage duration by RSP

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



All RSPs' rates of outages for all hours were relatively low; no higher than the equivalent of one outage every three days. This, combined with the information that the majority of outages last for no more than 3 minutes, means that 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. The measurement period had a total of 28 days with 4 busy hours each, totalling 112 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. We take each RSP's fifth-lowest hourly download performance as an indicator of performance during the busiest hours when networks are under the highest levels of stress.

The chart below considers NBN50 and NBN100 plans and has three columns for each RSP:

- The first column is a weighted average of the predominant typical busy hour speeds advertised for these plans by each RSP during the measurement period, expressed as a percentage of the maximum speed achievable by the plan. The weights used are the numbers of Whiteboxes online on the NBN50 and NBN100 plans. See the 'NBN50 and NBN100 Advertised Speed Tables' section further in the report for full detail.
- The second column shows download performance during busy hours, expressed as a percentage of plan speed.
- The third column shows download performance during the busiest hour (i.e. the fifth-lowest hourly average as explained above), expressed as a percentage of plan speed.

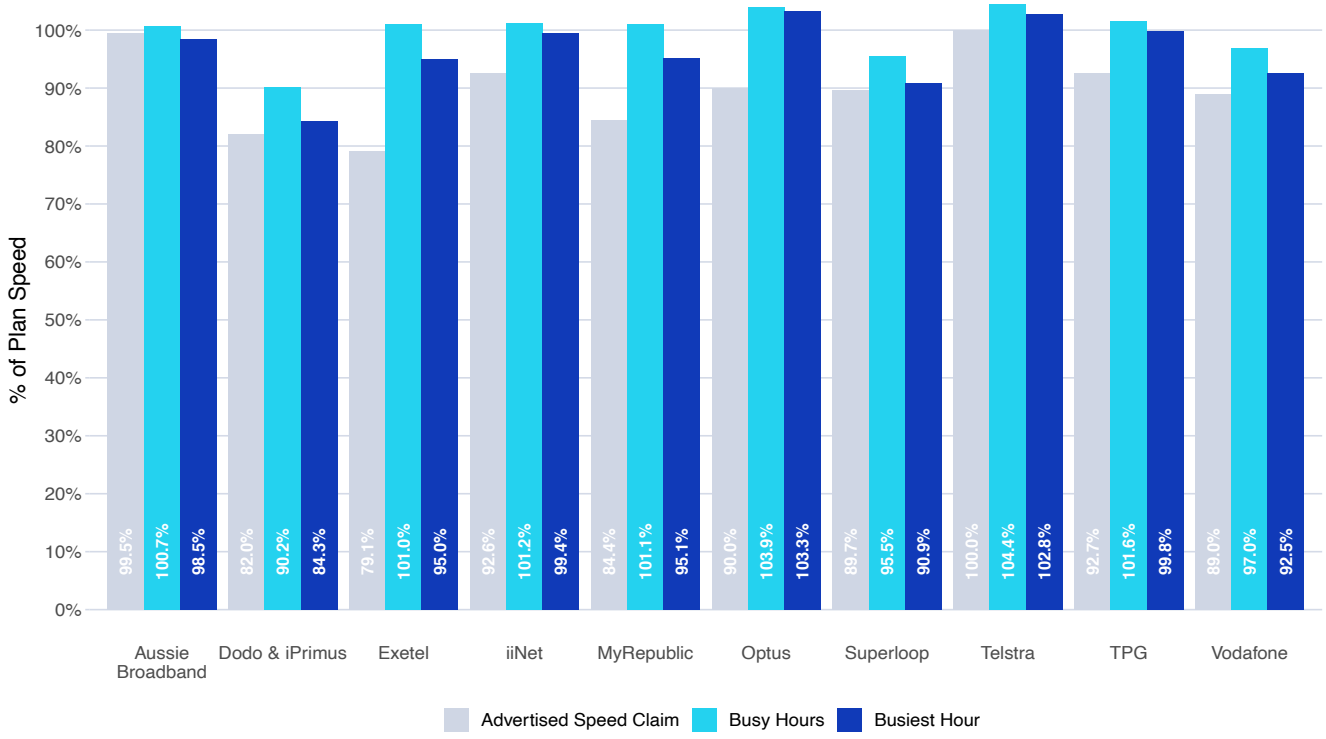
A result in which the busiest hour speed is relatively close to the average busy hour speed indicates that the plan is relatively unaffected by higher demand especially at busy times. Results in which busiest hour speeds are further below the average busy hour speeds indicates that the plan is more affected by particularly high demand peaks.

During the measurement period, RSPs advertised download speeds for their NBN50 and NBN100 products that were between 80% and 100% of the maximum achievable by the products. Exetel advertised the lowest speeds, and Telstra the highest. Telstra advertised a speed of 50Mbps for its NBN50 plan and 100Mbps for its NBN100 plan.

Any services which are underperforming (as defined above), or which have an acknowledged impairment which prevents the plan speed from being delivered, have been excluded.

Figure 21: Advertised speeds and average download speeds by RSP

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

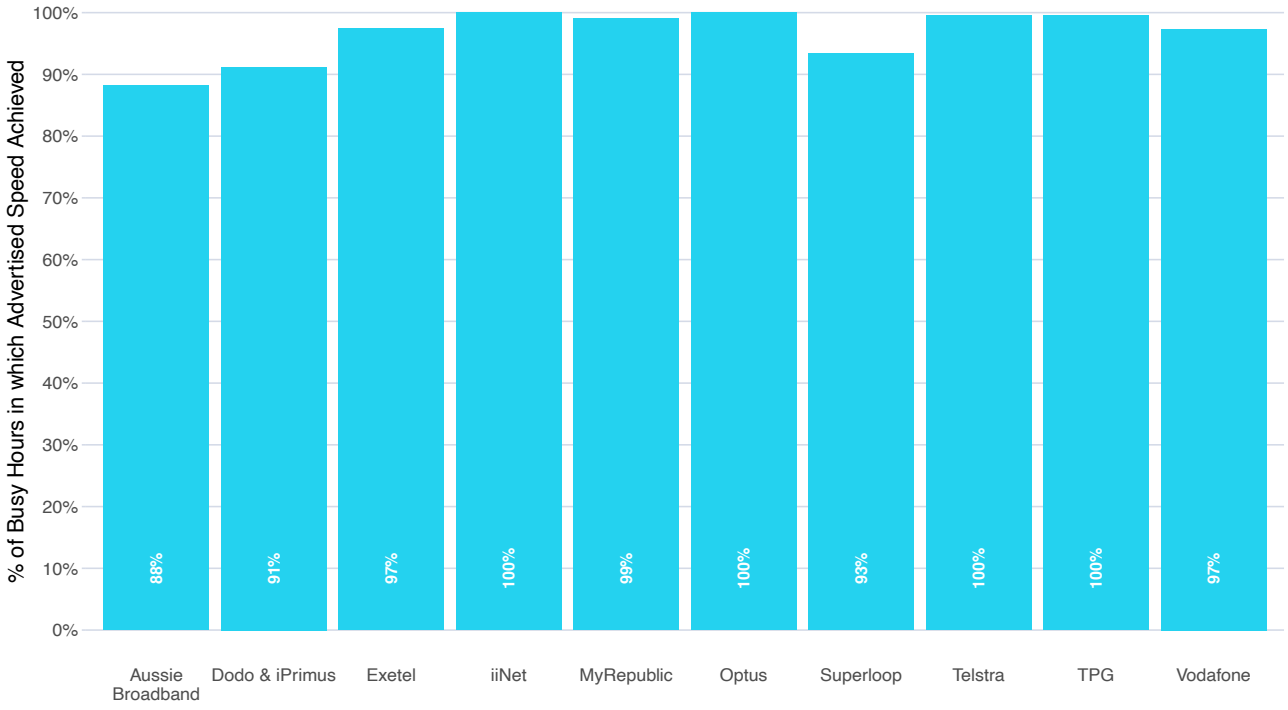


From these results we can see that if all underperforming services and impaired services had been remediated – or moved to a more appropriate plan - then all RSPs bar one would have average speeds that exceeded advertised speed claims during their busiest hour.

The chart below 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: Advertised speeds and average download speeds by RSP

NBN fixed-line plans. 50Mbps and 100Mbps.



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 any tested provider.

NBN very high speed services

This section presents results for NBN fixed-line very high speed services for the same period, February 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 500-990/50Mbps. This section is based on a total of 52 monitored very high speed services, across both fibre to the premises (FTTP) and hybrid fibre-coaxial (HFC) technologies.

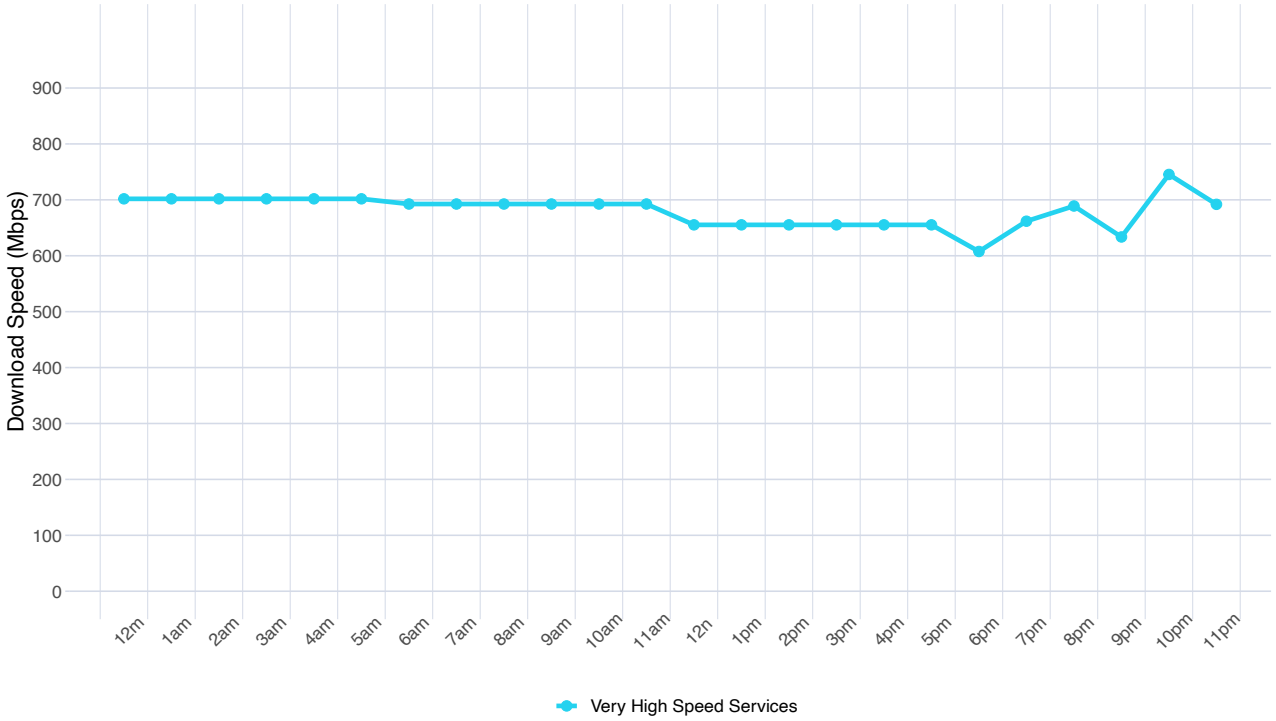
We note that unlike other NBN plans, currently NBN Co does not overprovision on the download component of very high speed services.

This coupled with the fact that the Whitebox connects via gigabit Ethernet to the CPE, means that the end-to-end link is limited to 1Gbps. After network/transport protocol overheads are deducted from this, the fastest speed we expect to observe on these plans is around 940Mbps.

As shown in figure 23, users on NBN very high speed connections attained an average download performance range of between 608 and 745Mbps, with decreases seen during the busy hours (between 7pm and 11pm) which is when networks experience higher user activity.

Figure 23: Average hourly download speed for very high speed services

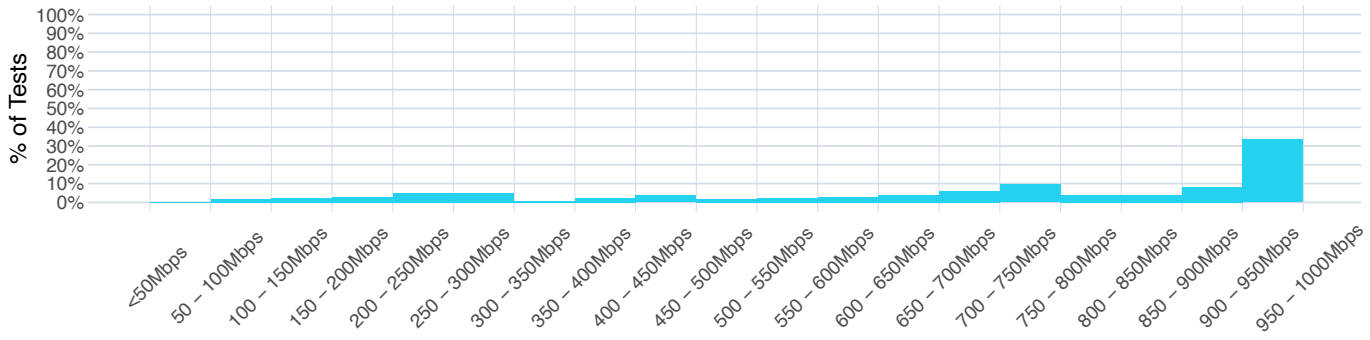
NBN very high speed services.



Average download speeds showed considerable variation throughout the day for very high speed services: speeds typically started to decrease during the evening, dipping to 138Mbps below the day's maximum speed by 6pm, 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 susceptible to congestion during busy periods than lower speed plans.

Figure 24: Frequency of download speeds attained during tests

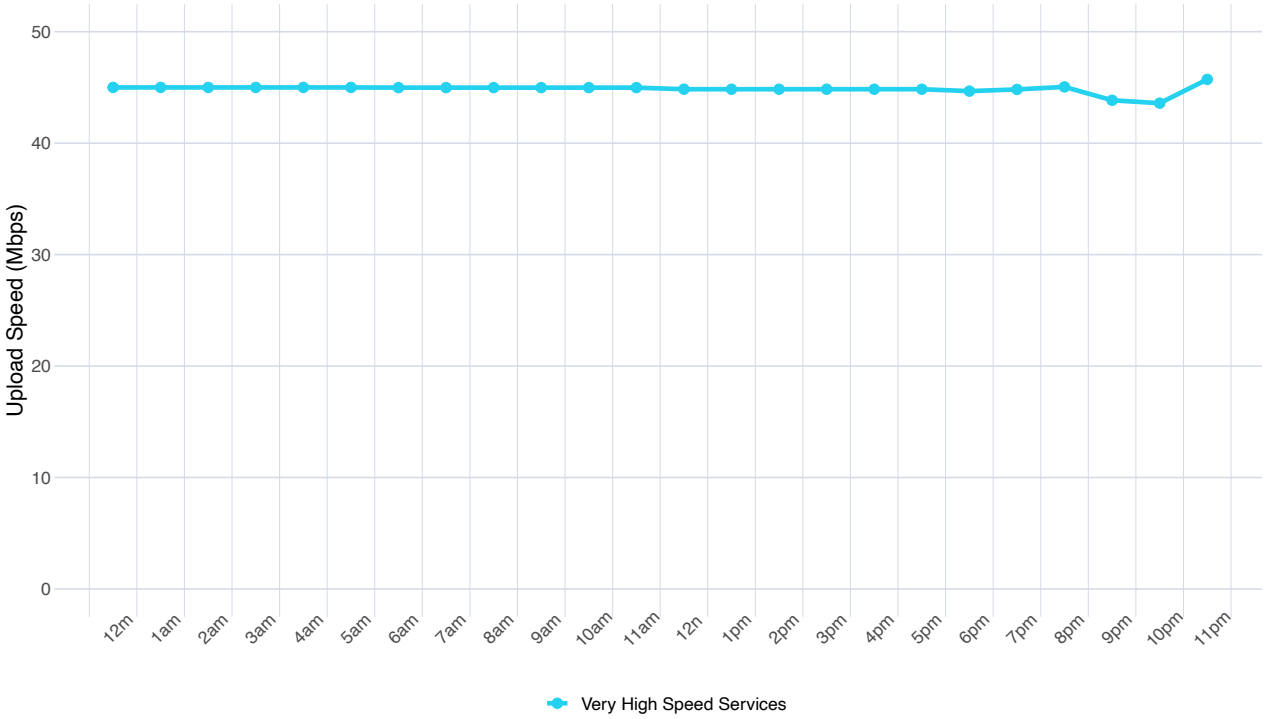
NBN very high speed services. All hours.



6,751 download speed tests were performed across 52 Whiteboxes connected to fixed-line NBN infrastructure during the period. 33.5% of tests conducted achieved a download speed of at least 900Mbps.

Figure 25: Average hourly upload speed for very high speed services

NBN very high speed services.



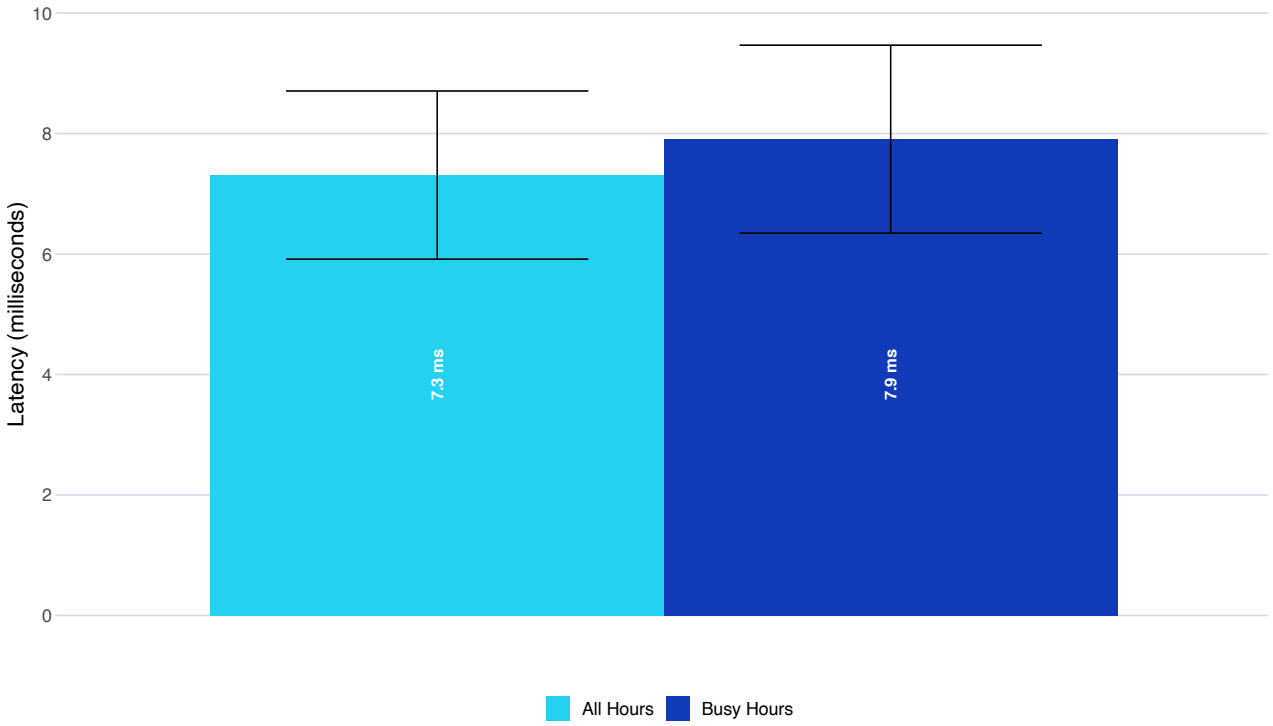
Upload speeds for very high speed services show little variation throughout the day.

Latency, Packet Loss and Outages

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

Figure 26: Average latency for very high speed services

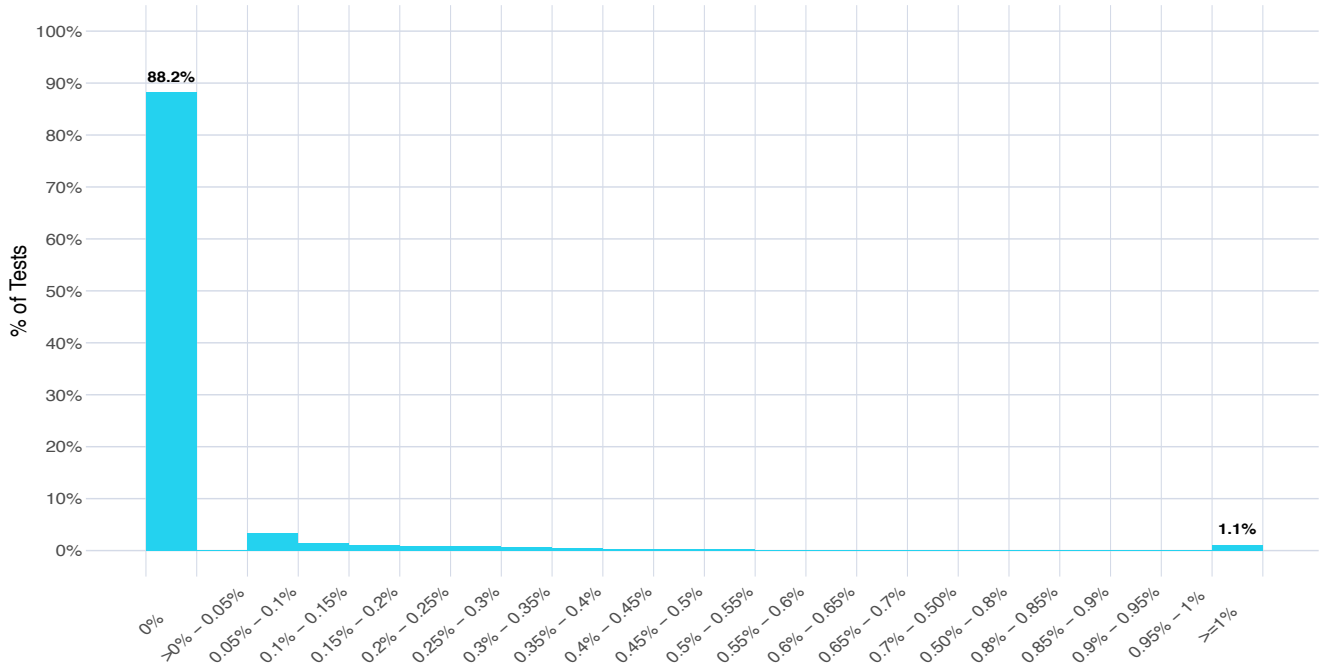
NBN very high speed services. Error bars indicate 95% confidence intervals of the mean.



Average latency for very high speed plans was recorded as 7.3 milliseconds during all hours, rising slightly to 7.9 milliseconds during busy hours.

Figure 27: Frequency of packet loss rates observed during tests

NBN very high speed services. All hours.



For very high speed services, 24,937 packet loss tests were conducted over the measurement period. 88.2% of these tests had packet loss of either zero or less than 0.05%.

At the other end of the scale, 1.1% of tests had packet loss greater than 1%.

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

The following charts show, 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 28: Average daily outages lasting over 30 seconds for very high speed services

NBN very high speed services. All hours.

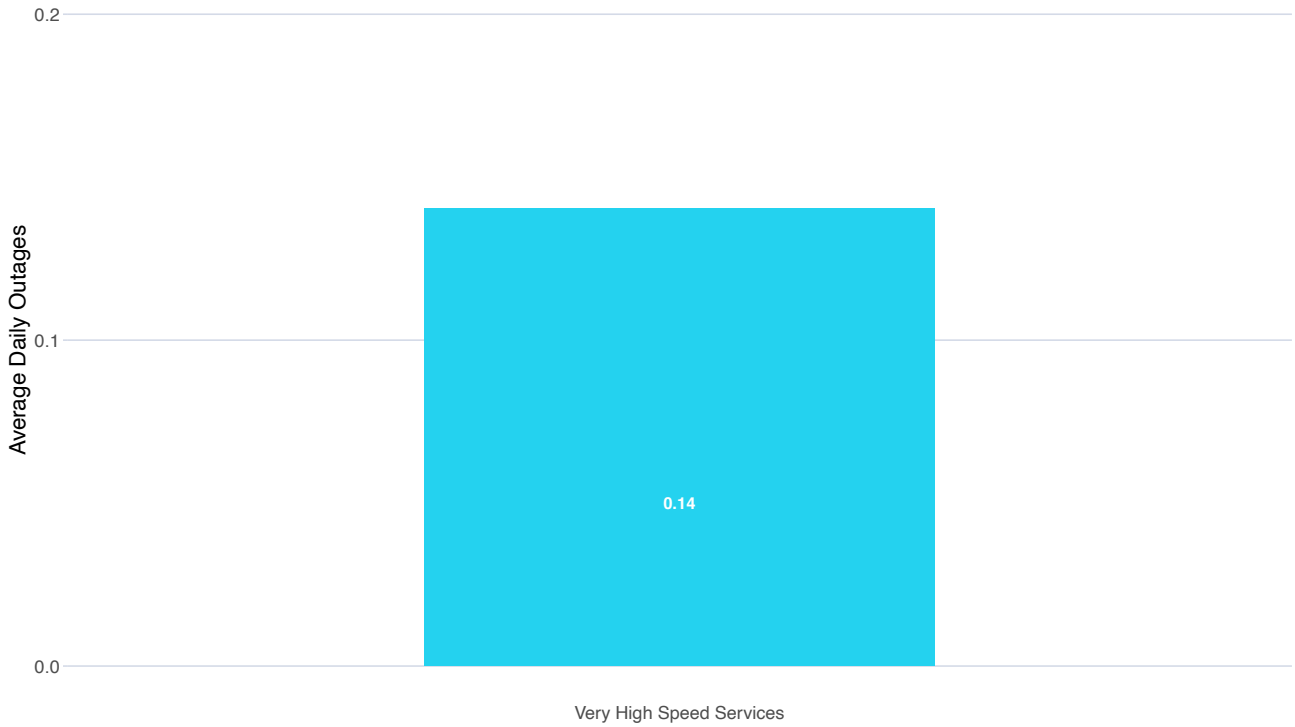
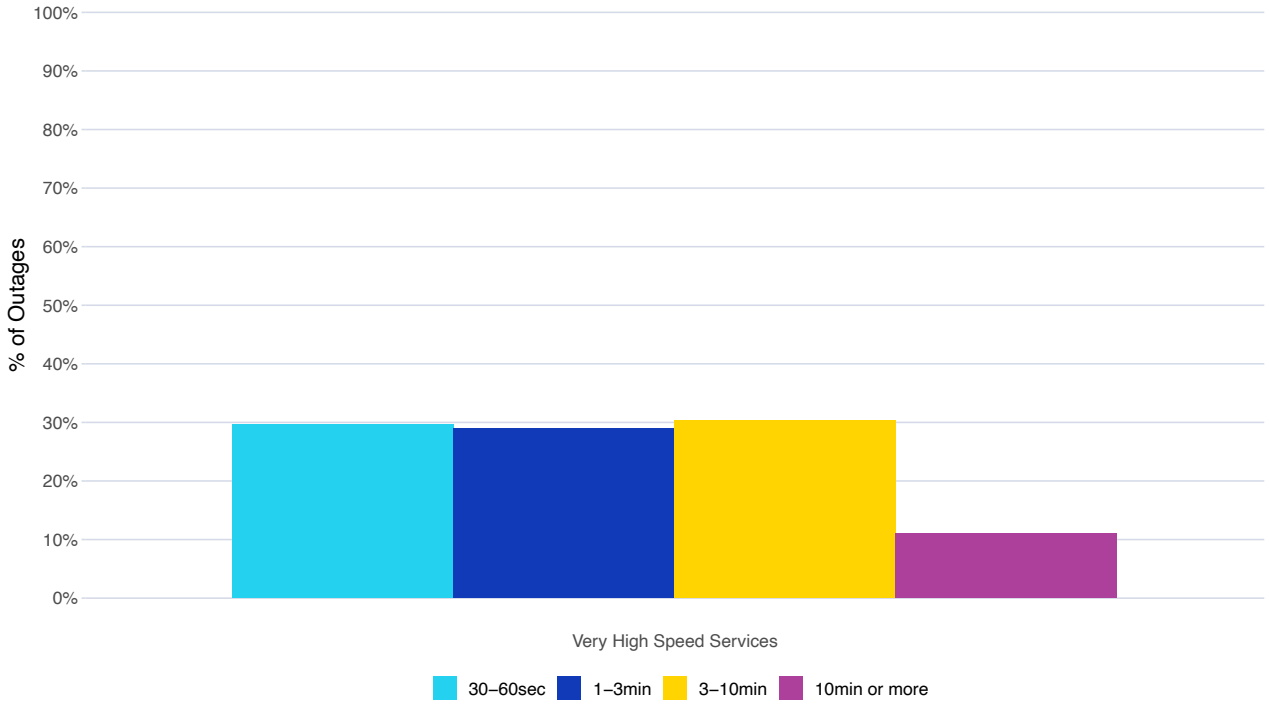


Figure 29: Distribution of outage duration by NBN very high speed services

NBN very high speed services. All hours.



The rate of outages was low and compared favourably to other fixed-line plans, although the very high speed services sample is small.

We note that these results exclude services where we identified that the volunteer was using speed constrained modem/Home Gateway and so are unable to receive the full benefit of their very high speed plans. The ACCC has engaged with RSPs to encourage them to reach out to their consumers who may be using a constrained gateway 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. The NBN fixed-line services tables are found at the end of the report following the subsequent NBN fixed wireless section.

NBN fixed wireless services

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

This is the second fixed wireless section in a quarterly report and is designed to increase transparency for users of alternative technologies to fixed-line.

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 quality of their internet experience.

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

The following sections present a brief summary of metrics for the NBN fixed wireless sample, for the 25/5Mbps and Fixed Wireless Plus plans.

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

Differences between NBN fixed-line and NBN fixed wireless connections

NBN fixed-line connections and NBN fixed wireless connections utilise different technologies that are not directly comparable in terms of performance. A NBN fixed-line connection utilises a physical line running to the household to connect it to the NBN network. 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 network 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 per cent of NBN consumers.

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 limits 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 the busy hours (between 7pm and 11pm).

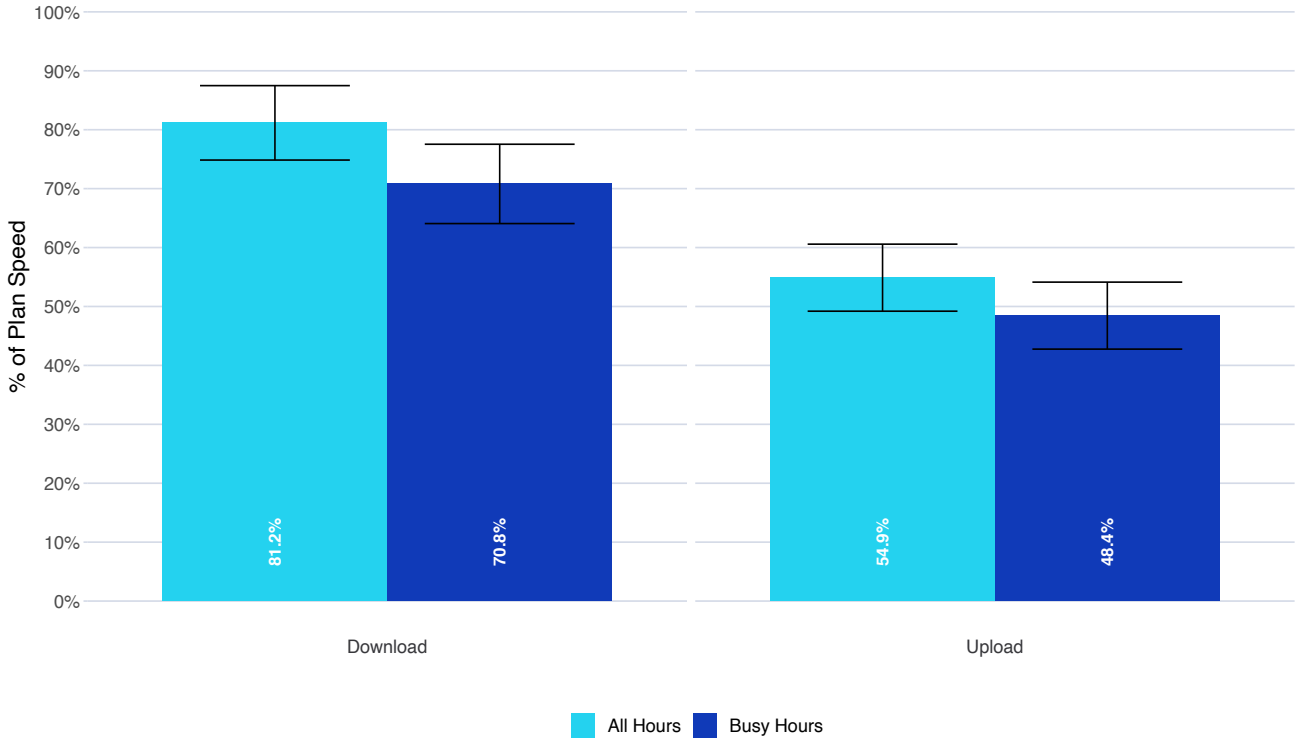
For further information on using NBN fixed wireless, see https://www.accc.gov.au/consumers/internetlandline-services/broadband-speeds/using-nbn-fixed-wireless.

Speed Test Results

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

Figure 30: Average download and upload speeds for fixed wireless

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

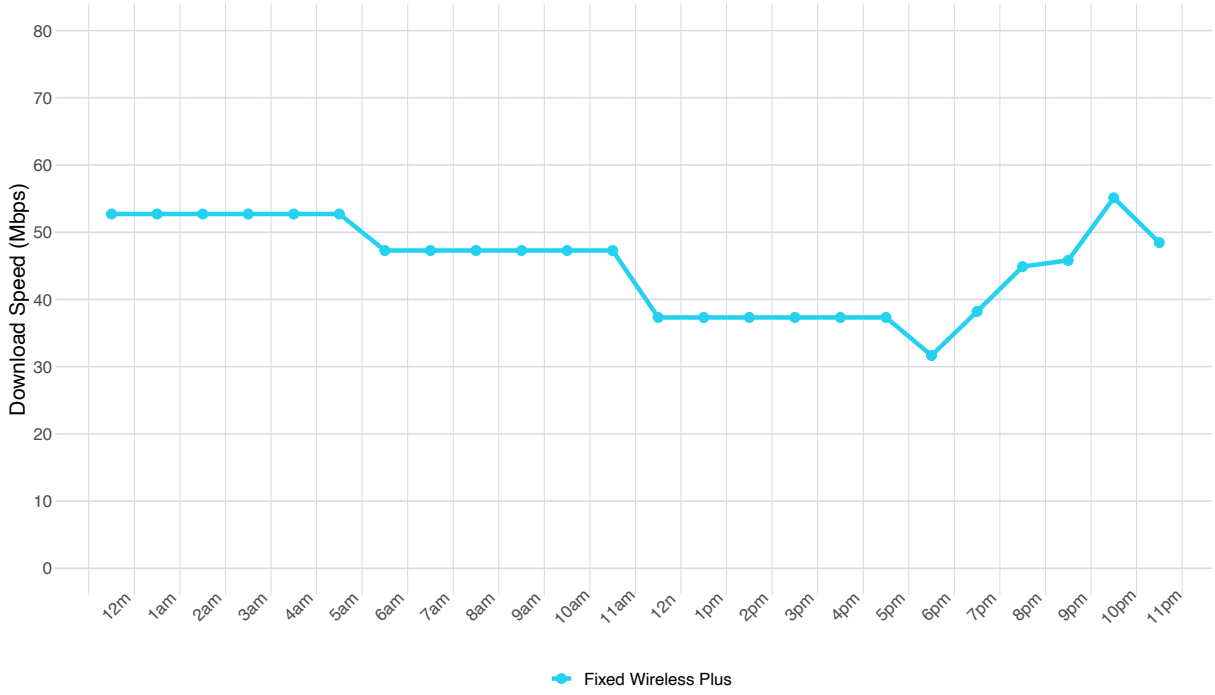


During this period, users on NBN fixed wireless connections attained an average download performance of 81.2% of plan speeds during all hours, decreasing to 70.8% during the busy hours (between 7pm and 11pm) which is when networks experience higher user activity. This is an improvement from our previous report which tested December 2020. In our previous report, average download performance was 78.5% of plan speeds during all hours and 68.4% during the busy hours. Figure 30 is based on a total of 55 NBN fixed wireless services across both the 25/5Mbps and Fixed Wireless Plus plans.

NBN fixed wireless connections attained an average upload performance of 54.9% of plan speeds during all hours, decreasing to 48.4% during the busy hours (between 7pm and 11pm). This is a decrease from our previous report, where average upload performance during all hours was 58.3% and during busy hours it was 52.2%.

Figure 31: Average hourly download speeds for the Fixed Wireless Plus plan

NBN fixed wireless plans.

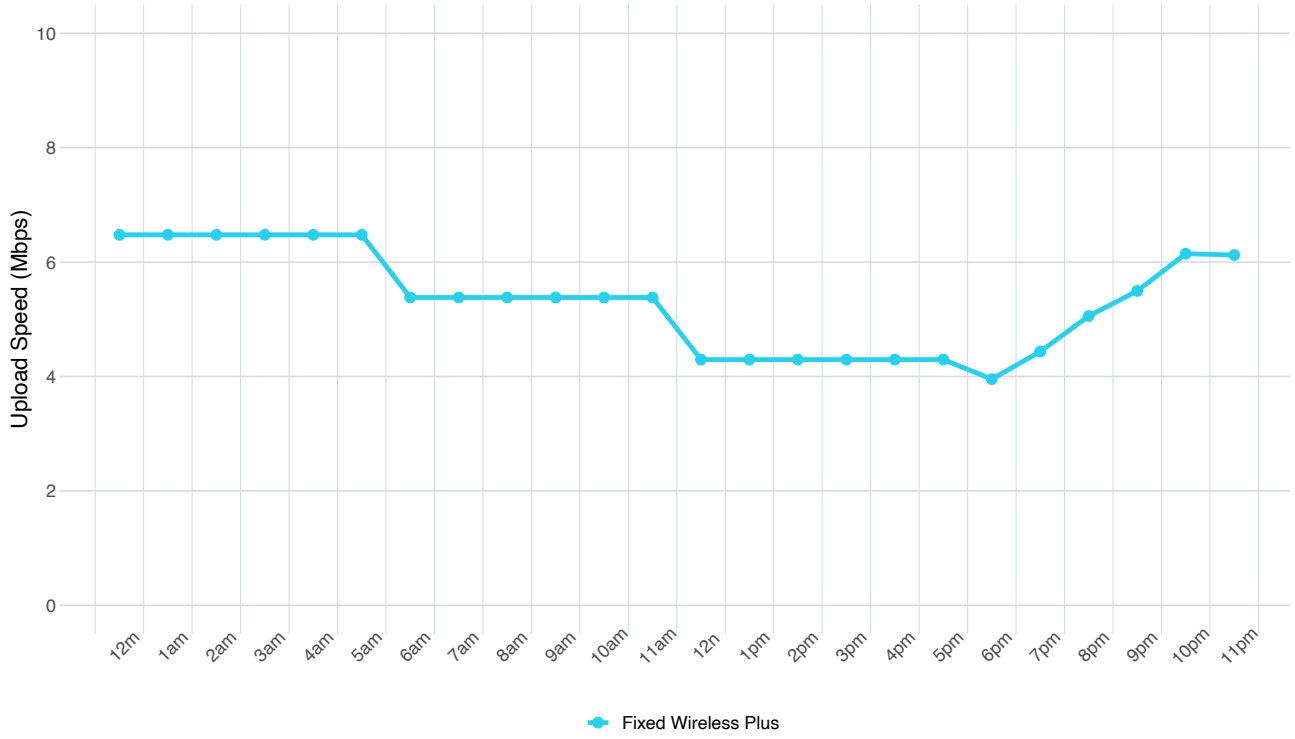


Average download speeds showed considerable variation throughout the day for the Fixed Wireless Plus speed tier: speeds typically started to decrease during the evening, dipping to 23Mbps below the day's maximum speed by 6pm, and recovering to higher levels later at night. While the significant decrease typically occurs during the busy hours (between 7pm and 11pm), there was also a notable decrease from midday, with speeds dipping to 10 Mbps below the day's maximum speed and remaining at that level during the course of the afternoon.

Uploads speeds showed a similar pattern to download speeds and recorded lower values both during the busy hours and during the afternoon. Both download and upload speeds show 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 32: Average hourly upload speeds for the Fixed Wireless Plus plan

NBN fixed wireless plans.



Figures 31 and 32 are based on a total of 42 NBN fixed wireless services on the Fixed Wireless Plus plan.

Time Series of Average Daily Download Speeds

Figures 33 and 34 track the average daily download speeds by plan for fixed wireless units for the period of February 2021 to April 2021. These fixed wireless units comprise both 25Mbps and Fixed Wireless Plus speed plans.

During all hours, performance of the 25Mbps plan is more stable with a daily average download speed around 20Mbps. The Fixed Wireless Plus plan oscillates above 40Mbps average download speed during all hours, with some dips below 40Mbps. During busy hours, performance of both plans is lower and variability in daily performance is slightly higher. In particular, the Fixed Wireless Plus plan oscillates at around 40Mbps during the busy hours for the first half of the period, and drops to be below 40Mbps towards the end of the period. Despite this busy hour speed reduction, this is an improvement compared to the previous monthly report, where Fixed Wireless Plus plans both during all hours and busy hours were generally lower compared with this report.

The results presented here are solely indicative and firm conclusions about the performance of fixed wireless products should not be inferred from these results.

Figure 33: Average daily download by plan

NBN fixed wireless plans. All hours.

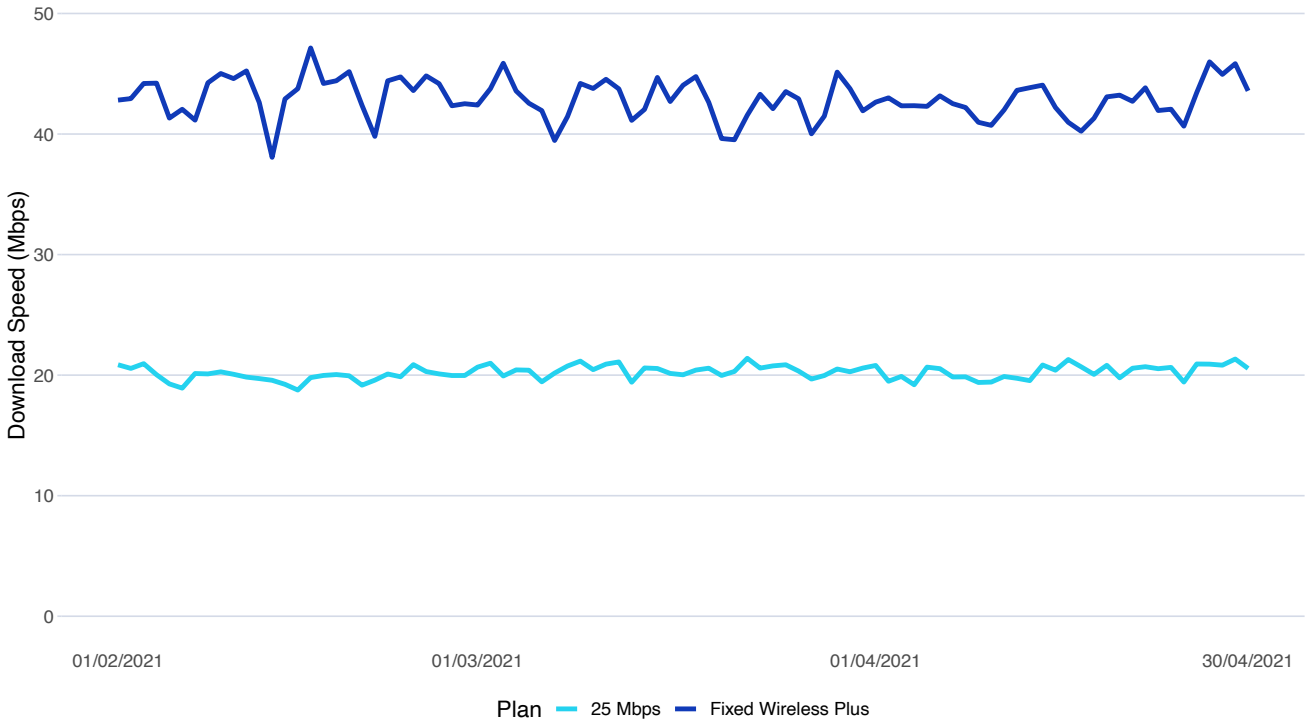
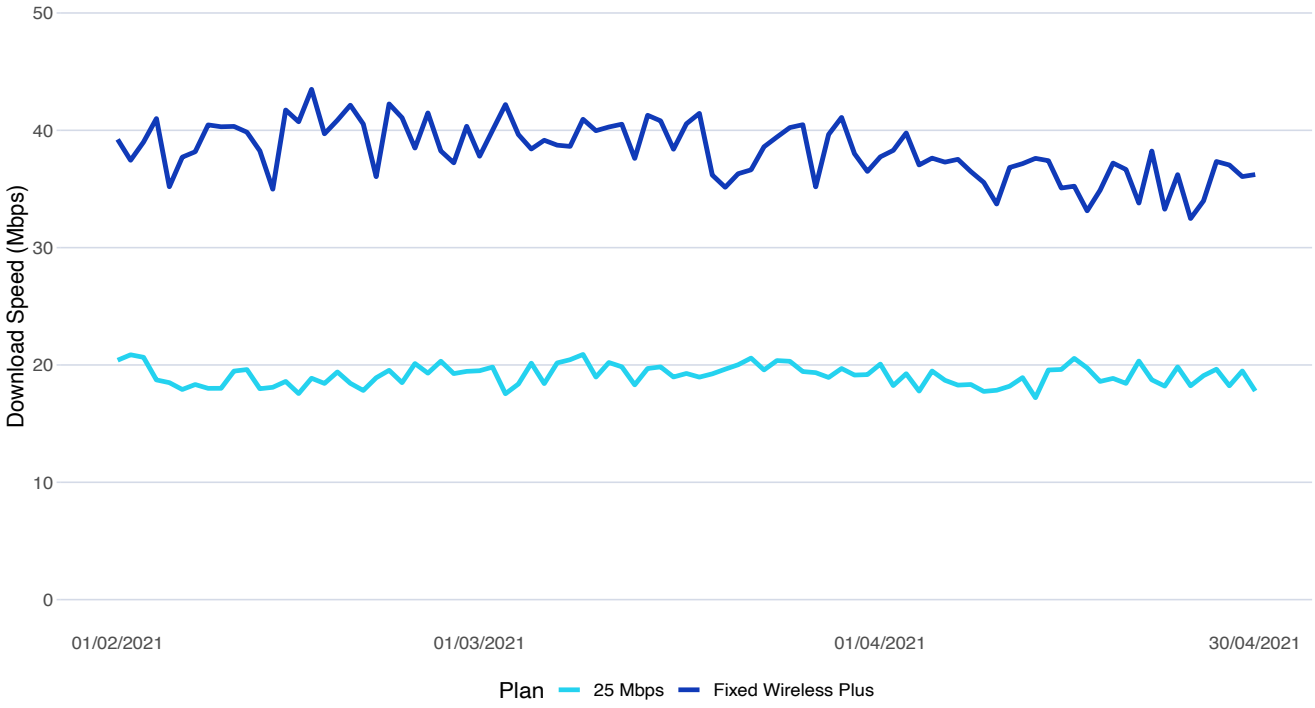


Figure 34: Average daily download speeds by plan

NBN fixed wireless plans. Busy hours.

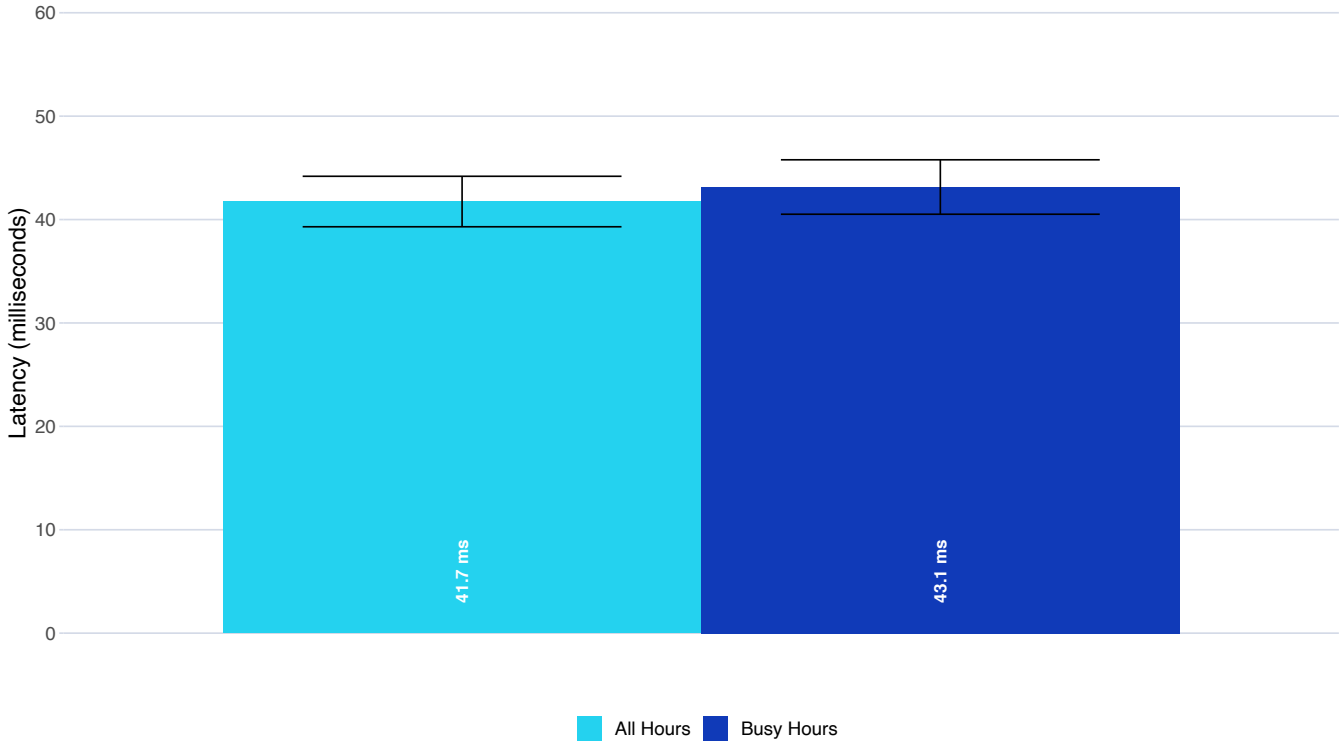


Latency, Packet Loss and Outages

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

Figure 35: Average latency for fixed wireless

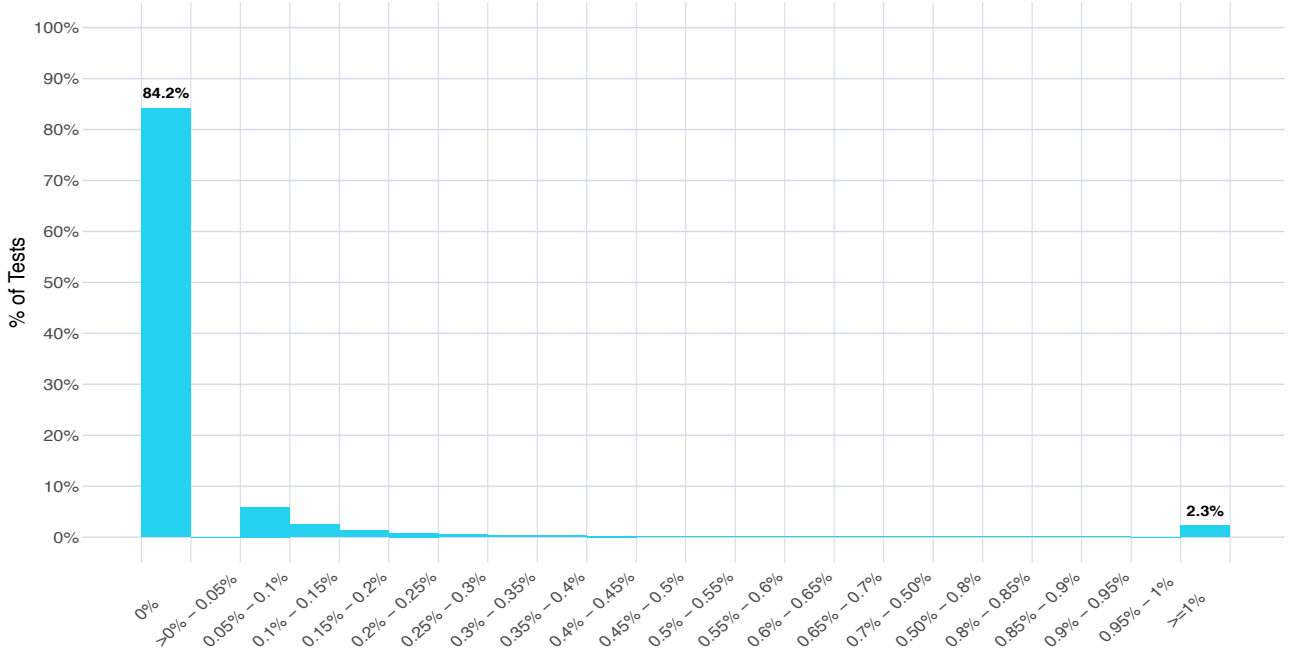
NBN fixed wireless plans. Busy hours. Error bars indicate 95% confidence intervals of the mean.



Average latency for fixed wireless plans was recorded as 41.7 milliseconds during all hours, rising slightly to 43.1 milliseconds during busy hours, broadly in line with the previous report.

Figure 36: Frequency of packet loss rates observed during tests

NBN fixed wireless plans. All hours.



For fixed wireless, 29,703 packet loss tests were conducted over the measurement period. 84.2% of these tests had packet loss of either zero or less than 0.05%.

At the other end of the scale, 2.3% of tests had packet loss greater than 1%. This is an increase since the previous report, where only 0.9% of tests had packet loss greater than 1%. At levels above 1%, packet loss can cause issues which are detrimental to user experience, such as webpages failing to load.

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

The following charts show, 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 37: Average daily outages lasting over 30 seconds for fixed wireless

NBN fixed wireless plans. All hours.

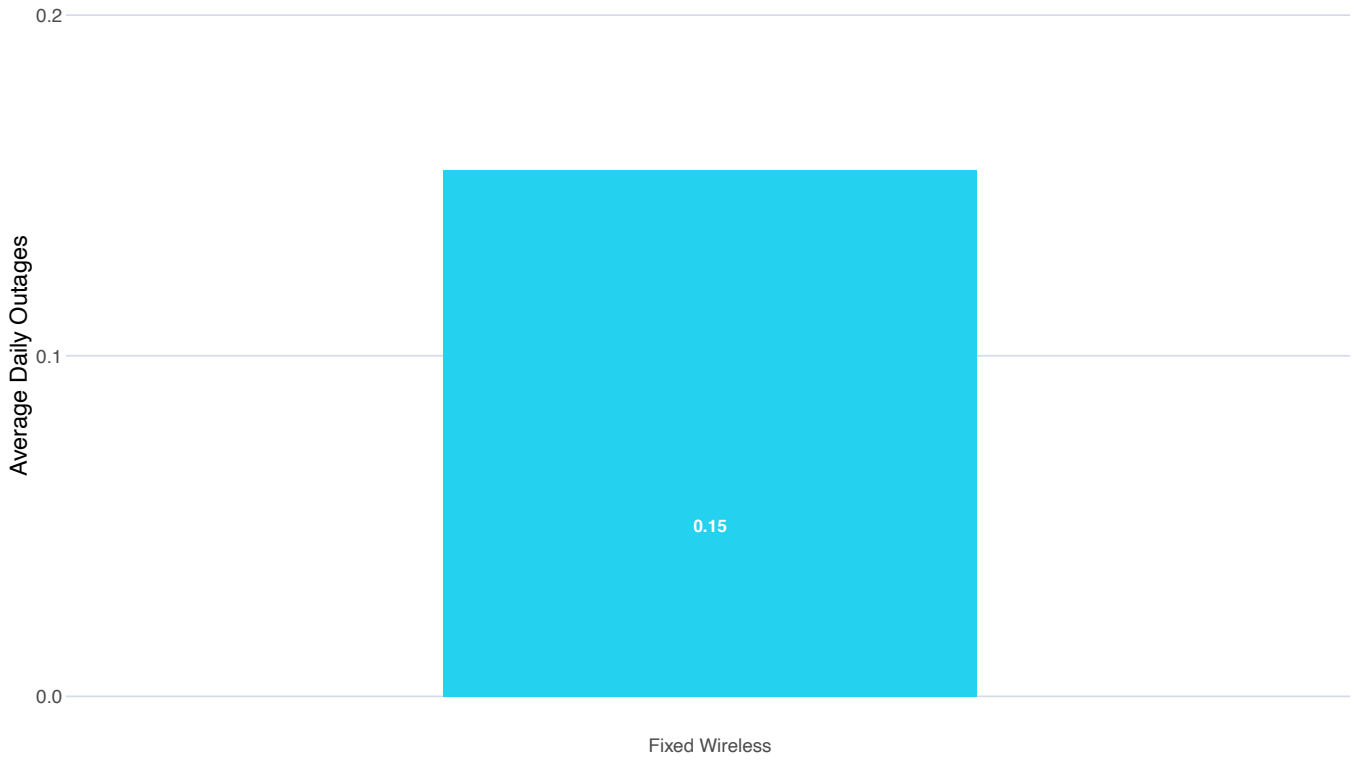
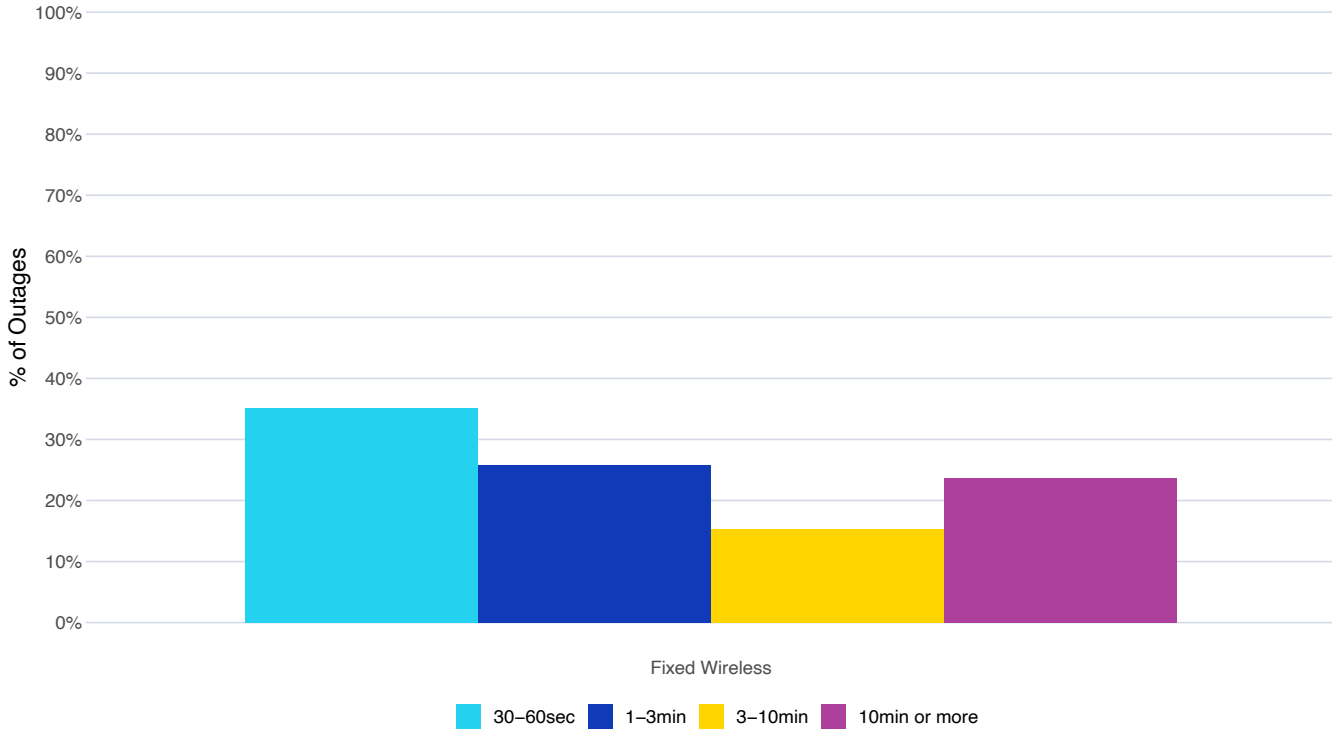


Figure 38: Distribution of outage duration by NBN fixed wireless plan

NBN fixed wireless plans. All hours.



The rate of outages was low and compared favourably even to fixed-line plans. While more outages for fixed wireless are of the longer variety, these charts give no indication user experience is being materially affected.

NBN tables[6]

NBN RSP tables

The following tables show statistical information on download speeds, upload speeds, and outages for each RSP across all NBN speed tiers, and for individual NBN speed tiers in instances where at least 40 Whiteboxes reported successfully during the test period.

- The overall speed is the average speed (download or upload) for the RSP, measured as a percentage of plan speed.
- Standard deviation is a measure of how widely or narrowly test speeds are distributed in the data set.
- The 95% confidence interval is a range in which the 'true' average value is estimated to lie and is a function of the sample size (i.e. number of Whiteboxes online) and standard deviation.

If the standard deviation is larger then the confidence interval will be wider, reflecting greater variability in the underlying data. If the sample size is larger then the confidence interval will be narrower, reflecting more certainty in the underlying data.

For example: during testing, we measured an average download performance of 85.6% of plan speed for Aussie Broadband across all NBN speed tiers with a 95% confidence interval of ±3.3%. If we were to repeat our sampling 100 times, we expect that this average would fall between 82.3% and 88.9% in at least 95 cases.

6 This section includes results from all major NBN fixed-line download speed plans, from NBN12 to NBN250. It excludes results from very high speed services as these are presented separately.

Period	RSP	Download Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Aussie Broadband	96.6%	13.9%	94.6% - 98.6%	182	29,997
All Hours	Dodo & iPrimus	87.7%	11.7%	84.6% - 90.9%	53	9,122
All Hours	Exetel	100.3%	14.4%	97.2% - 103.5%	79	14,207
All Hours	iiNet	95.5%	15.1%	93.1% - 98.0%	144	27,449
All Hours	MyRepublic	96.2%	20.6%	90.8% - 101.6%	56	10,158
All Hours	Optus	100.0%	15.4%	97.4% - 102.5%	137	24,786
All Hours	Telstra	98.3%	17.1%	95.9% - 100.7%	196	37,964
All Hours	TPG	97.5%	16.4%	94.8% - 100.3%	134	21,659
All Hours	Superloop	94.7%	11.7%	91.7% - 97.7%	57	9,409
All Hours	Vodafone	91.7%	20.3%	86.3% - 97.1%	54	8,937

Period	RSP	Download Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Aussie Broadband	96.0%	13.9%	93.9% - 98.0%	181	9,884
Busy Hours	Dodo & iPrimus	86.8%	11.8%	83.6% - 90.0%	52	2,893
Busy Hours	Exetel	98.7%	14.5%	95.5% - 101.9%	79	4,606
Busy Hours	iiNet	94.7%	15.0%	92.2% - 97.1%	144	8,792
Busy Hours	MyRepublic	94.3%	20.6%	88.9% - 99.7%	56	3,111
Busy Hours	Optus	99.1%	15.5%	96.5% - 101.7%	137	7,652
Busy Hours	Telstra	97.6%	17.2%	95.2% - 100.0%	196	11,746
Busy Hours	TPG	96.8%	16.3%	94.0% - 99.5%	134	6,776
Busy Hours	Superloop	92.7%	12.4%	89.4% - 95.9%	57	3,028
Busy Hours	Vodafone	90.9%	20.4%	85.5% - 96.4%	54	2,794

Period	RSP	Upload Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Aussie Broadband	81.9%	18.8%	79.1% - 84.6%	180	29,742
All Hours	Dodo & iPrimus	85.0%	16.0%	80.6% - 89.3%	53	9,131
All Hours	Exetel	89.2%	11.7%	86.6% - 91.8%	79	13,346
All Hours	iiNet	81.6%	20.7%	78.2% - 85.0%	144	27,338
All Hours	MyRepublic	87.0%	19.0%	82.1% - 92.0%	56	10,199
All Hours	Optus	84.1%	17.4%	81.2% - 87.0%	137	24,578
All Hours	Telstra	84.5%	17.6%	82.0% - 87.0%	196	37,768
All Hours	TPG	85.8%	17.3%	82.9% - 88.7%	134	21,571
All Hours	Superloop	84.7%	16.1%	80.5% - 88.8%	57	9,424
All Hours	Vodafone	86.9%	17.2%	82.3% - 91.5%	54	8,916

Period	RSP	Upload Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Aussie Broadband	81.7%	18.8%	78.9% - 84.4%	180	9,820
Busy Hours	Dodo & iPrimus	84.5%	16.2%	80.1% - 88.9%	52	2,884
Busy Hours	Exetel	89.1%	11.6%	86.5% - 91.6%	79	4,291
Busy Hours	iiNet	81.4%	20.7%	78.1% - 84.8%	144	8,742
Busy Hours	MyRepublic	86.5%	18.8%	81.6% - 91.4%	56	3,113
Busy Hours	Optus	82.7%	17.4%	79.8% - 85.6%	137	7,576
Busy Hours	Telstra	84.2%	17.6%	81.7% - 86.7%	196	11,669
Busy Hours	TPG	85.7%	17.2%	82.8% - 88.6%	134	6,709
Busy Hours	Superloop	84.2%	16.1%	80.0% - 88.4%	57	3,040
Busy Hours	Vodafone	86.6%	17.2%	82.0% - 91.2%	54	2,800

Period	RSP	Download Speed Tier	Download Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Aussie Broadband	50	94.3%	16.0%	90.8% - 97.8%	81	14,306
All Hours	Aussie Broadband	100	96.6%	12.8%	93.4% - 99.9%	60	9,438
All Hours	Exetel	50	100.8%	16.1%	96.5% - 105.1%	54	9,990
All Hours	iiNet	50	93.5%	17.0%	89.8% - 97.3%	79	15,874
All Hours	Optus	50	101.0%	15.2%	97.7% - 104.4%	78	14,810
All Hours	Optus	100	97.5%	16.0%	93.3% - 101.8%	54	8,812
All Hours	Telstra	50	97.0%	18.8%	93.5% - 100.5%	112	22,309
All Hours	Telstra	100	97.5%	16.2%	93.4% - 101.5%	61	10,784
All Hours	TPG	50	101.3%	9.4%	98.9% - 103.6%	61	9,619

Period	RSP	Download Speed Tier	Download Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Aussie Broadband	50	93.8%	16.0%	90.3% - 97.3%	81	4,661
Busy Hours	Aussie Broadband	100	96.0%	12.8%	92.8% - 99.3%	60	3,082
Busy Hours	Exetel	50	99.3%	16.2%	95.0% - 103.6%	54	3,265
Busy Hours	iiNet	50	92.9%	16.9%	89.2% - 96.7%	79	4,989
Busy Hours	Optus	50	100.1%	15.5%	96.7% - 103.5%	78	4,544
Busy Hours	Optus	100	96.7%	16.0%	92.4% - 101.0%	54	2,736
Busy Hours	Telstra	50	96.2%	19.0%	92.7% - 99.7%	112	6,845
Busy Hours	Telstra	100	96.9%	16.1%	92.8% - 100.9%	61	3,409

Busy Hours	TPG	50	100.3%	9.6%	97.9% - 102.7%	61	2,987

Period	RSP	Upload Speed Tier	Upload Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Aussie Broadband	20	80.0%	20.4%	76.3% - 83.7%	117	20,232
All Hours	Exetel	20	87.6%	13.7%	84.0% - 91.3%	54	9,500
All Hours	iiNet	20	76.8%	23.7%	71.6% - 82.0%	80	16,030
All Hours	Optus	20	82.7%	20.1%	78.4% - 87.0%	83	15,490
All Hours	Optus	40	87.0%	10.9%	84.0% - 90.1%	49	7,934
All Hours	Telstra	20	82.4%	20.0%	78.9% - 86.0%	122	24,169
All Hours	Telstra	40	86.4%	14.0%	82.6% - 90.3%	51	8,723
All Hours	TPG	20	83.3%	19.8%	78.6% - 88.1%	66	10,255

Period	RSP	Upload Speed Tier	Upload Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Aussie Broadband	20	80.0%	20.3%	76.3% - 83.7%	117	6,539
Busy Hours	Exetel	20	87.5%	13.6%	83.9% - 91.2%	54	3,067
Busy Hours	iiNet	20	76.7%	23.6%	71.6% - 81.9%	80	5,015
Busy Hours	Optus	20	81.7%	19.9%	77.4% - 86.0%	83	4,730
Busy Hours	Optus	40	85.0%	11.7%	81.8% - 88.3%	49	2,476
Busy Hours	Telstra	20	82.2%	20.0%	78.6% - 85.7%	122	7,387
Busy Hours	Telstra	40	86.0%	14.0%	82.2% - 89.9%	51	2,776
Busy Hours	TPG	20	83.3%	19.7%	78.5% - 88.0%	66	3,153

RSP	Average Daily Outages Lasting Longer than 30 Seconds	Standard Deviation	95% Confidence Interval of the Mean	Panel Size
Aussie Broadband	0.18	0.44	0.111 - 0.24	180
Dodo & iPrimus	0.30	0.58	0.142 - 0.45	53
Exetel	0.32	1.07	0.086 - 0.56	79
iiNet	0.15	0.56	0.063 - 0.25	143
MyRepublic	0.14	0.23	0.080 - 0.20	55
Optus	0.33	0.80	0.195 - 0.46	137
Telstra	0.25	1.55	0.035 - 0.47	196
TPG	0.22	0.77	0.092 - 0.35	134
Superloop	0.33	0.88	0.098 - 0.55	58
Vodafone	0.27	0.97	0.009 - 0.53	54

RSP	Percentage of Outages Lasting 30-60sec	Percentage of Outages Lasting 1-3min	Percentage of Outages Lasting 3-10min	Percentage of Outages Lasting 10min or more
Aussie Broadband	15.4%	23.9%	48.3%	12.4%
Dodo & iPrimus	41.2%	19.2%	31.1%	8.4%
Exetel	60.1%	24.4%	11.6%	4.0%
iiNet	10.1%	53.4%	31.1%	5.4%
MyRepublic	13.0%	29.3%	33.2%	24.5%
Optus	36.1%	31.6%	23.4%	8.9%
Superloop	16.1%	38.6%	36.3%	9.1%
Telstra	21.0%	57.4%	14.3%	7.2%
TPG	20.1%	43.1%	28.0%	8.9%
Vodafone	50.5%	32.9%	9.3%	7.3%

NBN speed tier tables

The following tables show statistical information on download and upload speeds for each NBN speed tier, including all tested RSPs.

- The overall speed is the average speed (download or upload) for the particular NBN speed tier, measured as a percentage of plan speed.
- Standard deviation is a measure of how widely or narrowly test speeds are distributed in the data set.
- The 95% confidence interval is a range in which the 'true' average value is estimated to lie.

For example: during testing, we measured an average download performance of 95.0% of plan speed for users subscribed to 100Mbps NBN fixed-line plans with a 95% confidence interval of ±1.6%. If we were to repeat our sampling 100 times, we expect that this average would fall between 93.4% and 96.6% in at least 95 cases.

For the 12Mbps tier, the sample size is considered low and results are indicative only.

The dataset used for this report includes data from 17 services on 250Mbps NBN speed tier. These services are implicitly included in the overall, by-RSP, and by-technology results, but the sample size is too low for us to report on results for 250Mbps tiers separately.

Period	Download Speed Tier	Download Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	12	102.4%	3.6%	100.7% - 104.0%	19	4,017
All Hours	25	102.7%	9.0%	100.9% - 104.5%	96	18,293
All Hours	50	96.3%	17.0%	94.9% - 97.7%	583	107,787
All Hours	100	94.7%	15.9%	93.1% - 96.3%	368	60,175

Period	Download Speed Tier	Download Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	12	101.5%	4.1%	99.6% - 103.4%	18	1,294
Busy Hours	25	102.0%	9.2%	100.1% - 103.8%	95	5,745
Busy Hours	50	95.4%	17.2%	94.0% - 96.8%	583	33,957
Busy Hours	100	93.6%	15.9%	92.0% - 95.3%	368	19,198

Period	Upload Speed Tier	Upload Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	1	98.0%	8.5%	94.2% - 101.9%	19	4,020
All Hours	5	90.6%	7.9%	88.7% - 92.4%	70	14,040
All Hours	20	82.1%	20.1%	80.6% - 83.7%	673	122,055
All Hours	40	87.6%	12.0%	86.2% - 89.0%	285	45,320

Period	Upload Speed Tier	Upload Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	1	97.9%	9.2%	93.7% - 102.2%	18	1,285
Busy Hours	5	90.3%	8.2%	88.3% - 92.2%	70	4,337
Busy Hours	20	81.9%	20.0%	80.4% - 83.4%	673	38,289
Busy Hours	40	86.9%	12.3%	85.5% - 88.3%	285	14,578

NBN technology tables

The following tables show statistical information on download speeds, upload speeds, and outages on a per-technology basis.

- The overall speed is the average speed (download or upload) for the technology type, measured as a percentage of the plan speed for each subscriber.
- Standard deviation is a measure of how widely or narrowly test speeds are distributed

in the data set.

- The 95% confidence interval is a range in which the 'true' average value is estimated to lie.

For example: during testing, we measured an average download performance of 92.6% of plan speed for fibre to the premises NBN fixed-line connections with a 95% confidence interval of ±0.4%. If we were to repeat our sampling 100 times, we expect that this average would fall between 92.2% and 93.1% (rounded to 1 decimal place) in at least 95 cases.

Period	Technology	Download Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Fibre to the premises - FTTP	102.9%	7.8%	101.9% - 103.8%	245	43,120
All Hours	Fibre to the curb - FTTC	99.1%	11.4%	96.9% - 101.4%	99	16,803
All Hours	Hybrid fibre-coaxial - HFC	101.6%	11.8%	100.0% - 103.1%	226	38,215
All Hours	Fibre to the node - FTTN	91.5%	18.7%	90.0% - 93.1%	547	100,030

Period	Technology	Download Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Fibre to the premises - FTTP	101.6%	8.8%	100.5% - 102.7%	245	13,593
Busy Hours	Fibre to the curb - FTTC	98.4%	11.6%	96.1% - 100.7%	99	5,193
Busy Hours	Hybrid fibre-coaxial - HFC	100.4%	12.2%	98.8% - 102.0%	226	12,251
Busy Hours	Fibre to the node - FTTN	90.7%	18.8%	89.1% - 92.3%	545	31,709

Period	Technology	Upload Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Fibre to the premises - FTTP	91.3%	8.8%	90.2% - 92.4%	244	42,481
All Hours	Fibre to the curb - FTTC	91.7%	3.8%	91.0% - 92.4%	99	16,586
All Hours	Hybrid fibre-coaxial - HFC	89.9%	8.6%	88.8% - 91.0%	226	37,928
All Hours	Fibre to the node - FTTN	78.0%	22.1%	76.1% - 79.8%	546	99,472

Period	Technology	Upload Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Fibre to the premises - FTTP	91.0%	9.0%	89.9% - 92.1%	244	13,371
Busy Hours	Fibre to the curb - FTTC	91.4%	3.8%	90.7% - 92.2%	99	5,132
Busy Hours	Hybrid fibre-coaxial - HFC	89.1%	9.1%	87.9% - 90.3%	226	12,152
Busy Hours	Fibre to the node - FTTN	77.7%	22.0%	75.8% - 79.5%	545	31,448

Technology	Average Daily Outages Lasting Longer than 30 Seconds	Standard Deviation	95% Confidence Interval of the Mean	Panel Size
Fibre to the premises - FTTP	0.12	0.43	0.069 - 0.18	244
Fibre to the curb - FTTC	0.47	1.52	0.171 - 0.77	99
Hybrid fibre-coaxial - HFC	0.33	1.41	0.146 - 0.51	228
Fibre to the node - FTTN	0.21	0.60	0.161 - 0.26	544

Technology	Percentage of Outages Lasting 30-60sec	Percentage of Outages Lasting 1-3min	Percentage of Outages Lasting 3-10min	Percentage of Outages Lasting 10min or more
Fibre to the curb - FTTC	59.4%	23.0%	14.1%	3.4%
Fibre to the node - FTTN	24.3%	29.1%	37.1%	9.5%
Fibre to the premises - FTTP	36.8%	38.7%	13.6%	10.9%
Hybrid fibre-coaxial - HFC	16.9%	56.6%	17.3%	9.2%

NBN state tables

This table shows statistical information on download speeds on a per-state basis. In this report, we have been able to draw upon all of the test results from a range of locations.

- The overall speed is the average speed (download or upload) for the state, measured as a percentage of the plan speed for each panellist.
- Standard deviation is a measure of how widely or narrowly test speeds are distributed in the data set.
- The 95% confidence interval is a range in which the 'true' average value is estimated to lie.

For example: during testing, we measured an average download performance of 93.2% of plan speed for NBN fixed-line services in QLD, with a 95% confidence interval of ±2.8%. If we were to repeat our sampling 100 times, we expect that this average would fall between 90.4% and 95.9% (rounded to 1 decimal place) in at least 95 cases.

Period	State/Territory	Download Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	NSW	98.0%	15.8%	96.4% - 99.7%	357	64,591
All Hours	ACT	93.4%	18.1%	88.6% - 98.1%	56	9,344
All Hours	VIC	97.0%	14.6%	95.4% - 98.7%	305	53,104
All Hours	QLD	95.1%	17.6%	92.6% - 97.6%	191	33,775
All Hours	WA	95.7%	15.8%	92.5% - 98.9%	96	17,748
All Hours	TAS	95.1%	17.1%	90.0% - 100.2%	43	7,602
All Hours	NT + SA	98.2%	13.5%	95.0% - 101.4%	69	12,004

NBN50 and NBN100 Advertised Speed Tables

The figures in the following table are based on the typical evening hour speeds that were the predominant speed advertised by RSPs during the measurement period. The single weighted average speed claim is calculated based on the number of Whiteboxes online for each RSP for each tier (excluding underperforming and impaired services).

RSP	NBN50 Advertised % of Plan Speed	NBN100 Advertised % of Plan Speed	Number of NBN100 Whiteboxes (excluding underperforming and impaired services	Number of NBN50 Whiteboxes (excluding underperforming and impaired services	Weighted Advertised % of Plan Speed
Aussie Broadband	100.0%	99.0%	52	58	99.5%
Dodo & iPrimus	82.0%	82.0%	12	26	82.0%
Exetel	80.0%	77.0%	20	50	79.1%
iiNet	96.0%	85.0%	25	55	92.6%
MyRepublic	86.0%	83.0%	25	22	84.4%
Optus	90.0%	90.0%	45	67	90.0%
Superloop	88.8%	90.0%	32	13	89.7%
Telstra	100.0%	100.0%	38	86	100.0%
TPG	96.0%	85.0%	24	55	92.7%
Vodafone	92.0%	85.0%	18	24	89.0%

Telstra's advertised speed claim of 100Mbps for its NBN100 plan does not apply to fibre to the node or fibre to the curb services, and so these technologies are excluded from Telstra's counts.

There were 112 busy hours across the 28 day period from 1st February 2021 to 28th February 2021. The following table shows the proportion of busy hours in which each RSP's average speed for each tier met the advertised claims above.

RSP	% of busy hours in which advertised download speed met or exceeded	% of busy hours in which advertised download speed met or exceeded (excluding underperforming and impaired services)
Aussie Broadband	6%	88%
Dodo & iPrimus	85%	91%
Exetel	97%	97%
iiNet	60%	100%
MyRepublic	88%	99%
Optus	99%	100%
Superloop	84%	93%
Telstra	52%	100%
TPG	79%	100%
Vodafone	67%	97%

NBN Whiteboxes connected to underperforming services

The following table shows the number of Whiteboxes on NBN connections for each RSP, alongside the number of Whiteboxes connected to underperforming services.

RSP	NBN Whiteboxes	NBN Whiteboxes on underperforming services	% NBN Whiteboxes on underperforming services
Aussie Broadband	182	15	8%
Dodo & iPrimus	53	5	9%
Exetel	79	3	4%
iiNet	144	16	11%
MyRepublic	56	5	9%
Optus	137	9	7%
Other RSPs	25	0	0%
Superloop	57	2	4%
Telstra	196	19	10%
TPG	134	10	7%
Vodafone	54	6	11%
Total	1117	90	8%

As highlighted earlier in the report, the majority of underperforming services are connected to fibre to the node infrastructure. The following table shows the number of Whiteboxes on fibre to the node services for each speed tier, alongside the number of underperforming services.

Technology	Speed Tier	NBN Whiteboxes	NBN Whiteboxes on underperforming services	% NBN Whiteboxes on underperforming services
Fibre to the node - FTTN	100	110	25	23%
Fibre to the node - FTTN	12	10	0	0%
Fibre to the node - FTTN	25	66	0	0%
Fibre to the node - FTTN	50	355	55	15%
Fibre to the node - FTTN	Other NBN Speed plan_ download_speeds	6	1	17%
Fibre to the node - FTTN	All NBN Speed Tiers	547	81	15%

NBN Very High Speed Services

The figures in the following table are based on very high speed services, where the underlying wholesale product sold by NBN Co has a download/upload speed range of 500-990/50Mbps.

Period	Speed tier	Download Average Mbps (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Very High Speed	670Mbps	236.9Mbps	605.7Mbps - 734.5Mbps	52	6,751

Period	Speed tier	Download Average Mbps (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Very High Speed	640Mbps	228.6Mbps	577.8Mbps - 702.1Mbps	52	2,091

Period	Speed tier	Upload Average Mbps (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Very High Speed	44.9Mbps	4.5Mbps	43.7Mbps - 46.2Mbps	52	6,752

Period	Speed tier	Upload Average Mbps (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Very High Speed	44.7Mbps	4.5Mbps	43.5Mbps – 46Mbps	52	2,075

Speed tier	Average Daily Outages Lasting Longer than 30 Seconds	Standard Deviation	95% Confidence Interval of the Mean	Panel Size
Very High Speed	0.14	0.26	0.07 - 0.21	52

Speed tier	Percentage of Outages Lasting 30-60sec	Percentage of Outages Lasting 1-3min	Percentage of Outages Lasting 3-10min	Percentage of Outages Lasting 10min or more
Very High Speed	29.7%	29.0%	30.3%	11.0%

NBN fixed wireless services tables

The figures in the following table are based on both the 25/5Mbps fixed wireless plan and the Fixed Wireless Plus plan.

Period	Technology	Download Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Fixed Wireless	81.2%	22.8%	74.9% - 87.5%	50	8,266

Period	Technology	Download Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Fixed Wireless	70.8%	24.3%	64.1% - 77.5%	50	2,656

Period	Technology	Upload Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Fixed Wireless	54.9%	20.5%	49.2% - 60.6%	50	8,223

Period	Technology	Upload Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Fixed Wireless	48.4%	20.5%	42.8% - 54.1%	50	2,627

Technology	Average Daily Outages Lasting Longer than 30 Seconds	Standard Deviation	95% Confidence Interval of the Mean	Panel Size
Fixed Wireless	0.15	0.39	0.05 - 0.26	50

Technology	Percentage of Outages Lasting 30-60sec	Percentage of Outages Lasting 1-3min	Percentage of Outages Lasting 3-10min	Percentage of Outages Lasting 10min or more
Fixed Wireless	35.2%	25.8%	15.4%	23.6%