AUSTRALIAN COMPETITION & CONSUMER COMMISSION

Mobile Infrastructure Report 2022

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1. Introduction

The Mobile Infrastructure Report 2022 provides analysis on the changes in the national mobile network operators' (MNOs) mobile infrastructure and coverage from 2018 to 2022, 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 2022. We have disclosed this data pursuant to section 151BUA of the Competition and Consumer Act 2010. The disclosed Infrastructure RKR data includes detailed information on the mobile sites operated by each MNO and historical coverage maps as at 31 January for each year from 2018 to 2022.

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 2022, the data made available includes:

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

The ACCC has also derived and published key statistics from the relevant data. These are contained in an Excel spreadsheet titled 'Mobile Infrastructure Report 2022 – output tables' and is available on the ACCC's website at: https://www.accc.gov.au/regulated-infrastructure/telecommunications-internet/mobile-services-regulation/mobile-infrastructure-report/mobile-infrastructure-report-2022.

The key statistics include:

- the total number and the change in the number of mobile sites that an MNO operates for 3G, 4G and 5G technologies[3]
- the number of new and decommissioned sites and the proportion of new sites that are co-funded under a government co-contribution program
- the extent to which the MNOs are co-locating on the sites they operate
- 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 coverage areas as a proportion of 3G coverage areas for each MNO's network over time.

The key statistics are also disaggregated by Australian Bureau of Statistics' (ABS) Australian Statistical Geography Standard (ASGS) Remoteness Structure and state/territory.

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

2 MNOs are only required to provide coverage maps by frequency bands from 2020 onwards. 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.

The disclosure of the Infrastructure RKR data, together with the derived statistics and Mobile Infrastructure Report stems from an earlier ACCC commitment and provides:[4]

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

4 ACCC, Measures to address regional mobile issues, October 2017, p 26.

2. Overview

Telstra continues to have the most mobile sites (11,002) followed by Optus (8,632) and TPG (5,728). In Major Cities, Optus had the most sites (5,294), overtaking Telstra (5,257) for the first time since at least 2018. However, outside Major Cities,[5] Telstra had significantly more sites than Optus and TPG.

The report shows that growth in 3G and 4G network deployment in regional and remote areas has generally slowed since 2019. This appears to be due to change in focus from the MNOs to 5G roll out predominately in Major Cities. This trend is in line with the findings of the 2021 report. In addition, the number of 5G sites in regional and remote areas has increased. Telstra holds a significant first mover advantage in all these areas with more 5G sites in total than Optus and TPG combined.

Due to the higher cost of network deployment in regional and remote areas versus metropolitan areas, the commercial incentives to deploy network infrastructure in these areas are typically lower than in metropolitan areas. The report also shows that co-contribution programs, like the Federal Mobile Black Spot Program (MBSP), continue to 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.

Furthermore, co-location or the sharing of passive infrastructure is another way to reduce the cost of site deployment. Reducing the cost of site deployment in this way 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. The report notes varying levels of co-location across the MNOs with declining rates of co-location as you move into less populous regional and remote areas.

In the most recent Federal MBSP round (Round 5A), Field Solution Group (FSG) was awarded funding to trial a neutral host mobile delivery model.[6] Neutral host models allow all MNOs including FSG to share the same mobile network equipment on a mobile tower. This model reduces the cost of network deployment by eliminating the need for service providers to build, operate and maintain their own individual towers. FSG has also been selected to lead the neutral host trial for the NSW Mobile Coverage Project Partnership Trial in April 2022.[7]

The ACCC's current Regional Mobile Infrastructure Inquiry is examining the economics of mobile networks. The ACCC has been directed to hold a public inquiry into access to telecommunications towers and associated passive and active infrastructure provided by telecommunications and other infrastructure providers in regional, rural, remote and peri-urban areas within Australia. The inquiry will look into the cost of providing tower infrastructure, the scope of access offered, the terms and conditions of access and the commercial and other fee arrangements for access.

The inquiry will focus on the real-world operating environment for tower access and associated facilities to provide evidence-based findings that will contribute to potential policy and program development to improve regional mobile coverage, capacity and competition.

The inquiry specifically requires the ACCC to consider and report on the implications (if any) for the provision of access to towers and associated infrastructure of mobile carriers divesting their tower and associated infrastructure businesses. The ACCC is also required to report on how these matters may affect the provision of greater mobile coverage. This will include an assessment of current mobile coverage in regional, rural remote and peri-urban areas.

It will also inquire into the feasibility of providing temporary mobile roaming services during natural disasters and other such emergencies.

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

6 Field Solutions, 'FSG awarded $3.66M for Regional Australia's First Neutral Host Radio Access Network Trial', 21 July 2021, accessed on 24 August 2022.

7 Field Solutions, 'FSG to Lead Neutral Host Trial (MOCN) for NSW Mobile Coverage Project (MCP) Partnership Trial', 28 April 2022, accessed on 24 August 2022.

3. Key findings

- As at 31 January 2022, Telstra had the most mobile sites (11,002) followed by Optus (8,632) and TPG (5,728). In Major Cities, Optus had the most sites (5,294), overtaking Telstra (5,257) for the first time since at least 2018. However, outside Major Cities, Telstra had significantly more sites than Optus and TPG.
- Between 2021 and 2022, Telstra's number of 3G sites decreased (51 sites) for the first time since at least 2018. TPG's 3G sites decreased marginally (5 sites) while Optus' 3G sites increased (189 sites).
- Since 2018, there has been a net increase in the number of 3G sites across all ABS Remoteness Areas for all MNOs except for Telstra sites in Major Cities. Optus has deployed the most 3G sites across all areas except Very Remote Australia during this period.
- Between 2021 and 2022, Optus deployed the most 4G sites (414) compared with Telstra (324) and TPG, whose 4G sites decreased by 154. TPG's decrease in 4G sites appears to have been driven by changes in its 4G spectrum deployment.
- As at 31 January 2022, the deployment of 5G sites has largely been in Major Cities, however, deployment is now moving out in regional and remote areas. Telstra has significantly more 5G sites (4,071) compared to the other MNOs across all areas with more than twice as many sites as Optus (1,932). Telstra also has significantly more 5G sites than TPG (1,029).
- Between 2021 and 2022, the MNOs added a similar number of 5G sites to their network in Major Cities; this was not the case for the previous year. Optus added 815 sites in Major Cities since 2021 and 551 sites between 2020 and 2021. Telstra added fewer sites (888) to its 5G network in Major Cities than in the previous year (1,621). In contrast, TPG added significantly more 5G sites to its network in Major Cities in the last year (830) then it did in the previous year (161).
- Between 2021 and 2022, the MNOs collectively added a total of 800 new sites across their 3 networks. This is down from the collective 1,000 new sites added between 2020 and 2021.
- Between 2021 and 2022, Telstra deployed the greatest number of new sites that were co-funded, with 67 of its new sites receiving co-contribution program funding, compared with 60 sites for Optus. TPG did not deploy any new sites with the assistance of funding from a co-contribution program between 2020 and 2022.
- As at 31 January 2022, Telstra had lowest percentage of co-location with 35% of its total sites co-located with another MNO. Rates of co-location vary across ABS Remoteness Areas and decreases across all MNOs as you move to less populous regional and remote areas. Co-location by all 3 MNOs was the most common co-location combination and TPG & Telstra was the least common.

4. 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 exists in various forms including on a mobile tower, on top of commercial or residential buildings and light poles as well as inside buildings, collectively referred to as passive infrastructure. Passive infrastructure may have been built by an MNO or a third party such as a specialist infrastructure company.

An MNO may deploy their equipment on the same passive infrastructure as another MNO(s), this is known as co-location (see section 4.8). Co-location is one way to reduce the cost of site deployment. Reducing the cost of site deployment 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. Due to this passive infrastructure co-location, the total number of mobile towers/structures in Australia is not equal to sum of the mobile sites for each MNO.

The number of mobile sites an MNO has equipment deployed on provides an indication of the overall scale of their network. MNOs add (see section 4.5) and remove sites (see section 4.7) from their network over time. An MNO may decommission a site because it has added equipment to a new mobile site nearby which provides the same or more depth and/or breadth of coverage. A mobile site can also have several technologies installed on it at once. Therefore, MNOs may also add new equipment compatible with newer mobile technology on new or existing sites or remove older, legacy technologies such as 2G and 3G. Furthermore, it may be costly to maintain or upgrade a site (for example, from 3G to 4G/5G) so an MNO may decommission a site and deploy a new site at a lower cost or rely on a nearby site for coverage and/or capacity.

For these reasons, changes in the number of mobile sites an MNO has in its network (see section 4.1–4.4) 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 a new site in a Remote or Very Remote area.

Due to the high cost of network deployment in regional and remote areas, the commercial incentives to deploy network infrastructure in these areas are typically lower than in metropolitan areas. Consequently, co-contribution funding is likely a key driver for MNOs when considering expanding mobile coverage into these areas. Local, state and federal governments have developed co-contribution programs to provide subsidies to network operators in infrastructure deployment in these areas. Mobile sites funded under these programs are considered co-funded sites (see section 4.6).

4.1 Total number of sites

As at 31 January 2022, Telstra had the most mobile sites (11,002) followed by Optus (8,632) and TPG (5,728) (table 4.1). TPG was the only MNO to reduce its mobile site count (down 164) between 2021 and 2022. This decrease was largely driven by changes in its 4G spectrum deployment (discussed further in section 4.11).

Figure 4.1 displays a breakdown of the MNOs' sites by ABS Remoteness Areas in 2022 and shows that in Major Cities, Optus had the most sites (5,294) in these areas, overtaking Telstra (5,257) for the first time since at least 2018. The number of sites each MNO had in Major Cities was relatively comparable in 2022. However, the gap between the MNO with the greatest and fewest number of sites in Major Cities has widened overtime to 963 sites in 2022. This up from a gap of 529 sites in 2018 and 663 in 2021 (figure 4.2).

Outside Major Cities, Telstra had significantly more sites than the other MNOs between 2018 and 2022 (table 4.1). In these areas in 2022, Telstra had 72% more sites than Optus, down from 77% in 2018, and 313% more sites than TPG, up from 286% in 2018.

Table 4.1: Total number of sites by MNO & ABS Remoteness Area – Major Cities of Australia vs outside Major Cities of Australia – 2018 to 2022

	2018	2019	2020	2021	2022
Major Cities of Australia					
Optus	4,691	4,758	4,874	5,037	5,294
Telstra	4,736	4,800	5,059	5,166	5,257
TPG	4,207	4,268	4,306	4,503	4,337
Outside Major Cities of Australia					
Optus	2,644	2,954	3,106	3,201	3,338
Telstra	4,693	5,172	5,392	5,600	5,745
TPG	1,215	1,340	1,369	1,389	1,391
Total					
Optus	7,335	7,712	7,980	8,238	8,632
Telstra	9,429	9,972	10,451	10,766	11,002
TPG	5,422	5,608	5,675	5,892	5,728

Figure 4.1: Total number of sites by MNO & ABS Remoteness Area – 2022

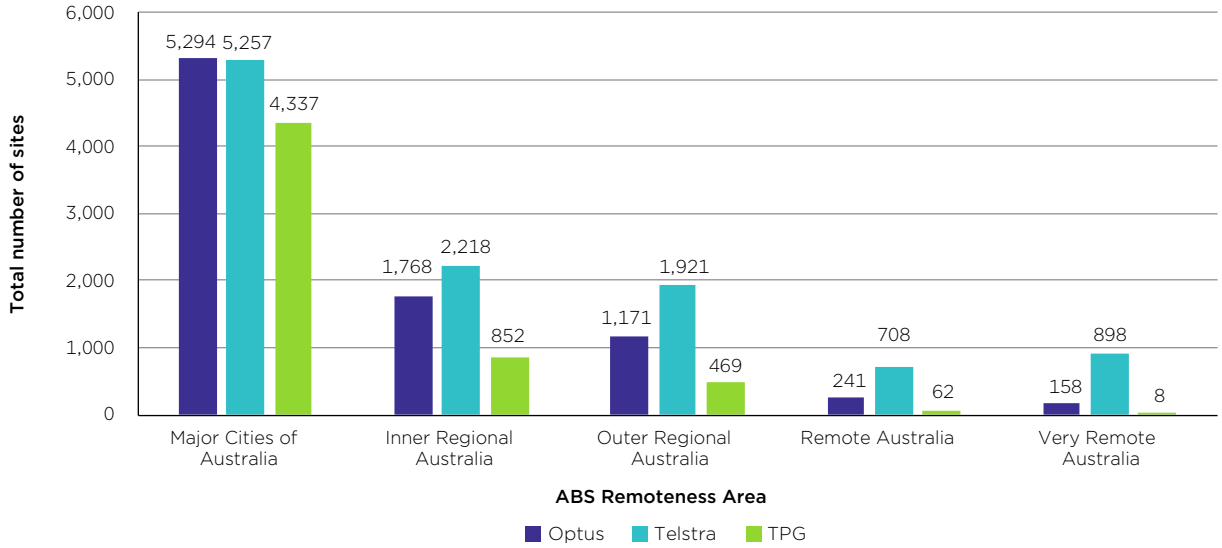
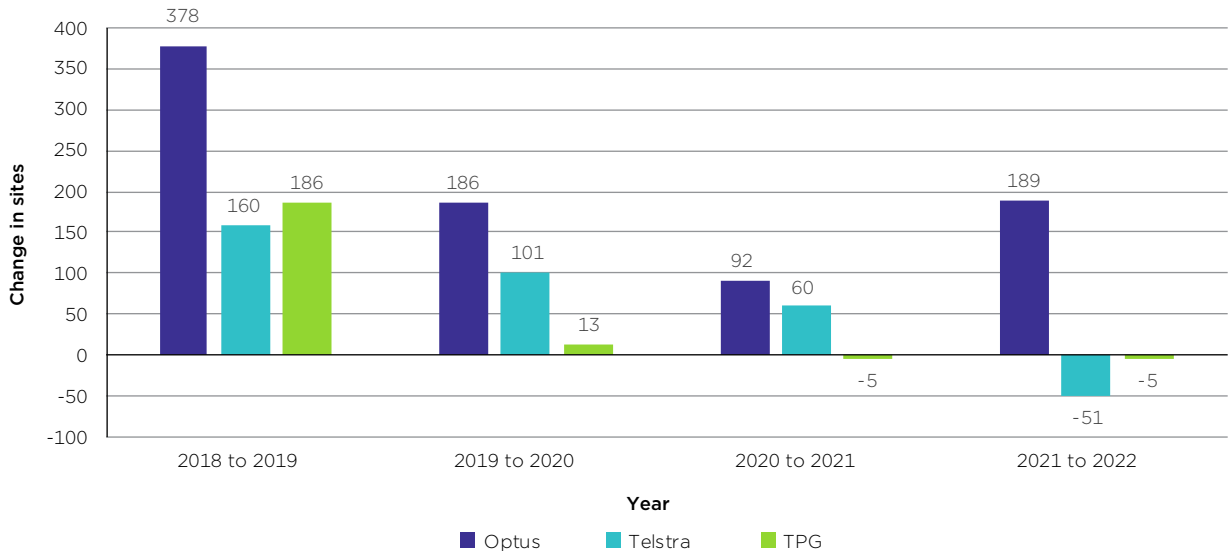


Figure 4.2: Differences between the MNO with the greatest and fewest number of sites – Major Cities of Australia, outside Major Cities of Australia & Total – 2018 to 2022

4.2 3G sites

Figure 4.3 below shows that the growth in the number of 3G sites has slowed during the period of 2018 to 2022, with the exception of Optus whose 3G sites increased between 2021 and 2022. TPG's number of 3G sites deployed declined marginally between 2021 and 2022, in line with decreases seen in the previous year. While Telstra's number of 3G sites fell for the first time between 2021 and 2022. This is not surprising as 3G technology nears 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 its 3G network (June 2024).

Figure 4.3: Change in number of 3G sites by MNO – year-on-year – 2018 to 2022



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 4.4). However, Optus continues to increase its number of 3G sites in Major Cities, adding 199 sites since 2018 (figure 4.5).

However, outside Major Cities, between 2018 and 2022, all 3 MNOs had a net increase in the number of 3G sites they had deployed. Telstra's 3G sites in Major Cities was the only area to decline from 2018 levels, decreasing by 169 sites between 31 January 2018 and 31 January 2022 (figure 4.5). However, as discussed below, Telstra has increased its 4G and 5G sites in Major Cities. Optus deployed the most 3G sites across all ABS Remoteness areas, except Very Remote Australia, between 31 January 2018 and 31 January 2022.

Figure 4.4: Change in number of 3G sites in Major Cities of Australia by MNO – year-on-year – 2018 to 2022

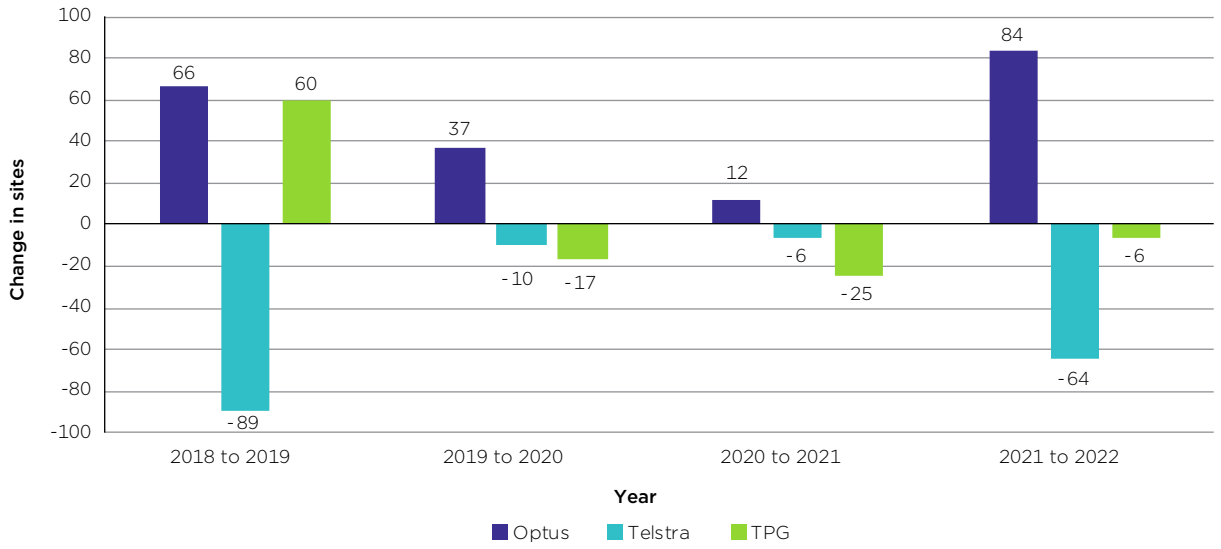
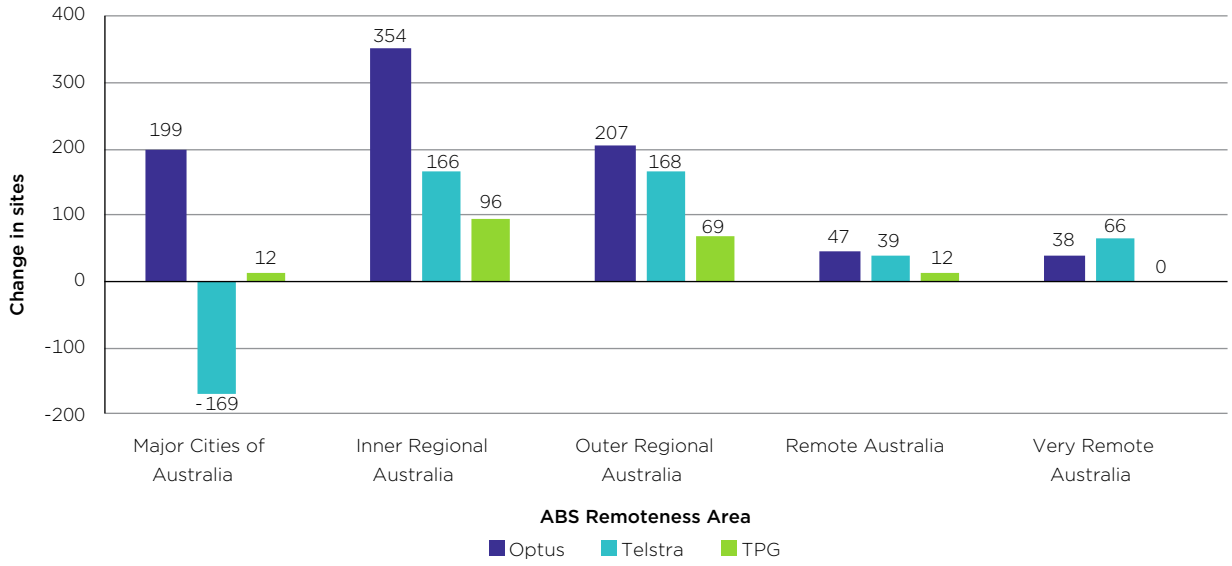


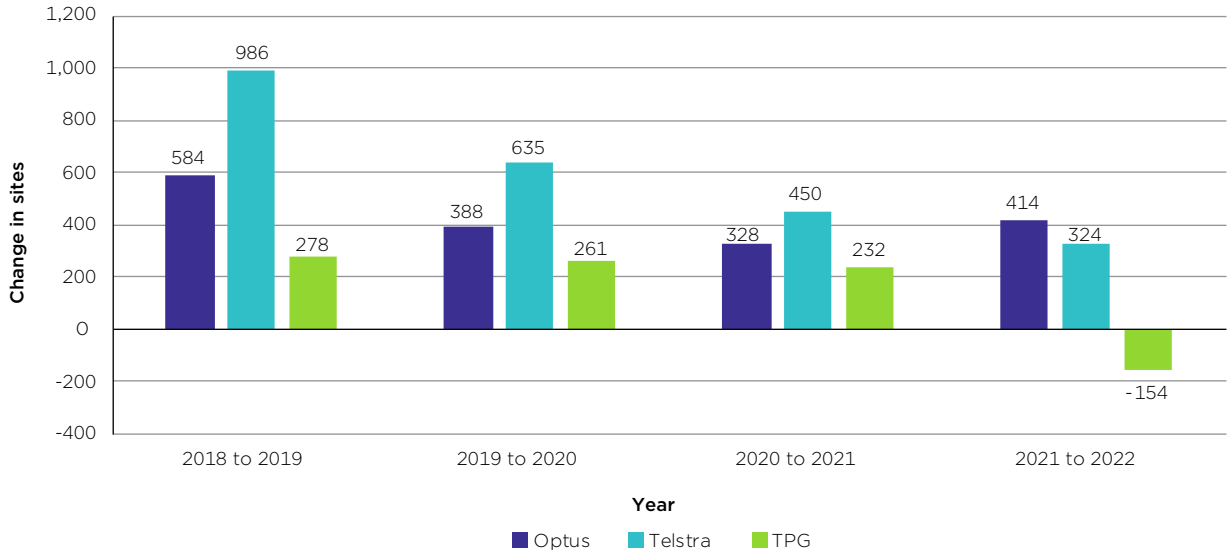
Figure 4.5: Change in number of 3G sites by MNO & ABS Remoteness Area – 2018 to 2022



4.3 4G sites

The growth in the number of 4G sites has been mixed across the MNOs since 2018 (figure 4.6). Telstra's growth in 4G sites has slowed year-on-year since 2019. While Optus' growth in 4G sites followed a similar trend until 2022 where its 4G site growth exceeded the preceding 2 periods (2019 to 2020 and 2020 to 2021). However, like Telstra, its 4G growth for the last year is down from 2018 to 2019 levels. On the other hand, TPG's growth in 4G sites remained relatively steady since 2018 except in the last year where its total 4G sites decreased. This decrease was largely driven by changes in its 4G spectrum deployment (discussed further in section 4.11).

Figure 4.6: Change in number of 4G sites by MNO – year-on-year – 2018 to 2022



Telstra and TPG's slowdown in 4G deployment in Major Cities contrasts with Optus, which added more 4G sites (966) in these areas since 2018 (figure 4.7). This equates to 18% more sites than Telstra (822) and twice as many sites as TPG (479).

Figure 4.7: Change in number of 4G sites in Major Cities of Australia by MNO – year-on-year – 2018 to 2022

Notably, in Inner and Outer Regional Australia, 4G deployment has significantly slowed across all the MNOs in recent years (figure 4.8). There was slight rebound in growth for Optus in these areas between 2021 and 2022.

4G deployment in Remote and Very Remote Australia has been more mixed for the MNOs (figure 4.9). In Remote Australia there was a slowing of growth in 4G site numbers from 2019 to 2020 onwards across the MNOs. Telstra experienced slight rebound in 4G deployment from 2020 to 2021. While Optus experienced a mild rebound in deployment between 2021 and 2022. There is a similar story in Very Remote Australia with the exception of Optus' 4G site growth remaining steady after a slowing of growth between 2019 and 2020. Although, given the low number of sites in these areas it is difficult to make definitive observations regarding investment.

Figure 4.8: Change in number of 4G sites in Inner & Outer Regional Australia by MNO – year-on-year – 2018 to 2022

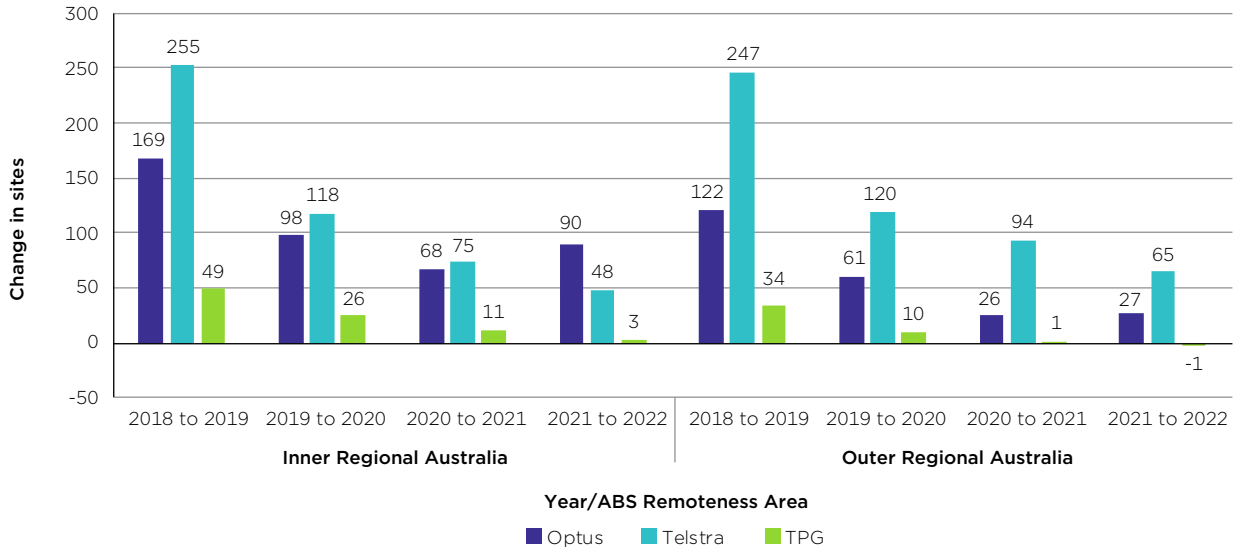
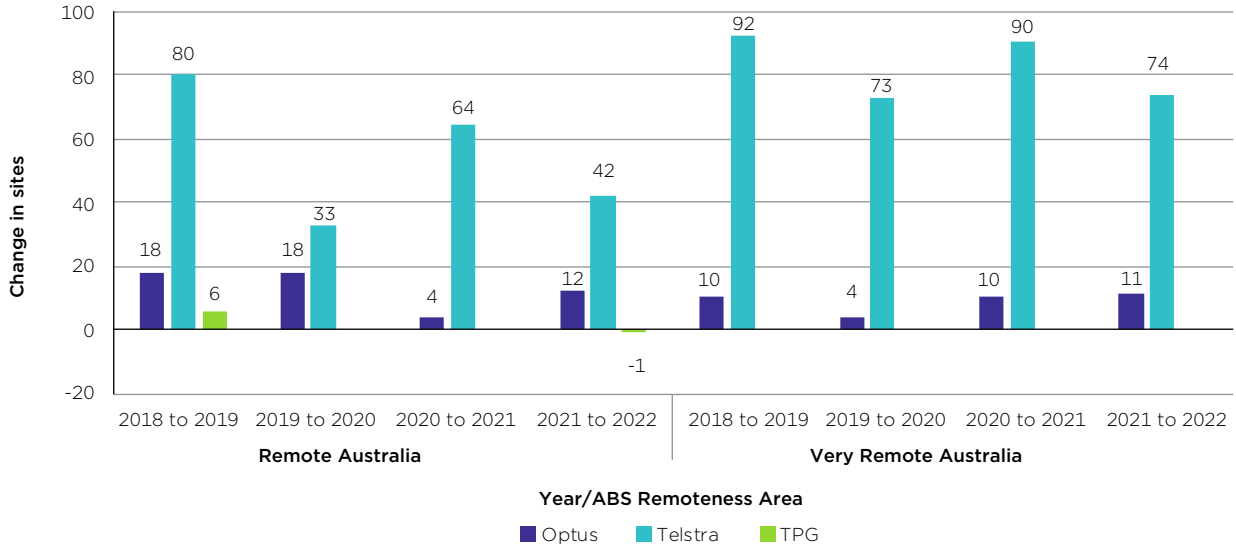


Figure 4.9: Change in number of 4G sites in Remote & Very Remote Australia by MNO – year-on-year – 2018 to 2022



4.4 5G sites

By 31 January 2021, all 3 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 (figure 4.10). For example, Optus reported 5G sites in Outer Regional and Remote Australia for first time in 2022.

Since 2021, the MNOs have added a similar number of sites to their network in Major Cities, this was not the case for the previous year (figure 4.11). Optus has added 815 sites in Major Cities since 2021 and 551 sites between 2020 and 2021. Telstra added fewer sites (888) to its 5G network than in the previous year (1,621). Finally, TPG added significantly more 5G sites to its network in the last year (830) then it did in the previous year (161). As at 31 January 2022, Telstra had significantly more 5G sites (4,071) compared to the other MNOs across all areas with more than twice as many sites as Optus (1,932).

The ACCC expects to see continued growth in 5G sites for the 2023 report as MNOs continue 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 4.10 and figure 4.11. This is because the reference date for each year's data is 31 January.

Figure 4.10: Number of 5G sites by MNO & ABS Remoteness Area – 2020 to 2022

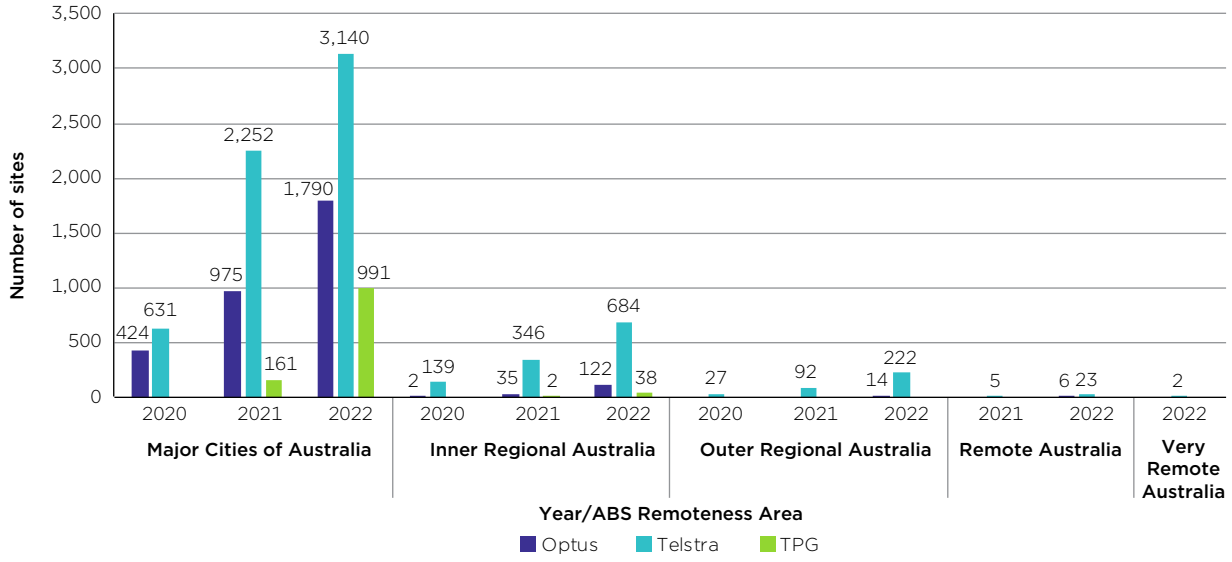
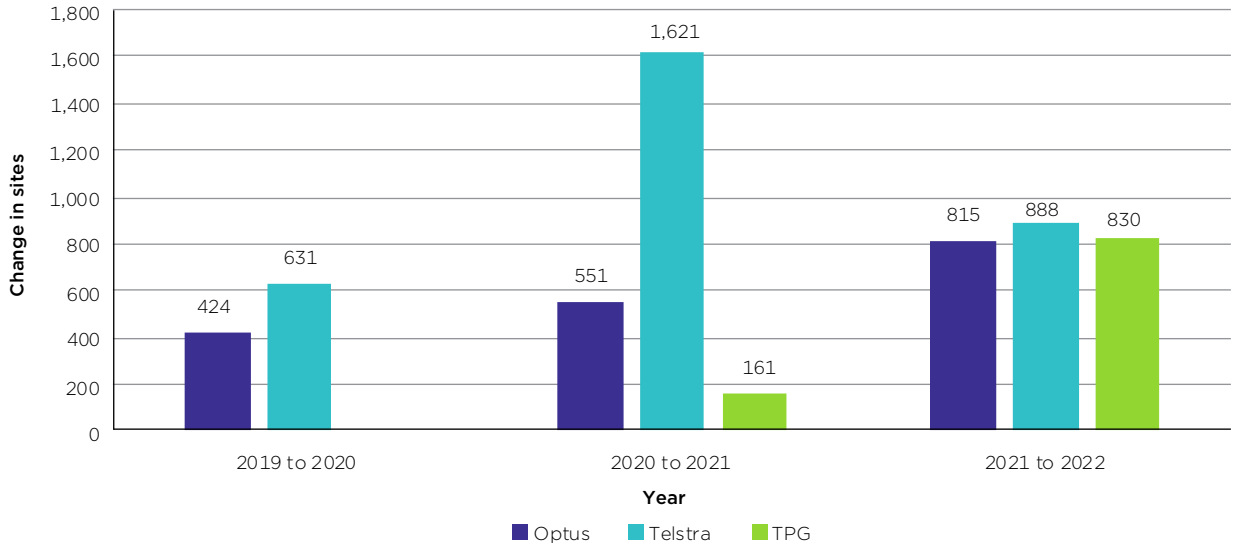


Figure 4.11: Change in number of 5G sites in Major Cities of Australia by MNO – year-on-year – 2020 to 2022

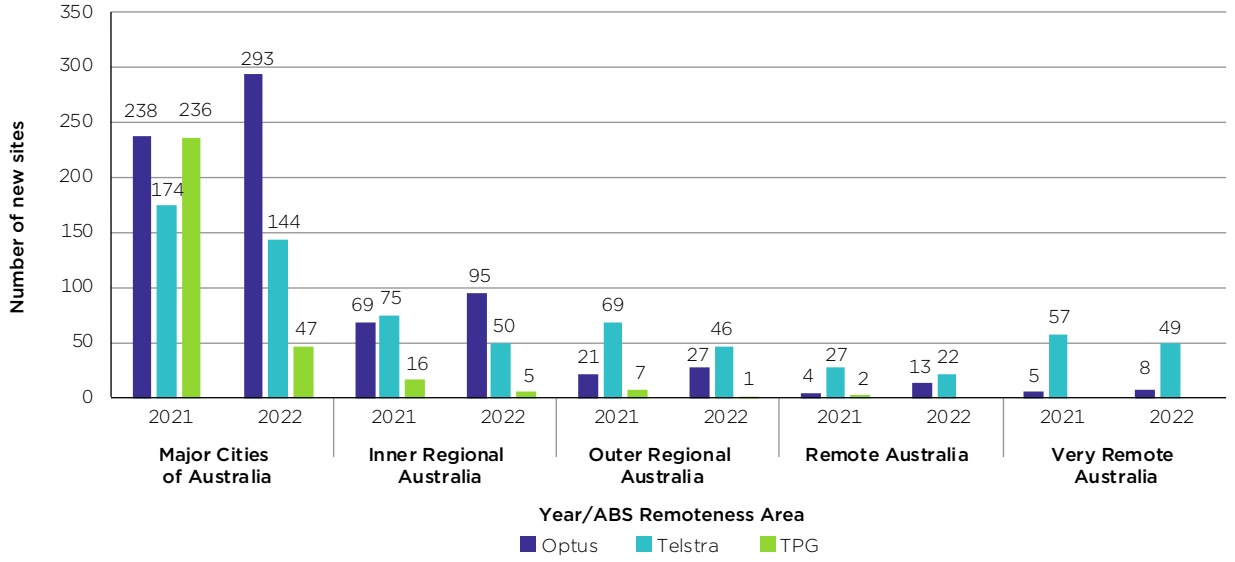


4.5 New sites[8]

Between 2021 and 2022, the MNOs collectively added a total of 800 new sites across their 3 networks. This is down from the collective 1,000 new sites added between 2020 and 2021. A majority of these new sites added between 2021 and 2022 were deployed in Major Cities, where Optus deployed the most new sites (293), followed by Telstra (144). TPG added the fewest new sites in Major Cities (47).

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. Outside Major Cities, Telstra added slightly more new sites (167) than Optus (143) and significantly more than TPG (6) (figure 4.12). Telstra continues to dominate the number of new sites in Very Remote Australia with 86% of new sites in these areas rolled out by Telstra since 2021. In contrast, in Inner Regional Australia Optus (95) deployed nearly twice as many new sites than Telstra (50) since 2021.

Figure 4.12: Number of new sites by MNO & ABS Remoteness Area – 2020 to 2022



8 Due to the data requirements of the Infrastructure RKR, data is only available for new sites added from 2020 onwards. New sites should be distinguished from net increase in the number of sites, which has been discussed in previous sections.

4.6 Co-funded sites[9][10]

Between 2021 and 2022, Telstra deployed the greatest number of new sites that were co-funded, with 67 of its new sites receiving co-contribution program funding, followed by Optus with 60 sites. For Telstra, this is significantly down from the previous year (115 sites), but a sizeable increase for Optus (18 sites) (table 4.2). TPG did not deploy any new sites with the assistance of funding from a co-contribution program between 2020 and 2022.

Table 4.2: Number of new sites that are co-funded by MNO & ABS Remoteness Area – 2020 to 2022

	2021	2022
Major Cities of Australia		
Optus	0	4
Telstra	3	3
Inner Regional Australia		
Optus	11	29
Telstra	38	19
Outer Regional Australia		
Optus	3	12
Telstra	46	23
Remote Australia		
Optus	1	8
Telstra	13	7
Very Remote Australia		
Optus	3	7
Telstra	15	15
Total		
Optus	18	60
Telstra	115	67

In recent years, one of the most significant co-contribution programs is the Federal Government's MBSP. As at 31 January 2022, Telstra had deployed 788 sites with the assistance of funding from this co-contribution program. This is significantly more co-funded sites than Optus and TPG combined (table 4.3). Table 4.3 also shows that a continuing majority of the Federal Government's MBSP funded sites are in Inner and Outer Regional Australia with a small number of sites located in Major Cities. There were a total of 273 co-funded sites across the MNOs in Remote and Very Remote areas in 2022, up from 245 in 2021 and 217 in 2020.

9 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.

10 The Infrastructure 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.

Table 4.3: Total number of Federal Government Mobile Black Spot Program sites by MNO & ABS Remoteness Area – 2020 to 2022

	2020	2021	2022
Major Cities of Australia			
Telstra	8	11	14
Inner Regional Australia			
Optus	22	26	41
Telstra	187	222	234
TPG	8	8	8
Outer Regional Australia			
Optus	21	22	30
Telstra	276	320	340
TPG	44	44	43
Remote Australia			
Optus	16	17	21
Telstra	87	96	102
TPG	8	8	8
Very Remote Australia			
Optus	34	37	44
Telstra	72	87	98
Total			
Optus	93	102	136
Telstra	630	736	788
TPG	60	60	59

4.7 Decommissioned sites[11]

Between 31 January 2021 and 31 January 2022, the MNOs collectively decommissioned a total of 334 sites, up from 210 sites between 2020 and 2021. Of the 334 decommissioned sites, 302 or 90% were in Major Cities. In total, TPG decommissioned the most sites (217) followed by Telstra (75). Optus decommissioned the fewest sites (42) in the same period (table 4.4). TPG's decommissioning of sites was largely driven by changes in its 4G spectrum deployment (discussed further in section 4.11).

11 Due to the data requirements of the Infrastructure RKR, data is only available for decommissioned sites from 2020 onwards.

Table 4.4: Number of decommissioned sites by MNO & ABS Remoteness Area – 2020 to 2022

	2021	2022
Major Cities of Australia		
Optus	75	36
Telstra	67	53
TPG	39	213
Inner Regional Australia		
Optus	3	4
Telstra	4	8
TPG	3	2
Outer Regional Australia		
Optus	-	1
Telstra	6	3
TPG	2	2
Remote Australia		
Optus	1	-
Telstra	5	4
Very Remote Australia		
Optus	-	1
Telstra	5	7
Total		
Optus	79	42
Telstra	87	75
TPG	44	217

4.8 Co-located sites[12]

Between 31 January 2021 and 31 January 2022, 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 2022, 35% were co-located with another MNO. The percentage of co-location was much higher for Optus and TPG with co-location occurring at 70.5% and 90% of their total active sites, respectively (table 4.5).

Table 4.5 also indicates that the level of co-location varies significantly across MNOs and across ABS Remoteness Areas. For example, co-location in 2022 is as high as 92.9% of TPG's total sites in Major Cities but as low as 4.8% 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.

This low level of co-location for Telstra flows through to a high number of 'Telstra Only' sites. Where co-location did occur, the most common combination was TPG & Optus in 2020 and then all 3 MNOs in 2021 and 2022. The least common combination of co-location was sites co-located by TPG & Telstra across all 3 years (table 4.6).

12 Due to the data requirements of the Infrastructure RKR, data is only available for co-located sites from 2020 onwards.

Table 4.5: Co-located sites as percentage (%) of total sites by MNO & ABS Remoteness Area – 2020 to 2022

	2020	2021	2022
Major Cities of Australia			
Optus	84.9	83.4	80.3
Telstra	46.0	46.2	46.4
TPG	92.2	89.1	92.9
Inner Regional Australia			
Optus	63.4	62.5	60.9
Telstra	35.5	35.3	35.8
TPG	85.3	85.4	85.4
Outer Regional Australia			
Optus	52.9	52.9	52.4
Telstra	26.1	25.9	25.6
TPG	75.7	75.3	75.7
Remote Australia			
Optus	40.9	41.2	41.1
Telstra	11.8	11.7	11.9
TPG	61.7	62.9	64.5
Very Remote Australia			
Optus	26.7	25.8	27.8
Telstra	4.7	4.4	4.8
TPG	62.5	62.5	62.5
Total			
Optus	73.7	72.7	70.5
Telstra	35.1	34.9	35.0
TPG	89.5	87.2	90.0

Table 4.6: Total number of sites by MNO co-location combination – 2020 to 2022

	2020	2021	2022
Optus & Telstra	1,028	1,070	1,137
Optus ONLY	2,095	2,252	2,548
Telstra ONLY	6,787	7,005	7,149
TPG & Optus	2,441	2,446	2,440
TPG & Telstra	220	221	209
TPG ONLY	598	755	572
TPG, Optus & Telstra	2,416	2,470	2,507

4.9 Types of spectrum deployed

An MNO 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 3 categories – low band, mid-band and high band. Each band has different propagation characteristics which serve a different main purpose (capacity and/or coverage) in the MNOs' networks. The equipment at a mobile site can also support the use of multiple bands at the same time.

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.

Table 4.7: Spectrum overview

Spectrum band	Purpose	Key characteristic	Site density	Band deployment by technology type in 2022
Low (Less than 1 GHz)	Mainly provides coverage with some capacity.	Transmits information over greater distances and through obstacles such as buildings more easily than higher frequencies. This means it is ideal for providing mobile services in sparsely populated regional/remote areas.	Allows for the deployment of a smaller number of sites, as a given site provides coverage over a greater geographical area.	Optus: 3G, 4G Telstra: 3G, 4G, 5G TPG: 3G, 4G, 5G
Mid (1–6 GHz)	Mainly provides capacity with some coverage, supplements low band.	Transmits information over shorter distances than that of low band spectrum. It 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.	An MNO may need to build more sites when using this spectrum compared to low-band, to cover areas of the same size.	Optus: 3G, 4G, 5G Telstra: 3G, 4G, 5G TPG: 3G, 4G, 5G
High (Greater than 6 GHz)	Mainly provides capacity.	The distances information can travel is very short range (mainly line of site) and less than both low band and mid-band spectrum. Provides significant capacity making it ideal for use in high traffic areas.	An MNO will need to build more sites when using this spectrum compared to low-band and mid band to cover areas of the same size.	Optus: 5G Telstra: 5G TPG: 5G

4.10 3G sites – spectrum deployed

All 3 MNOs have progressively reduced the use of mid-band spectrum (i.e. 2100 MHz) (table 4.8) for 3G services as 3G networks reach the end of their life cycle and 2100 MHz spectrum is repurposed for 4G and 5G services. Telstra is substantially more advanced in its reduced use of 2100 MHz for 3G services than Optus and TPG. Conversely, the use of low-band spectrum (i.e. 850 or 900 MHz) for 3G services has increased slowly over time for all MNOs with the exception of Telstra, who experienced a slight decline in 3G 850 MHz capable sites between 2021 and 2022.

Table 4.8: Total number of 3G sites by MNO & radiofrequency spectrum deployed – 2018 to 2022

	2018	2019	2020	2021	2022
Optus					
900 MHz	6,539	7,103	7,359	7,480	7,688
2100 MHz	5,707	5,852	5,789	5,745	5,627
Telstra					
850 MHz	8,944	9,114	9,221	9,283	9,238
2100 MHz	1,381	640	46	42	25
TPG					
900 MHz	4,801	5,141	5,391	5,438	5,472
2100 MHz	4,615	4,684	2,689	1,771	1,367

4.11 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 4.9 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 that 4G is currently the predominant mobile technology that carries most of the traffic across the networks.

Table 4.9 also shows that TPG appears to have repurposed some its 700 MHz spectrum from 4G to 5G (also see table 4.10). While TPG discontinued use of 2600 MHz for 4G services and sold this spectrum to Dense Air in August 2021.[13] These changes are reflected in TPG's reduction in its total sites (see section 4.1) and 4G sites (see section 4.3), its higher proportion of decommissioned sites (see section 4.7) and the lower number of 'TPG only' sites (see section 4.8) in 2022.

13 TPG Telecom, TPG Telecom boosts 5G spectrum holdings with Dense Air transaction [media release], TPG Telecom, 2 August 2021, accessed 29 July 2022.

Table 4.9: Total number of 4G sites by MNO & radiofrequency spectrum deployed – 2018 to 2022

	2018	2019	2020	2021	2022
Optus					
700 MHz	5,590	6,271	6,639	6,895	7,196
900 MHz	33	36	40	542	1,531
1800 MHz	4,519	5,340	5,751	6,140	6,522
2100 MHz	1,053	3,014	3,486	4,037	4,656
2300 MHz	2,984	3,253	3,426	3,575	3,701
2600 MHz	2,235	2,795	3,139	3,489	4,093
3500 MHz	-	-	-	1	-
Telstra					
700 MHz	6,641	7,680	8,220	8,631	8,913
900 MHz	94	16	15	-	10
1800 MHz	4,994	5,160	5,358	5,581	5,861
2100 MHz	67	600	1,378	2,051	2,513
2600 MHz	1,139	2,010	2,700	3,421	3,757
TPG					
700 MHz	4	6	55	318	11
850 MHz	4,774	5,082	5,321	5,383	5,401
1800 MHz	3,792	4,161	4,445	4,525	4,623
2100 MHz	2,355	2,983	3,546	3,800	3,949
2600 MHz	-	-	-	155	-

4.12 5G sites – spectrum deployed

As at 31 January 2022, the roll out of 5G is still in its early stages and so far it has been predominantly using the 3.5 GHz and 3.6 GHz bands[14], with Optus and Telstra also starting to use other mid-bands for 5G from 2021 onwards (table 4.10). As at 31 January 2022, Telstra has deployed the most sites that utilise low band 5G spectrum with 1,836 sites using 850 MHz spectrum. This is followed by TPG who has 906 5G sites using 700 MHz spectrum. Optus is yet to make use of low band spectrum for 5G site deployment.

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. For example, to date the use of high-band spectrum for 5G sites appears limited, following the auction of the 26 GHz band in 2021.[15]

14 Please note, references to 3600 MHz can also be referred to as 3500 MHz. Such terms are used interchangeably to refer to the same spectrum band.

15 Australian Communications and Media Authority (ACMA), Auction summary – 26 GHz band (2021), ACMA website, n.d., accessed 29 July 2022.

Table 4.10: Total number of 5G sites by MNO & radiofrequency spectrum deployed – 2020 to 2022

	2020	2021	2022
Optus			
2100 MHz	-	208	956
2300 MHz	-	291	988
3500 MHz	426	1,006	1,596
26000 MHz	-	4	25
Telstra			
700 MHz	-	-	10
850 MHz	2	-	1,836
2100 MHz	-	-	1
2600 MHz	-	60	269
3600 MHz	797	2,641	3,904
26000 MHz	-	-	102
TPG			
700 MHz	-	19	906
3600 MHz	-	145	947
26000 MHz	-	-	1

5. Mobile coverage analysis[16]

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.

The MNOs estimate and illustrate mobile coverage by producing coverage maps which indicate where their customers can expect to have mobile reception. 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.

Coverage maps are modelled on predicted 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 the end user's device.

Furthermore, the parameters that underpin these predictive coverage models differ across the MNOs and can change over 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 'on the ground' experience of end users. Instead, the changes may reflect differences in the parameters 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.

From 2018 to 2022, the MNOs have provided coverage maps based on different levels of coverage (i.e. indoor, outdoor or external antenna coverage). In 2018, the ACCC wrote to the MNOs encouraging them to work together to improve coverage information.[17] In response, the MNOs have agreed to adopt the same terminology for the level of coverage described (i.e. indoor, outdoor or external antenna coverage).[18] However, in providing coverage maps in accordance with the RKR, the MNOs have interpreted its requirements differently.

Analysis below relates to 2 levels of coverage maps:

1. Outdoor coverage – coverage and quality of reception a customer can expect when using a device outdoors with typical handheld use, based on an elevated upright standing, head height position.[19]
2. External antenna (Ext Ant) coverage – expected coverage when a device is augmented using an external antenna or other coverage extension device that utilises an external antenna. This includes an external antenna mounted to a vehicle.[20]

In general, coverage maps which are based on external antenna coverage predict wider coverage areas than coverage maps based on outdoor coverage.

The ACCC has taken steps to resolve this inconsistency in the level of coverage maps submitted by the MNOs under the RKR. Following a public review, the ACCC has amended the Infrastructure RKR to

16 Refers to geographic land mass coverage and ocean/sea coverage has been excluded from analysis.

17 ACCC, Industry engagement on implementing proposed measures, ACCC, 16 May 2018, accessed 29 July 2022.

18 Australian Mobile Telecommunications Association (AMTA), Networks & Coverage, AMTA website, n.d., accessed 29 July 2022.

19 AMTA, Networks & Coverage.

20 AMTA, Networks & Coverage.

clarify the coverage maps reporting requirements to ensure that the MNOs provide the same level of coverage maps.[21]

However, ensuring the MNOs' coverage maps are comparable requires the MNOs to adopt a set of common parameters 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 parameters for predicting coverage. In the absence of industry-led process, it may be necessary for the government and regulators to prescribe these parameters to address the issue.

For these reasons discussed above, the coverage analysis below 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 2022. For the most up to date coverage information, mobile users should refer to the coverage maps available on the website of their service provider.

Finally, like the 2021 report, we have not included commentary on changes in 5G coverage given the limited amount of data that was available at 31 January 2022 and the extreme percentage changes experienced year-on-year. Some analysis can be found in the output tables that accompany this report. We will aim to include commentary on changes in 5G coverage in future reports.

5.1 Optus – 3G geographic coverage

5.1.1 Optus – 3G geographic coverage – outdoor

Analysis on changes in Optus 3G outdoor coverage from 2021 to 2022 cannot be included in this year's report as Optus stopped providing these coverage maps to the ACCC. In 2022, Optus changed what it submitted to the ACCC from outdoor coverage maps to external antenna coverage maps. However, as 3G networks approach end of life, fluctuations in 3G outdoor coverage have historically been marginal. Based on last year's report, Optus' average change in its 3G outdoor coverage from 2018 to 2021 was 0.3%. 3G outdoor coverage analysis from last year's report is available in the output tables that accompany this year's report.

We will have some analysis available in the 2023 report following the finalisation of the Infrastructure RKR review which will require the MNOs to provide both outdoor and external antenna coverage maps from the 2023 reporting period onwards.

5.1.2 Optus – 3G geographic coverage – external antenna

Analysis on changes in Optus' 3G external antenna geographic coverage has not been included in this year's report as only one years' worth of data is available. In 2022, Optus changed what it submitted to the ACCC from outdoor coverage maps to external antenna coverage maps. Discussion on changes in 3G coverage for external antenna will be included in future reports.

21 ACCC, Audit of telecommunications infrastructure assets record keeping, 19 August 2022, accessed 29 August 2022.

5.2 Optus – 4G geographic coverage

5.2.1 Optus – 4G geographic coverage – outdoor

Analysis on changes in Optus' 4G outdoor coverage cannot be included in this year's report as Optus stopped providing these coverage maps to the ACCC in some capacity in 2021. Between 2021 and 2022, Optus changed what it submitted to the ACCC from a combination of 4G outdoor and external coverage maps to entirely 4G external antenna coverage maps. Results from the 2021 report can be found in the output tables that accompany this year's report.

We will have some analysis available in the 2023 report following the finalisation of the Infrastructure RKR review which will require the MNOs to provide both outdoor and external antenna coverage maps from the 2023 reporting period onwards.

5.2.2 Optus – 4G geographic coverage – external antenna

In 2021, Optus moved to predicting its 4G geographic coverage based largely on external antenna, when previously it was based on outdoor coverage. Therefore, 2021 4G results are based on a combination of predicted external antenna and outdoor coverage. For this reason, Optus' results for '2020 to 2021' and '2021 to 2022' should be considered with caution and as estimates only. Optus 4G data for 2022 is based entirely on external antenna.

Table 5.1 shows that percentage changes follow a similar trend. Between 2020 and 2021 and 2021 and 2022, the percentage increases in 4G external antenna geographic coverage grow in magnitude as you move out from Major Cities to less populous regional and remote areas. Optus' 4G external antenna geographic coverage has increased by 21.5% since 2021.

Table 5.2 indicates that in 2022 at an absolute/aggregate level, 4G external antenna geographic coverage as a percentage of 3G external antenna geographic coverage was close to or above 100% across all ABS Remoteness Areas.

Table 5.1: Percentage change (%) in 4G external antenna geographic coverage by ABS Remoteness Area – Optus – 2020 to 2022

	2020 to 2021	2021 to 2022
Major Cities of Australia	0.6	1.1
Inner Regional Australia	13.6	9.3
Outer Regional Australia	41.3	16.1
Remote Australia	113.8	32.6
Very Remote Australia	225.7	40.3
Total	**57.2**	**21.5**

Table 5.2: 4G external antenna geographic coverage as percentage of 3G external antenna geographic coverage by ABS Remoteness Area – Optus – 2022

	2022
Major Cities of Australia	99.6
Inner Regional Australia	97.1
Outer Regional Australia	98.0
Remote Australia	102.4
Very Remote Australia	110.9
Total	**100.9**

5.3 Telstra – 3G geographic coverage

5.3.1 Telstra – 3G geographic coverage – outdoor

Analysis on changes in Telstra's 3G outdoor geographic coverage has not been included in this year's report as only one years' worth of data is available. Discussion on changes in 3G outdoor coverage will be included in future reports.

5.3.2 Telstra – 3G geographic coverage – external antenna

Between 31 January 2018 and 31 January 2022, Telstra increased its 3G external antenna geographic coverage by 4.2% largely due to an increase of 2.6% between 2018 and 2019. Very Remote Australia experienced the greatest increase in geographic coverage, up 6.5% since 2018 (table 5.3). However, in line with the changes in its 3G sites (figure 4.3), the magnitude of the increases in external antenna geographic coverage have slowed since 2019.

Table 5.3: Percentage change (%) in 3G external antenna geographic coverage by ABS Remoteness Area – Telstra – 2018 to 2022

	2018 to 2019	2019 to 2020	2020 to 2021	2021 to 2022	2018 to 2022
Major Cities of Australia	0.1	0.0	-0.2	0.6	0.4
Inner Regional Australia	0.7	0.2	0.1	0.1	1.1
Outer Regional Australia	1.6	0.3	0.2	-0.1	2.0
Remote Australia	2.3	0.6	0.7	0.2	3.8
Very Remote Australia	3.9	1.6	0.0	0.9	6.5
Total	**2.6**	**0.9**	**0.2**	**0.4**	**4.2**

5.4 Telstra – 4G geographic coverage

5.4.1 Telstra – 4G geographic coverage – outdoor

Analysis on changes in Telstra's 4G outdoor geographic coverage has not been included in this year's report as only one years' worth of data is available. Discussion on changes in 4G outdoor coverage will be included in future reports.

As at 31 January 2022, Telstra's 4G outdoor geographic coverage was 75.5% of its 3G outdoor geographic coverage. 4G outdoor geographic coverage as a percentage of 3G outdoor geographic coverage was highest in Major Cites (100.8%) following closely by Inner Regional Australia (99.2%). Very Remote Australia had the lowest percentage (54.1%).

Table 5.4: 4G outdoor geographic coverage as percentage of 3G outdoor geographic coverage by ABS Remoteness Area – Telstra – 2022

	2022
Major Cities of Australia	100.8
Inner Regional Australia	99.2
Outer Regional Australia	85.3
Remote Australia	71.4
Very Remote Australia	54.1
Total	**75.5**

5.4.2 Telstra – 4G geographic coverage – external antenna

Telstra's 4G external antenna geographic coverage increased by 28.0% between 31 January 2018 and 31 January 2022 with an increase of 5.9% since 2021 (table 5.5). But like 3G external antenna coverage, most of the increases over the period occurred between 2018 and 2019 and reflect similar trends to changes in 4G sites (figure 4.6). Remote and Very Remote Australia experienced the greatest increase in 4G external antenna geographic coverage, up 36.6% and 52.9%, respectively, since 2018. Very Remote Australia also had the largest increase (11.4%) in 4G external antenna geographic coverage between 2021 and 2022.

Table 5.5: Percentage change (%) in 4G external antenna geographic coverage by ABS Remoteness Area – Telstra – 2018 to 2022

	2018 to 2019	2019 to 2020	2020 to 2021	2021 to 2022	2018 to 2022
Major Cities of Australia	-0.2	0.3	-0.3	0.5	0.4
Inner Regional Australia	2.4	1.1	0.3	1.3	5.2
Outer Regional Australia	6.2	2.7	1.5	2.1	13.0
Remote Australia	16.4	5.9	4.1	6.4	36.6
Very Remote Australia	19.1	11.7	3.2	11.4	52.9
Total	**11.4**	**5.9**	**2.4**	**5.9**	**28.0**

As at 31 January 2022, Telstra's total 4G external antenna geographic coverage was 78.3% of its 3G external antenna geographic coverage, up from 63.7% in 2018 (table 5.6). In 2022, 4G geographic coverage as a percentage of 3G geographic coverage was greater than 90% in Major Cities and Regional areas. However, more work is required before its 3G network is shutdown (expected to be by June 2024). 4G external antenna geographic coverage as percentage of its 3G external antenna geographic coverage in Remote and Very Remote Australia was 81.1% and 62.0%, respectively, in 2022.

Table 5.6: 4G external antenna geographic coverage as percentage of 3G external antenna geographic coverage by ABS Remoteness Area – Telstra – 2018 to 2022

	2018	2019	2020	2021	2022
Major Cities of Australia	100.1	99.9	100.2	100.2	100.0
Inner Regional Australia	96.7	98.3	99.2	99.4	100.6
Outer Regional Australia	84.7	88.5	90.6	91.8	93.8
Remote Australia	61.7	70.2	73.9	76.4	81.1
Very Remote Australia	43.2	49.6	54.4	56.1	62.0
Total	**63.7**	**69.2**	**72.6**	**74.2**	**78.3**

5.5 TPG – 3G geographic coverage[22] [23]

5.5.1 TPG – 3G geographic coverage – outdoor

Between 31 January 2018 and 31 January 2022, TPG's 3G outdoor geographic coverage remained relatively steady (increased by 0.8%) (table 5.7). 3G outdoor 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 outdoor geographic coverage between 2018 and 2022.

Table 5.7: Percentage change (%) in 3G outdoor geographic coverage by ABS Remoteness Area – TPG – 2018 to 2022

	2018 to 2019	2019 to 2020	2020 to 2021	2021 to 2022	2018 to 2022
Major Cities of Australia	0.0	-0.4	0.0	0.1	-0.4
Inner Regional Australia	1.1	-4.1	0.2	0.0	-2.9
Outer Regional Australia	3.7	-0.8	-0.4	0.1	2.5
Remote Australia	4.5	-1.5	-0.2	0.1	2.8
Very Remote Australia	0.9	0.1	-0.4	0.3	0.8
Total	**2.8**	**-1.8**	**-0.2**	**0.1**	**0.8**

5.6 TPG – 4G geographic coverage[24]

5.6.1 TPG – 4G geographic coverage – outdoor

TPG's 4G outdoor geographic coverage increased by 3.0% between 31 January 2018 and 31 January 2022 (table 5.8). All the gains in 4G outdoor geographic coverage were experienced between 2018 and 2020 with minor declines experienced since 2020. 4G outdoor geographic coverage increased across all ABS Remoteness Areas except Very Remote Australia which declined by 2.4% from 2018 to 2022. In contrast, coverage in Very Remote Australia increased by 2.5% between 2021 and 2022 after 3 years of decreases.

Table 5.8: Percentage change (%) in 4G outdoor geographic coverage by ABS Remoteness Area – TPG – 2018 to 2022

	2018 to 2019	2019 to 2020	2020 to 2021	2021 to 2022	2018 to 2022
Major Cities of Australia	0.4	0.3	0.0	0.0	0.7
Inner Regional Australia	2.2	0.4	-0.4	-0.1	2.0
Outer Regional Australia	4.5	0.4	-1.1	0.1	3.9
Remote Australia	7.9	-0.1	-1.3	-1.7	4.5
Very Remote Australia	-0.7	-0.8	-3.3	2.5	-2.4
Total	**3.6**	**0.3**	**-0.9**	**-0.1**	**3.0**

Between 31 January 2018 and 31 January 2022, TPG's 4G outdoor geographic coverage as a percentage of its 3G outdoor geographic coverage marginally improved across all ABS Remoteness Areas except Very Remote Australia (table 5.9). Inner Regional Australia experienced the greatest increase over the period. 4G outdoor geographic coverage as a percentage of 3G outdoor geographic coverage increased from 60.5% in 2018 up to 61.8% in 2022. This 2022 figure is largely unchanged from 2021 levels (61.9%).

22 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.

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

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

Table 5.9: 4G outdoor coverage as percentage of 3G outdoor geographic coverage by ABS Remoteness Area – TPG – 2018 to 2022

	2018	2019	2020	2021	2022
Major Cities of Australia	97.9	98.3	99.1	99.1	99.0
Inner Regional Australia	73.7	74.5	78.0	77.5	77.4
Outer Regional Australia	55.6	56.1	56.8	56.4	56.4
Remote Australia	43.2	44.6	45.2	44.7	43.9
Very Remote Australia	44.3	43.6	43.2	41.9	42.9
Total	**60.5**	**61.0**	**62.3**	**61.9**	**61.8**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