

# 5G Snapshot Series

## Spectrum

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# 5G: Our connected future

**THE PRIME MINISTER SCOTT MORRISON HAS HERALDED 5G AS “the next evolution of mobile technology. It promises the ability to improve the daily lives of Australians, strengthen our connectivity and accelerate our networks. 5G will change the way people use, and rely on, mobile services, driving improvements in a range of ways for businesses and communities. It will enable a new wave of innovation across our community and be used to connect other critical infrastructure, including electricity and water. 5G will underpin the development of smart cities and Internet of Things, and connect industrial control and safety of life systems, like remote surgery, and autonomous vehicles.” Scott Morrison and Mitch Fifield, Joint Media Release 23 August 2018.**

**In our 5G “snapshot” series, we take a key component of 5G deployment and consider the state of play domestically and abroad. In this second ‘snapshot’ of the series, we’re looking at the approach of different regions to allocating spectrum for 5G.**

## Spectrum

5G, and its promises of ultra-high download and upload speeds and ultra-low latency, is key to realising the potential of new technologies such as augmented reality, connected cars, industrial automation and Internet of Things. However, as each frequency band on the radiofrequency spectrum has different characteristics - such as speed, latency, the distance the radio waves can travel and whether they can penetrate buildings - governments and network operators need to harness contiguous spectrum in several frequency ranges across the radiofrequency spectrum to truly deliver the promise of 5G across their nation.

With a growing number of operators already having started to offer 5G services, government regulators around the world are increasingly moving to assign spectrum suitable for 5G services.

# Overview of Spectrum Bands

## Low-band spectrum (sub – 1 GHz)

**Features:** Low bands (especially 700 MHz) are needed by network operators to deliver widespread 5G coverage as these bands offer wide coverage area and good penetration through buildings / trees. However, this comes at the cost of lower peak speeds and latency. Use of these bands is seen as important to support 5G in rural areas and for many IoT use cases.

**Availability for 5G:** Although some network operators are starting to offer 5G services over these bands and Europe has prioritised the 700 MHz band, there has been less focus on these lower bands as they are often already licensed for other uses. The use of these bands (plus some ranges in the mid bands) for 5G services has already been identified as an area for exploration at the 2023 ITU World Radiocommunications Conference.

## Mid-band spectrum (between 1 GHz and 6 GHz)

**Features:** Often dubbed the ‘goldilocks’ of the frequency bands for 5G services, the combination of speed (faster than low bands but slower than high bands) and coverage (wider than high bands but narrower than low bands) is seen as being “just right” for meeting the predicted demand for 5G services in urban environments.

**Availability for 5G:** Both network operators and regulators have been focusing their attention on the mid bands (especially in the 3.3–4.2 GHz range). The majority of commercial 5G networks are already using these bands and there have been a number of spectrum auctions (including in Australia, Europe, the United States and across Asia) in the last two years to support this.

## High-band / mmWave spectrum (specified bands between 24 GHz and 71 GHz)

**Features:** High bands (with 26 GHz, 28 GHz and 40 GHz currently having the most support internationally) are needed to enable the promised ultra-high speed and ultra-low latency 5G services. They are considered key frequencies for the successful development of virtual reality, augmented reality, high speed entertainment services and autonomous vehicles. However, the higher bands face significant limitations in terms of coverage and penetration ability.

**Availability for 5G:** Although the United States was initially very active in auctioning spectrum licences in the high bands, the majority of countries have only just started to move towards auctioning spectrum licences for these bands. The importance of these high bands was recognised at the 2019 ITU World Radiocommunications Conference which identified a number of mmWave frequency bands (such as 26 GHz, 40 GHz and 66 GHz) to support ultra-high speed / ultra-low latency 5G services.

# Australia

## Summary

The Australian Government allocated spectrum in the mid-band frequency for 5G, with the auction of the 3.6 GHz band that finished in December 2018.

The focus has now turned to complementing the mid-band 5G spectrum with additional spectrum in both the high-band and low-band frequencies, with 2021 shaping up to be the "Year of 5G".

The Australian Communications and Media Authority (ACMA) is planning to auction off parts of the 26 GHz band in April 2021, making mmWave spectrum available for 5G in Australia for the first time.

Given the importance of low-band spectrum in providing mobile services, to regional Australia in particular, the Government has also issued a spectrum reallocation declaration that allows the ACMA to reconfigure parts of the 850 / 900 MHz bands for carriage of 4G and 5G services.

The spectrum reallocation declaration covers 2 x 10 MHz of new spectrum for mobile broadband services in the 850 MHz expansion band and 2 x 25 MHz in the 900 MHz band, which is currently used by carriers for 3G and 4G services. It also applies Australia-wide, with the exception of the mid-west Radio Quiet Zone, which is an area used for radioastronomy research.

An auction of the reconfigured low-band spectrum is planned for the second half of 2021, with a transition period that will allow existing licensees to continue using the band until 30 June 2024.

## Insights

The Australian Government has recognised the importance of spectrum to the rollout of 5G, providing \$7.1 million to the ACMA for spectrum management in the 2020-21 Budget. \$1.8 million will be invested in digital auction systems that promote the efficient allocation of spectrum, while \$5.3 million will be used to create an updated and simplified digital spectrum licence system.

Competition concerns have been a focus for some in the allocation of 5G spectrum, with governments and regulators around the world grappling with how to balance the need for operators to hold large blocks of contiguous spectrum to make full use of, and fulfil the potential of, 5G technologies, with the risk of potential anticompetitive effects of concentrating the finite resource in a few operators' hands.

In Australia, competition concerns were raised in early 2020 about the impact in downstream markets of the allocation of spectrum and apparatus licences in the 26 GHz and 28 GHz bands. This has resulted in a Ministerial Direction that bidders in the upcoming 26 GHz band auction are to be limited to an aggregate of 1 GHz in each designated area. Practically, this

limitation translates to approximately 40% of the mmWave spectrum on offer in any geographical area.

To ensure that industry can access spectrum in the most suitable way for their 5G needs, there is likely to be increased focus on spectrum sharing methods, both traditional and non-traditional. Recent consultations by ACMA have demonstrated a strong divergence in industry views as to whether non-traditional sharing such as dynamic shared-access regimes – a model where lower-tier users of a band dynamically give way to higher-tier users – are suitable for Australia.

In particular, there are concerns among Mobile Network Operators that dynamic shared-access undermines the rights of spectrum licensees, creates uncertainty in investment and potentially gives rise to concerns under the Australian Consumer Law.

As a result, the ACMA has indicated that it is unlikely there will be further focus (in the short term) on formal dynamic shared-access regimes in Australia. However, given the potential for industry-led trials of non-traditional spectrum sharing, this remains an area to watch.

# The regions

## Americas

Under the 5G FAST strategy, early allocations of spectrum for 5G in the United States prioritised mmWave spectrum, with auctions undertaken in the 24, 28, and upper 37, 39 and 47 GHz bands. Despite the limitations of deploying mmWave networks (such as poor coverage and penetrability), network operators (such as Verizon) have been actively expanding their mmWave 5G services.

However, the Federal Communications Commission (FCC) has raised concerns that there is a mid-band spectrum shortage in the United States for commercial 5G networks. For example, in April 2020, FCC Commissioner O'Rielly noted in a letter to President Trump that US carriers will need upwards of 350 MHz of mid-band spectrum beyond what had been allocated at that point.

To free up the mid bands, the allocation of priority access licences in the shared 3.5 GHz band was finalised in late August 2020, while the FCC has scheduled an auction for the 3.7-4.2 GHz bands for early December 2020. The FCC is offering incentive payments totalling US\$9.7 billion to satellite companies to clear 280 MHz of spectrum in the 3.7-3.98 GHz band ahead of the December auction.

Notably, large parts of mid-band spectrum in the United States have been reserved for United States Federal Agencies. The US Government announced in August 2020 that the Department of Defense had relinquished 100 MHz of spectrum from the 3.45-3.55 GHz band so it can be used for commercial 5G services. It is expected an auction of the spectrum will occur in December 2021.

## Europe

The European Commission (EC) plays a significant coordination role in the implementation of 5G in the EU, ensuring a consistent approach to spectrum availability and the implementation of standards to reduce the risk of fragmentation and service discontinuity across borders (e.g. for connected vehicles).

The EC has designated the 700 MHz, 3.4-3.8 GHz, and 24.25-27.5 GHz bands as the 'pioneer' bands that will support the initial launch of 5G services in the EU, ensuring that there is "a mix of spectrum with different characteristics to address the versatile 5G requirements". Member States are required to make spectrum in the 'pioneer' bands available for 5G use, and harmonise the technical conditions and principles of use for those bands.

EU countries were required to allow the use of the 'pioneer' 700 MHz band for 5G by 30 June 2020 (subject to a two-year delay for justified reasons). Similarly, noting that no exclusive use of 5G has been mandated, EU Member States can allow the use of both the 'pioneer' 3.4-3.8 GHz and 24.25-27.5 GHz bands by the end of 2020.

To date, many EU Member States have primarily focused on the 700 MHz and 3.4-3.8 GHz bands including Finland, Luxembourg, Germany and (noting the auction process is scheduled to commence in November 2020), the United Kingdom. However, due to existing licences in the mid bands, a number of Member States (such as the Netherlands) have been focusing on a number of other mid-band spectrums in recent auctions. Sweden has also announced plans to assign 24.25-27.5 GHz spectrum by 2021.

## Asia

The Chinese Government has prioritised the allocation of mid-band spectrum for 5G, granting the country's four 5G providers access to spectrum across the 700 MHz, 2.5-2.7 GHz, 3.3-3.6 GHz and 4.8-4.9 GHz bands. It has been reported that the Ministry of Industry and Information Technology is considering a usage plan for high-band frequencies although there has not yet been a formal allocation of mmWave 5G spectrum.

In June 2018, South Korea held the world's first auction for both mid-band and high-band spectrum, awarding spectrum in the 3.5 GHz and 28 GHz bands to its big three mobile operators. Under its 5G+ Spectrum Plan, South Korea's Ministry of Science and ICT intends to almost double the amount of 5G spectrum available to mobile operators by freeing up an additional 2,640 MHz by 2026, starting with the reallocation of spectrum in the 3.7-4.0 GHz band currently used for satellite communications.

Similarly, in April 2019 the Japanese Ministry of Internal Affairs and Communications assigned (via a beauty contest) spectrum to four Japanese mobile operators in the 3.7, 4.5 and 28 GHz bands and in June 2020 the Singaporean government assigned (via an auction) two 800 MHz lots across the 3.5 GHz band and two 800 MHz lots across the 26 and 28 GHz bands.

Europe

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