Huawei Australia submission to

House of Representatives Standing Committee

on Communications and the Arts

"Inquiry into 5G in Australia"

31 October 2019

Opening Statement

Not only does Huawei welcome the opportunity to contribute to this timely inquiry into 5G in Australia, this Submission:

1. Sets out the enormous cost and consequences to Australia's economy and jobs by excluding Huawei from 5G in Australia;
2. Seeks to answer the unfounded attacks and smears on Huawei, and our willingness to be open, transparent and completely cooperative to refute the baseless claims against us;
3. Sets out that Huawei, both the autonomous Australian subsidiary and the parent company, are committed to a robust framework of safeguards, checks and balances - similar to those in the United Kingdom and the EU - to ensure its superior 5G technology can only be used in Australia's national interest and for its economic well-being;
4. Calls on the Committee to request the government reconsider the 5G ban on Huawei as a matter of urgency, taking into account all of the factual evidence, particularly Huawei's faster and more cost effective 5G technology, coupled with powerful and effective cyber security safeguards;
5. Irrespective of the existing 5G ban on Huawei in Australia, as the world's leading 5G innovator, manufacturer and supplier of 5G technology, is committed to freely providing information that will assist in the Committee's understanding of the enormous potential benefits of 5G.

In the following submission we will highlight the transformative opportunities 5G technology can bring to Australia, especially the benefits for regional Australia and industries like mining, agriculture, health and education. The submission will also highlight the policy settings that will enable Australia to not only keep pace with the rest of the world's 5G roll-outs but ensure the country continues to be a wireless technology leader as we have been with 3G and 4G. 5G will be the bedrock technology for Australia's future economic prosperity across the whole economy and what we do today will have long term consequences. As a nation, we cannot afford to get it wrong.

This year Huawei celebrates its 15th year in Australia. In that time we have become the largest provider of mobile network technology and more than half the Australian population relies on Huawei for their communications needs. **Huawei's almost 25,000 3G and 4G mobile base stations provide reliable, affordable and secure mobile services to Australian business and consumers – helping to drive the Australian economy.**

We will illustrate that the exclusion of Huawei in Australia's 5G roll-out will act as a **5G Tax** on Australian citizens. Australian operators will pay between 20%-40%[1] more than the rest of the world for 5G technology. This cost will mean Australian's will have higher telecom bills at a time when they are already suffering from higher electricity and petrol prices.

The lack of competition has already had an impact on Australia's 5G roll-out. **Australia has the distinction of being the only country in the world found to have its 4G network faster than its 5G networks.**[2] We have also seen one of Australia's leading telecom operators (TPG) cease its wireless roll-out investment because of the Huawei ban.

One of the biggest impacts from the current 5G policy setting will be the ability for regional Australia to get access to 5G. Because of the 20-40% increase in technology costs, **the business case for telecom operators to roll-out 5G in regional Australia becomes near impossible**[3]. At a time where 5G smart farms are operating now in the UK, South Korea and Switzerland, Australian farmers will be waiting years to get an opportunity to benefit from the productivity gains from 5G. Many may never get the opportunity, especially farmers on the fringe of the current 4G network.

Only three global vendors are capable of supplying large scale advanced 5G mobile network equipment – Huawei, Nokia and Ericsson. Already Australia has reduced this to a duopoly situation. It is Huawei's belief that in reality Australia's 5G technology vendor market will be a near monopoly, with one company dominating, if not becoming the sole supplier of 5G in Australia. This will have a profound impact on the cost, innovation and security of Australia's 5G future.

We have prepared this submission based on the terms of reference for this inquiry, we note the addendum to those specific terms of reference that:

> '*Matters relating to national security are out of scope for this Committee.'*

Whilst we understand the constraint of this addendum, we respectfully suggest this is the key factor that is going to prevent Australia from deploying the world's best 5G and ensure regional Australia doesn't miss out.

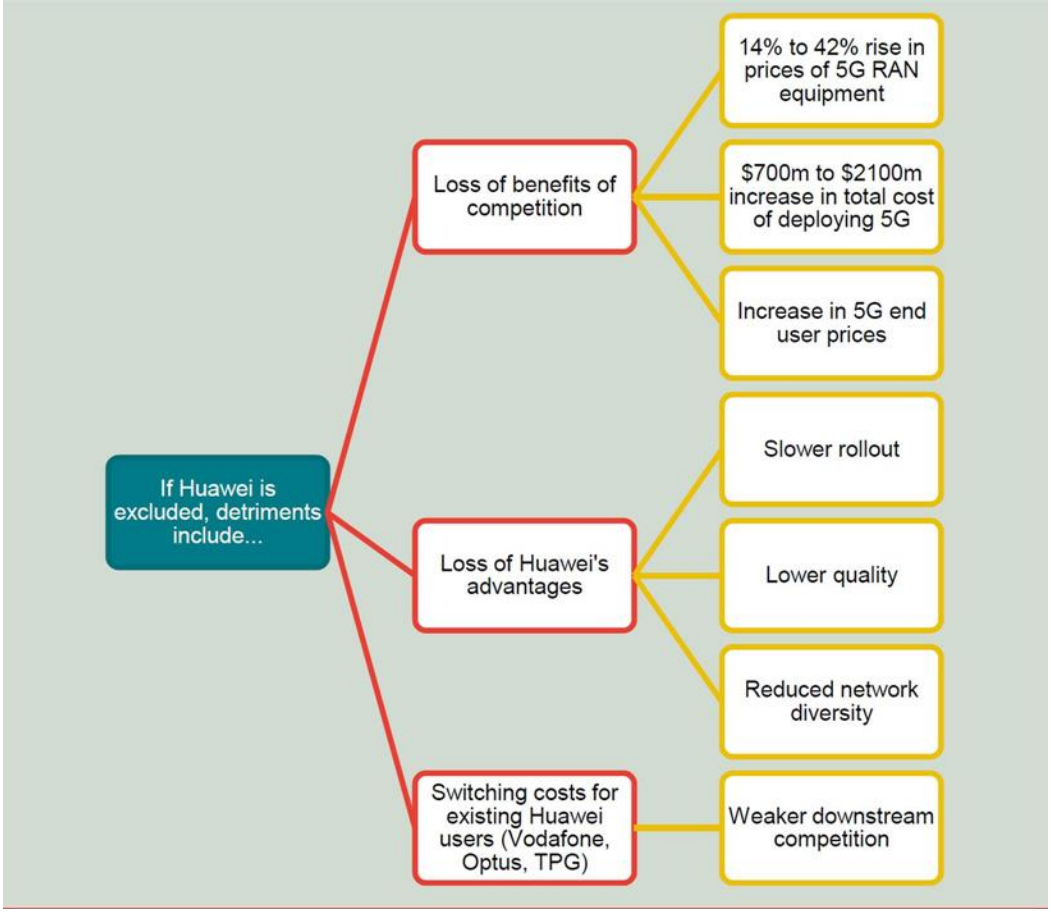
[1] https://www.frontier-economics.com.au/costs-of-excluding-huawei-from-5g-networks-in-australia/
[2] https://www.opensignal.com/blog/2019/07/08/5g-boosts-the-maximum-real-world-download-speed-by-up-to-27-times-4g-users-top-speeds
[3] https://www.frontier-economics.com.au/costs-of-excluding-huawei-from-5g-networks-in-australia/

Therefore, realising the Committee cannot traverse the rationale or basis for Huawei's 5G ban in Australia, we make the point that we welcome a rigorous and transparent examination of this ban, with the learnt experience in the UK and the European Union of robust checks and balances as a way forward to revisit the ban.

Both Huawei Australia and its parent company are determined and committed to a forensic and transparent decision-making process that is based on facts, not innuendo.

Huawei delivered the first 3G network in Australia, the first 4G network and has constructed the largest private 4G network in the Southern Hemisphere in the Cooper Basin. Huawei Australia's locally incorporated board and over 600 dedicated and trusted staff are proud of the contribution they have made and continue to make to the Australian telecommunications sector.

The cost of not having Huawei in Australia's 5G mix



SOURCE: Frontier Economics[4]

[4] https://www.frontier-economics.com.au/costs-of-excluding-huawei-from-5g-networks-in-australia/

Introduction

Australian businesses and consumers need to have access to the world's best telecommunication services to ride the wave of the next industrial revolution. Globally 5G is already transforming the way communities do business, live their lives and deliver vital services. 5G is Australia's last chance to get world class high speed broadband for all Australian's.

Australia stands to benefit from 5G in two key areas:

- *Delivery of ultra-fast broadband – particularly to under-served areas.*
- *Drive the next-generation of applications across multiple industry sectors.*

The Australian 5G deployment has been so constrained it is more a marketing tool than the substantial transformative technology for the Australian economy. **There are more 5G marketing billboards than there are 5G base stations in Australia.** Whilst deploying 5G at the MCG for the AFL Grand Final might make for a whimsical media release it doesn't make up for the fact that our 5G coverage remains miniscule compared to our international peers.

Other countries in Europe and Asia have near nationwide 5G coverage already in place. The vast percentage of even our major cities do not have 5G coverage. Australia is being left behind in the global race to roll-out 5G and the consequences for Australia's competitiveness and future prosperity are enormous.

The correct 5G policy settings will create a competitive market that drives lower telecommunications costs, promotes superior innovation and enables greater access to 5G services. If we fail to set the correct policy framework, Australia faces two major risks. Firstly, widening the technology gap between regional and metropolitan communities. Secondly, it will leave Australia behind our global competitors who are benefiting from the economic gains of a highly competitive telecommunications market.

Only three global vendors are capable of supplying large scale advanced 5G mobile network equipment – Huawei, Nokia and Ericsson. Across Asia, Europe, the Middle East and Africa we are seeing the support of open, dynamic and competitive telecommunications marketplaces. This creates increased price, innovation and delivery competition. Australia had such a policy framework for the rollout of 2G, 3G and 4G technology, making us a global leader in mobile services.

With an open and competitive telecom industry there is an increased incentive to drive the roll-out of 5G. Governments and telecom operators focused on using the best supplier for their 5G network deployment will substantially shorten the time-to-market of this new technology.

For example, **LG U+ in South Korea has already launched 5G services after deploying 5G networks with Huawei equipment.** LG U+ has delivered 5G services to around 90% of the national population with end-users now downloading substantially more data than that under 4G services and able to enjoy new 5G services.[5]

In Switzerland, Huawei technology has already enabled local operator Sunrise to deploy **much needed 5G technology to around 300 smaller villages across the country**, mostly in rural farming communities, enabling the deployment of next-generation farming applications.[6]

Indeed, it should come as little surprise that two of the most advanced 5G markets in the world, South Korea and Switzerland, have open markets for vendors with intense competition between Huawei, Nokia and Ericsson to deploy the best technology in the market.

China will switch on its first 5G service on November 1st, 2019. Already 10 million people have made bookings for 5G services. **China Mobile will have 5G running across 50 cities in 2019 and 340 cities by the end of 2020.** The three Chinese mobile operators will invest around $USD43bn and build around 130,000 5G base stations.[7] In Shenzhen (home to Huawei HQ) 15,000 5G base stations will be completed by the end of 2019 and by August 2020 that number will be 45,000 5G base stations.[8] China has a more open market approach to 5G vendors than Australia with Nokia, Ericsson and Huawei all supplying China's 5G development.

In the United Kingdom, all four major operators (EE, Vodafone, Three & O2) have started rolling out 5G. By the end of 2019, 43 towns and cities across the UK will have 5G and by mid-2020 that number will be 52.[9] Huawei is the major supplier of Radio Access Network (RAN) 5G technology in the UK, working with three of the four major UK carriers.

[5] https://www.telecomlead.com/5g/lg-u-leads-in-5g-speed-test-latency-and-data-reliability-91733
[6] https://ausdroid.net/2019/10/17/opinion-australia-vs-the-world-and-why-our-5g-isnt-winning/
[7] https://www.bloomberg.com/news/articles/2019-10-25/china-carriers-to-debut-commercial-5g-nov-1-beijing-news-says
[8] https://www.lifewire.com/china-5g-4178852
[9] https://5g.co.uk/coverage/

Australia must understand the success it has enjoyed through previous generations of mobile technology was built on a fundamental ingredient - an open and competitive market approach to industry policy settings. This is no longer the case for 5G and this will continue to have a profound impact on Australia's 5G future and on the Australian economy and jobs more broadly. Having a duopoly situation for 5G vendors is already bad enough but Huawei believes if we continue with this policy framework, Australia will likely end up with one 5G vendor dominating the market. **We believe that one vendor will be the dominant provider of 5G technology for Australia across all the major carriers establishing a near monopoly situation.**

The Australian 5G outlook

Australian consumers have benefitted from the fierce competition between local mobile network operators, producing a vibrant and dynamic market for mobile services. Prices for **mobile phone services have fallen by an average of 4.2 per cent annually since 1997** and Australia ranks in the top 5 in the OECD for mobile penetration. The exceptional outcomes for Australian mobile users have been underpinned by competition between global equipment vendors to supply network equipment – through the various generations of mobile services. The open, dynamic and competitive 4G market has also pushed Australia to 5th place on Ookla Speedtest Global Mobile Broadband Speed Index.[10]

Unfortunately, Australia's mobile technology leadership position is set to plummet as 5G is rolled out elsewhere around the world.

Increased costs

A study by Frontier Economics[11] (Huawei-commissioned), found the cost to industry and Australian consumers of reduced competition from excluding Chinese vendors (Huawei) to be significant. They estimate **the exclusion of Huawei will increase the cost of 5G radio access network (RAN) equipment in Australia by 18-42% for carriers**, which will be recovered from consumers through higher retail prices. Further, for networks already using Huawei for 3G and 4G equipment, additional switching costs could add several billion dollars and materially delay 5G deployments.

In the UK an independent report by respected research company Assembly Research estimated that the cost of **excluding in effect Huawei from their 5G builds would cost the UK economy £6.8bn and delay the widespread establishment of 5G by 18-24months**.[12]

Taking a broader look at the cost of excluding Huawei the GSMA – the global trade group for mobile operators - found that should Huawei be excluded from deploying 5G in Europe then the cost to operators would be some €55bn.[13]

Three different reports, from three respected authors all saying the same thing: Reduce vendor competition and it will have an impact on prices and roll-out timelines of 5G.

[10] https://www.speedtest.net/global-index
[11] https://www.frontier-economics.com.au/costs-of-excluding-huawei-from-5g-networks-in-australia/
[12] https://www.mobileuk.org/supply-chain-security
[13] https://www.reuters.com/article/us-huawei-europe-gsma/europes-5g-to-cost-62-billion-more-if-chinese-vendors-banned-industry-idUSKCN1T80Y3

Wireless telecom prices for consumers have had the unique situation over the past several years of a decrease in prices while enjoying an increase in service and coverage. This is about to change. Australia's restrictive 5G policy is effectively a **'5G Tax'** on the Australian telecommunications industry and consumers.

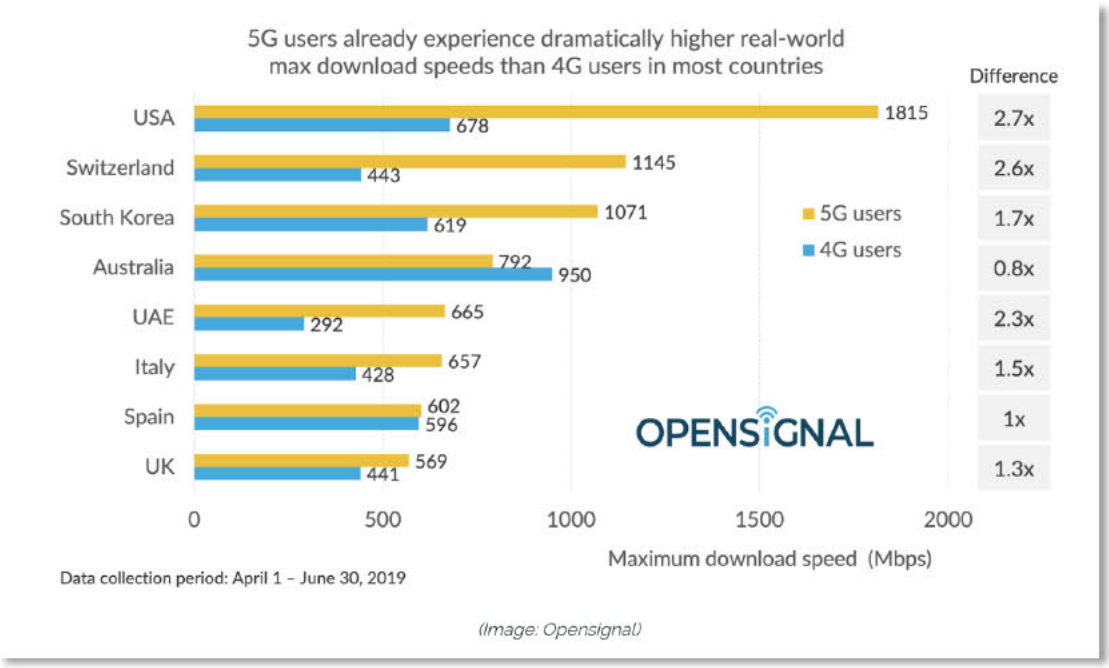
The profound lack of market activity and competition in Australia will have a major impact on 5G cost, innovation, roll-out efficiency and speed, ecosystem development, network reach and security – indeed, the glacial nature of current 5G deployment shows this is already happening. **The financial business case for operators to build coverage in regional Australia will be difficult to stack up.** A 30% increase in equipment costs will destroy what business case they currently have. We will see the Australian 5G footprint plans reduce considerably at the cost of regional Australia.

The restrictive Australian 5G ecosystem will also have an impact on the ability for Australian companies who are developing 5G applications to take their products to the global market. Huawei is and will remain the largest provider of 5G technology in the world. For example 60% of the current 5G Radio Access Network (RAN) equipment in the United Kingdom is Huawei. Australian companies developing 5G applications will not be able to test their products with the major global 5G technology player, restricting their opportunity to export to the world and holding back the local 5G ecosystem investment.

While the reasons for the exclusion of Huawei from the Australian 5G market is not the remit of this Committee inquiry, the exclusion policy will have a deep impact on the benefits that 5G can bring to Australia. As the reasons for such an exclusion policy is not being reviewed by this Committee we will not go into any detail in our submission but as the effects of the policy have a great impact on this Committee's area of review **we have included a brief Cyber Security summary in Appendix 1** for the Committee's reference on the facts indicating Australia stands alone in its technological understanding of 5G. No other nation, standards body or network expert makes the assumptions Australia does on 5G network architecture that led to the exclusion of Huawei from providing 5G here.

Current 5G situation in Australia

At the moment there is a marketing war between two Australian telecom operators trying to convince Australians that we are leading the world in 5G. Unfortunately, the marketing hype doesn't match the factual reality that Australia is already way behind in the global 5G race. In fact, **Australia has the distinction of being the only country in the world found to have its 4G network faster than its 5G networks.** [14]



(Image: Opensignal)

Two of our leading operators have launched 5G services, albeit in extremely limited areas, whilst the third has yet to launch 5G services and a likely fourth player has announced it will no longer provide mobile services because of the Huawei 5G ban last year.

Our local situation is in direct contrast to the high competition on 5G we see in other global markets such as Germany, South Korea, Spain, the UK and many others where multiple operators are deploying 5G networks.

As the preferred 4G equipment supplier to Optus, Vodafone and TPG, Huawei was in a very strong position to quickly and efficiently drive their upgrades to 5G. Deploying 5G equipment faster and earlier **would have allowed these companies to compete more effectively with Telstra and allow Australia to establish itself as a dominant 5G market leader**. It would have also allowed local

[14] https://www.opensignal.com/blog/2019/07/08/5g-boosts-the-maximum-real-world-download-speed-by-up-to-27-times-4g-users-top-speeds

developers and start-ups focused on 5G applications to gain an early edge on the use of the technology. It is clear Australia will move back to a telecom industry ecosystem heavily dominated by Telstra. When asked about the Huawei ban in April this year, Vodafone CEO Inaki Berroeta was very clear, "[there will be) *profound, long-term impacts - There is a very material impact on the industry, but one that is not being felt by the largest mobile operator [Telstra]. This, in turn, gives that operator a huge advantage going into 5G."*[15]

Optus have delayed their 5G roll-out[16] and have been even less active in their 5G roll-out plans than Telstra.

When Australia starts its large scale 5G deployment, the network operators will deploy 5G in city areas initially to maximise their return on their considerable investment. As stated earlier, with a 30% increase in network costs, the business case for carriers in many regional and rural areas disappears.

As we will outline later, alternative funding arrangements will also need to be considered to broaden the 5G network reach to the city fringe and semi-rural areas.

[15] https://www.afr.com/companies/telecommunications/huawei-ban-gives-telstra-unfair-advantage-vodafone-20190409-p51cgq
[16] http://theconversation.com/blocking-huawei-from-australia-means-slower-and-delayed-5g-and-for-what-117507

Rural 5G Network reach

5G is Australia's last chance to deliver ultra-fast broadband to rural and regional Australia following the disappointing outcomes for consumers on the NBN. Huawei is deeply concerned regional and rural consumers will receive limited or no 5G service. The reality of limiting vendors from both the NBN deployment and the 5G market is that the digital divide is exacerbated by making the roll-out far more costly and resulting in many Australian businesses and consumers, particularly in rural areas, denied access to this revolutionary technology.

In his address to the National Press Club in 2015, then NBN CEO, Bill Morrow said:

"We all agree the NBN network will go a long way to closing the divide between the city and regional Australia. There is a deep cultural tradition with the bush, its rural towns, and farming. And of course with the people of these communities. ***The fortunes of our country are linked to the land.*** *Most of us live in cities, and Australians always have, but the land provided a lot of the prosperity – and still does."*

As the completion of the National Broadband Network comes into view it is clear the project has failed to close the divide between the city and the regions. Australia has invested **$51 billion** in a network that is not delivering 50Mbps to around one million of its fixed-broadband end-user premises and close to 200,000 end-user premises on the Fibre-to-the-Node network cannot even get 25Mbps.

When examining the network requirements for accessing the fundamental technologies enabling the 4th industrial revolution it is clear these are much higher than what NBN can deliver.

Indeed, without access to 5G technology Australian farmers and agricultural sectors will be locked out of the 'Fourth Industrial Revolution' whilst their counterparts in Europe and Asia have full access to it and leapfrog ahead of us.

Major farming corporations and those in the mining sector have the capability to build their own private 5G networks to make sure they can get access to the applications that 5G enables – this route is simply not available to family-owned Australian farmers.

5G will open up a whole new era of connected farming that is simply not possible under 4G or fixed-broadband technology.

To illustrate how little value regional and rural Australia has acquired from the NBN we need to look at the performance of the NBN Fixed Wireless network. To date NBN Co has spent around $4 billion on the Fixed Wireless network that currently has around 280,000 activated end-users – that averages out at around $10,000 per activated household.

This figure is made worse when examining how that network is actually performing for the Australians relying on it for their broadband connection. Unfortunately in hundreds of cell sites across the country the NBN Fixed Wireless network is now delivering 6Mbps to each end-user premises at peak-time – with many end-users receiving much lower speeds.

At $10,000 per household Australia's NBN is delivering speeds at peak-times – when people in their homes want to use the network – slower than most people were receiving on ADSL before. Regional communities deserve better.

There is simply no point expecting NBN Co to be able to fix-up the NBN Fixed Wireless network to the levels to which it should be performing – NBN does not have either enough available spectrum or sufficient capex to deliver the service levels required.

Indeed, we have already seen NBN Co back away from delivering a planned 100Mbps Fixed-Wireless product and even dilute its 50Mbps offering such is the lack of confidence the company has in actually delivering those speeds.

There are hundreds of thousands of homes and businesses in the NBN Fixed Wireless footprint that deserve another option other than the congested NBN service and it could be delivered by 5G if the right incentives are there for operators to extend networks in those areas.

Committee members should be absolutely clear that farmers in countries such as Switzerland and Korea are already accessing 5G technology that enables them to operate far more efficiently. This is no longer a pipe-dream, PowerPoint presentation or a slick TV commercial, it is happening right now – but not here in Australia.

Solving the Regional Communications divide

The solution to the problem can be simple. In outer-suburban and regional areas the mobile operators have spare spectrum available as there are very low population densities in those areas. Using the successful Federal Mobile Blackspot program as a template, **the Government could encourage the mobile network operators to extend their regional networks and use that available spectrum to deliver 5G Fixed Wireless services to consumers**.

Huawei believes the focus should be on delivering Fixed Wireless services in the sub-6GHz spectrum given mmWave Fixed Wireless services fundamentally cannot be deployed on a large scale in regional and rural Australia, because of the propagation and cost limitations.

Satellite solutions are also questionable, as the necessary connectivity performance requirements (such as end-to-end latency) cannot be achieved for access to revolutionary technologies.

Indeed, even though there are only 100,000 end-users on the NBN Sky Muster satellite service end-users are limited to around 150GB per month of peak-time usage – with off-peak usage only allowed between 1.00am and 7.00am each day.

Given that overall NBN average data usage is now around 200GB per month it can be clearly demonstrated that whilst Sky Muster provides good coverage for isolated end users it cannot deliver the data volumes required for the kind of applications the future will bring.

The NBN pricing structure means 1Gbps speeds are currently priced at over $350/month – so to make high-speed 5G Fixed Wireless available to regional Australians there is little point trying to do it via the NBN.

Importantly we also need to look at how we generate funding for this kind of 'Broadband Blackspots' program – looking beyond the Federal Government and examining what can be generated from state and local government as well.

The technology is already there to solve the challenges Australia is facing. What we need now is the policy settings to allow the technology to do what it was designed to do. We need to adopt a different approach with regard to delivering universal high-speed broadband.

A Government-funded 5G blackspot program, building on the success of the 4G program, may be beneficial to deliver 5G to under-served city fringe and rural areas. To further expand the 5G footprint to industrial and commercial activity centres – ports, industrial parks, stadiums, shopping centres, logistics centres, local government areas, refineries, mines, hospitals, and/or universities – a model that includes financial contributions from these organisations could be considered. The network could be sliced to provide both critical connectivity to the commercial operation and the local community.

CASE STUDY – 5G Wireless Broadband Switzerland

In Switzerland, 5G is already closing the digital divide with continuous improvement of 5G network quality and performance bringing about more and more service innovations with broadband internet connections, offering more choice and convenience to people in Swiss cities and villages.

Working with Huawei, Swiss telco Sunrise is the first in Europe to launch a 5G network, continuing to implement its "5G for People" plan to secure Europe's top position in digital infrastructure for Switzerland. Through the close cooperation with Huawei, Sunrise is now providing 5G coverage in nearly 300 cities/villages throughout Switzerland, offering maximum 5G speeds to enable broadband internet, HD-TV, interactive gaming, 5G services etc.

In fact, Sunrise and Huawei achieved a top speed of 3.67Gbps downlink with multiple 5G smartphones in one 5G cell in Zürich.

Sunrise is actively implementing its plan to provide the entire Swiss population with 5G and wants to expand its 5G network as quickly as possible in all regions. Sunrise and Huawei will strengthen their cooperation in 5G, providing more product and services in 5G for the people in Switzerland, and continuously deploy 5G networks in both urban and rural area.

Sunrise is now delivering 5G Fixed Wireless services to over 150 villages in Switzerland – covering many of the areas that are not currently served with fixed-broadband – there is no reason why the same could not be done in Australia.

Economic boost or 5G backwater – the choice is ours

Over the next decade Australia's telecommunications infrastructure has the potential to be transformed by 5G. **The much needed productivity gains in our economy can be delivered by smarter and more efficient roads, ports, farms, mines and factories. The scope and opportunities are across the whole economy.** As the world leader in 5G innovation and delivery, Huawei can make a significant and positive contribution to the construction of these networks in Australia. Supporting a rapid, efficient and safe rollout by the Australian network operators as we have already done with 3G and 4G.

Better digital connectivity is key to delivering Australia's future economic ambitions, leading to improved productivity and driving growth in industrial sectors. The Government has rightly highlighted the impact that improved connectivity can have in supporting rural areas, but sadly they remain under-served by current policy settings and networks.

To power Australia's connectivity ambitions we must embrace competition, as the rest of the world is doing, which drives innovation and cost-effective solutions for operators. It ultimately ensures that consumers enjoy the dynamic effects of a plurality of suppliers. **This competition is the key policy lever that the government can use to ensure Australia has a deep and rapid rollout of 5G infrastructure. We cannot afford another NBN-like policy failure.**

5G User Cases

Undoubtedly, consumers in Australia will want faster services with more data. However, there are a raft of non-consumer facing services which need faster and better mobile connectivity to function effectively.

There are two defining features of 5G that separate it from previous developments – near-zero latency and data rates up to 10Gbps. These features support the deployment of enhanced services across a range of different industries. Analysts, vendors and interested stakeholders have developed detailed examples of how 5G technology could be used.

These include:

- Enhanced proliferation of the internet of things (IoT), through supporting a greater number and diversity of things to be connected, and increasing the speed and capacity of data transfer between devices
- Virtual and augmented reality, which is expected to support a range of different industries, such as healthcare (e.g. the ability to perform surgery remotely), the automotive sector (e.g. driverless cars, and improved monitoring of traffic and accidents in real time), and entertainment (e.g. more immersive gaming)
- Low-latency and ultra-reliable communications, which will support the delivery of critical communications in areas ranging from disaster management and public safety, to robotics and artificial intelligence
- Enhanced mobile broadband, through faster network speeds to allow viewing of high-resolution content, increased network capacity to support more users in crowded areas and peak times, and improved coverage – this is certain to be the first mass market use case for 5G.

5G will also reduce latency and improve overall network efficiency. Streamlining network architectures will deliver end-to-end latency requirements of less than 1 millisecond.

Digital technologies enable continuous innovation across a diverse range of industries. The ICT, media, finance, and insurance sectors are the current leaders in digital transformation. But this digitalization is also accelerating in the retail, automobile, oil and gas, chemical engineering, healthcare, mining, and agriculture sectors.

Key technologies that underpin digitalisation include software-defined devices, big data, cloud computing, block chain technology, network security, latency sensitive networks, virtual reality (VR), and augmented reality (AR).

Communication networks are the key to connectivity of everything. Mobile networks have emerged as fundamental to productivity, enabling digital transformation throughout all industries. To support a wide enough range of different services, continuous and long-term network development in an open, dynamic and competitive environment is absolutely necessary. We can see from the applications used in our daily lives that they are always changing and evolving.

Mobile networks are designed to create a super connected world, in which the generated data is contextualized, constructed and processed over the cloud, continuously creating value. Smart transport, smart manufacturing, smart health, global logistics tracking, smart agriculture, intelligent mining, connected cars, smart metering and other applications are some of the first, most promising areas for us as a nation to focus on. These applications are poised to rapidly develop in the 5G era. Although all Australian industries will benefit from the deployment of 5G, Huawei has identified key industries in which Australia can benefit and show global leadership in 5G development.

5G/Wireless Fibre

In rural, semi-rural and outer metropolitan areas, it is clear home broadband needs are not being met. One of the very first commercial use cases for 5G is fixed wireless access or ‘wireless fibre’ as it has been recently dubbed.

The 5G wireless fibre could provide internet access to homes using wireless mobile network technology rather than fixed lines. The technology will prove more convenient to set up as it accesses existing tower sites and spectrum. More Australians could enjoy ultra-fast broadband and video-based applications such as home surveillance, content streaming (Netflix) and other cloud based applications more quickly.

The capital expenditure required to implement 5G is much lower compared to other technologies. According to NBN, fixed wireless deployment is 30% to 50% lower than fibre-to-the-premise. ‘Wireless fibre’ saves mobile network operators from the necessity of laying fibre to every household and significantly reduces the amount of capital expenditure on poles, cabling and trenches and lessens the environmental disruption.

TV, gaming and home applications place the telco at the centre of the smart home. With 5G the telco can provide a platform for a number of smart home value added services that can be enhanced by AI digital assistant integration, data aggregation analysis and software app development.

This 5G broadband-enabled smart home ecosystem allows telcos to offer:

- Unified family packages, integrated broadband, and video services at competitive prices
- Very low latency immersive HD and higher video and gaming content at competitive prices
- Integrated third-party smart home applications that leverage the telco gateway

On a global basis it has been broadly accepted that 5G Fixed Wireless is going to play a critical role in delivering 'fibre like' services to end-users that cannot easily be served by fixed-broadband technology.

5G will be used to achieve this purpose in both developed and developing markets – indeed, this is already taking place in markets as diverse as the UK and the Philippines.

The UK is already the most advanced of the big five European Union countries (France, Germany, Italy, Spain and UK) in terms of availability of 'Superfast' broadband – categorised as download speeds of 30Mbps or more.

However, at the same time the UK has one of the lowest deployment rates in the EU of full FTTH broadband – mainly because so many residents live in Single Dwelling Units (standalone houses) compared to other countries where most people live in Multi Dwelling Units that are easier to serve with FTTH.

As a result some of the UK operators, most notably Hutchison Telecom, which operates the '3' branded mobile network, are offering their 5G fixed wireless services as a direct replacement for fixed-broadband and are advertising speeds way in excess of what are available to most fixed-broadband end-users in the country.[17]

The same situation is also playing out in France where the national government is now looking to embrace the usage of fixed wireless to ensure the delivery of universal high-speed broadband.

[17] https://inews.co.uk/news/technology/three-5g-home-broadband-london-cities-496679

Back in 2010 the French government embarked on an ambitious plan to deliver nationwide FTTH but with FTTH deployment concentrated mainly on urban areas the government is now looking for ways to use 4G and 5G fixed wireless to deliver high-speed connectivity to regional and rural areas.[18]

It is a similar story in the Philippines, a market in which only a minority of consumers are currently able to get a fixed-broadband connection with most end-users heavily reliant on mobile broadband to deliver connectivity.

SingTel-backed mobile network operator Globe Telecom has already launched 5G services – using Huawei technology – in an effort to deliver high-speed connectivity to Filipinos across the country.[19]

There are similar stories to be told right across the world with 5G Fixed Wireless set to play a major role in delivering services to rural and regional end-users across Western Europe and North America over the coming years.

In some cases 5G fixed wireless will compete against existing fixed-broadband, as is happening in the UK, but in many others it will deliver services where it is too expensive to deliver fixed-broadband services.

5G Mining

In the era of rapidly developing industrial internet and intelligence, technology is constantly changing our world: intelligent mining is no longer unattainable, but instead is here right in front of us. Given the scale of Australia's mining industry, creating a smarter, more efficient and safer operating model is essential. Australia has the potential to set the standard for 5G technology development in the mining sector and take these learnings to the world.

Huawei recognised Australia's mining leadership and saw great potential developing local 5G mining solutions with cutting edge Australian developers. Huawei sought to work with local mining researchers to develop products for the global market. Huawei explored the potential of establishing a global mining R&D centre in Australia. Huawei has now scrapped this multi-million dollar research and development investment in Australia following the 5G exclusion.

[18] https://www.rcrwireless.com/20180907/5g/orange-says-fwa-key-driver-5g-rollout
[19] https://www.reuters.com/article/us-globe-huawei-tech/philippines-globe-telecoms-launches-5g-service-backed-by-huawei-equipment-idUSKCN1TL1YH

Huawei is deploying ICT and AI solutions in mines around the world, transforming mines into smart, automated hives of productivity that will cut fatalities to zero and increase profits for even small mines by millions of dollars.

Smart agriculture

Australia has the potential to be a global ag-tech leader. However, many rural and remote areas of Australia still lack the critical connectivity that is necessary to enable widespread adoption of ag-tech solutions. In addressing this challenge, Australia needs to pioneer new technical and organisational approaches that will establish us as a global leader, while also laying the foundation for future innovations in ag-tech. **Access to stable and reliable connectivity is key to transforming agricultural operations and realise our potential as a global leader in ag-tech innovation.**

The 'Connected Farm' is the future of farming and 5G has the potential to transform agriculture, as the development of smart farming is heavily dependent on both mobile internet and automated devices to achieve real-time, precise production and management. The concept is spreading quickly and creating significant disruption in the agricultural sector. With a much higher peak data rate, lower latency and massive capability, 5G can not only raise the speed and precision of data transmission and processing, but also improve the control accuracy and stability of drones and robots. When 5G combines with AI and cloud computing, new production scenarios such as live video monitoring, remote diagnostics and on-site prescription would emerge to enable precision agriculture. Taking advantage of the real time data farmers can receive updates from any farm asset or monitor anywhere on their properties. **Unless we solve the critical issue of access, mainly family run farms will be left behind. Larger company run operations can afford private telecom networks, we run a real risk of having technology haves and have not's across rural Australia.**

E-Health

The healthcare industry has the opportunity to develop a fully personalised medical advisory service that is complemented by doctor-driven AI medical systems connected by 5G. These AI medical systems can be embedded into hospital call-in centres, home medical advisory assistants, local doctor clinics, and rural clinics that lack on-site medical staff. **In China, 5G real-time remote video consultation is available now and earlier this year surgeons performed remote brain surgery on a patient 3000km away.** Rural and regional health has the most to gain from the roll out of 5G.

The Australian Institute of Health and Welfare statistics highlight the aging of our population: "In 2017, there were 3.8 million Australians aged 65 and over (comprising 15% of the total population)

—increasing from 319,000 (5%) in 1927 and 1.3 million (9%) in 1977. The number and proportion of older Australians is expected to continue to grow. By 2057, it is projected there will be 8.8 million older people in Australia (22% of the population)."

Access to specialists in regional Australia is a real issue. Many have to travel great distances to get a simple scan or consultation. In China, at a Chengdu hospital, they are already performing remote consultations with Electro-cardiograms and Ultrasounds diagnoses with 5G.[20] Enabling more people to gain access to high level care.

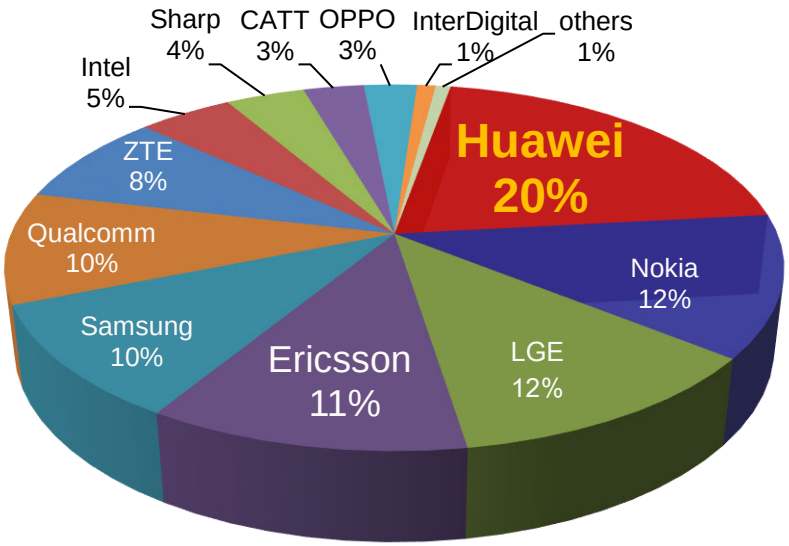
New technology must be at the forefront of preventing, managing and curing illness.
5G networks can also serve as the foundation of a comprehensive emergency medical aid system consisting of connected ambulances and AI-supported applications like AR, VR and drones. When a patient boards a 5G-connected ambulance, the paramedic can use the in-vehicle medical equipment to complete medical examinations like a blood test, ECG test, or other scans. At the same time, related information, such as scan images, medical signs, and medical records of the injured can be sent to hospitals in real time, so that doctors can make emergency treatment plans and prepare for operations in a timely manner.

[20] https://govinsider.asia/connected-gov/how-china-is-using-5g-to-close-the-digital-divide/

Appendix 2

Huawei & 5G Innovation

Huawei is the global pioneer and clear leader in the development of 5G technology. Huawei holds the majority of global 5G patents and in 2018 invested $USD13.8bn in research and development – more than the other two major 5G vendors combined. Huawei leads on 5G and will surely lead on 6G and beyond.



Source: ETSI: % of global 5G patents

Over the next 20 years Asia, and especially China, will lead on the next wave of IT innovation and technology and unfortunately Australia has decided to isolate itself from this world leading technology. China already leads on 5G and is likely to lead on 6G, Internet of Things, Artificial Intelligence and Robotics. The economic cost of ignoring this reality or turning our backs on this innovation will be considerably high to Australia's national prosperity and jobs.

Huawei invests heavily in long-term research and development and attributes its 5G success to three unique things:

1. Invest early. Huawei started 5G research as early as 2009, when 4G was just starting to see commercial deployment.
2. Invest heavily, and continue to do so. Over the past ten years, Huawei has invested $USD4bn in 5G.

3. Invest deeply. This is what sets Huawei apart from its competitors. When the company began 5G research, there were no standards to speak of. Huawei had to basically start from scratch – it couldn't jump into product development right away. Products are only the results customers see at the tail end of a very long process. In the beginning, Huawei focused on standards development and basic research in chips, materials and algorithms.

This ongoing investment in R&D has helped Huawei stay ahead. Huawei holds more than 2,500 standard essential patents for 5G, which is roughly 20% of all 5G patents in the world. Huawei's 5G solutions now outperform competitors, ranking No.1 across many key indicators.

But innovation isn't just about technology. Part of Huawei's success is the incredible customer focus to make 5G easier to operate, more affordable and simpler to deploy.

Huawei's 5G base stations outperform 4G base stations by a factor of 20 and they are lighter and smaller. This significantly reduces deployment costs for customers. Now, telecommunications operators only need two people and they can install a Huawei 5G base station in only 2 hours. That's half the time it takes for 4G.

Appendix 3

About Huawei

Founded in 1987, Huawei is a leading global provider of information and communications technology (ICT) infrastructure and smart devices. We are committed to bringing digital to every person, home and organisation for a fully connected, intelligent world. We have nearly 188,000 employees, and we operate in more than 170 countries and regions, serving more than three billion people around the world.

Huawei's end-to-end portfolio of products, solutions and services are both competitive and secure. Through open collaboration with ecosystem partners, we create lasting value for our customers, working to empower people, enrich home life, and inspire innovation in organisations of all shapes and sizes. Huawei's innovation focuses on customer needs. We invest heavily in basic research, concentrating on technological breakthroughs that drive the world forward.

Huawei is a private company wholly owned by its employees. Through the Union of Huawei Investment & Holding Co., Ltd., the company implements an Employee Shareholding Scheme that involves 96,768 employee shareholders. This scheme is limited to employees. **No government agency or outside organization holds shares in Huawei.**

Huawei is the front-runner in the race to 5G. It is more than a year ahead of the rest of the industry in terms of 5G technology and deployment and the only company that can provide end-to-end 5G systems. This includes both wireless base stations and self-developed antennas and chips. This unique technological advantage allows Huawei to deliver the best-performing, most-integrated, and energy-efficient 5G solutions in the industry.

Huawei has earned the trust of more partners for 5G deployment than any other company. It has signed 60 commercial contracts and signed cooperation agreements with more than 50 partners. It has shipped more than 200,000 5G base stations across Europe, Asia and the Middle East.

Between 2009 and 2013, Huawei invested more than $USD600 million into 5G technology research. Following this, in 2017 and 2018 Huawei invested almost $USD1.4 billion into 5G product development.

Huawei started 5G research as early as 2009 and has been a key contributor to the 5G global standards. Huawei believes in an open and competitive marketplace that allows operators and consumers to realize the benefits of affordable 5G. To that end, it has established industry organisations, such as the 5G Automotive Association (5GAA), 5G Slicing Association (5GSA) and 5G Alliance for Connected Industries and Automation (5G-ACIA) and are a member of the EU's 5G Infrastructure Public-Private Partnership (5G PPP).

Celebrating 15 years in Australia this year, Huawei supplies key 3G and 4G equipment for Optus and Vodafone mobile networks. Today, more than half of the Australian population use Huawei mobile technology for their daily communication needs.

Huawei also supplies Australian enterprises with rail communication equipment for the Sydney and Perth Metros, remote mining communications solutions, stadium WiFi, high performance computing for TAFEs and universities and a range of other enterprise IT products.

Huawei's high-end smart phones and consumer devices are also well supported by Australian consumers. The latest Huawei smart phones are ranked among the world's best for performance and style.

Huawei is a member of the Federal Government's 5G Working Group.