The 5G Huddle 2020

Spectrum pricing for 5G: a global perspective

6 February 2020

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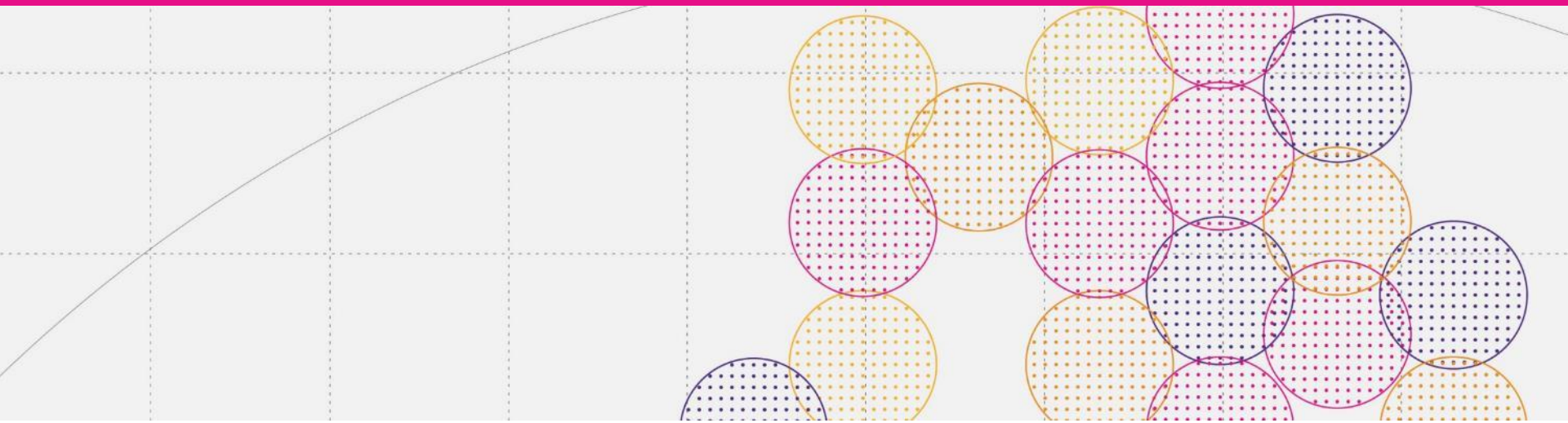

What we do

- Plum Consulting provides a comprehensive advisory service for governments, regulators, vendors and service providers who are looking to identify, assign and use spectrum.
- Our advice is based on rigorous economic analysis and specialist technical knowledge of radio engineering and we combine this with extensive market knowledge of the communications sectors to provide clear and sound analysis.
- For more information https://plumconsulting.co.uk/

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- 5G business cases
- 5G procurement support
- Spectrum pricing and fees
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Overview

- Objectives and principles of spectrum pricing
- How has spectrum pricing worked to date
- What's different with 5G?
- Observations from the first wave of 5G awards
- Future approaches for 5G

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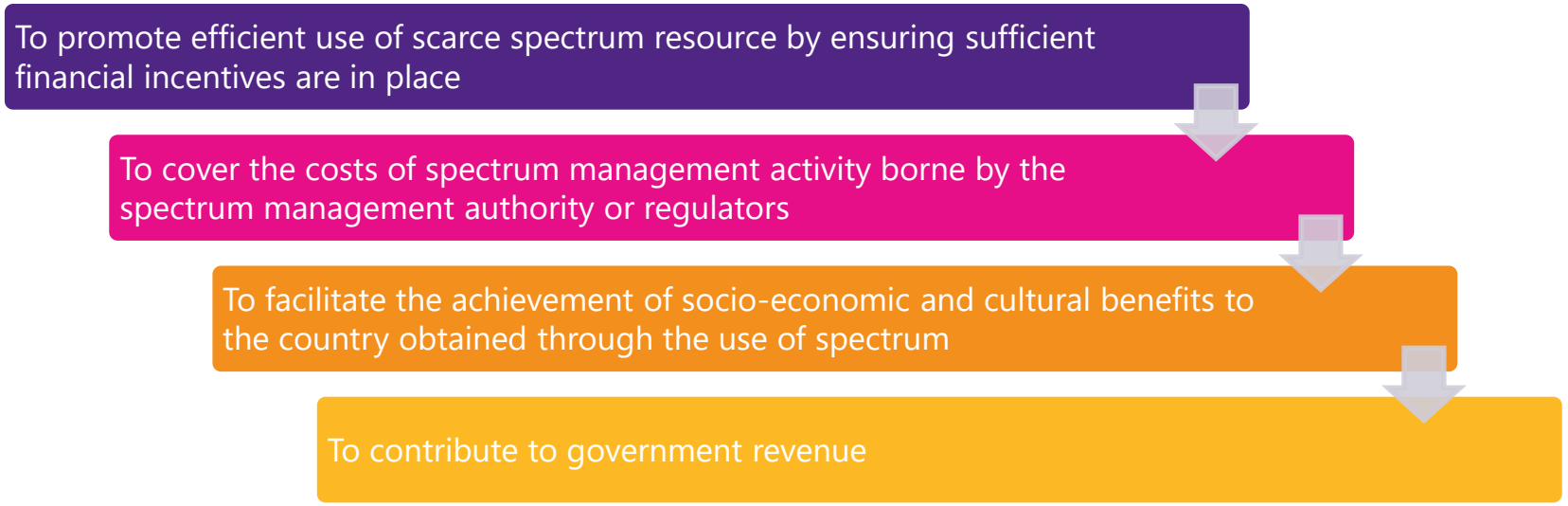
Spectrum pricing – what's the purpose?

"For any resource, including radio spectrum, the primary economic objective is to maximize the net benefits to society that can be generated from that resource such that there is an efficient distribution of resources resulting in maximum benefits to society. Prices are used as an important mechanism to ensure the spectrum resources are used efficiently by users." (Source: ITU, *ICT Regulation toolkit*)



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General spectrum pricing principles

- Spectrum should be allocated to the highest value use or uses to ensure maximum benefits to society.
- Where there is excess demand, pricing is a tool to enable and encourage spectrum moving to its highest value use.
- Prices can be determined through market-based mechanisms or administratively by the regulatory authority.
- Fairness and objectivity – prices or fees should be based on objective factors and all licence holders in a given frequency band should be treated on an equitable basis.
- Transparency – the basis on which prices or fees are calculated should be made clear.
- In the absence of scarcity, prices or fees should be set to recover the costs of managing the spectrum.

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A brief history of IMT licensing and pricing

- Excess demand for 3G spectrum
- 5 MHz channels
- Auction the preferred mode of assignment
- Market-based prices
- Long term licences (lump-sum fees usually)

What about 5G?

- Direct award/beauty contest
- 200kHz channels (900/1800 MHz), no scarcity
- Annual fees, usually formula-based (by bandwidth or transmitter)

- Multiple LTE bands (sub-3 GHz)
- Scarcity under most situations
- 5 MHz up to 20 MHz channels
- Shift towards technology / service neutral licences
- Auction/renewals/hybrid awards

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What's different with 5G?

- A powerful form of wireless connectivity capable of supporting a multitude of services (enhanced mobile broadband, massive IoT, ultra-reliable, low latency communications).
- 5G will eventually be deployed over a vast range of bands – low (sub-1GHz), mid (1-6 GHz), high (>6 GHz).
- Techniques such as network function virtualisation (NFV) and soft-defined networking (SDN) allow a single network to be 'sliced' to serve heterogenous user needs
- 5G can be delivered over public or private networks (or a combination of both)
- Different spectrum access mechanisms possible and may be needed to cater for emerging use cases and new business models

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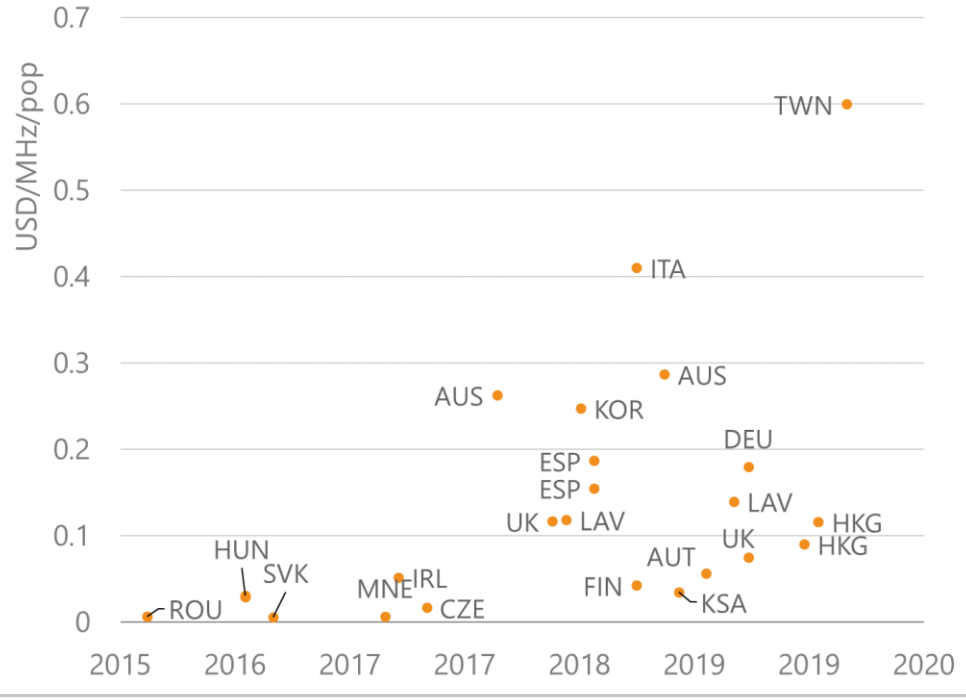
First wave of 5G spectrum assignments

- Main focus is on C-band (3.3-3.8 GHz) and mmWave bands (26/28 GHz); use cases predominantly eMBB.
- To date, >20 countries have assigned C-band; wide variation in prices but general upwards trend reflecting growing ecosystem around C-band



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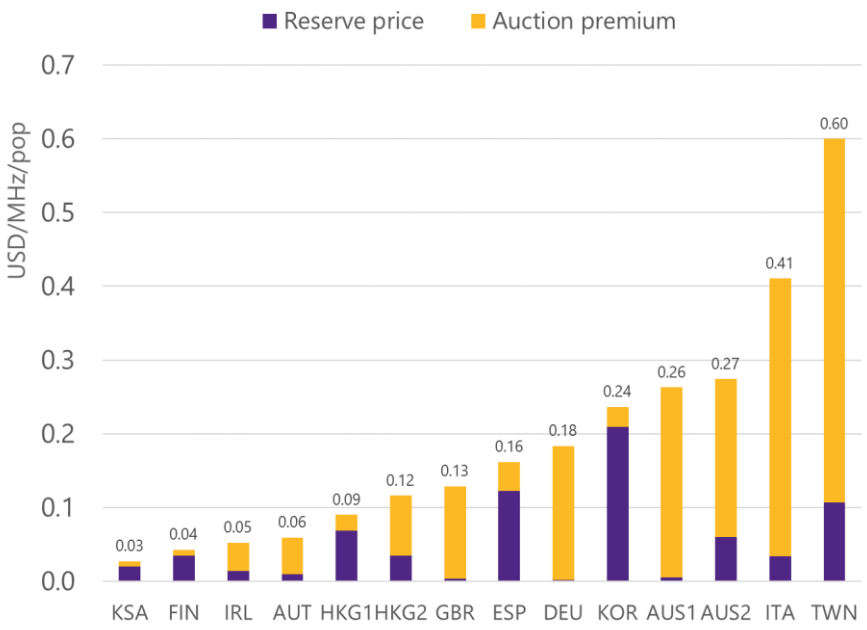
Compared to 4G auctions, C-band awards not too dissimilar, but…

- Wider recognition of the economics of 5G and investment needed for network rollout; generally lower auction reserve prices and more open approach to network sharing
- More complex conditions to address policy objectives and prevent hoarding
- Delicate balance between facilitating access to large bandwidths (80-100 MHz) and maintaining adequate competition at the network and service levels
- Greater receptivity towards use of comparative tenders or hybrid awards with a focus on non-price criteria
- Set-asides proposed in some cases (e.g. Germany, Sweden, Netherlands)

Comparison of reserve prices and auction premium in recent 3.5 GHz auctions



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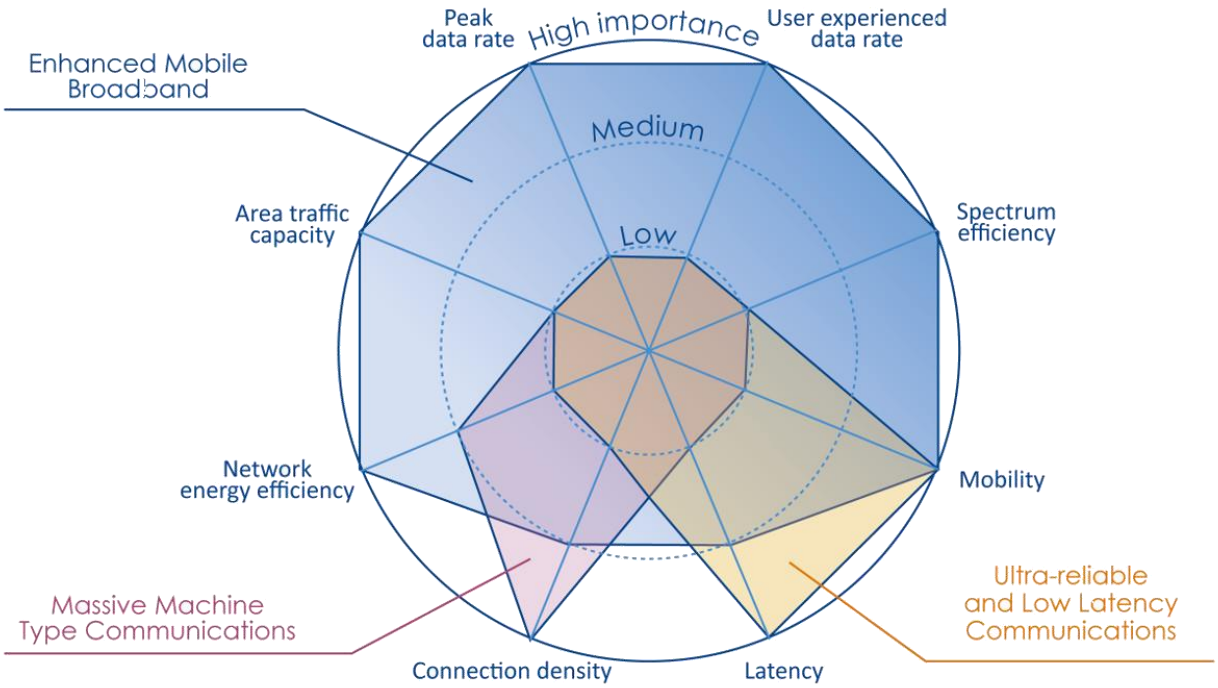
5G goes beyond just enhanced mobile broadband

- **Bespoke network design to meet different user requirements and preferences will be more prevalent with 5G**



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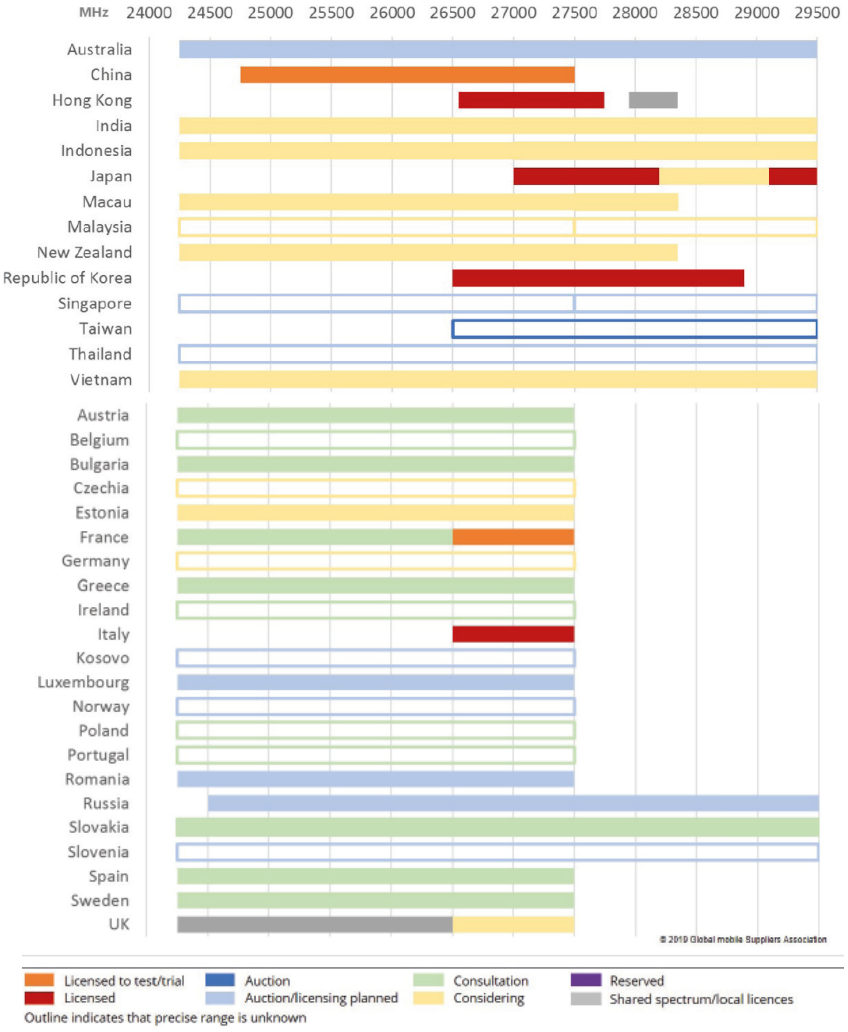
mmWave may require different approaches

- Unlike 700 MHz and C-band, mmWave spectrum is likely to merit a different approach because:
  - Uncertainty over what it will be used for and the extent of coverage.
  - Large amount of bandwidth, such that supply may exceed demand, or at least the degree of scarcity may be lower.
  - Short range of mmWave (often less than 100m) allows greater sharing possibilities since interference is less likely.
  - Potentially many players beyond the MNOs that find use for the spectrum, for example railways for backhaul from the train, fixed operators for FWA, airports for dense areas, etc.



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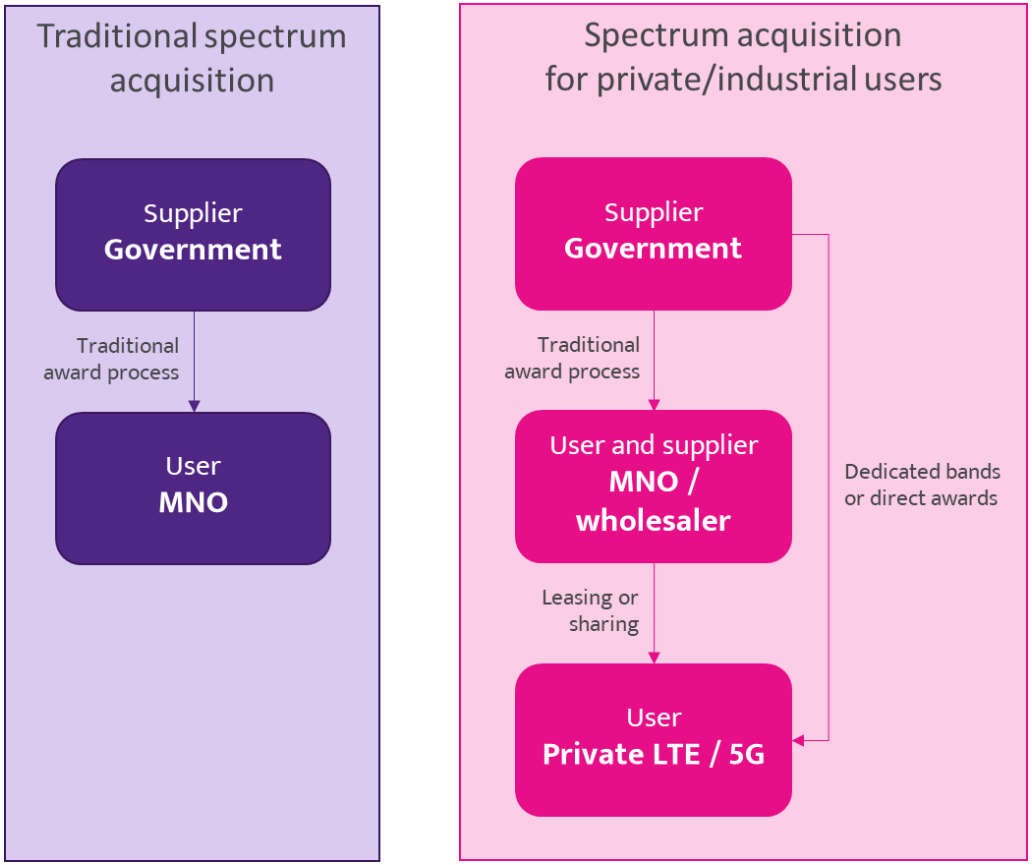
Addressing spectrum access for industrial users



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Alternative forms of spectrum access

- Aside the traditional licensing approach, other possible models include:
  - Wholesale network (e.g. LTE 450 MHz in some Scandinavian countries)
  - Dynamic sharing involving geolocation databases (e.g. TVWS, CBRS); Licensed Shared Access (LSA) a similar concept but with more regulatory oversight
  - Club model – licensed but not exclusive (e.g. Italy 26 GHz)
  - Spectrum brokerage – performing function of spectrum demand aggregation
  - Light licensing, local area licensing
- Ideally there would be quick access to spectrum (e.g. through an online interface) and spectrum database techniques could play a significant role in facilitating more flexible access arrangements
- As 5G develops and matures, likely to see a combination of different access models

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Concluding thoughts

- The principles and objectives of spectrum management and spectrum pricing are still relevant in the 5G era.
- However, unlike previous generations, 5G is designed to support a multitude of use cases and requirements across a vast range of frequency bands.
- The economics of 5G and investment challenges, particularly in the case of eMBB, should be taken into account when in spectrum pricing decisions.
- Divergent approaches to award and pricing observed across countries and these also differ across spectrum bands.
- To facilitate 5G use cases for industrial sectors, regulators should focus on removing obstacles to innovation and ensuring regulatory frameworks are flexible to accommodate different forms of spectrum access.
- Going forward, technical solutions which enable more flexible access and improved spectrum utilisation could change the nature of spectrum management and pricing.

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Thank you

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