

FACTSHEET ON 5G PUBLIC CONSULTATION 2019

1. The Infocomm Media Development Authority (“**IMDA**”) launched a public consultation today to seek views from the industry and public on the appropriate regulatory frameworks and policies for 5G. IMDA’s vision is for Singapore to be a global 5G front-runner for innovation in secure and resilient 5G applications and services.

5G Capabilities

Ultra-high speed, reliable and low latency, supporting large-scale connected devices

2. Globally touted as the next big leap in mobile and wireless communications, 5G has significant enhancements over existing 3G/4G networks, such as:
 - a. Enhanced mobile broadband speeds (up to 20 Gbps, a 20-fold increase over 4G’s theoretical peak speed);
 - b. Ability to support large-scale machine-type communications (one million devices per km², a 1000-fold increase over 4G’s capacity); and
 - c. Ultra-reliable low latency communications (less than 1ms, a 25-fold improvement over 4G’s latency).

5G networks allow dynamic service provisioning to support different use cases and different sets of end-users

3. With 5G, operators can customise service offerings to support a wide variety of use cases. For example, the network can provide essential and critical services such as connectivity services for controlling autonomous vehicles while providing high quality consumer mobile broadband services such as cloud gaming in the same location. This is not possible with current generations of mobile technologies.

“Standalone” Architecture to Deliver Full-fledged 5G Capabilities

4. To achieve the full benefits of 5G technology, IMDA will support the adoption of “standalone” technical specifications that are expected to be internationally harmonised in early 2020¹. 5G deployments in many countries today are based on “non-standalone” specifications, which leverages on existing 4G networks for connectivity. Such deployments are limited to higher speeds and will not support the full suite of 5G capabilities.

¹ Standards will be harmonised by the 3rd Generation Partnership Project (“**3GPP**”), the global standards organisation which develops protocols for mobile telephony, and is the same organisation responsible for the development of the 3G and 4G standards we use today.

Overarching Strategies to Leverage 5G

5G's value proposition: supporting Singapore's Digital Economy

5. Unlike most jurisdictions where 5G plays a key role in delivering last-mile fixed wireless broadband to homes, Singapore already has a nationwide fibre broadband network with residential wired broadband household penetration of more than 90%, capable of delivering 1 Gbps for as low as S\$34/month. Singapore's mobile market is also vibrant with competitive prices and innovative services such as the recent introduction of SIM-only plans, data add-ons and unlimited data plans. For example, there are 1 Gigabyte mobile plans from as low as \$0, and unlimited data plans from S\$29.99/month. For Singapore, 5G's value lies in helping the industry and enterprises to exploit market opportunities and to develop innovative applications and services in a wide range of sectors including manufacturing, transport, media and healthcare.
6. Singapore seeks to leverage 5G to spearhead innovation, and develop differentiated offerings in 5G applications. Globally, as the business case and economics of 5G are still nascent, IMDA will nurture the 5G ecosystem by focusing our development efforts in selected areas. These include enabling the deployment of 5G networks, partnering industry to build sustainable business use cases, and developing strong human capabilities to exploit the technology to spur innovation and adoption.

IMDA's Policy Objectives and Regulatory Approach to Enable 5G Deployment

Maximise benefits of 5G technology for the economy and consumers, through optimising scarce spectrum resources and building trusted and resilient networks

7. IMDA seeks to achieve the following key policy objectives for the deployment of 5G networks in Singapore:
 - a. Maximise value of 5G for the economy and welfare for the consumers;
 - b. Facilitate efficient allocation of scarce resources such as spectrum;
 - c. Ensure that Singapore's 5G networks are designed to be trusted and resilient; and
 - d. Support the growth of a vibrant telecommunication sector.
8. To achieve these policy objectives, IMDA proposes the following strategies:
 - a. Facilitate early deployment of 5G from 2020 based on standalone network specifications and architecture;

- b. Facilitate sustainable competition with at least two nationwide 5G networks at the outset while encouraging network sharing;
- c. Ensure 5G networks are designed to be resilient and trusted at the outset; and
- d. Provide regulatory flexibility to allow the mobile market to grow and adapt to technology changes.

The key regulatory measures in support of the strategies are set out below.

Spectrum identified for 5G

9. Globally, the front-runner 5G spectrum bands today are the 3.5 GHz, and the 26 GHz and 28 GHz (also known as millimetre wave or “**mmWave**”) bands.
10. Spectrum in the 3.5 GHz band is key to providing wide-area 5G coverage. However, the band is currently used extensively for satellite communications in the Asia Pacific region by countries including Singapore, Malaysia and Indonesia. IMDA is working closely with existing 3.5 GHz users and our neighbouring countries to ready this band for 5G.
11. IMDA plans to free up spectrum in the 3.4 – 3.6 GHz band for 5G by 2021. IMDA estimates that some of this spectrum can be used for network deployment in both outdoors and indoors (“**unrestricted**”), while the remaining spectrum may be limited to indoor/underground (“**restricted**”) use due to potential interference issues.
12. IMDA will also make available the mmWave bands to provide ultra-high speed connectivity in localised hotspots.
13. IMDA may open up other spectrum bands progressively, potentially around 2025, when the global ecosystem is more ready for cost-efficient deployment.

Initial 5G market structure and first wave of spectrum allocation

14. To optimise scarce spectrum resources to deliver the full potential of 5G and to address the current nascent business case in 5G, IMDA proposes to enable the deployment of at least two nationwide networks capable of delivering full-fledged 5G functionalities in the initial phase. At the same time, IMDA will also encourage network sharing and services-based competition.
15. To this end, IMDA proposes to allocate:

- a. Two spectrum packages of: (i) a 100 MHz lot comprising spectrum for unrestricted and restricted use; and (ii) a 50 MHz lot for unrestricted use; and
- b. Two lots of 800 MHz of the mmWave band to be paired with the 3.5 GHz spectrum, to be issued to the two successful 3.5 GHz spectrum holders (refer to **Annex A** for the spectrum packages).

Spectrum rights duration

16. IMDA proposes a spectrum right duration of 12 to 15 years to provide sufficient investment certainty, while catering for technological changes and new 5G spectrum bands. The spectrum rights for the 3.5 GHz and mmWave spectrum will expire at the same time.

Spectrum assignment mode

17. IMDA proposes to assign 5G spectrum through a Call For Proposal (“**CFP**”) regulatory process. The CFP is only open to existing mobile network operators (“**MNO**”)².
18. Specifically, the CFP approach will require interested players to indicate their preference for the 3.5 GHz and mmWave lots, submit detailed proposals on their plans for 5G deployment, explain how these deployments would meet IMDA’s desired policy objectives; and submit the offer price(s) they are willing to pay for the 3.5 GHz lots, which shall be above IMDA’s base price(s).
19. To arrive at the base price for the 3.5 GHz lots, IMDA is considering to take reference from international benchmarks of base and final bid prices for similar bands auctioned globally between 2017-2019 (see **Annex B**). Given the excess supply in mmWave spectrum, this spectrum will be issued at cost-based annual administrative fees to successful spectrum right holders of the 3.5 GHz lots.

Regulatory obligations

20. To meet IMDA’s policy objectives, interested players will be required to meet baseline regulatory requirements. These include:
 - a. Providing 5G standalone networks with more than 50% coverage within 24 months from the commencement of the 3.5 GHz spectrum right and putting the mmWave spectrum to use within 12 months from the start of the spectrum right;

² This may include any joint ventures and/or consortiums involving at least one existing MNO, or between two or more existing MNOs.

- b. Designing and building trusted and resilient 5G networks to meet IMDA's regulatory requirements; and
 - c. Providing 5G wholesale services to other MNOs/Mobile Virtual Network Operators.
21. Given that the 5G networks will be supporting mission critical and essential services, Singapore encourages vendor diversity in our telecommunication systems to mitigate risks from dependency on any one vendor. In addition, operators should ensure that the performance and reliability of equipment purchased from vendors meets their commercial operational needs and regulatory requirements, including those pertaining to quality of service, resilience and security.

Evaluation criteria for spectrum award

22. IMDA will evaluate the strengths of each proposal beyond baseline requirements, in areas such as commitment to augment network rollout and performance, quality of network design and resilience, financial capability of interested players, and offer price for spectrum.
23. IMDA welcomes partnerships amongst MNOs to build and deploy 5G networks so as to more effectively use the scarce spectrum resources and expedite the deployment of the networks.

Regulatory facilitation and support for network deployment

24. In response to industry interest in conducting further technical and/or commercial trials, IMDA will extend the waiver of frequency fees for 5G spectrum under the existing IMDA Technical and Market Trial frameworks until the spectrum rights for the respective spectrum have been issued.
25. New 5G network architecture may require new infrastructure support such as lamp posts and bus stops. IMDA will thus facilitate industry dialogue to co-develop the infrastructure support requirements for 5G deployment, in collaboration with other key Government agencies.

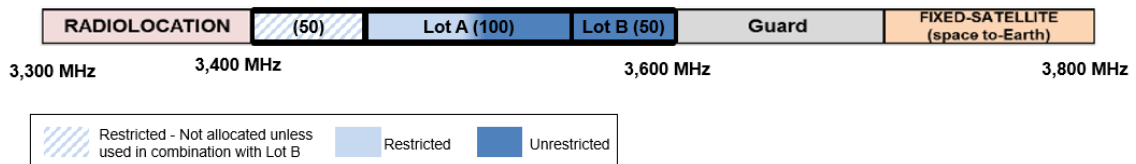
Invitation to Comment

26. The 5G Consultation will open for comments today, 7 May 2019 and close at 12 noon, 19 June 2019. As part of the consultation, IMDA also welcomes proposals from the industry to conduct technical trials on interference mitigation measures and feasibility and versatility of different infrastructure sharing models, and to discuss how IMDA can partner the industry to develop a vibrant 5G ecosystem.

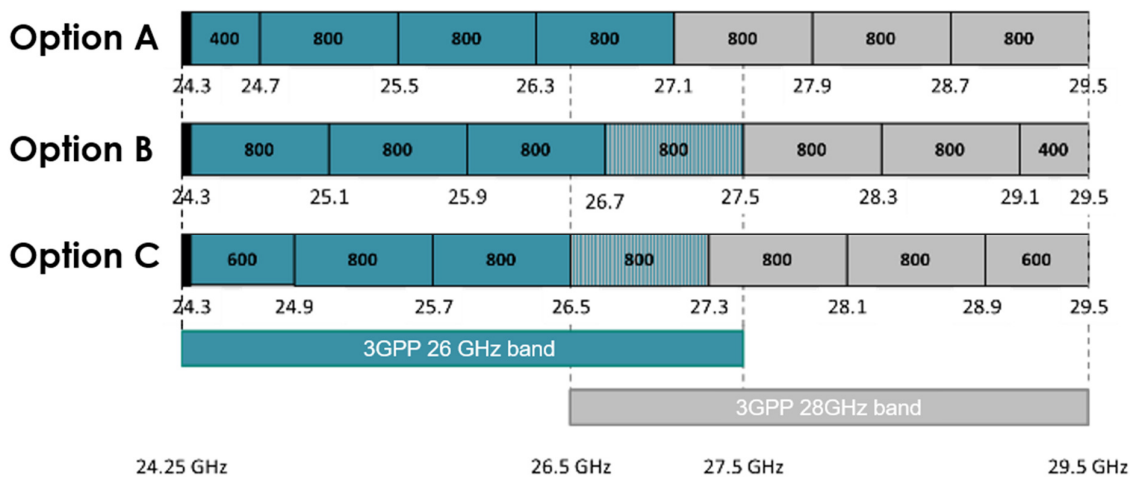
Annex A

Proposed Band Plan and Spectrum Allocation Options for 3.5 GHz and mmWave Bands

1. IMDA proposes to allocate Lot A and Lot B for 5G deployment in the initial phase.
2. IMDA proposes to assign the remaining 50 MHz spectrum lot, which is restricted for indoor/underground use, in the next phase after the unrestricted spectrum is awarded. This is in view that there may be little benefits in having restricted use of spectrum, unless the industry views that there are compelling reasons to pair it with the right most unrestricted 50 MHz spectrum (i.e., Lot B) to optimise performance using non-contiguous spectrum.



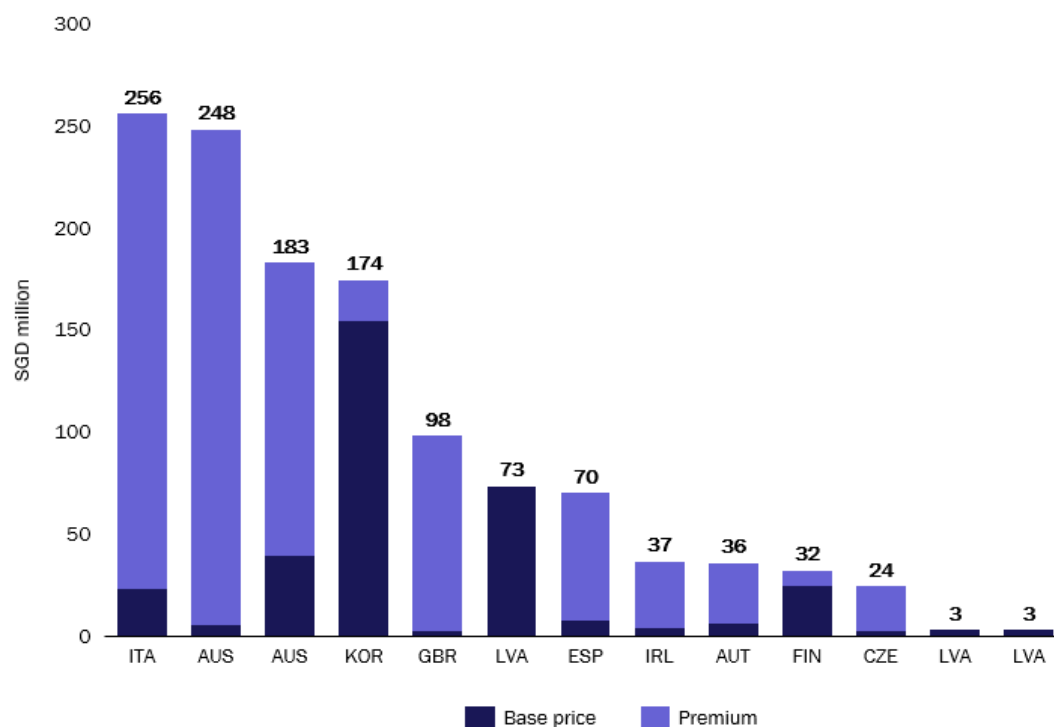
3. IMDA is considering three possible band plan options for the mmWave band. Of the three possible options, IMDA's preference is for either Option B or C as the channelling arrangements are more aligned with the 3GPP recommended band plans.
4. The successful spectrum right holder of a 3.5 GHz lot will be allowed to select its preferred assignment of the 800 MHz mmWave lot based on the finalised band plan option.



Annex B

International Base and Clearing Prices for 100 MHz of 3.4 – 3.8 GHz band

- Based on international benchmarks for a 100 MHz unrestricted 3.5 GHz spectrum (normalised to Singapore's population and 13-year spectrum duration), the clearing price at the 25th percentile, median, and 75th percentile are approximately S\$32 mil, S\$70 mil, and S\$174 mil respectively.



Source: Analysys Mason and regulators' websites