



Australian Government

Department of Communications and the Arts

House of Representatives Standing Committee on Communications and the Arts: Inquiry into the deployment, adoption and application of 5G in Australia

Submission

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Introduction

Digital connectivity is a key enabler of Australia's social and economic activity. The mobile and fixed telecommunications networks that provide this connectivity are critical to our lives. Mobile services have long outnumbered fixed services, although fixed services carry greater volumes of data. The direct contribution from the technology sector in Australia is around \$69 billion while the broader total contribution from the technology sector is around \$122 billion (including both direct and indirect contributions).¹

While still at an early stage, the fifth generation of mobile technology, or 5G, promises to be a significant advance on current 3G and 4G networks. 5G is designed to provide greater network capacity, higher speeds and lower latency. It is expected to be a transformative technology that could have significant implications; supporting greater innovation, productivity and international competitiveness. However, there is a need to keep 5G in perspective and balance hype with the reality.

The Government recognises the potential of 5G and put in place Australia's first 5G Strategy in October 2017. The Department of Communications and the Arts (the Department) is working with industry to implement the 5G Strategy, through spectrum allocation and improving regulations such as powers and immunities in order to facilitate the rollout of 5G and its operation. The establishment of the 5G Working Group is another example of this collaboration.

A large amount of material has been published about 5G as a technology and its potential uses. We also expect many other submitters will cover these matters in detail with the Committee. Our submission therefore discusses 5G technology and its uses only briefly, and largely where this helps explain 5G's capabilities and related policy issues. In the main, our submission focusses on the potential benefits of 5G for Australia and what the Government is doing to support its rollout, up-take and productive use.

5G technology and network design

5G represents a step change in mobile communications, with several characteristics that differentiate it from 4G. In particular, 5G will offer significantly greater capacity and faster data speeds, significantly lower signal latency or delay, and will support much larger numbers of devices in a given area.

5G also promises better outcomes in terms of spectrum efficiency, energy usage (both in the network and in devices), mobility at high speed and reliability.

It has been deliberately designed to deliver greater capabilities to support improved and new applications, not only for the mass market, but also industrial and enterprise users. As such 5G is seen as a potential general purpose technology that can underpin a range of industrial, agricultural and other commercial applications.

To achieve these outcomes 5G will operate over several different spectrum bands, including low bands (sub 1 GHz), mid bands (1 to 6 GHz) and high, or millimetre wave (mmWave), bands (24 to 86 GHz). The reason for this is that signals can travel longer distances at low frequencies but carry less data, while they can carry large amounts of data at high frequencies but only over shorter distances.

¹ AlphaBeta, September 2019, *Australia's Digital Opportunity: Growing a \$122 billion a year tech industry*, Page 12, www.alphabeta.com/wp-content/uploads/2019/09/australias-digital-dividend-final.pdf



5G network operators will draw on the complementary properties of these different spectrum bands to deliver the full potential of 5G.

This use of spectrum will see a different approach to network design to prior generations of mobile telecommunications. 5G will continue to use towers with transmitters using lower bands, providing wide area coverage. In areas with greater concentrations of users and traffic, 5G will use high band frequencies to carry larger amounts of data with less latency but over shorter distances, and will use more small cells to do this. Typically small cells are used in high traffic areas such as transport hubs or office buildings, as is common with 4G today.

Generally established carriers like Telstra, Optus and Vodafone in Australia will operate commercial networks offering services to the public. However, 5G can also be used to operate private networks. For example, 5G can be used to provide networking in a specific area such as a factory or warehouse. Apart from its high performance, 5G could reduce costs associated with more typical cabled approaches.

Features such as the use of different spectrum and new network design approaches raise new issues for Government, for example, in spectrum management and access to transmission sites.

In addition to its use of mmWave bands, 5G's capabilities are attributable to technologies like multiple input, multiple output (MIMO) antennas, beamforming, edge computing and network slicing. MIMO antennas have multiple constituent antennas to send and receive more data simultaneously. Beamforming uses MIMO and advanced signal processing algorithms to direct radio signals to users and devices using the best path, rather than transmitting signals in all directions.

With edge computing, data is processed near the edge of the network, where the data is generated, rather than a distant centralised data-processing facility, improving performance. Network slicing allows the network to be segmented or sliced allowing particular services and applications to particular users like consumers, businesses or utilities on a dedicated basis. This makes it feasible for a 5G customer to be assigned a dedicated 5G network slice and rely on 5G for their communications rather than building their own dedicated network infrastructure.

As well as being a significant technological advance in its own right, 5G will also be able to work with other emerging technologies like cloud computing, artificial intelligence and robotics to provide powerful new tools for consumers and enterprise.

The International Mobile Telecommunications-2020 (IMT-2020) is the international technical framework supported by the International Telecommunications Union (ITU) to underpin 5G, including broadband networks and customer devices. The development of 5G as a concrete technology is, however, largely driven by industry, through the 3rd Generation Partnership Project (3GPP). In April 2019, 3GPP announced that work had been completed on Release 15, the first full set of 5G standards. Release 15 enables vendors to progress chip design and initial network implementation.² The second of the two 5G technical specifications, Release 16, is due for release in March 2020. Release 16 will provide the technical specifications for full-scale 5G networks.³ Development of specifications will continue to be enhanced even after Release 16 is completed.⁴

² 3GPP, *Release 15*, www.3gpp.org/release-15

³ 3GPP, *Release 16*, www.3gpp.org/release-16

⁴ Ericsson, *5G NR release 16 – start of the 5G Evolution*, www.ericsson.com/en/blog/2018/9/5g-nr-release-16--start-of-the-5g-evolution



At present, 5G is at a relatively early stage of deployment. Its standards are still being finalised, spectrum is still being allocated and equipment and handsets are still being developed. 5G is currently operating in conjunction with 4G infrastructure in what is known as non-standalone mode, with full 5G standalone operation to come. As such the full potential of 5G is still some time off. This needs to be taken into account in assessing 5G's performance today.

Economic potential of 5G

Given its capabilities, 5G is widely seen as a platform for improved productivity growth around the world. The potential for new and improved products, and better efficiency in their production, means that 5G is likely to have an economic effect well beyond any short-term commercial return. Depending on the scale and pace of the rollout, and the development and uptake of the services it supports, it has the potential to produce far-reaching economic benefits by supporting, and even accelerating, Australia's digital transformation.

The overall productivity effect of 5G will stem from how inputs and outputs change as a result of the technology. On the outputs side, the benefits from 5G are expected to lead to more efficiently produced goods and services—a greater volume of production for given inputs. On the inputs side, there will be additional investment and costs to build the physical infrastructure of the network (upgrading new and existing base stations, and upgrading backhaul capacity) as well as purchasing access to spectrum.

In April 2018, the Department's Bureau of Communications and Arts Research (BCAR) examined publicly available sources on the likely costs and benefits of 5G in order to model the impact of the technology on productivity and economic growth. Based on this evidence, the BCAR estimated 5G could provide an additional \$1,300 to \$2,000 in gross domestic product per person after the first decade of the rollout.⁵ The sooner 5G networks are deployed, the sooner these economic opportunities are likely to be realised.

This estimate of the economic benefit is likely to be conservative in that it does not fully take into account the consumer and non-market benefits that are not captured in economic statistics. These include cost and time savings for households enabled by better mobile telecommunications. The sharing economy (which harnesses household assets for market production) is also likely to increasingly blur the line between productive and household sectors in terms of the drivers of output, innovation and productivity growth.

Other research has identified the economic value and importance of 5G in the future. A 2019 report released by Deloitte estimated that the economic benefits of mobile connectivity (including 5G and other generations of technology) to the Australian economy by 2023 would be \$65 billion or approximately \$2500 for every Australian.⁶ From a global perspective, a 2017 report commissioned by Qualcomm found that 5G could enable US\$12 trillion in economic activity by 2035.⁷

⁵ BCAR, 2018, *Impacts of 5G on productivity and economic growth: Working paper*, Page 1, www.communications.gov.au/departamental-news/impacts-5g-productivity-and-economic-growth

⁶ Deloitte Access Economics, 2019, *Mobile Nation 2019: The 5G future*, Page 1, www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloitte-au-economics-mobile-nation-2019-080419.pdf

⁷ IHS Economics & IHS Technology, January 2017, *The 5G economy: How 5G technology will contribute to the global economy*, Page 4, www.qualcomm.com/media/documents/files/ihs-5g-economic-impact-study.pdf



5G use cases

5G has three core capabilities around which use cases are built:

- Enhanced mobile broadband (eMBB);
- Ultra reliable, low latency communications (URLLC); and
- Massive machine to machine communications (MMMC) – commonly associated with the enhanced Internet of Things (IoT).

5G has the potential to better support existing applications as well as new and emerging applications.

5G promises to significantly improve many existing uses of mobile and wireless broadband, both for the everyday consumer and businesses. This includes more data intensive applications like video conferencing, video streaming, online gaming, teleworking and extended reality. This is because 5G will provide much greater capacity and thus minimal congestion as well as low latency and high reliability. Moving traffic to 5G will also improve the performance of 4G services. The capability of enhanced mobile broadband was recently demonstrated by Telstra at this year's AFL Grand Final at the Melbourne Cricket Ground.⁸ Telstra has indicated that 5G users experienced three to four times the speeds available on 4G, and 4G users also had improved performance due to traffic moving to 5G.⁹

Telstra's Chief Executive Officer, Andy Penn, has been reported as saying for 5G "the business case for the technology stands up purely on the increased capacity and throughput it gives to our networks".¹⁰

5G is being used to provide fixed broadband services in many countries. Optus has actively pursued this option in Australia, as has Verizon in the USA¹¹ and BT in the UK.¹²

Beyond the familiar mass market uses, 5G is seen as providing a wide range of new capabilities for commercial, industrial and other business users.

5G can significantly enhance the use of IoT, improving the use of networked remote sensors and actuators for data collection, analytics and control. IoT has been in operation for some time, using a range of communication platforms. However, 5G will facilitate new IoT applications as it can support more devices per square kilometre and will be able to utilise the ultra-low latency communications to support applications existing technologies cannot facilitate. Smart factories and warehouses, logistics management and autonomous vehicles are some examples expected to be able to leverage these capabilities.

⁸ Nikos Katinakis, 22 September 2019, *5G arrives at the MCG, just in time for the AFL Grand Final*, Telstra Exchange, www.exchange.telstra.com.au/5g-arrives-at-the-mcg-just-in-time-for-the-afl-grand-final/

⁹ Nikos Katinakis, 21 October 2019, Communications Day Congress, *Communications Day*, Page 9

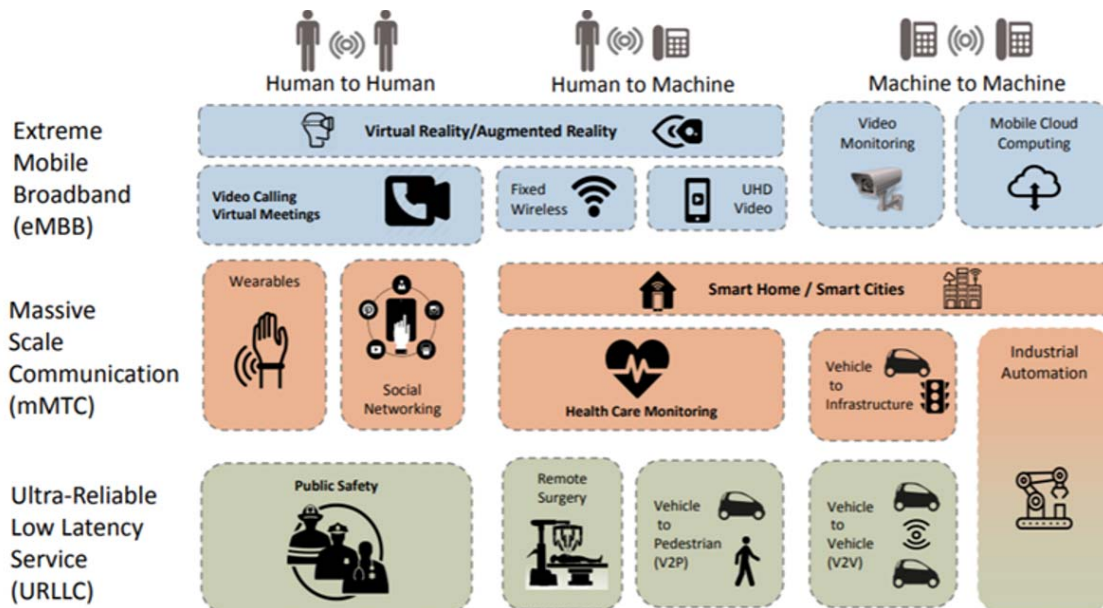
¹⁰ 25 February 2019, 5G price hike unlikely, say's Telstra's Andy Penn, *The Australian*, www.theaustralian.com.au/business/technology/telstra-cba-team-for-5g-finance-applications/news-story/c056eed2ca7d0bc614944aedd2b12ea3

¹¹ George Paul, 13 September 2019, Verizon's fixed 5G improvements will boost the appeal of its broadband service, *Business Insider*, www.businessinsider.com/verizons-fixed-5g-rollout-will-shake-up-home-internet-2019-9/?r=AU&IR=T

¹² Manny Pham, 9 October 2019, BT rings in convergence changes with Halo offer, *Mobile World Live*, www.mobileworldlive.com/featured-content/home-banner/bt-rings-in-convergence-changes-with-halo-offer/



5G’s capabilities lend themselves to a wide range of other new use cases. The diagram below provides a sample of applications that may be enhanced or supported by 5G.



Source: 5G Americas, 5G Services and Use Cases¹³

While 5G will provide a connectivity platform of greater capability, users, particularly in the commercial sector who best understand their business needs, will play a key role. They can best determine how 5G’s capabilities can be best employed to innovate to improve production and distribution process and capture savings and productivity gains. Given 5G’s technological and commercial potential, particularly if combined with artificial intelligence and automation, significant work to develop use cases continues around the world. This includes work by vendors, carriers, software developers and retail service providers, typically collaborating closely.

Early reporting has already indicated a strong interest by business in 5G. For example, the recent *5G for Business in Australia* report identified that in the next 18 months 24 per cent of Australian businesses plan to adopt 5G services. Nearly 80 per cent of Australian businesses in the next three years are looking to adopt 5G.¹⁴

There are opportunities for Australian businesses to develop services and applications that leverage 5G. In this context, Telstra established its 5G Innovation Centre on the Gold Coast in 2018. Amongst other things, Telstra has been reported as working with the Commonwealth Bank on how to use 5G to provide better banking experiences.¹⁵ Optus has access to SingTel’s 5G Garage in Singapore.¹⁶ Global

¹³ 5G Americas, November 2017, *5G Services and Use Cases: 5G Americas Whitepaper*, Page 19, www.5gamericas.org/wp-content/uploads/2019/07/5G_Service_and_Use_Cases_FINAL.pdf

¹⁴ Eliza Booth, 18 October 2019, *Research explores the 5G readiness of Australian Businesses*, Infrastructure Magazine, www.infrastructuremagazine.com.au/2019/10/18/research-explores-the-5g-readiness-of-australian-businesses/

¹⁵ Telstra Media Release, 25 February 2019, *Telstra, CBA and Ericsson to trial 5G for the banking sector*, www.telstra.com.au/aboutus/media/media-releases/Telstra_CBA_Ericsson_trial_5G_banking_sector

¹⁶ Singtel News Release, 22 February 2019, *Singtel, Optus, Ericsson and OPPO achieve ground-breaking Augmented Reality 5G video call between Singapore and Australia*, www.singtel.com/about-us/news-releases/singtel-optus-ericsson-and-oppo-achieve-ground-breaking-augmented-reality-5g-vi



software developer, InfoSys, opened one of five 5G innovation labs globally in Melbourne in June 2019.¹⁷

In December 2018, the Minister for Industry, Innovation and Science, the Hon Karen Andrews MP, launched Australia's Tech Future.¹⁸ The document sets out a vision for a strong, safe and inclusive economy, boosted by digital technology, identifying four key areas of focus – people, services, digital assets and the enabling environment. 5G is identified as a potential general purpose technology. The document notes the opportunities and challenges of new technologies and seeks to ensure that Australia's digital infrastructure, such as 5G, is built on the principle of 'secure-by-design'.

How to foster the productive use of 5G across the economy and society is a key priority for the Government. As businesses see their competitors looking to use 5G to gain a commercial edge, they too will need to do so, opening up the prospective of a wave of 5G-based innovation. With an early lead in 5G in the field, there may be scope for Australian firms to leverage this intellectual property more widely around the world.

Government's 5G Strategy

Recognising the transformative potential of 5G, the Australian Government released a 5G Strategy 'Enabling the Future Economy', in 2017.¹⁹

The 5G Strategy is set within the context of Australia's competitive mobile communications market and competition is fundamental to the overall Strategy. This is discussed below.

The Strategy highlighted four key actions the Government would take to support the timely rollout of 5G in Australia:

- making spectrum available in a timely manner;
- actively engaging in global spectrum harmonisation processes;
- streamlining arrangements for the deployment of infrastructure; and
- reviewing other regulatory arrangements to ensure they are fit-for-purpose.

The Strategy also flagged the formation of the 5G Working Group to enable an ongoing dialogue between industry and Government on 5G issues.

In targeting these matters, Australia's 5G Strategy is similar to many others in developed countries around the world.

The following is a short report on progress against the Strategy, noting that its elements are under constant review, with a view to updating it as appropriate. We envisage the Committee's report will provide useful guidance in this regard.

¹⁷ Infosys Newsroom, 6 June 2019, *Infosys launches Melbourne 5G Living Lab*, www.infosys.com/newsroom/features/Pages/launches-5G-living-lab-melbourne.aspx

¹⁸ Department of Industry, Innovation and Science, December 2018, *Australia's Tech Future*, www.industry.gov.au/data-and-publications/australias-tech-future

¹⁹ Department of Communications and the Arts, October 2017, *5G—Enabling the future economy*, www.communications.gov.au/departmental-news/5g-enabling-future-economy



Competition

Competition is the foundation of Australia's 5G Strategy. Competition in Australia's mobile market has been highly successful in delivering investment in infrastructure across both metropolitan and regional Australia, strong consumer take-up of mobile services and positive consumer outcomes on pricing and inclusions. This has occurred with minimal regulation. Australia has been assessed as having some of the world's best mobile services.²⁰

As noted above, 5G is being used as a fixed broadband option by Optus and in markets overseas. Such competition is welcome. 5G's ability to compete in this market may, however, be constrained by its carrying capacity relative to that of fixed lines. That is, the vast majority of data in Australia is currently delivered over the fixed line networks, notwithstanding the vast majority of services being mobile.²¹ In this context, 5G may be a more attractive option for users needing a high speed service with relatively low data consumption.

The Department's preference is to continue to foster strong competition and minimal regulation as the best means of promoting network investment and delivering consumer benefits. In this context, it is important that competitors are strong and robust and have appropriate flexibility to determine their mode of operation. The spectrum allocation framework takes into account the promotion of competition (as a relevant policy objective of the Government, and through the imposition of allocation limits to prevent monopolisation of the spectrum and promote competitive market outcomes). Mobile network operators are treated equally in other relevant areas like numbering and powers and immunities. The 5G Strategy should be understood as operating in this broader pro-competitive framework.

Spectrum

Spectrum is key to the rollout of 5G. Spectrum allocations involve a number of complex decisions regarding existing users and future usage and can take a number of years to plan and undertake.

The rollout of 5G services in Australia is being facilitated by Government actions to make 5G-suitable spectrum available in a timely manner.

In December 2018, the Government successfully auctioned 125 MHz of the 3.6 GHz spectrum which mobile network operators are starting to use for 5G via early access arrangements to the band.

Optus and Telstra also hold spectrum in the 3.4 GHz band which we understand they are currently using for early 5G services. The Government is working to optimise the 3.4 GHz band to make it better suited for 5G services. As the existing wireless broadband arrangements in the band are fragmented and not optimally configured for future technologies, including 5G, the Australian Communications and Media Authority (ACMA) is considering restacking apparatus licences in regional areas and undertaking a defragmentation of the band. This will improve spectral efficiencies for incumbents, and in turn, support the deployment of 5G infrastructure. The Government also anticipates the optimisation of the band will free up further spectrum, which ACMA can allocate via market-based mechanisms.

²⁰ GSMA, 2018, *State of Mobile Internet Connectivity 2018*, Page 7 www.gsma.com/mobilefordevelopment/resources/state-of-mobile-internet-connectivity-2018/

²¹ ACMA, 2019, *ACMA Communications Report 2017-18*, Page 61, www.acma.gov.au/publications/2019-02/report/communications-report-2017-18



The Government has also recently taken steps to bring 5G-suitable mmWave spectrum to market. On 25 October 2019, the Minister for Communications, Cyber Safety and the Arts, the Hon Paul Fletcher announced his decision to issue a spectrum re-allocation declaration for the 26 GHz band, consistent with advice from ACMA. This decision paves the way for ACMA to auction 2.4 GHz of 5G-suitable spectrum in the 26 GHz band in early 2021. This will give carriers access to mmWave band spectrum with high data carrying capacity, which will be important for achieving 5G's full potential. The spectrum will be auctioned in geographic areas covering 29 cities and regional centres. Pending access to spectrum in the 26 GHz band, carriers and others can make use of scientific licences to trial services in new bands, including mmWave.

Spectrum in the 3.4 GHz, 3.6 GHz and 26 GHz bands will be vital to ensuring that mobile network operators can optimally deploy 5G networks around Australia. The 3.4 GHz and 3.6 GHz bands will provide broader geographic coverage for 5G services, while the 26 GHz band will provide for shorter-range, higher capacity services.

The Department continues to work with ACMA to determine required spectrum, undertake spectrum auctions for allocation and to provide the regulatory framework to prevent monopolies and promote competition. ACMA's Five Year Spectrum Outlook 2019-2023 (FYSO) provides details of its forward looking spectrum management priorities and work plan. This includes optimisation of existing holdings in the 3.4 GHz, and the allocation of spectrum in the 26 GHz band, as mentioned above.

Global spectrum harmonisation

The Government is further supporting 5G through its work internationally on spectrum harmonisation. This includes engagement in international forums such as the World Radiocommunication Conference (WRC), where member states of the International Telecommunication Union (ITU), and key industry experts, are working to identify frequency bands for use by 5G International Mobile Telecommunication (IMT) services, and coordinate the development of telecommunication standards.

The ITU is the United Nations' specialised agency for information and communication technologies. Every three to four years, the ITU holds the WRC to review and, if necessary, revise the Radio Regulations, the international treaty governing the use of the radio-frequency spectrum and satellite orbits.

A multi-stakeholder Australian delegation is currently attending the World Radiocommunication Conference 2019 (WRC-19) in Sharm El-Sheikh, Egypt. One of the key issues being considered at WRC-19 is the identification of several frequency bands above 24 GHz for use by IMT services. Australia supports identification (and associated spectrum allocations) in the 24.25-27.5 GHz, 40.5-42.5 GHz, 42.5-43.5 GHz, 47.2-50.2 GHz and 66-71 GHz frequency bands, subject to varying band-specific conditions.

Additionally, several other countries have made proposals for bands between 3.3 GHz and 24 GHz to be studied for use by IMT over the next four years.

Deployment

Carriers can choose to deploy facilities under relevant state and territory planning laws or Commonwealth laws in some cases. Where a carrier chooses to deploy under state or territory planning laws, they must follow the processes for community and local government consultations set out in those laws. Approvals for the installation of free-standing towers, for example, are the responsibility of state, territory and local governments.



However, there are laws at the Commonwealth level that are designed to assist carriers to deploy their networks and support ready access to telecommunications services. Telecommunications carriers have certain specific legal powers under Schedule 3²² of the *Telecommunications Act 1997* (the Act) to undertake inspections and to install and maintain facilities, and have immunity from some state and territory laws, such as planning, when doing so. These laws are known as carrier “powers and immunities” and primarily relate to low-impact facilities which are specified in the *Telecommunications (Low-impact Facilities) Determination 2018*²³ (LIFD). Powers and immunities are important as they provide a nationally consistent framework for the deployment of facilities that helps reduce the time and cost involved for carriers in delivering services to the wider community.

The types of facilities that are listed as low-impact are those considered to be essential to the effective and efficient operation of telecommunications networks in providing services to the public, but are considered to be of low visual impact and unlikely to cause significant disruption to the community during installation or operation. Low-impact facilities include cabinets, antennas, or underground cables, but exclude other kinds of facilities such as free standing towers, which are covered by state and territory arrangements as noted above.

The specification of low-impact facilities encourages carriers to roll out networks using components that fall within strict type, size, colour and location limitations, thereby minimising the impact of telecommunications infrastructure on the community generally while expediting the supply of services.

The powers and immunities framework has safeguards built in so the interests of landowners and the community are taken into account. In exercising their powers, carriers must adhere to strict requirements including notifying landholders and land occupiers of their intention to install telecommunications infrastructure on land. Carriers must also advise landholders of their right to object, the grounds for objection (for example, the use of the land or the location of the facility on the land), the right to have a decision reviewed by the Telecommunications Industry Ombudsman (TIO) and timeframes for lodging objections.

In addition to the conditions in the Act, the *Telecommunications Code of Practice 2018*²⁴ (Code of Practice) sets out further obligations on carriers. For example, under the Code of Practice, carriers must comply with good engineering practice and consider noise limits, the environment, and obstruction of essential services when installing or maintaining facilities. Obligations on carriers under the Act and Code of Practice also apply to contractors acting on behalf of carriers.

The Act makes provision for the payment of compensation in certain circumstances. Clause 42 of Schedule 3 to the Act specifically provides that if a person suffers financial loss or damage because of a carrier’s actions in exercising its powers and immunities, compensation is payable. If an affected party is dissatisfied with the amount of compensation offered, it may apply to a court of competent jurisdiction. The laws also allow for compensation with regard to an acquisition of property.

Telecommunications carriers installing low-impact facilities for mobile phone networks must also comply with the Industry Code for *Mobile Phone Base Station Deployment C564:2018*²⁵ (the Industry

²² *Telecommunications Act 1997*, www.legislation.gov.au/Details/C2019C00273/Html/Volume_2#_Toc19539643

²³ *Telecommunications (Low-impact Facilities) Determination 2018*, www.legislation.gov.au/Details/F2018C00150

²⁴ *Telecommunications Code of Practice 2018*, www.legislation.gov.au/Details/F2018L00171

²⁵ Communications Alliance, 2018, *Industry Code C564:2018 Mobile Phone Base Station Deployment*, www.commsalliance.com.au/_data/assets/pdf_file/0018/62208/C564_2018-181206.pdf



Code). The Industry Code sets out additional processes that mobile carriers are to follow when they are installing low-impact facilities.

Following public consultation, in early 2018 the Government amended the powers and immunities framework with a number of changes to help carriers rollout new infrastructure, including 5G. The amendments clarified a facility is a co-located facility where it is installed on or in a telecommunications facility or public utility infrastructure. They also specified omnidirectional antennas as low-impact facilities in residential and commercial areas, not just industrial and rural areas. In addition, they replaced the technology-specific term ‘microcell’ with ‘radiocommunications facility’ to be more inclusive of small cellular and non-cellular transmitters, including WiFi.

The Department is working to identify further opportunities to streamline deployment processes to support the timely rollout of 5G in Australia, whilst ensuring that the views of landowners and the community are taken into account.

To further help with the deployment of telecommunications infrastructure so it is readily available for users, the Department has proposed in various forums that state and territory planning regimes give greater consideration in their early stages to the provision of telecommunications facilities. This could include, for example, working with carriers to identify sites for facilities, rights of way for ducts and conduits and require the installation of ducts and conduits. This has gained some traction, particularly through the digital commitments in the Western Sydney City Deal (see below). Such engagement will be an ongoing focus for the Department.

The rollout of 5G facilities could also be facilitated by infrastructure owners like councils, state and territory governments or other authorities providing access to their assets. However, this would need to be at a cost and using arrangements that make it viable for carriers. Carriers, such as Telstra²⁶ and Optus,²⁷ have recently expressed concerns about rental arrangements proposed by NSW’s Independent Pricing and Regulatory Tribunal for communication towers on Crown land.

Another area of interest to the Department, industry and other stakeholders is improving the visual amenity of telecommunications facilities. With 5G’s network design there are opportunities to deploy facilities, like small cells, by integrating them into street furniture or co-locating on existing infrastructure with minimal visual impact. The Department is engaged in the Western Sydney City Deal, which includes a commitment to develop uniform local government engineering design standards and telecommunications planning to enhance connectivity outcomes.²⁸ Through mechanisms such as this there are opportunities to advocate for improvements in visual amenity.

Reviewing other regulation

The 5G Strategy also provides for the review of other regulation relevant to 5G. This has taken three main forms to date.

First, the Government has been reviewing and revising the *Radiocommunications Act 1992*, which governs the management of the spectrum so important to the operation of 5G and many other

²⁶ Itnews, 29 July 2019, *Telstra warns NSW influencing Australia-wide mobile costs*, www.itnews.com.au/news/telstra-warns-nsw-influencing-australia-wide-mobile-costs-528807

²⁷ Optus, 2019, *Review of Rental Arrangements for Communication Towers on Crown Land*, www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/investigation-section-9-submissions-rental-arrangements-of-communication-towers-on-crown-lands-draft-report/online-submission-optus-l.-van-hooft-6-sep-2019-160414510.pdf

²⁸ *Western Sydney City Deal Implementation Plan*, 2018, www.infrastructure.gov.au/cities/city-deals/western-sydney/files/western-sydney-city-deal-implementation-plan.pdf



services. A key aim of this work has been to develop a more efficient process for the allocation of spectrum. This work is well advanced, following public consultation on draft legislation in May 2017. The Department now expects amendments to the existing legislation will be put forward in early 2020.

Second, a focus of the 5G Working Group is identifying regulatory enablers and barriers to 5G, including in industry sectors or ‘verticals’ in which 5G is expected to play a keen role. To date, the Working Group has focussed on the potential use of 5G in health, transport and agriculture, but has not identified significant regulatory issues at this time. A generic issue which has arisen is whether regulation governing the use of data could unduly inhibit the use of data collected by IoT applications. This is something the Department is continuing to explore. The role of the Working Group is discussed further below.

In considering 5G’s potential use in various industry sectors, it is apparent that there may be issues outside the Commonwealth’s jurisdiction and the regulation of 5G itself that are relevant to its success. If 5G is to be used to support downstream technologies they also need to have appropriate sectoral frameworks. For example, if 5G is to support autonomous vehicles there needs to be a framework for autonomous vehicles so there is scope for 5G to support them. In the case of autonomous vehicles, Australia is well advanced in this regard, in that several jurisdictions have relevant legislation in place, all have trials underway and there are Guidelines for Trial of Autonomous Vehicles in Australia.²⁹

Third, the Department has recently established a deregulation review as part of the Government’s wider deregulation agenda. This will be another mechanism by which possible regulatory enablers and barriers to 5G and its use can be explored.

5G Working Group

In October 2017, the Government announced the formation of a 5G Working Group to bring together industry and Government. The Group was established in February 2018.

The Working Group provides a forum for ongoing dialogue between industry and the Government on 5G issues. A key focus of the group is to identify enablers and barriers to 5G and use cases that can help with sectoral productivity.

Membership of the 5G Working Group includes relevant Government departments, mobile carriers, equipment vendors and industry peak bodies.

The 5G Working Group’s terms of reference are:

1. identify enablers and barriers to the deployment and effective use of 5G in Australia, including at the sector and industry level
2. examine how the Commonwealth regulatory settings in sectors, including but not limited to communications, can be optimised for 5G networks and technologies
3. provide a platform for collaboration across Government and industry on 5G matters
4. engage, with the input of subject matter experts, in ongoing strategic dialogue about 5G matters.³⁰

²⁹ NTC, *Automated Vehicle Trial Guidelines*, www.ntc.gov.au/codes-and-guidelines/automated-vehicle-trial-guidelines

³⁰ Department of Communications and the Arts, 2017, *5G Working Group membership and terms of reference*, www.communications.gov.au/departmental-news/5g-working-group-membership-and-terms-reference



The Working Group has met four times to date and focussed on 5G's use in the transport, agricultural and health sectors as well as its ongoing role.

The Group's terms of reference have recently been reviewed and its role going forward is being considered.

Western Sydney City Deal

In recognition of the importance of telecommunications in modern cities and in particular to the Western Parkland City that's growth is being supported by the construction of the Western Sydney International (Nancy-Bird Walton) Airport, the Western Sydney City Deal includes a number of digital commitments. These are developing a Western City Digital Action Plan, delivering a Smart Western City Program for smart and secure technology, developing a 5G Strategy including the trialling of 5G, and making data publicly available in line with open-data principles. Also relevant is the planning and housing commitment to develop uniform, best practice local government engineering design standards to simplify the development assessment process, including for telecommunications.

These commitments seek to raise awareness of the potential of 5G in our cities, demonstrate its utility through early use trials, streamline rollout through forward looking community-sensitive planning arrangements, and maximise its utility through appropriate open data arrangements. It is envisaged that the lessons learnt in Western Sydney may be of benefit in other contexts and the Department is interested in the role of 5G being considered in future City and Regional Deals.

Concerns about the health effects of 5G

Radio transmitters on telecommunications equipment emit electromagnetic energy (EME) emissions to function. Importantly, these emissions are in the non-ionizing part of the electromagnetic energy spectrum.³¹ There is nevertheless strict regulation of the EME from telecommunications facilities, so the community can have reassurance that there are no negative health effects from the EME from telecommunications facilities.

There are a number of agencies involved in the regulation of EME emissions from telecommunications equipment. These include the Australian Radiation and Nuclear Protection Agency (ARPANSA) and the National Health and Medical Research Council (NHMRC) in the Health portfolio. Within the Communications portfolio, the Department sets the policy and legislative framework for deployment of telecommunications equipment, and ACMA regulates industry's compliance with legislative requirements.

ARPANSA is the Australian Government's independent authority on radiation protection and nuclear safety. ARPANSA's role is to protect people and the environment from the harmful effects of radiation, which is done through a range of activities, including setting standards on the emission of radiation. The Department and ACMA, like industry, rely on the expert scientific advice of ARPANSA on EME.

The ARPANSA *Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 200 GHz* (the RF Standard)³² limits the amount of radio frequency EME telecommunications facilities can emit. The RF Standard is based on decades of Australian and international peer-reviewed research into EME and is set well below the level at which adverse health effects occur, it includes a

³¹ ARPANSA, *What is radiation?*, www.arpansa.gov.au/understanding-radiation/what-is-radiation

³² ARPANSA, 2002, *Maximum Exposure Levels to Radiofrequency Fields – 3 KHz to 300 GHz*, www.arpansa.gov.au/sites/g/files/net3086/f/legacy/pubs/rps/rps3.pdf



wide safety margin to further protect the public, and covers the frequency ranges that 5G technology will use.

The *Radiocommunications Act 1992* allows ACMA to determine conditions in relation to a particular type of apparatus licence. The *Radiocommunications Licence Conditions (Apparatus Licence) Determination 2015* (LCD) sets the licence conditions for apparatus licences, including a requirement that transmitters operating under an apparatus licence must comply with the RF Standard.

Regarding spectrum licences, a standard licence condition for those licences requires compliance with the LCD. This regulatory approach means that transmitters being operated under a spectrum licence must also comply with RF Standard.

ACMA also regulates portable equipment, such as mobile phone handsets, through the *Radiocommunications (Compliance Labelling – Electromagnetic Radiation) Notice 2014* and the *Radiocommunications (Electromagnetic Radiation – Human Exposure) Standard 2014*, which also requires compliance with the RF Standard.

Telecommunications devices and facilities are also subject to testing and compliance checks to ensure that they do not exceed the ARPANSA exposure limits. Equipment deployed as part of a 5G network will need to comply with the RF Standard and ACMA regulations just as other equipment does today.

Research into EME

The effects of EME exposure have been the subject of extensive and rigorous scientific study around the world for many decades. ARPANSA consults with the world's peak health bodies, such as the World Health Organization and the International Commission on Non-Ionizing Radiation Protection (ICNIRP), so that Australia can contribute to and benefit from the best international research and guidance on this matter. Based on the best available research, ARPANSA and other leading health authorities advise that there are no known health effects of EME at levels below the RF Standard.

There have been many studies done on electromagnetic energy, by a host of national and international bodies, which cover but are not necessarily restricted to the range in which 5G technology will operate. ARPANSA published an independent review of the state of research on RF health effects, covering a large number of studies, in its *Review of Radiofrequency Health Effects Research – Scientific Literature 2000-2012*.³³ These studies cover research on EME overall, including the frequency ranges where 5G technology will operate.

The Australian Government also directs funding to the NHMRC to implement a domestic research program about exposure to EME from mobile phones, mobile phone towers and broadcast towers. NHMRC has granted \$2.5 million over five years to the Australian Centre for Electromagnetic Bioeffects Research (ACEBR) to undertake a range of EME research projects. ACEBR's programs include research into human neurophysiology, cellular response studies, dosimetry, and social sciences³⁴.

There has been an increased level of misinformation spread about EME and 5G through social media, including claims that research studies prove that EME is dangerous. Internationally, it has been noted that on occasion low-quality studies have been put forward as evidence that the deployment of 5G

³³ ARPANSA, 2014, *Review of Radiofrequency Health Effects Research – Scientific Literature 200-2012*
www.arpansa.gov.au/sites/default/files/legacy/pubs/technicalreports/tr164.pdf

³⁴ Further information about ACEBR's research is available through its website at www.acebr.uow.edu.au.



will be dangerous.³⁵ Where a particular study raises community interest, ARPANSA and ACEBR may publish position statements about the implications of the study. For example, ARPANSA published a paper in 2018 in the *British Medical Journal Open* on mobile phone use and incidence of brain tumours. The research reported no increase in brain tumours that can be attributed to mobile phone use in Australians aged 20-59. The article received significant attention and some criticism. As a result, ARPANSA undertook further research to address the identified gap in their sample group and released its results in August this year³⁶ which showed that any increases in older people are minor and consistent with improvements in diagnosis.

Similarly, ACEBR has published an analysis of a US Toxicology Program study on rats. This study is often referred to by people who are concerned about EME. However, ACEBR's position statement notes several methodological and interpretational issues with the study, including abnormalities in the control group.³⁷

Information for the community

Depending on the particular nature of their concern, individuals and community groups may seek information about the safety and regulation of EME from a range of sources. Residents who have been notified of a proposed installation or maintenance activity may be supplied with information about a particular site from the relevant telecommunications carrier. This information usually includes a report of the expected EME from the site. Interested parties can also find this information by searching on the industry-managed Radio Frequency National Site Archive.³⁸ ACMA's website contains a range of information for both industry and consumers relating to EME from telecommunications facilities.³⁹ ARPANSA's website⁴⁰ provides a range of resources at a more technical level. ARPANSA also operates a program, accessible online, where the public can talk directly with scientific experts on EME exposure.⁴¹

If a person is concerned about a facility's compliance with EME requirements, they should contact the carrier in the first instance. If those concerns are not resolved, then they can contact ACMA at info@acma.gov.au, which can investigate whether the relevant carrier is meeting its regulatory obligations.

Progress of the 5G rollout

The rollout of 5G is fundamentally a commercial activity of private sector carriers like Telstra, Optus and Vodafone, however, the Department is monitoring its rollout, take-up and performance because of its potential benefits for everyday consumers, business and productivity.

³⁵ David Robert Grimes, 28 October 2019, *Don't Fall Prey to Scaremongering about 5G*, www.blogs.scientificamerican.com/observations/dont-fall-prey-to-scaremongering-about-5g/

³⁶ BMJ Open, www.bmjopen.bmj.com/content/8/12/e024489.responses

³⁷ ACEBR, *Position Statements*, www.acebr.uow.edu.au/position-statements/index.html

³⁸ AMTA, *Welcome to the Radio Frequency National Site Archive*, www.rfnsa.com.au

³⁹ ACMA, *Emehub*, www.acma.gov.au/emehub

⁴⁰ ARPANSA, *ARPANSA website landing page*, www.arpansa.gov.au

⁴¹ ARPANSA, *Talk to a Scientist*, www.arpansa.gov.au/contact-us/talk-to-a-scientist



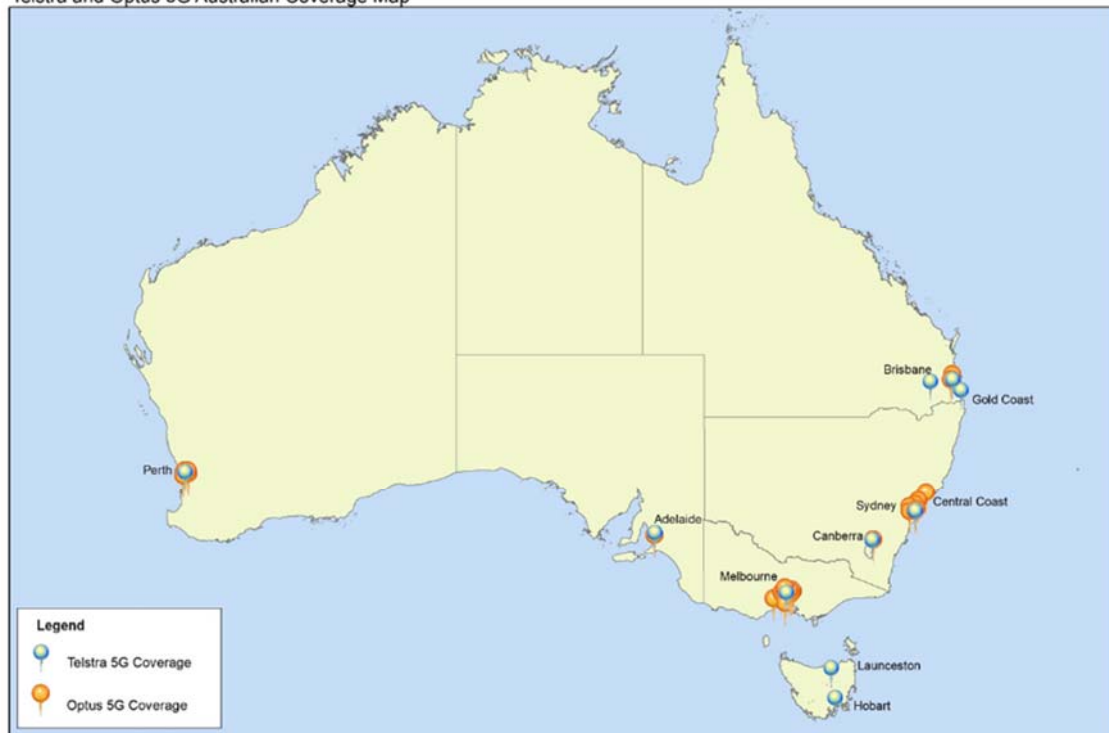
Telstra and Optus have started offering 5G services in select centres. Vodafone is expected to start offering services in 2020. Dense Air’s business model is around extending mobile coverage on a neutral host basis for carriers, rather than direct marketing to consumers.⁴²

Optus has built around 230 5G sites in six areas in Southeast Queensland, Sydney and the central coast of NSW, Canberra, Melbourne and surrounds, Adelaide and Perth. It is aiming for 1,000 sites by March 2020.⁴³ Optus launched its initial 5G services on 31 January 2019 on a fixed basis in select locations in Canberra and Sydney. Optus has been using a range of fixed customer devices and launched its first 5G mobile handset, the Samsung Galaxy Note 10, in late September 2019.

Telstra is offering 5G in ten cities across Australia, including Sydney, Adelaide, Brisbane, Canberra, Gold Coast, Hobart, Launceston, Melbourne, Perth and Toowoomba. Over the next 12 months it expects its 5G service area to increase almost five-fold⁴⁴ and include an additional 20 cities. It has launched a number of commercial devices including an HTC 5G Hub and three 5G phones.

The map below shows the locations of 5G infrastructure deployed across Australia as at October 2019.

Telstra and Optus 5G Australian Coverage Map



Source: Departmental analysis of announced 5G deployments

Consumer expectations and experience

Earlier rollouts of new mobile technologies have generally been smooth for consumers, but ensuring consumers have realistic expectations and a positive experience will be important to 5G’s reception.

⁴² Cision PR Newswire, 26 September 2019, *Dense Air Partners With Spark to Launch 5G Services*, www.prnewswire.com/news-releases/dense-air-partners-with-spark-to-launch-5g-services-300926129.html

⁴³ Optus, *Optus 5G*, <https://www.optus.com.au/for-you/5g>

⁴⁴ Andrew Penn, 22 May 2019, *Providing our customers with more choice as we build 5G*, www.exchange.telstra.com.au/providing-our-customers-with-more-freedom-as-we-build-5g/



As 5G is in its early stages and much is yet to be done, it will be important that carriers do not over promise and under deliver.

There may be concerns in the community, such as how long deployment will take, coverage, performance, service and prices of handsets.

The rollout of 5G will take time. Spectrum needs to be secured and infrastructure installed. It is expected that the rollout will take a number of years and that not all areas in Australia will be covered. Even now, while more than 99% of people in Australia have access to 3G and 4G, their geographical coverage is around 31% of Australia's area.

The full capabilities of 5G are dependent on finalisation of its specifications and its deployment in a manner that allows the performance goals to be achieved.

As with other new technologies, the price of 5G handsets initially may be higher compared to 3G and 4G phones, but prices are expected to reduce over time.

Appropriate information and good customer service from carriers and service providers will be important to consumer's experience, particularly if 5G is marketed and viewed as a premium product, particularly in its earlier stages.

Conclusion

The Department considers that 5G is a potentially transformative technology that could contribute significantly to Australia's future innovation, productivity and international competitiveness. As well as a platform for mass market communications, it may also be a new general purpose technology for wider business use.

5G is however in its early stages and its full potential is as yet uncertain. Nevertheless, given its potential significance, it is important that we seek to capture the opportunities that it offers. Other countries are introducing 5G and Australia is currently one of the global leaders in this regard. We should seek to leverage this advantage and not allow Australia to fall behind.

The Department is seeking to support 5G in a balanced way as set out in our submission. This includes implementing the Government's 5G Strategy and identifying further measures that may be of assistance.

The Department would be happy to provide the Committee with further information on matters that may be of interest to it.

We look forward to the Committee's report and its ideas on how the benefits of 5G can be captured for the advantage of the Australian community.

