ACCC

AUSTRALIAN COMPETITION
& CONSUMER COMMISSION

# Mobile Infrastructure Report 2021

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Australian Competition and Consumer Commission
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# Contents

# 1. About this report

## 1.1 Introduction

The Mobile Infrastructure Report 2021 provides analysis on the change in the mobile network operators' (MNOs) mobile infrastructure and coverage from 2018 to 2021, based on information collected from the MNOs under the *Audit of Telecommunications Infrastructure Assets – Record Keeping Rules* (Infrastructure RKR).

The ACCC has collected relevant Infrastructure RKR data from the MNOs – Singtel Optus Pty Limited (Optus), Telstra Corporation Limited (Telstra) and TPG Telecom Limited (TPG) – for the period from 2018 to 2021. We have disclosed this data pursuant to section 152BUA(2) of the *Competition and Consumer Act 2010*. The disclosed Infrastructure RKR data includes detailed information on the mobile sites operated by each of the MNOs as well as historical coverage maps as at 31 January for each year from 2018 to 2021.

The datasets are available at data.gov.au at the following address: https://data.gov.au/dataset/ds-dga-4b472a18-d0fa-409c-994a-ab17162bcb90/details?q=ACCC.

For each year from 2018 to 2021, the data made available includes:

- an excel spreadsheet containing a full list of the MNO's active mobile sites, with unique identification number, the location of the site, the type of technology and associated spectrum deployed at each site, whether the site is co-funded under a government co-contribution program and if so which one[1]
- coverage maps by technology (3G, 4G, 5G) and, in some instances, also by frequency bands.[2]

In addition, the ACCC has also derived and published key statistics from the relevant data. These are contained in an Excel spreadsheet titled 'Mobile Infrastructure Report 2021 – output tables' and is available on the ACCC's website at: https://www.accc.gov.au/regulated-infrastructure/communications/mobile-services/regional-mobile-issues/mobile-infrastructure-report-2021.

The key statistics derived include:

- the total number and the change in the number of mobile sites that an MNO operates for 3G, 4G and 5G technologies[3] across each remoteness area as classified by the Australian Bureau of Statistics' (ABS) Australian Statistical Geography Standard (ASGS) Remoteness Structure[4], and across states and territories
- the extent to which the MNOs are co-locating on the sites they operate across each remoteness area and by each states and territory
- the number of new and decommissioned sites and the proportion of new sites that are co-funded under a government co-contribution program
- the number of, and the change in the number of, sites on which each frequency band is deployed for each technology
- percentage change in the land mass covered by each MNO's network as shown by their historical coverage maps for each technology
- 4G geographic coverage areas as a proportion of 3G geographic coverage areas for each MNO's network over time.

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1 Unique identification number (RFNSA ID) and co-funding status only available for 2020 and 2021.

2 MNOs are only required to provide coverage maps by frequency bands from 2020. However, some have chosen to provide maps by frequency bands in previous years whereas others have provided maps by technology type. The ACCC has used the frequency band maps provided by an MNO to construct technology level maps where the latter was not already provided by the MNO.

3 Analysis is limited to 3G, 4G and 5G technologies. 2G sites were switched off by Optus and Telstra before 2018. TPG turned off its 2G sites by 2019. Mobile site information and coverage maps for TPG's 2G network in 2018 is available as part of this reports data disclosure.

4 More information available here: https://www.abs.gov.au/websitedbs/D3310114.nsf/home/remoteness+structure.

The ACCC has consulted very closely with the three MNOs this year to ensure that the data is an accurate reflection of their networks in the relevant years. The ACCC expects that future data disclosures will be available earlier in the year given they will only involve one additional year worth of data.

## 1.2 Regional mobile issues and need for more transparency

This report stems from the ACCC's commitment to use its Infrastructure RKR to provide more transparency and accountability over the MNOs' investment in infrastructure, particularly in regional Australia.

The ACCC released its final report for the Domestic Mobile Roaming Declaration Inquiry 2016 in October 2017. During the inquiry the ACCC heard from consumers in some regional areas about the inadequacy of their mobile services. We are aware that these concerns remain ongoing. In response to these concerns the ACCC released a supplementary paper with its final report. This paper outlined a number of measures to address regional mobile issues that were identified during the inquiry. One of the key measures was greater transparency regarding network quality and coverage information to enable consumers and businesses to make informed decisions and to inform policy makers.

The paper identified the following issues:

- A lack of transparency and consistency regarding network coverage information (including technology and quality) for consumers and businesses. This impacts on their ability to choose a mobile service and service provider that meets their needs.
- Consistent, transparent and publicly available data on mobile networks would benefit regulatory decisions and program effectiveness as well as policy formulation.
- A lack of transparency around future network deployments and investment has a particularly profound effect on consumers and business in regional areas.

Since then, the ACCC amended its Infrastructure RKR on two occasions which required the MNOs to provide more detailed information on its mobile infrastructure and coverage maps.[5]

The ACCC anticipates that the disclosure of the Infrastructure RKR data, together with the ACCC's derived statistics and Mobile Infrastructure Report, could be used to:

- provide more transparency on how the MNOs' mobile infrastructure and coverage have changed over time
- enable more scrutiny of these changes in specific geographic areas
- provide more accountability over investment claims made by the MNOs, particularly in specific geographic areas
- provide useful information on the state of mobile networks for policymakers, particularly when formulating policy responses to mobile coverage issues.

## 1.3 Competitive dynamics in the mobiles market

During the ACCC's public inquiry into whether to declare a mobile roaming service in 2016 and 2017, the ACCC found that geographic coverage and quality of service are key factors of competition between the MNOs. The ACCC also found that the MNOs have ongoing incentives to differentiate themselves on these factors to gain competitive advantage over their rivals. These incentives are likely to drive incremental improvements in mobile coverage over time, particularly in regional areas.

Since the roaming inquiry, the mobile services market has undergone significant changes, especially the merger of Vodafone Hutchison Australia and TPG Telecom in 2020. This means that the market

5 See the ACCC website at: https://www.accc.gov.au/regulated-infrastructure/communications/monitoring-reporting/infrastructure-record-keeping-rules.

structure is now stable with little prospect of a new MNO entrant on a national scale in the foreseeable future. The MNOs continue to compete on a range of factors, such as coverage and network quality. The Infrastructure RKR data shows that in recent years, the MNOs continued to invest in network deployment, although their focus has shifted to the roll out of 5G technology. The data shows that 3G and 4G network deployment has generally slowed.

## 1.4 The economics of regional network deployment

Due to the low returns from building network infrastructure in sparsely populated regional and rural areas, the commercial incentives to roll out network infrastructure in these areas are typically lower than in metropolitan areas. Consequently, co-contribution funding is likely to be a key driver for MNOs when considering expanding mobile coverage. As a result, local, state and federal governments have developed co-contribution programs from time to time to provide subsidies to network operators to roll out infrastructure in these areas.

Co-contribution programs, like the Federal Mobile Black Spot Program (MBSP), provide incentives to invest in areas where there is either inadequate or no mobile coverage. However, the design of these programs often means that governments are generally subsidising individual commercial entities without requiring broader benefits to be shared by consumers. The ACCC considers that setting clear objectives for improving coverage, and promoting competition, for such programs will deliver more benefits for consumers and communities. It remains important that the regulatory settings, while promoting competition, do not undermine incentives to continue investing in mobile infrastructure in regional Australia.

## 1.5 Difficulties in comparing and assessing mobile coverage

While the report and underlying data analysis can accurately depict changes in mobile infrastructure, namely mobile sites, assessment of changes in coverage maps provided by the MNOs has been challenging. This is due to a number of factors:

- The MNOs have provided coverage maps showing different standards of coverage (i.e. outdoor coverage[6] or external antenna coverage[7]) from 2018 to 2021. This is due to the MNOs interpreting the requirements of the RKR differently.
- The coverage maps are based on predicted coverage. We understand the MNOs use different input assumptions when predicting their coverage. This means that the coverage maps, as well as the coverage analysis of those maps, could not be directly compared across the MNOs.
- The MNOs have said that they may change some of the input assumptions for predicting coverage over time. This means that large coverage changes shown by the coverage maps and analysis from year to year may not necessarily reflect an actual increase in coverage but may be a result of a change in an input assumption. Where this is the case, the report has explicitly pointed out the input assumption change to assist in the interpretation of the coverage analysis. This also means that the coverage analysis could only provide a broad indication of the trend in each MNOs' coverage over the relevant period.
- As the coverage analysis is based on predicted coverage, it should not be taken to suggest any changes in 'on the ground' experience.
- Finally, the coverage analysis is based on data submitted as at 31 January of the reporting year. As such, consumers should rely on coverage maps provided on the MNOs' websites to determine whether the predicted coverage meets their needs.

6 Outdoor coverage maps show the predicted mobile coverage that can be accessed outside with a handheld device.

7 External antenna coverage maps show the predicted coverage for a handheld device which has extended coverage through an attached external antenna or through a coverage extension device.

The inconsistency in the standard of coverage is relatively easy to resolve. The ACCC is currently reviewing the Infrastructure RKRs and is proposing to clarify the requirements in reporting coverage maps to ensure that the MNOs provide coverage maps using the same standards.

Ensuring the MNOs' coverage maps are comparable however, requires the MNOs to adopt a set of common input assumptions in predicting their coverage. This is particularly important in the mobiles market, as the MNOs compete on coverage and consumers make purchasing decisions based on coverage.

Coverage information is particularly critical for regional communities. Many regional consumers have a limited choice of networks and need to know if they will have coverage at home, on properties or along regular transit corridors. This is for both connection and for safety purposes. The availability of comparable coverage information will enable consumers, particularly in regional areas, to make informed choices and promote competition in the market. As such, industry should collaborate on the development of a common set of assumptions for predicting coverage. In the absence of industry-led process, it may be necessary for the government and regulators to prescribe these assumptions to address the issue.

Improving public information on mobile coverage is one of the enduring issues regarding regional telecommunications that the Regional Telecommunications Independent Review Committee 2021 has been considering. The ACCC supports the implementation of policy measures that seeks to improve connectivity and service delivery for regional communities.

# 2. Mobile site analysis

A mobile site hosts radio equipment that uses radiofrequency spectrum to provide connectivity to mobile devices. With the use of backhaul, they connect end users to their service provider's core network for voice and data connectivity. A mobile site can exist in various forms, such as an individual mobile tower, buildings or light poles as well as inside buildings.

For the purposes of our analysis, a mobile site is determined as being a physical location where an MNO has deployed active radio equipment on a structure.[8] Proposed sites are not included in this report as the Infrastructure RKR only collects information on sites where active equipment has been deployed. The sum of each MNO's number of mobile sites does not reflect the total number of physical site structures in Australia. This is because an MNO may deploy their equipment on the same physical structure as another MNO. This is known as co-location and is discussed in more detail in section 2.8.

The number of mobile sites an MNO has equipment deployed on provides an indication of the overall scale of their network. MNOs add new sites and remove sites from their network over time. MNOs may also add new equipment compatible with newer mobile technology on new or existing sites. MNOs may remove older, legacy technologies such as 2G and 3G as well. A site can also have several technologies installed on it at once.

For these reasons changes in the number of mobile sites an MNO has in its network is not necessarily indicative of the financial investment it has made on their network. The cost of rolling out a new mobile site could also vary across ABS Remoteness Areas. Adding a new site in a Major City will generally cost less than rolling out a new site in a Remote or Very Remote area.

In addition, due to the low returns from building network infrastructure in sparsely populated regional and rural areas, the commercial incentives to roll out network infrastructure in these areas are typically lower than in metropolitan areas. Consequently, co-contribution funding is likely to be a key driver for MNOs when considering expanding mobile coverage into these areas. As a result, local, state and federal governments have developed co-contribution programs from time to time to provide subsidies to network operators to roll out infrastructure in these areas. Mobile sites that are funded under these programs are considered co-funded sites. Co-funded sites are discussed in more detail in section 2.6.

## 2.1 Total number of sites

As at 31 January 2021, Telstra had largest number of sites (10,766) followed by Optus (8,238) and TPG (5,892) (Table 2.1). Figure 2.1 displays a breakdown of the MNOs' sites by ABS Remoteness Areas in 2021 and shows that in Major Cities, the number of sites each MNO had was relatively comparable in 2021. However, Outside of Major Cities[9], Telstra had significantly more sites than the other MNOs between 2018 and 2021 (Table 2.1). For example, in these areas in 2021, Telstra had 75% more sites than Optus compared with 3% more sites in Major Cities. Compared to TPG, Telstra had 15% more sites in Major Cities but over 300% more sites outside of Major Cities.

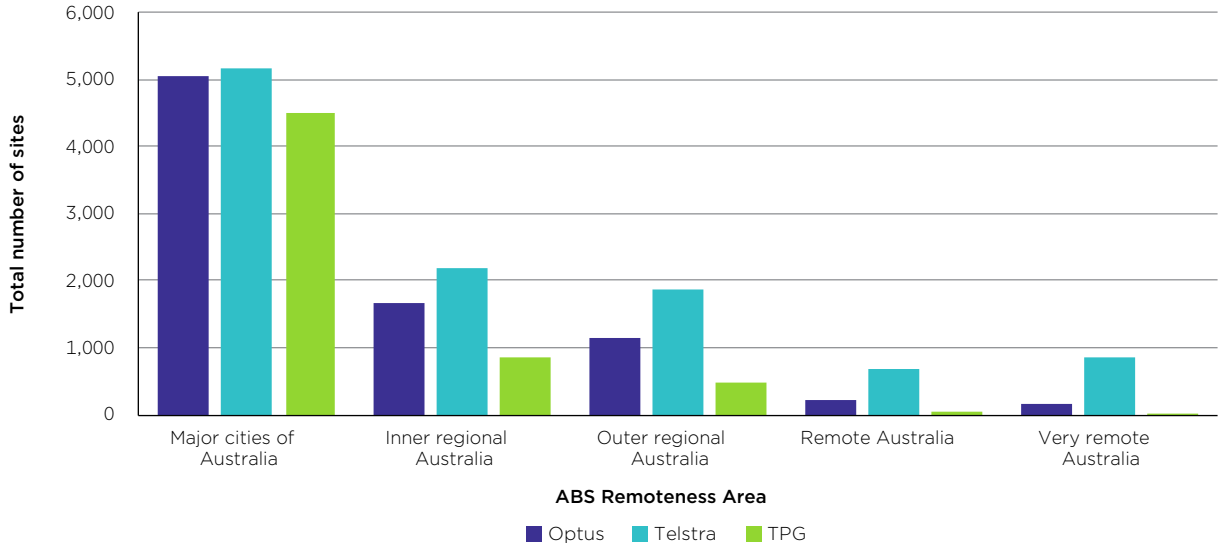
8 An MNOs may deploy equipment on a site that is owned by another party.

9 Outside of Major Cities means the sum of Inner Regional, Outer Regional, Remote and Very Remote Remoteness Areas.

**Table 2.1: Total number of sites by MNO & ABS Remoteness Area – Major Cities of Australia vs Outside Major Cities of Australia – 2018 to 2021**

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| **Major Cities of Australia** | | | | |
| Optus | 4,691 | 4,758 | 4,874 | 5,037 |
| Telstra | 4,737 | 4,801 | 5,060 | 5,165 |
| TPG | 4,207 | 4,268 | 4,306 | 4,503 |
| **Outside Major Cities of Australia** | | | | |
| Optus | 2,644 | 2,954 | 3,106 | 3,201 |
| Telstra | 4,692 | 5,171 | 5,391 | 5,601 |
| TPG | 1,215 | 1,340 | 1,369 | 1,389 |
| **Total** | | | | |
| Optus | 7,335 | 7,712 | 7,980 | 8,238 |
| Telstra | 9,429 | 9,972 | 10,451 | 10,766 |
| TPG | 5,422 | 5,608 | 5,675 | 5,892 |

**Figure 2.1: Total number of sites by MNO & ABS Remoteness Area – 2021**




The ACCC does not currently have information to identify the types of mobile sites that are being deployed by the MNOs (e.g. macro or small cells). The ACCC also could not assess the extent to which the deployment of additional sites has been used to increase the geographic coverage of the networks or to densify the networks.

## 2.2 3G sites

Figure 2.2 below shows that the growth in the number of 3G sites has slowed during the period of 2018 to 2021. There was also a reduction in the total number of 3G sites deployed by TPG from 2020 to 2021. This is not surprising as 3G is near the end of its life cycle and MNOs are focussing on the 4G/5G rollout. Currently, only Telstra has committed to a public timeframe for shutting down 3G (June 2024).

To date, the closure of 3G sites appears to be largely taking place in Major Cities. Telstra and TPG have been reducing their number of 3G sites in Major Cities since 2018 and 2019 respectively (Figure 2.3). However, Optus continues to increase its number of 3G sites in Major Cities.

**Figure 2.2: Change in number of 3G sites by MNO – year-on-year – 2018 to 2021**

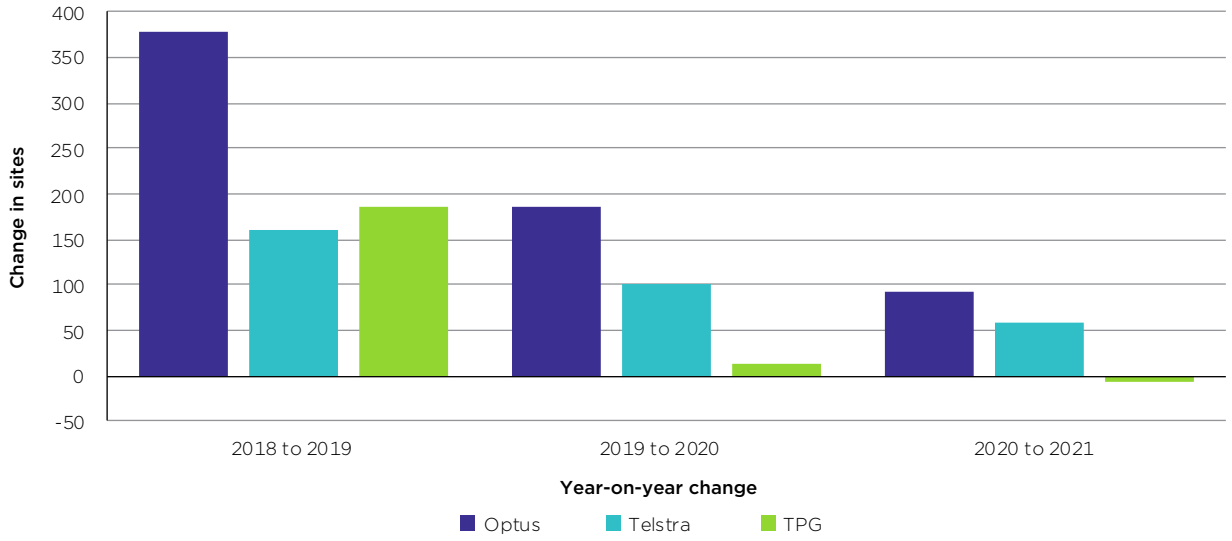
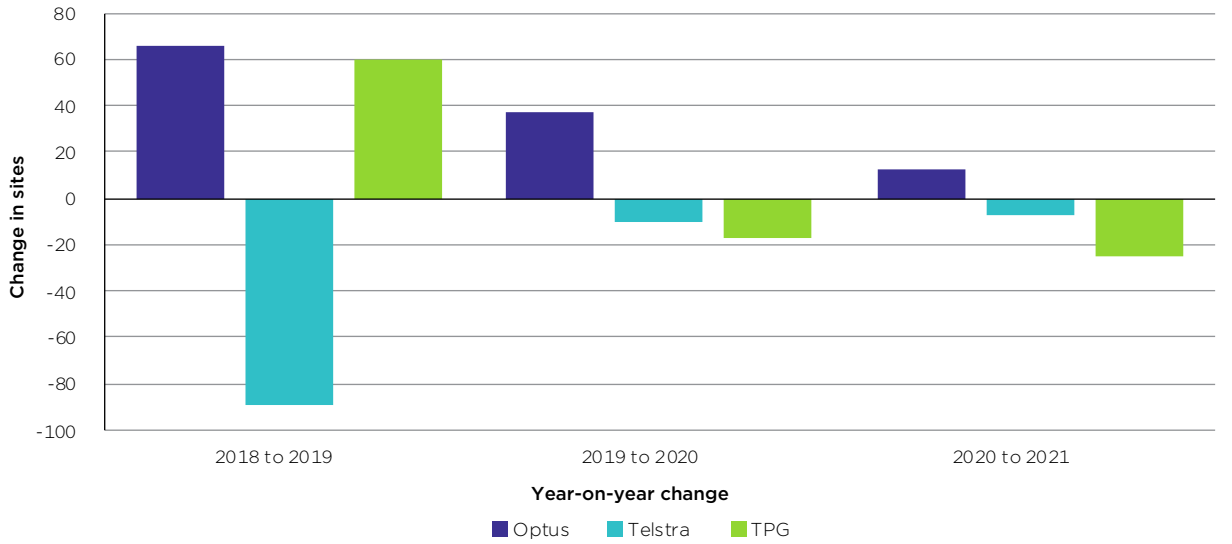
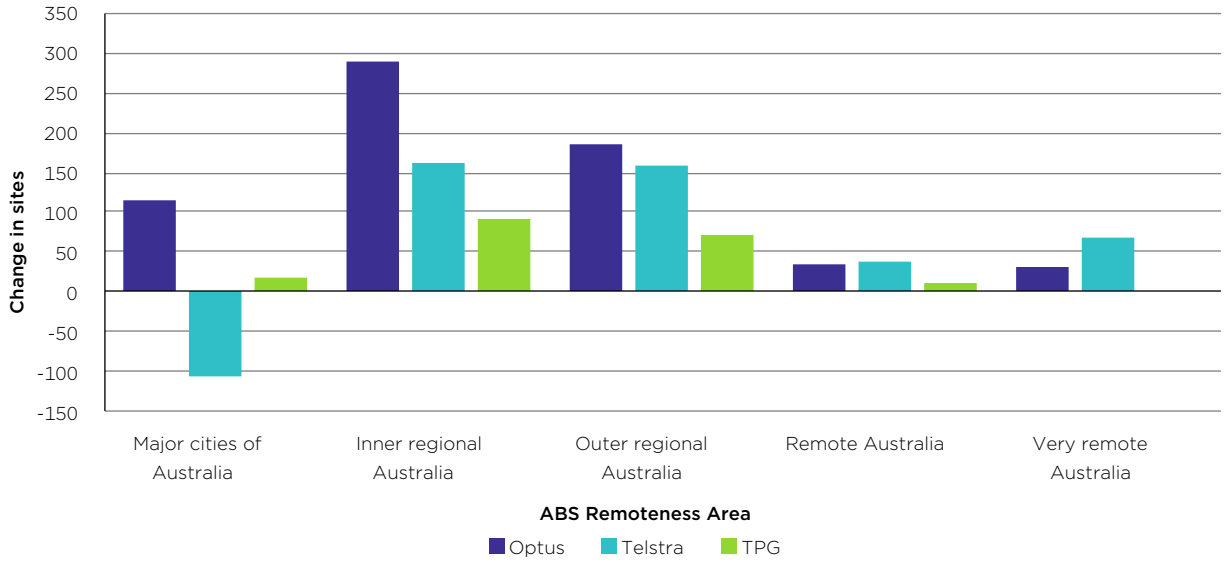



**Figure 2.3: Change in number of 3G sites in Major Cities of Australia by MNO – year-on-year – 2018 to 2021**




Between 2018 and 2021 all three MNOs had a net increase in the number of 3G sites they have deployed outside Major Cities. Telstra's 3G sites in Major Cities was the only area to decline from 2018 levels, decreasing by 106 sites between 31 January 2018 and 31 January 2021 (Figure 2.4). However, as discussed below, Telstra has increased its 4G and 5G sites in Major Cities.

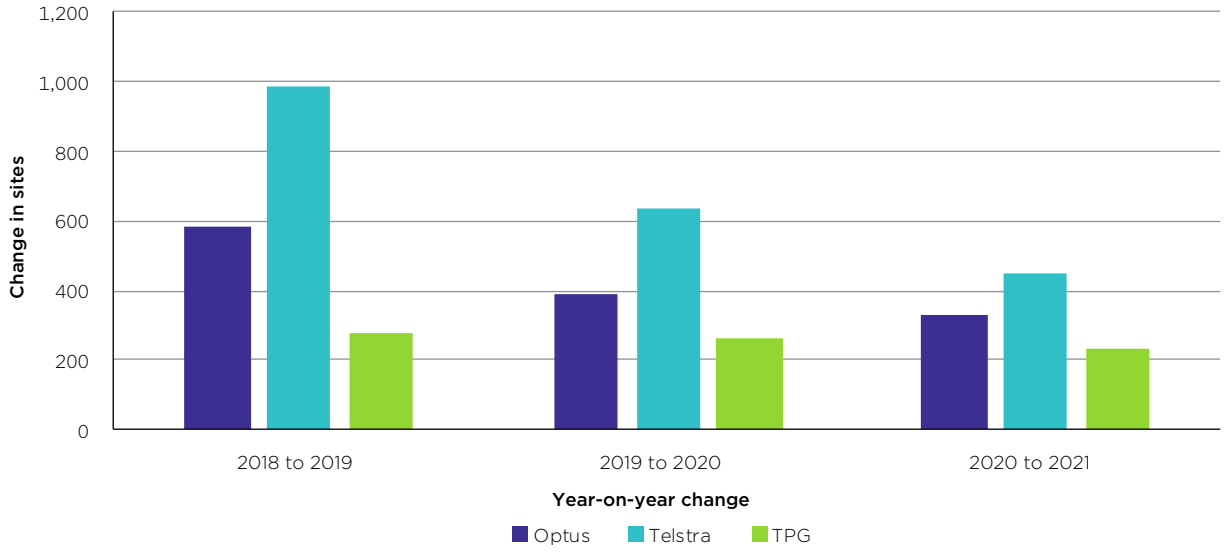
**Figure 2.4: Change in number of 3G sites by MNO & ABS Remoteness Area – 2018 to 2021**




## 2.3 4G sites

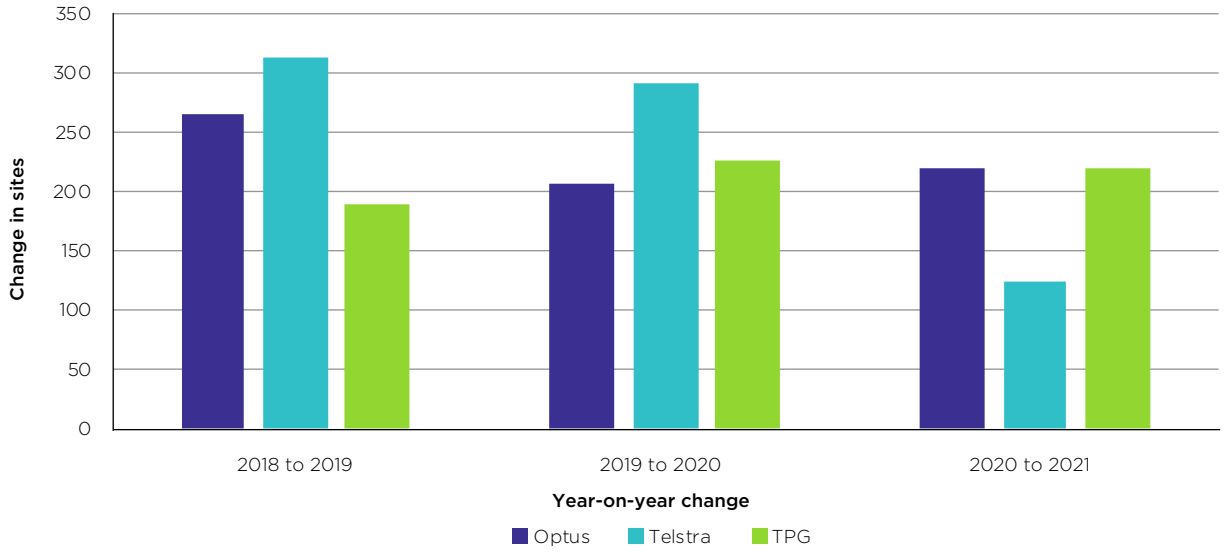
Likewise, the growth in the number of 4G sites has slowed since 2019. This slowdown is more noticeable for Telstra and Optus who have both reduced their 4G site deployment by a much greater percentage than TPG, whose 4G deployment year-on-year has remained relatively steady since 2018 (Figure 2.5). These changes likely reflect a shift in focus to the rollout of 5G which is at varying stages of deployment across the MNOs.

**Figure 2.5: Change in number of 4G sites by MNO – year-on-year – 2018 to 2021**




Telstra's slowdown in 4G deployment is most prominent in Major Cities with both Optus (427 sites) and TPG (445 sites) adding more 4G sites in Major Cities than Telstra (415 sites) since 2019 (Figure 2.6).

**Figure 2.6: Change in number of 4G sites in Major Cities of Australia by MNO – year-on-year – 2018 to 2021**




Notably, in Inner and Outer Regional Australia, 4G deployment has significantly slowed across all the MNOs in recent years (Figure 2.7). However, deployment in Remote and Very Remote Australia has been more mixed. After slowed growth in site numbers from 2019 to 2020, there appears to have been a slight rebound in 4G deployment for Telstra from 2020 to 2021 in Remote Australia, and for Telstra and Optus in Very Remote Australia over the same period (Figure 2.8).

**Figure 2.7: Change in number of 4G sites in Inner & Outer Regional Australia by MNO – year-on-year – 2018 to 2021**

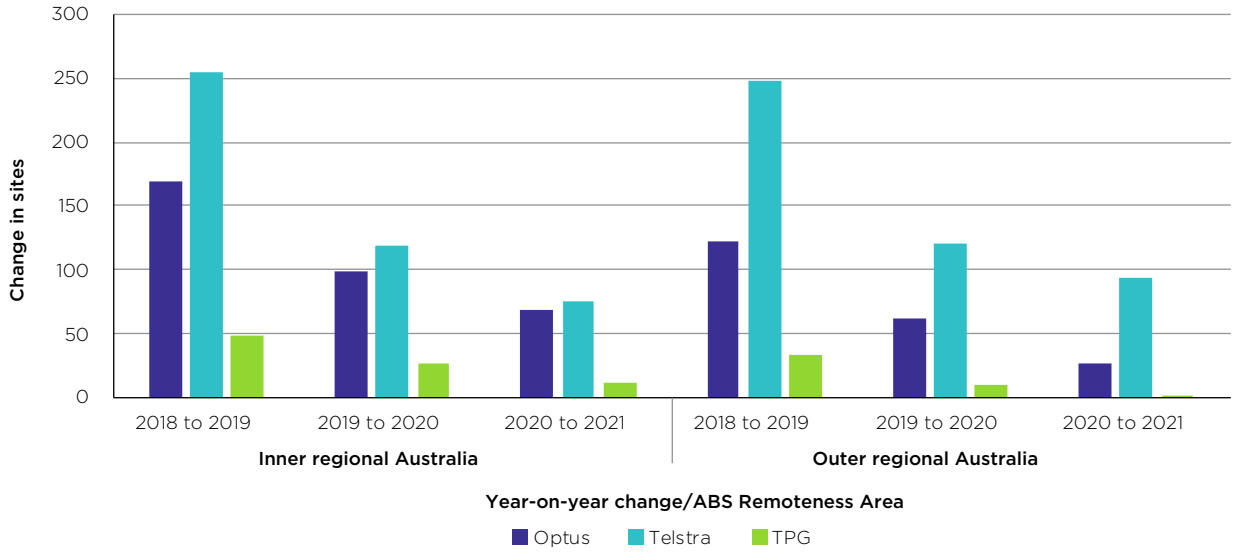
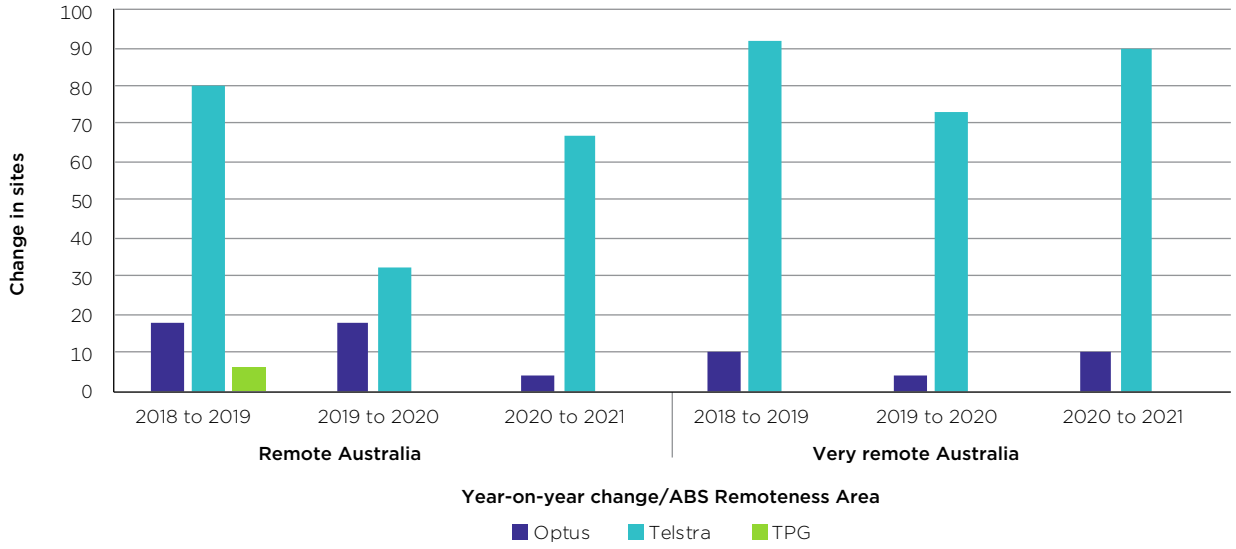


**Figure 2.8: Change in number of 4G sites in Remote & Very Remote Australia by MNO – year-on-year – 2018 to 2021**

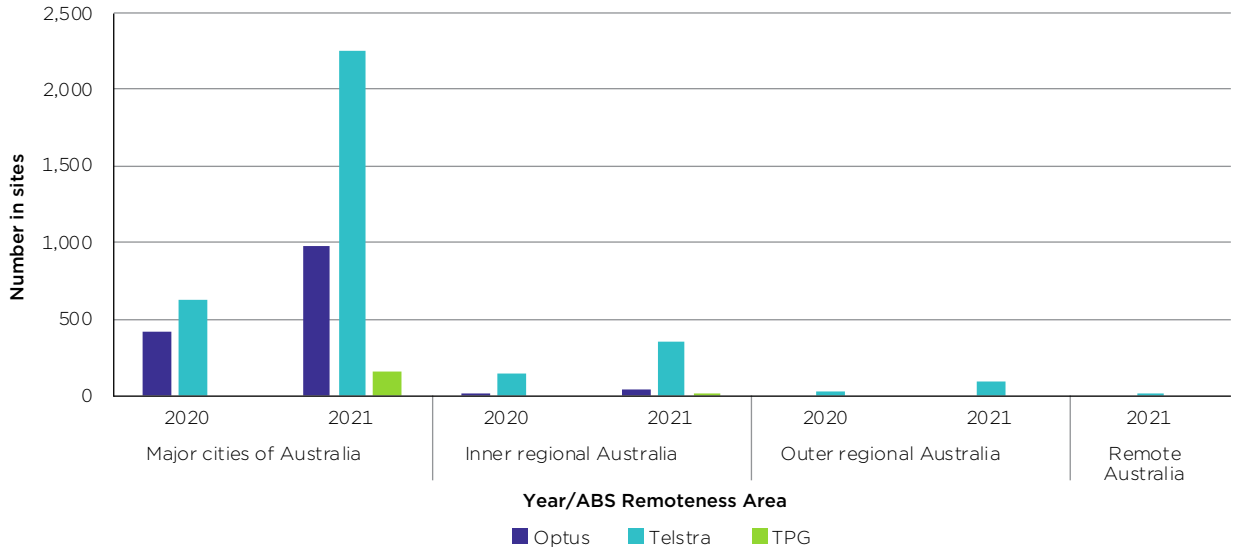



## 2.4 5G sites

By 31 January 2021, all three MNOs started to report active 5G sites under the Infrastructure RKR with most of the early progress being made in Major Cities, although the 5G rollout has started to extend into areas outside Major Cities. Telstra has significantly more 5G sites compared to the other MNOs across all areas.

The ACCC expects to see significant growth in 5G sites for the 2022 report as MNOs continued to roll out 5G sites. Given the MNOs are focussing on the 5G roll out and network expansion is likely to be significant in early phases of deployment, the MNOs' current state of 5G network may be significantly different to what is shown in Figure 2.9.

**Figure 2.9: Number of 5G sites by MNO & ABS Remoteness Area – 2020 and 2021**



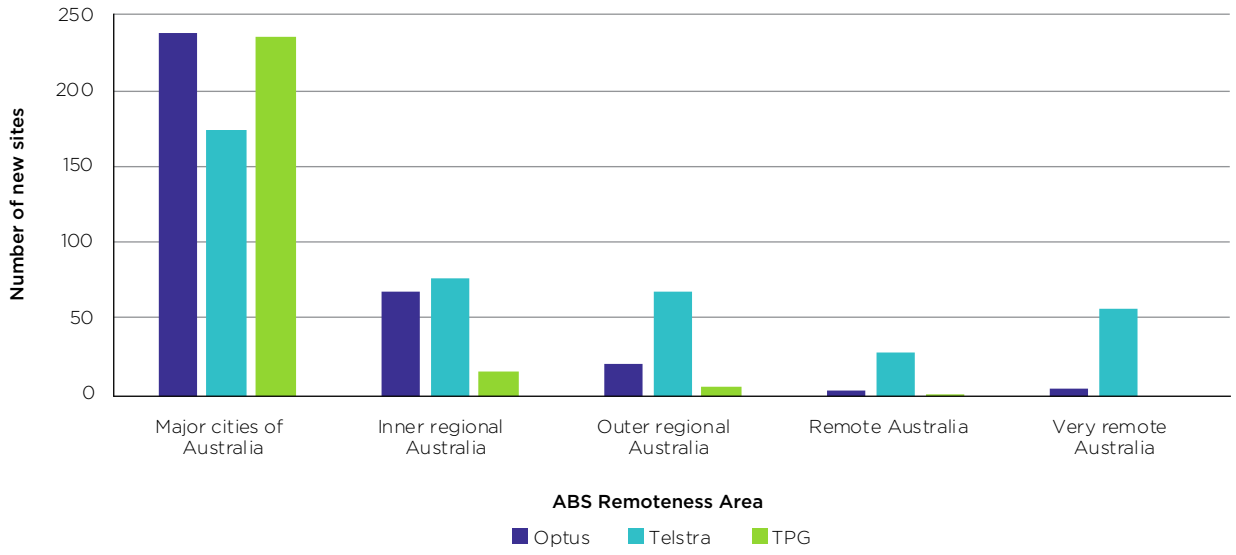
## 2.5 New sites

For the purposes of our analysis, an MNO is considered to have added a new site to its network in a particular year, if it has deployed equipment on that site in that year, but not in the previous year. A new site could be a new or existing structure that may have been built or is owned by an MNO or a third party. New sites can also be added to an MNOs network with the assistance of a co-contribution program.

The number of new sites is determined by increases in the number of unique sites from one year to the next. A unique site is identified by the site's Radio Frequency National Site Archive (RFNSA) identification number (ID). As an RFNSA ID is location based it is possible for an MNO to have multiple sites at the same RFNSA ID particularly in high traffic areas (For example, at the Sydney Opera House). As such, mobiles site with the same RFNSA ID are given a count suffix i.e. RFNSA ID XXXXX_1, XXXXX_2 to accurately capture and track new sites. Due to the data requirements of the Infrastructure RKR[10], data on site IDs are only available for new sites added between 2020 and 2021.[11]

Between 2020 and 2021, the MNOs collectively added a total of 1,005 new sites across their three networks. A majority of these new sites were deployed in Major Cities, where Optus deployed the greatest number of new sites (238 new sites), closely followed by TPG (236 new sites). Telstra added the lowest number of new sites in Major Cities (174 new sites). Over the same period, the MNOs deployed a materially lower number of new sites in Inner and Outer Regional areas, as well as Remote and Very Remote Australia compared to Major Cities. However, outside Major Cities, Telstra added significantly more new sites than Optus and TPG (Figure 2.10).

**Figure 2.10: Number of new sites by MNO & ABS Remoteness Area – 2020 to 2021**




10 MNOs were only required to provide RFNSA IDs for their mobile sites from 2020 onwards.

11 New sites should be distinguished from net increase in the number of sites, which has been discussed in previous sections.

## 2.6 Co-funded sites

As discussed earlier in this chapter, co-funded sites are sites that have been partly funded by government co-contribution programs and are a subset of the total sites an MNO operates. From 2020, MNOs have been required to identify co-funded sites on their networks if the sites received funding on or after 18 May 2020, or if the site received funding under the Federal Government's Mobile Black Spot Program.[12] The RKR requires reporting on active sites only so there will be a lag between when funding is awarded and when the proposed site becomes active.

Between 2020 and 2021, Telstra had the greatest percentage of new sites that were co-funded, with 28.3% of its new sites receiving some form of co-contribution program funding, with almost all of these funded under the Federal Government's Mobile Black Spot Program (MBSP). This trend continues across all ABS Remoteness Areas except Very Remote Australia where Optus had the greatest percentage (80%) of new sites that were subject to co-contribution program funding (Table 2.2). TPG did not deploy any new sites between 2020 and 2021 with the assistance of funding from a co-contribution program.

**Table 2.2: Percentage (%) of new sites that are co-funded by MNO & ABS Remoteness Area – 2020 to 2021**

| | 2021 |
|---|---|
| **Major Cities of Australia** | |
| Optus | - |
| Telstra | 1.7 |
| **Inner Regional Australia** | |
| Optus | 15.9 |
| Telstra | 49.4 |
| **Outer Regional Australia** | |
| Optus | 14.3 |
| Telstra | 66.7 |
| **Remote Australia** | |
| Optus | 25 |
| Telstra | 44.8 |
| **Very Remote Australia** | |
| Optus | 80 |
| Telstra | 25.9 |
| **Total** | |
| Optus | 5.6 |
| Telstra | 28.3 |

In recent years, one of the most significant co-contribution programs is the Federal Government's MBSP. As at 31 January 2020 and 31 January 2021, Telstra had deployed 629 and 735 sites respectively with the assistance of funding from this co-contribution program. This is significantly more co-funded sites than Optus and TPG combined (Table 2.3). Table 2.4 shows that in 2021 a majority of the Federal MBSP funded sites are in Inner and Outer Regional Australia with a small number of sites located in Major Cities. There were 245 co-funded sites in Remote and Very Remote Australia in 2021.

**Table 2.3: Total number of Federal Mobile Black Spot Program sites by MNO – 2020 and 2021**

| MNO | 2020 | 2021 |
|---|---|---|
| Optus | 93 | 126 |
| Telstra | 629 | 735 |
| TPG | 60 | 60 |

12 Under Rule 5(3) of the Infrastructure RKR 2020, the record-keeper is only required to identify the relevant co-contribution programs for sites that received funding on and after 18 May 2020, unless the co-contribution program is the Federal Government's Mobile Black Spot Program (MBSP), for which the record-keeper is required to identify the sites that received funding on and after 1 January 2015 and were still in operation in May 2020. This amendment did not require MNOs to resubmit its historical mobile site information with co-funded sites identified.

Table 2.4: Total number of Federal Mobile Black Spot Program sites by MNO & ABS Remoteness Area – 2020 and 2021

| | 2020 | 2021 |
|---|---|---|
| **Major Cities of Australia** | | |
| Telstra | 8 | 11 |
| **Inner Regional Australia** | | |
| Optus | 22 | 43 |
| Telstra | 187 | 222 |
| TPG | 8 | 8 |
| **Outer Regional Australia** | | |
| Optus | 21 | 29 |
| Telstra | 275 | 319 |
| TPG | 44 | 44 |
| **Remote Australia** | | |
| Optus | 16 | 16 |
| Telstra | 87 | 96 |
| TPG | 8 | 8 |
| **Very Remote Australia** | | |
| Optus | 34 | 38 |
| Telstra | 72 | 87 |

## 2.7 Decommissioned sites

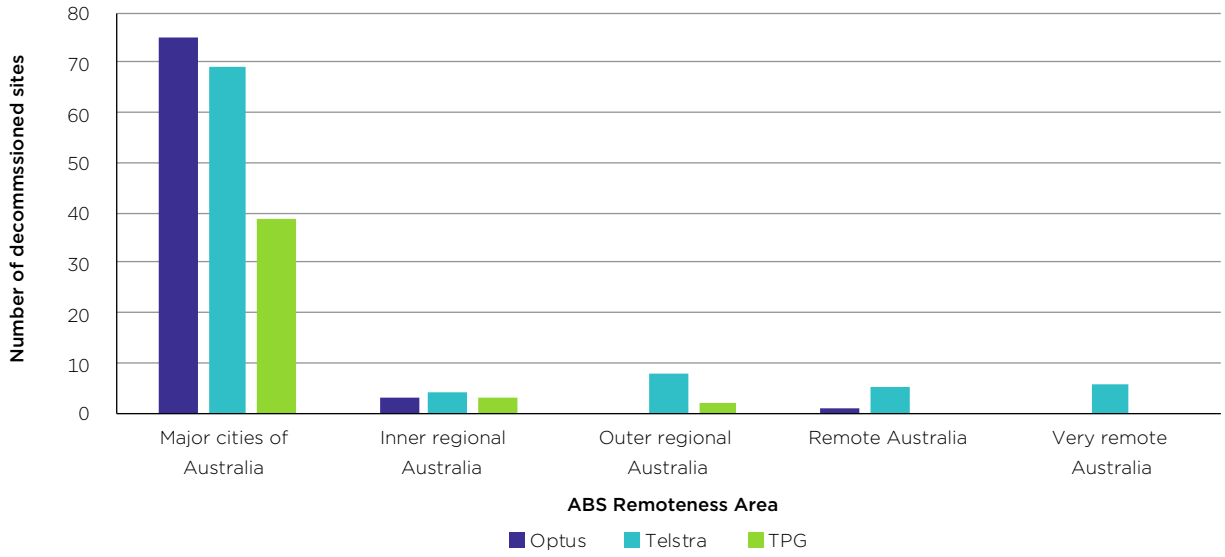
For the purposes of our analysis, an MNO is taken to have decommissioned a site if they had deployed equipment on that site in a particular year, but no longer deployed equipment on that site in the following year. Decommissioned sites are determined by decreases in the number of unique sites from one year to the next. Unique sites are based on the site's RFNSA ID in the same manner as new sites are calculated. Due to the data requirements of the Infrastructure RKR[13], data is only available for decommissioned sites that occurred between 2020 and 2021.

An MNO may decommission a site for a variety of reasons including that it has added equipment to a new mobile site nearby which provides the same or more depth and/or breadth of coverage which makes the decommissioned site redundant due to its close proximity. It may also be costly to maintain or upgrade (for example, from 3G to 4G/5G) a site so an MNO may decommission it and deploy a new site at a lower cost or rely on a nearby site for coverage.

Between 31 January 2020 and 31 January 2021, the MNOs collectively decommissioned a total of 215 sites. Of the 215 decommissioned sites, 183 or 85% were in Major Cities of Australia. In total, Telstra decommissioned the greatest number of sites (92 sites) followed by Optus (79 sites). TPG decommissioned the least number of sites (44 sites) in the same period (Figure 2.11).

13 MNOs were only required to provide RFNSA IDs for their mobile sites from 2020 onwards.

**Figure 2.11: Number of decommissioned sites by MNO & ABS Remoteness Area – 2020 to 2021**




## 2.8 Co-located sites

Co-location occurs when an MNO deploys a mobile site on the same structure as another MNO(s). Co-location is one way to reduce the cost of site deployment by allowing MNOs to share passive infrastructure (i.e. physical infrastructure such as a tower). By reducing the cost of deployment, it enhances the ability of MNOs to expand mobile infrastructure to improve the breadth or depth of their coverage, thereby promoting delivery of competing downstream services.

Co-location may occur when one MNO builds and owns site infrastructure such as a tower and allows another MNO(s) to install active equipment on that tower. It could also occur when two or more MNOs install active equipment on site infrastructure owned by a third party, such as towers owned by specialist infrastructure companies and rooftops of commercial or residential buildings.

For the purposes of our analysis, a site is determined as being co-located if the RFNSA ID of a mobile site of one MNO is the same RFNSA ID as a mobile site of another MNO in the same reporting period. In instances where MNOs have several mobile sites at the same RFNSA ID (e.g. Sydney Harbour Bridge), the number of co-located sites is the lowest common value across the MNOs. This means if MNO 'A' has two structures and MNO 'B' has five structures with the same RFNSA ID, only two sites will be counted as co-located not five. As the MNOs have only been required to report RFNSA ID information from 2020 onwards, the extent of co-location could only be assessed for 2020 and 2021.

Between 31 January 2020 and 31 January 2021, the level of co-location across the MNOs remained relatively steady. Telstra has the lowest percentage of co-location across the MNOs. Of its total active sites in 2021, 34.9% were co-located with another MNO. The percentage of co-location was much higher for Optus and TPG with co-location occurring at 72.7% and 87.2% of their total active sites, respectively (Table 2.5).

This low level of co-location for Telstra flows through to a high percentage of 'Telstra Only' sites. Where co-location did occur, the most common combination was TPG & Optus in 2020 and then all three MNOs in 2021. The least common combination of co-location was sites co-located by TPG & Telstra in both 2020 and 2021 (Table 2.6).

Table 2.7 indicates that the level of co-location varies significantly across MNOs and across ABS Remoteness Areas. For example, co-location in 2021 is as high as 89.1% of TPG's total sites in Major Cities of Australia but as low as 4.4% of Telstra's sites in Very Remote Australia. The level of co-location declines across all MNOs as their site locations move from Major Cities to less populated Regional and Remote areas.

### Table 2.5: Co-located sites as a percentage (%) of total sites by MNO – 2020 and 2021

| | 2020 | 2021 |
|---|---|---|
| Optus | 73.7 | 72.7 |
| Telstra | 35 | 34.9 |
| TPG | 89.5 | 87.2 |

### Table 2.6: Total number of sites by MNO co-location combination – 2020 and 2021

| | 2020 | 2021 |
|---|---|---|
| Optus & Telstra | 1,028 | 1,070 |
| Optus ONLY | 2,095 | 2,252 |
| Telstra ONLY | 6,788 | 7,006 |
| TPG & Optus | 2,442 | 2,447 |
| TPG & Telstra | 220 | 221 |
| TPG ONLY | 598 | 755 |
| TPG, Optus & Telstra | 2,415 | 2,469 |

### Table 2.7: Co-located sites as percentage (%) of total sites by MNO & ABS Remoteness Area – 2020 and 2021

| | 2020 | 2021 |
|---|---|---|
| **Major Cities of Australia** | | |
| Optus | 84.9 | 83.4 |
| Telstra | 45.9 | 46.2 |
| TPG | 92.2 | 89.1 |
| **Inner Regional Australia** | | |
| Optus | 63.4 | 62.5 |
| Telstra | 35.5 | 35.3 |
| TPG | 85.3 | 85.4 |
| **Outer Regional Australia** | | |
| Optus | 52.9 | 52.9 |
| Telstra | 26.1 | 25.9 |
| TPG | 75.7 | 75.3 |
| **Remote Australia** | | |
| Optus | 40.9 | 41.2 |
| Telstra | 11.8 | 11.7 |
| TPG | 61.7 | 62.9 |
| **Very Remote Australia** | | |
| Optus | 26.7 | 25.8 |
| Telstra | 4.7 | 4.4 |
| TPG | 62.5 | 62.5 |

## 2.9 Types of spectrum deployed

An MNO typically uses a range of radiofrequency spectrum bands for the purpose of providing mobile services. The spectrum an MNO deploys at each of its mobile sites is one of the factors that may impact end-user experience. Radiofrequency spectrum can be used across a variety of technologies including 3G, 4G and 5G and can also be repurposed or re-farmed over time to support a different technology. Generally, spectrum is classified into three categories – low band, mid-band and high band. Each band serves a different purpose in the MNOs' networks and the equipment at a mobile site can support the use of multiple bands at the same time.

**Low band**

- Radiofrequency bands less than 1 Gigahertz (GHz) or 1,000 Megahertz (MHz).
- Typically used by a mobile network to provide the core coverage layer and also provides capacity.
- Can transmit information over greater distances and through obstacles such as buildings and trees more easily than higher frequencies. This means it is ideal for providing mobile services in sparsely populated regional and remote areas. It also allows for the deployment of a smaller number of sites, as a given site provides coverage over a greater geographical area.

**Mid-band**

- Refers to radiofrequency bands between 1 GHz and 6 GHz.
- Typically deployed to supplement low-band spectrum.
- Information sent and received through mid-band spectrum can only occur over shorter distances than that of low band spectrum, meaning an MNO may need to build more sites when using this spectrum compared to low-band, to cover areas of the same size.
- Is likely to have a larger amount of spectrum available than in the low band, and hence a higher capacity, which makes it very useful in more populated and congested areas.

**High band**

- High band spectrum generally refers to radiofrequency bands greater than 6 GHz.
- The distances information can travel using high band spectrum is less than both low band and mid-band spectrum. The notable characteristic of this frequency band is that it delivers very short range, mainly line of sight coverage. This is combined with significant capacity, due the large amount of spectrum available, for very high-speed data transmission, making it ideal for use in heavy-traffic areas.

The capacity of a network depends on the quantity of spectrum available in a band, not on the frequency of that band. That is, the same quanta of spectrum in the low band can provide the same capacity as the same quanta of spectrum in the mid or high band. However, because larger amounts of spectrum are available in the higher bands those bands are likely to have greater capacity.

## 2.10 3G sites – spectrum deployed

As shown in Table 2.8, from 2018 to 2021, Telstra and TPG have progressively reduced the use of mid-band spectrum (i.e. 2100 MHz) for 3G services. The use of low-band spectrum (i.e. 900 MHz) for 3G continued to increase slowly across all three MNOs.

Table 2.8: Total number of 3G sites by MNO & radiofrequency spectrum deployed – 2018 to 2021

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| **Optus** | | | | |
| 900 MHz | 6,539 | 7,103 | 7,359 | 7,480 |
| 2100 MHz | 5,707 | 5,852 | 5,789 | 5,745 |
| **Telstra** | | | | |
| 850 MHz | 8,944 | 9,114 | 9,221 | 9,283 |
| 2100 MHz | 1,381 | 640 | 46 | 42 |
| **TPG** | | | | |
| 900 MHz | 4,801 | 5,141 | 5,391 | 5,438 |
| 2100 MHz | 4,615 | 4,684 | 2,689 | 1,771 |

## 2.11 4G sites – spectrum deployed

In contrast to 3G sites, the focus for MNOs on their 4G sites has been the increased use of mid-band spectrum. MNOs also use several mid-bands for the deployment of 4G services. Table 2.9 shows that the number of 4G sites utilising mid-band spectrum has increased at a faster rate than the number of 4G sites that use low band spectrum since 2018. This is likely to reflect the fact that 4G is currently the predominant mobile technology that carries most of the traffic across the networks.

Table 2.9: Total number of 4G sites by MNO & radiofrequency spectrum deployed – 2018 to 2021

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| **Optus** | | | | |
| 700 MHz | 5,590 | 6,271 | 6,639 | 6,895 |
| 900 MHz | 33 | 36 | 40 | 542 |
| 1800 MHz | 4,519 | 5,340 | 5,751 | 6,140 |
| 2100 MHz | 1,053 | 3,014 | 3,486 | 4,037 |
| 2300 MHz | 2,984 | 3,253 | 3,426 | 3,575 |
| 2600 MHz | 2,235 | 2,795 | 3,139 | 3,489 |
| 3500 MHz | - | - | - | 1 |
| **Telstra** | | | | |
| 700 MHz | 6,641 | 7,680 | 8,220 | 8,631 |
| 900 MHz | 94 | 16 | 15 | - |
| 1800 MHz | 4,994 | 5,160 | 5,358 | 5,581 |
| 2100 MHz | 67 | 600 | 1,378 | 2,051 |
| 2600 MHz | 1,139 | 2,010 | 2,700 | 3,421 |
| **TPG** | | | | |
| 700 MHz | 4 | 6 | 55 | 318 |
| 850 MHz | 4,774 | 5,082 | 5,321 | 5,383 |
| 1800 MHz | 3,792 | 4,161 | 4,445 | 4,525 |
| 2100 MHz | 2,355 | 2,983 | 3,546 | 3,800 |
| 2600 MHz | - | - | - | 155 |

## 2.12 5G sites – spectrum deployed

As at 31 January 2021, the roll out of 5G sites is still in its early stages and so far it has been predominantly using the 3.5 GHz and 3.6 GHz bands, with Optus and Telstra also starting to use other mid-bands for 5G in 2021 (Table 2.10). So far, the use of low-band and high-band spectrum for 5G appear limited.

The ACCC expects to see significant changes in the spectrum deployed at 5G sites for future reports as MNOs continue to roll out 5G sites. As 3G sites are decommissioned, some of the spectrum will be repurposed to deploy 5G sites. Additionally, the Australian Communications and Media Authority's (ACMA) upcoming 850/900 MHz spectrum auction is expected to see MNO's acquire additional spectrum to deploy predominately 5G services.

**Table 2.10: Total number of 5G sites by MNO & radiofrequency spectrum deployed – 2018 to 2021**

| | 2020 | 2021 |
|---|---|---|
| **Optus** | | |
| 2100 MHz | - | 208 |
| 2300 MHz | - | 291 |
| 3500 MHz | 426 | 1,006 |
| 26000 MHz | - | 4 |
| **Telstra** | | |
| 850 MHz | 2 | - |
| 2600 MHz | - | 60 |
| 3600 MHz | 797 | 2,641 |
| **TPG** | | |
| 700 MHz | - | 19 |
| 3600 MHz | - | 145 |

# 3. Mobile coverage analysis

Mobile coverage is an extremely important factor for consumers when deciding which mobile service to acquire. Mobile coverage is also an important point of differentiation between MNOs. Many consumers are willing to pay higher prices for greater levels of mobile coverage notably in regional and remote areas. For this reason, MNOs continue to compete on mobile coverage. An MNO can increase its network coverage by building more sites and/or by making use of low band radiofrequency spectrum. Increasing the geographic coverage of its network is one way in which an MNO can improve its network for end users.

One way the MNOs estimate and illustrate mobile coverage is by producing coverage maps which indicate where their customers can expect to have mobile reception. Coverage maps are modelled on predictive coverage and therefore may not reflect the 'on the ground' experience for all end users. There are several factors that can impact mobile coverage including buildings, foliage/trees, bad weather, hills or mountains, the number of nearby people using the same mobile site and hardware compatibility.

The assumptions that underpin these predictive coverage models differ across the MNOs. The assumptions can also change across time for a given MNO. These changes could mean that increases or decreases in the measurement of coverage from year to year may not necessarily reflect changes in the predicted 'on the ground' experience of end users. Instead, the changes may reflect differences in assumptions that underpin the modelling of the predictive coverage maps or variations in the precision/accuracy of the models. Slight fluctuations in coverage areas from year to year could also result from optimisation activities undertaken by the MNOs, such as adjusting the tilt of antennas to reduce interference. Additionally, the introduction of new versions of prediction models/tools and potential differences in rounding and aggregation can also result in minor variability in coverage predictions from year to year, even if there are no actual changes in coverage.

In addition, from 2018 to 2021, the MNOs have provided coverage maps based on different standard of coverage. In 2018, the ACCC wrote to the MNOs encouraging them to work together to improve coverage information.[14] In response, the MNOs have agreed to adopt the same terminology for the standard of coverage described (i.e. indoor, outdoor or external antenna coverage).[15] However, in providing coverage maps in accordance with the RKR, the MNOs have interpreted the requirements differently. Telstra's coverage analysis is based on predicted coverage for external antennas and TPG's results are based on predicted outdoor coverage. Optus' analysis is mostly based on predicted outdoor coverage, except its 4G 2021 analysis, which largely reflects predicted coverage for external antennas.[16] In general, coverage maps which are based on external antenna coverage predict wider coverage areas than coverage maps based on outdoor coverage. The ACCC is currently reviewing the RKR to ensure consistency in the standard of coverage maps that the MNOs provide in future years.[17]

For these reasons, the coverage analysis does not support any direct comparison between the coverage data across the MNOs. The key purpose of our analysis is to provide a broad indication of the trend in how each MNO's coverage has changed over time based on the coverage maps provided by the MNOs. Where an MNO has made changes to any input assumption that has significantly impacted its predicted coverage, these are noted in the analysis below.

The coverage analysis is based on historical coverage maps that reflect the MNOs' network coverage as at 31 January for each respective year from 2018 to 2021. For the most up to date coverage information, users of the network should refer to the coverage maps available on the website of their service provider.

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14 See ACCC website at: https://www.accc.gov.au/regulated-infrastructure/communications/mobile-services/regional-mobile-issues/industry-engagement-on-implementing-proposed-measures.

15 See Australian Mobile Telecommunications Association website at: https://amta.org.au/understanding-coverage-maps/.

16 This is because the 700 MHz frequency band coverage map that contributes significantly to this 4G map is based on external antenna coverage. All other coverage maps provided by Optus are based on outdoor coverage.

17 For more information on this review, see ACCC website at: https://www.accc.gov.au/regulated-infrastructure/communications/monitoring-reporting/infrastructure-record-keeping-rules/2021-infrastructure-rkr-consultation-paper.

For the analysis below, coverage refers to geographic land mass coverage and ocean/sea coverage has been excluded from analysis.

Lastly, for this year's report, we have not included analysis on changes in 5G coverage given the limited amount of data that was available at 31 January 2021. This information can be found in the Mobile Infrastructure Report 2021 – output tables that accompany this report. We will include discussion on changes in 5G coverage in future reports.

## 3.1 Optus – 3G geographic coverage

Between 31 January 2018 and 31 January 2021, Optus' 3G geographic coverage marginally increased by 0.7%. Very Remote Australia experienced the greatest increase in 3G geographic coverage, up 30.9% since 2018 (Table 3.1). However, Inner and Outer Regional Australia experienced decreases of 4.6% and 5.5% respectively, over the same period.

**Table 3.1: Percentage change (%) in 3G geographic coverage by ABS Remoteness Area – Optus – 2018 to 2021**

| | 2018 to 2019 | 2019 to 2020 | 2020 to 2021 | 2018 to 2021 |
|---|---|---|---|---|
| Major Cities of Australia | 0.9 | 0.2 | 0.0 | 1.0 |
| Inner Regional Australia | 2.0 | 0.8 | -7.2 | -4.6 |
| Outer Regional Australia | 3.1 | 0.7 | -9.0 | -5.5 |
| Remote Australia | 1.8 | 3.2 | 2.1 | 7.2 |
| Very Remote Australia | -3.2 | 15.1 | 17.5 | 30.9 |
| **Total geographic coverage** | **2.0** | **2.5** | **-3.7** | **0.7** |

## 3.2 Optus – 4G geographic coverage[18]

Optus' 4G geographic coverage increased by 43.7% between 31 January 2018 and 31 January 2021 (Table 3.2). Most of the increase occurred between 2020 and 2021 when Optus moved to predicting coverage based on external antenna instead of predicted outdoor coverage, which had previously been used. Remote and Very Remote Australia experienced the greatest increase in 4G geographic coverage, up 88.8% and 182.1%, respectively, since 2018.

Given the change in predicted coverage standard for 4G in 2021, Optus' results for '2020 to 2021' and '2018 to 2021' should be considered with caution.

**Table 3.2: Percentage change (%) in 4G geographic coverage by ABS Remoteness Area – Optus – 2018 to 2021**

| | 2018 to 2019 | 2019 to 2020 | 2020 to 2021 | 2018 to 2021 |
|---|---|---|---|---|
| Major Cities of Australia | -0.5 | 0.4 | 0.6 | 0.4 |
| Inner Regional Australia | -6.6 | 2.6 | 13.6 | 8.9 |
| Outer Regional Australia | -11.7 | 2.4 | 41.3 | 27.8 |
| Remote Australia | -15.5 | 4.5 | 113.8 | 88.8 |
| Very Remote Australia | -14.6 | 1.4 | 225.7 | 182.1 |
| **Total geographic coverage** | **-11.0** | **2.6** | **57.2** | **43.7** |

As at 31 January 2021, Optus' total 4G geographic coverage was 115.4% of its 3G geographic coverage, up from 80.9% in 2018 (Table 3.3). In 2021, 4G geographic coverage as a percentage of 3G geographic coverage was 100% or above across all Remoteness Areas. However, as noted above, in 2021, Optus moved to predicting its 4G geographic coverage based largely on external antenna, when previously it was based on outdoor coverage. This means that the results for 2021 should be treated with caution.

18 2021 results are largely based on predicted external antenna coverage. All other 4G results are based on predicted outdoor coverage.

**Table 3.3: 4G geographic coverage as percentage of 3G geographic coverage by ABS Remoteness Area – Optus – 2018 to 2021**

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Major Cities of Australia | 100.6 | 99.2 | 99.4 | 100.0 |
| Inner Regional Australia | 91.4 | 83.8 | 85.2 | 104.4 |
| Outer Regional Australia | 82.7 | 70.8 | 72.0 | 111.9 |
| Remote Australia | 71.2 | 59.1 | 59.9 | 125.4 |
| Very Remote Australia | 62.0 | 54.7 | 48.2 | 133.6 |
| **Total geographic coverage** | **80.9** | **70.6** | **70.7** | **115.4** |

Significant changes and fluctuations observed in some of the years in Optus' coverage analysis are likely due to changes in input assumptions in predicting coverage, which Optus did not reveal due to confidentiality reasons.

## 3.3 Telstra – 3G geographic coverage

Between 31 January 2018 and 31 January 2021, Telstra increased its 3G geographic coverage by 3.7% largely due to an increase of 2.6% between 2018 and 2019. Very Remote Australia experienced the greatest increase in geographic coverage, up 5.6% since 2018 (Table 3.4). However, in line with the changes in its 3G sites (Figure 2.2), the magnitude of the increases in geographic coverage have slowed since 2019.

**Table 3.4: Percentage change (%) in 3G geographic coverage by ABS Remoteness Area – Telstra – 2018 to 2021**

| | 2018 to 2019 | 2019 to 2020 | 2020 to 2021 | 2018 to 2021 |
|---|---|---|---|---|
| Major Cities of Australia | 0.1 | 0.0 | -0.2 | -0.2 |
| Inner Regional Australia | 0.7 | 0.2 | 0.1 | 1.0 |
| Outer Regional Australia | 1.6 | 0.3 | 0.2 | 2.1 |
| Remote Australia | 2.3 | 0.6 | 0.7 | 3.6 |
| Very Remote Australia | 3.9 | 1.6 | 0.0 | 5.6 |
| **Total geographic coverage** | **2.6** | **0.9** | **0.2** | **3.7** |

## 3.4 Telstra – 4G geographic coverage

Telstra's 4G geographic coverage increased by 20.8% between 31 January 2018 and 31 January 2021 (Table 3.5). But like 3G coverage, most of the increases in geographic coverage over the period occurred between 2018 and 2019 and reflect similar trends to changes in 4G sites (Figure 2.5). Remote and Very Remote Australia experienced the greatest increase in 4G geographic coverage, up 28.4% and 37.2%, respectively, since 2018.

**Table 3.5: Percentage change (%) in 4G geographic coverage by ABS Remoteness Area – Telstra – 2018 to 2021**

| | 2018 to 2019 | 2019 to 2020 | 2020 to 2021 | 2018 to 2021 |
|---|---|---|---|---|
| Major Cities of Australia | -0.2 | 0.3 | -0.3 | -0.1 |
| Inner Regional Australia | 2.4 | 1.1 | 0.3 | 3.8 |
| Outer Regional Australia | 6.2 | 2.7 | 1.5 | 10.7 |
| Remote Australia | 16.4 | 5.9 | 4.1 | 28.4 |
| Very Remote Australia | 19.1 | 11.7 | 3.2 | 37.2 |
| **Total geographic coverage** | **11.4** | **5.9** | **2.4** | **20.8** |

As at 31 January 2021, Telstra's total 4G geographic coverage was 74.2% of its 3G geographic coverage, up from 63.7% In 2018 (Table 3.6). In 2021, 4G geographic coverage as a percentage of 3G geographic coverage was greater than 90% in Major Cities of Australia and Regional areas. However, further work is required before its 3G network is shutdown (expected to be by June 2024). 4G geographic coverage as percentage of 3G geographic coverage in Remote and Very Remote Australia was 76.4% and 56.1%, respectively, in 2021.

**Table 3.6: 4G geographic coverage as percentage of 3G geographic coverage by ABS Remoteness Area – Telstra – 2018 to 2021**

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Major Cities of Australia | 100.1 | 99.9 | 100.2 | 100.2 |
| Inner Regional Australia | 96.7 | 98.3 | 99.2 | 99.4 |
| Outer Regional Australia | 84.7 | 88.5 | 90.6 | 91.8 |
| Remote Australia | 61.7 | 70.2 | 73.9 | 76.4 |
| Very Remote Australia | 43.2 | 49.6 | 54.4 | 56.1 |
| **Total geographic coverage** | **63.7** | **69.2** | **72.6** | **74.2** |

## 3.5 TPG – 3G geographic coverage[19] [20]

Between 31 January 2018 and 31 January 2021, TPG 3G geographic coverage remained relatively steady (increased by 0.7%) (Table 3.7). 3G geographic coverage in Outer Regional Australia, Remote Australia and Very Remote Australia has increased since 2018. However, Major Cities of Australia and Inner Regional Australia experienced minor decreases in 3G geographic coverage between 2018 and 2021.

**Table 3.7: Percentage change (%) in 3G geographic coverage by ABS Remoteness Area – TPG – 2018 to 2021**

| | 2018 to 2019 | 2019 to 2020 | 2020 to 2021 | 2018 to 2021 |
|---|---|---|---|---|
| Major Cities of Australia | 0.0 | -0.4 | 0.0 | -0.5 |
| Inner Regional Australia | 1.1 | -4.1 | 0.2 | -3.0 |
| Outer Regional Australia | 3.7 | -0.8 | -0.4 | 2.5 |
| Remote Australia | 4.5 | -1.5 | -0.2 | 2.8 |
| Very Remote Australia | 0.9 | 0.1 | -0.4 | 0.5 |
| **Total geographic coverage** | **2.8** | **-1.8** | **-0.2** | **0.7** |

## 3.6 TPG – 4G geographic coverage[21]

TPG's 4G geographic coverage increased by 3.1% between 31 January 2018 and 31 January 2021 (Table 3.8). All the gains in 4G geographic coverage were experienced between 2018 and 2020. 4G geographic coverage increased across all ABS Remoteness Areas except Very Remote Australia which declined by 4.8% from 2018 to 2021.

19 TPG's 3G 2018 and 2019 coverage maps are based on higher power thresholds than its 2020 and 2021 coverage maps due to a bug in its mapping software. Higher power thresholds for mobile sites means each site has a wider area of predicted coverage. It is a significant exercise to re-predict historical maps. Therefore, 2018 and 2019 coverage maps have not been re-predicted to align with the lower power threshold of the 2020 and 2021 coverage maps.

20 TPG's 3G coverage maps do not include coverage it could access via its roaming agreement with Optus.

21 TPG's 4G coverage maps do not include coverage it could access via its roaming agreement with Optus.

**Table 3.8: Percentage change (%) in 4G geographic coverage by ABS Remoteness Area – TPG – 2018 to 2021**

| | 2018 to 2019 | 2019 to 2020 | 2020 to 2021 | 2018 to 2021 |
|---|---|---|---|---|
| Major Cities of Australia | 0.4 | 0.3 | 0.0 | 0.7 |
| Inner Regional Australia | 2.2 | 0.4 | -0.4 | 2.1 |
| Outer Regional Australia | 4.5 | 0.4 | -1.1 | 3.8 |
| Remote Australia | 7.9 | -0.1 | -1.3 | 6.3 |
| Very Remote Australia | -0.7 | -0.8 | -3.3 | -4.8 |
| **Total geographic coverage** | **3.6** | **0.3** | **-0.9** | **3.1** |

Between 31 January 2018 and 31 January 2021, TPG's 4G geographic coverage as a percentage of 3G geographic coverage marginally improved across all ABS Remoteness Areas except Very Remote Australia (Table 3.9). Inner Regional Australia experienced the greatest increase over the period. 4G geographic coverage as a percentage of 3G geographic coverage increased from 60.5% in 2018 up to 61.9% in 2021.

**Table 3.9: 4G geographic coverage as percentage of 3G geographic coverage by ABS Remoteness Area – TPG – 2018 to 2021**

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Major Cities of Australia | 97.9 | 98.3 | 99.1 | 99.1 |
| Inner Regional Australia | 73.7 | 74.5 | 78.0 | 77.5 |
| Outer Regional Australia | 55.6 | 56.1 | 56.8 | 56.4 |
| Remote Australia | 43.2 | 44.6 | 45.2 | 44.7 |
| Very Remote Australia | 44.3 | 43.6 | 43.2 | 41.9 |
| **Total geographic coverage** | **60.5** | **61.0** | **62.3** | **61.9** |


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