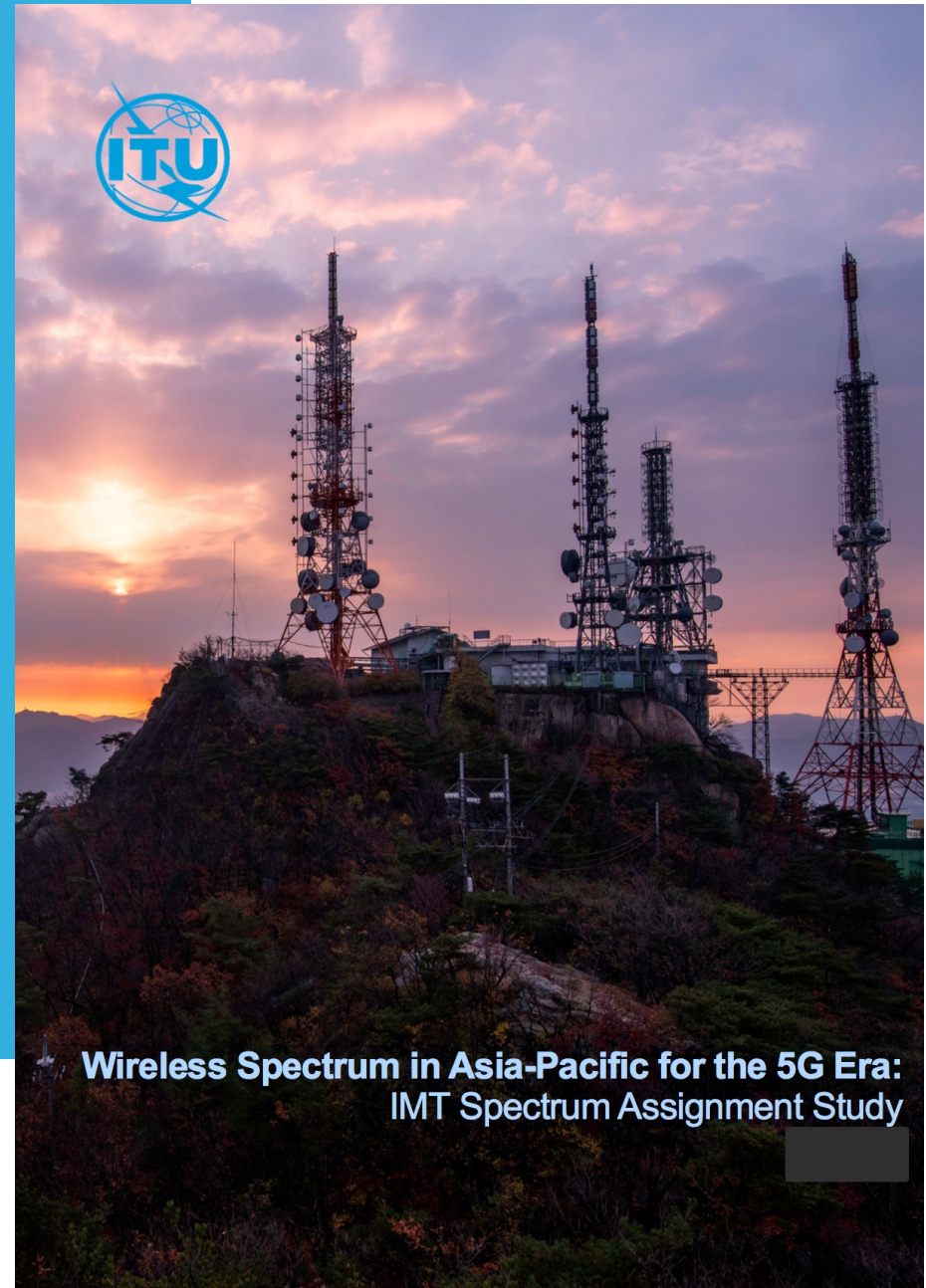


Asia-Pacific for the 5G Era: IMT Spectrum Assignment Study”

**Presentation to The Asia and the Pacific
Regional Dialogue on Digital
Transformation: Gearing Up for Inclusive
and Sustainable Development**

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Overview

- The scope of the ITU study
- Considerations underlying IMT spectrum assignments
- Key findings for IMT spectrum assignments in Asia-Pacific
- Case studies - Australia, Pakistan, Thailand, Japan
- Key learnings from ITU IMT Spectrum Study



The scope of the ITU study

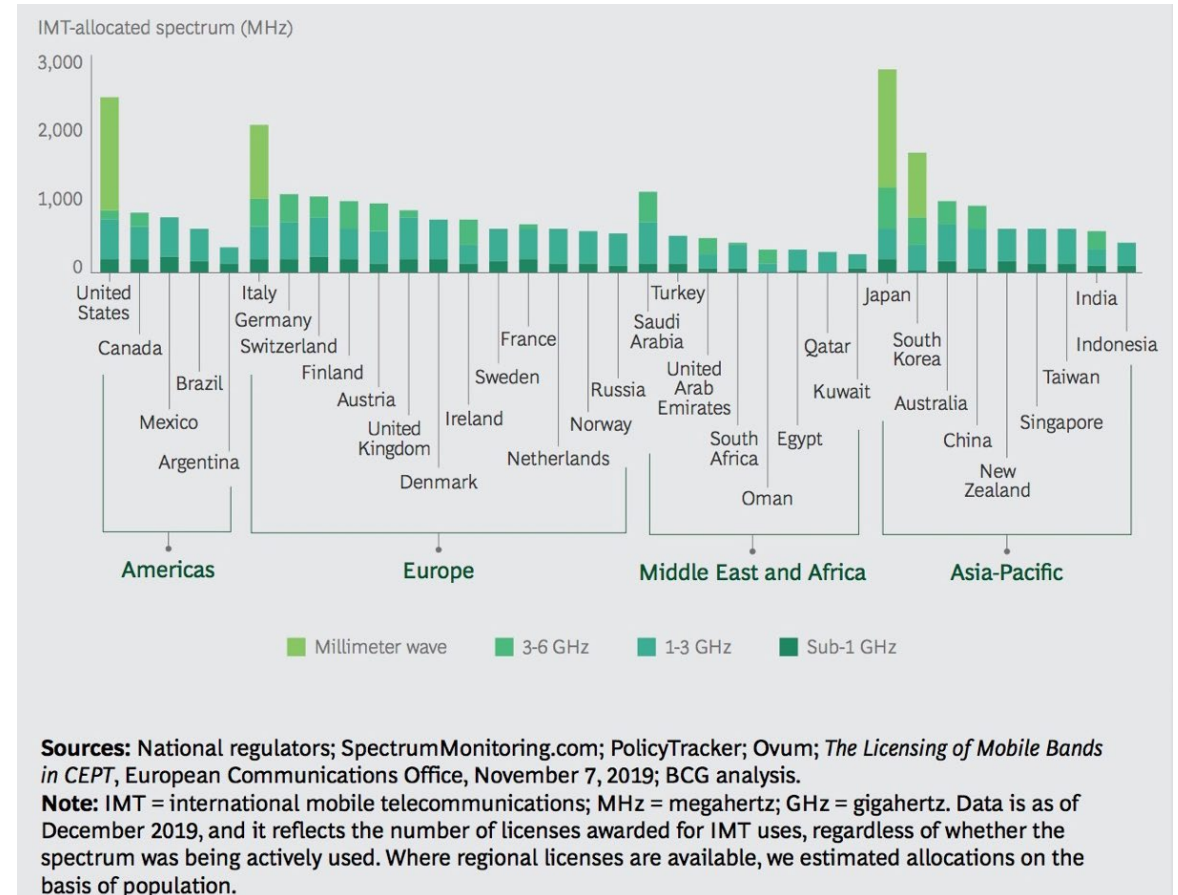
- The key objective was to develop a resource for the ITU's Asia-Pacific member states which provides **information and insights concerning IMT spectrum assignments in the region**. There are five major components of this study, namely:
 - (i) Considerations underlying spectrum assignments
 - (ii) IMT spectrum assignments in the Asia-Pacific region in the last 5 years
 - (iii) Proposed IMT spectrum assignments in the Asia-Pacific region
 - (iv) Approaches to the setting reserve prices for spectrum assignments
 - (v) Policy and regulatory settings for spectrum assignments.
- Key to the report is the compilation of a database of Asia-Pacific IMT spectrum assignments as well as number of country case studies on the release of IMT spectrum.



Considerations underlying IMT spectrum assignments

- Since 2019, the world of spectrum has changed. The maximum quantum of IMT spectrum that was assigned in any one country/region has risen from approximately 1 GHz, mainly in the low to mid bands (ie sub-6 GHz band), to 3 GHz and more.
- When allocating spectrum, governments and regulators should be concerned with achieving **two forms of efficiency**, technical efficiency and economic efficiency:
 - **Economic efficiency** requires maximisation of value of outputs
 - **Technical efficiency** requires complete utilisation of all available spectrum

IMT Allocated Spectrum Worldwide 2020



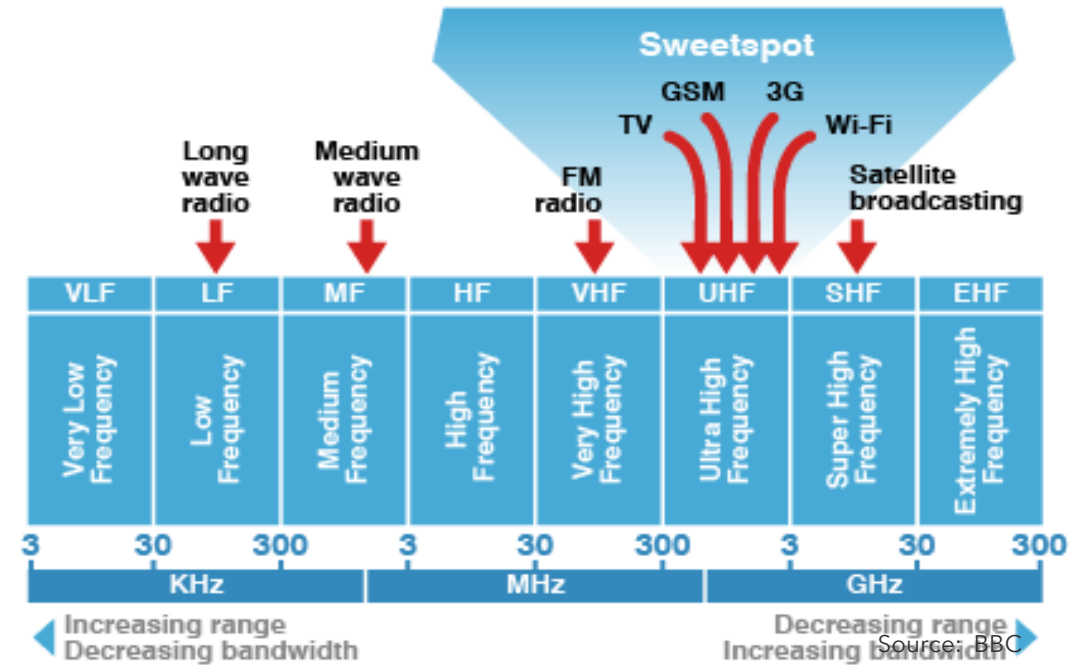
Source: BCG, February 2020. Note since this graphic was produced a range of countries have significantly increased IMT allocations including *inter alia* Australia, China, Germany, Saudi Arabia and Thailand.



Key findings for IMT spectrum assignments in Asia-Pacific (1)

The key observations of our study:

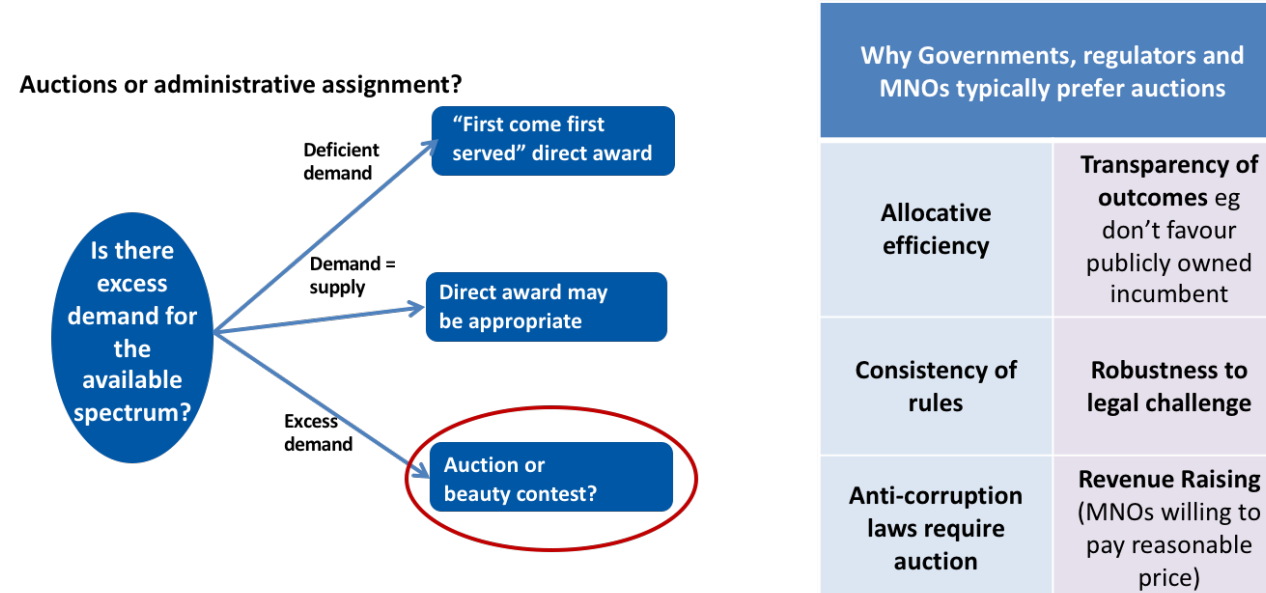
- Most ASP countries covered by the ITU study have allocated spectrum (34 out of 37) over the past 5 years, (note we were unable to access data from some Pacific countries)
- The top **three most popular IMT spectrum bands allocated** were: 1) **700 MHz band** for 4G and 5G services, 2) **1800 MHz** typically used for 4G services & 3) **3.5 GHz** band for 5G services
- **5G spectrum allocations in the pioneer band (3.5 GHz/ n77/78 band) took off from 2018**. The 3.5 GHz band allocations continued throughout 2019 and peaked in the region in 2020.



Key findings for IMT spectrum assignments in Asia-Pacific (2)

Key observations of our study (continued):

- There was an overwhelming preference in the region for **spectrum allocation through spectrum auctions**. Other methods of spectrum assignment included assignment, administrative allocations, beauty contests, hybrid (assignment and auction), direct offers and call for proposals.
- Additionally, due to COVID-19 **different payment terms** have occasionally been negotiated between MNOs and regulators including discounts and annual payment terms, or waiving of fees (eg in China).



Source: NERA Economic Consulting + WPC additions, 2021

Key findings for IMT spectrum assignments in Asia-Pacific (3)

The key observations of our study (continued):

- The **length of licence varies between Asia-Pacific countries**. The most common licence length in the region over the past five years is 15 years (eg Hong Kong, Malaysia, Mongolia, Myanmar, Singapore, Thailand, etc.)
- **Conditions have imposed to encourage the rollout of a 5G networks and/or ensure nation-wide coverage**, For example, In Thailand, NBTC motivated 5G investment in Thailand by giving 3 years grace period for any repayment if 5G is deployed in 50 percent of Eastern Economic Corridor (ECC) Area within 1 year and 50 percent of smart city within 4 years.
- Exemplar markets in the Pacific and East Asia are leading the way in **the switch off of legacy 2G/3G networks** and refarming such IMT spectrum for 4G and 5G services.

Key drivers of legacy 2G/3G network switch off

Country/Region	Spectrum re-use for 3G/4G	Spectrum harmonisation	Spectrum licence expiry	Cost optimisation	Declining 2G demand
Australia	●			●	●
Japan		●		●	
Macao, SAR	●				●
New Zealand	●			●	●
Singapore	●		●		●
South Korea	●			●	●
+ Taiwan, P.R China	●		●		●

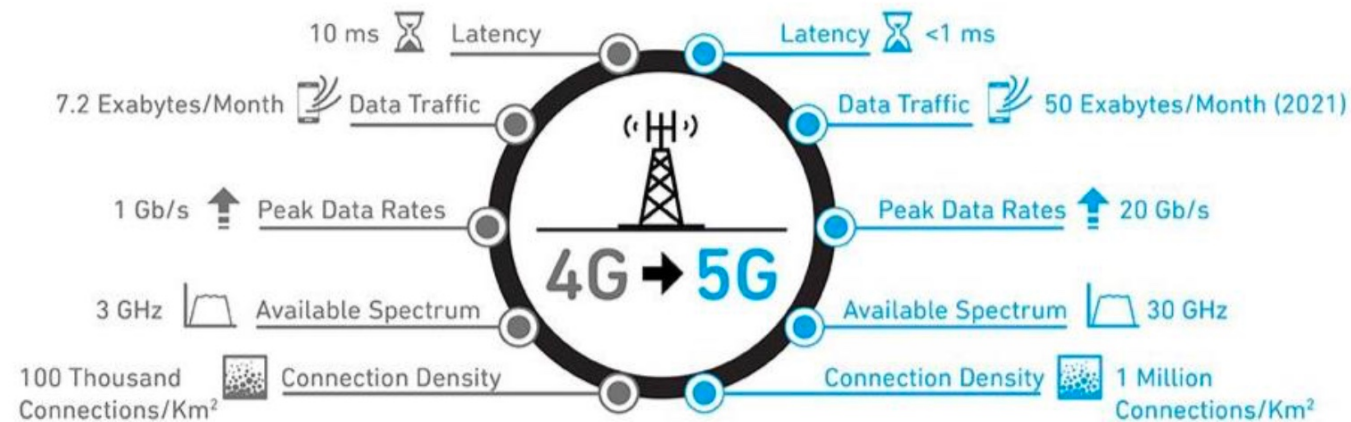
Source: WPC with Network Strategies of New Zealand of a report for the GSMA, entitled *Legacy mobile network rationalisation: Experience of 2G and 3G migrations in Asia-Pacific*, (May 2020) with the addition of Taiwan, PR China from WPC



Key findings for IMT spectrum assignments in Asia-Pacific (4)

The key observations of our study (continued):

- Over the past five years, there have been numerous examples of **refarming spectrum** in the Asia-Pacific region (eg Australia, Indonesia, Malaysia, Pakistan)
- It is mostly developed markets prioritising 5G that have **already allocated mmWave spectrum**, although there are exceptions (notably China).
- **Allocations have been to facilitate/promote competition, and regulators have imposed spectrum limits on MNOs:** there have been many instances of spectrum caps being utilised to avoid creating an uneven market, such as in Thailand and Australia.

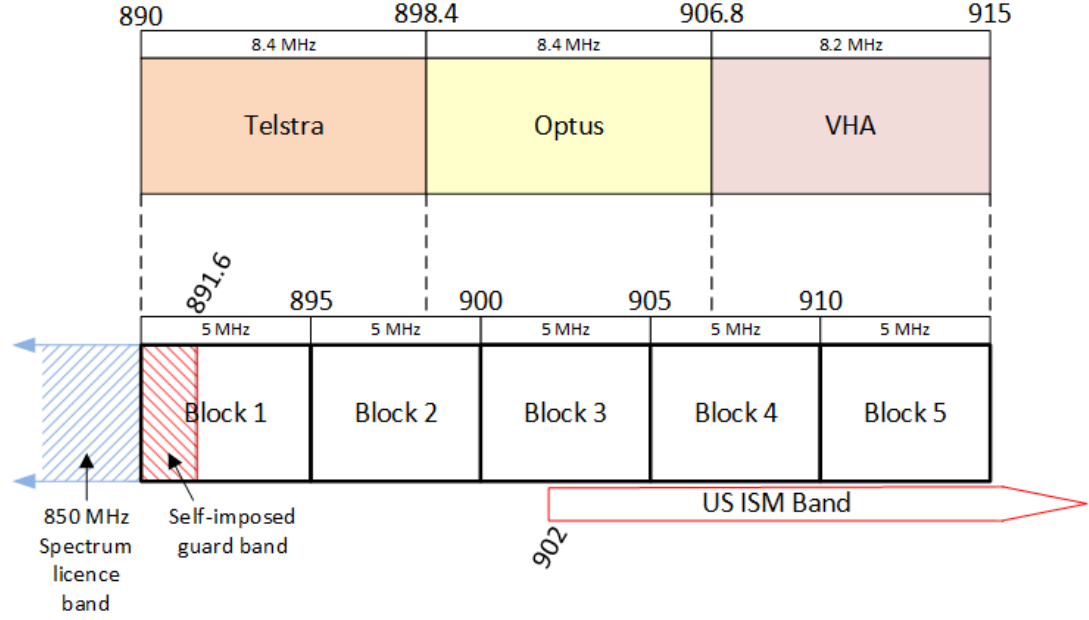


Source: Telstra, March 2020,

Case studies: Australia, refarming and late 2021 auction

- **The ACMA's long-term strategy for the 803-960 MHz band** intended to reorganise 900 MHz GSM band into 5 MHz lots, optimising its utility for 4G, as parts of the band were unused due to allocations to outdated technologies
- **ACMA created a transition timeline for operators to comply with as part of the refarming:** operators given one year from the stated date to comply with milestone requirements involving transitions to a particular band.
- 900 MHz band is currently licensed to Telstra, Optus and Vodafone in 8.4 and 8.2 MHz blocks. ACMA recognised that **a 5 MHz channel plan would be far more conducive to 4G and 5G deployments** than the current 8.2/8.4 MHz arrangements.
- Self-imposed guard blocks would mean that the efficiency gains of moving to a 5 MHz block plan would not be realised and issues with interference may arise. **See figure below.**

Current and proposed arrangements for the base receive component of the 'GSM' band



Late 2021 Spectrum Auction

- **ACMA plans to allocate, via market-based processes, 2 x 10 MHz in the 850 MHz expansion band and 2 x 25 MHz in the 900 MHz band. The policy objectives behind this move are:**
 1. support the deployment of 4G and 5G technologies;
 2. promote competitive market outcomes for the long-term benefit of consumers;
 3. encourage investment in telecommunications infrastructure, including in region;
 4. support continuity of services; and
 5. support a national Public Safety Mobile Broadband capability.

Case studies: Pakistan's 1800 MHz, 2100 MHz auction

Overview of the Spectrum Auction

- **Licence duration:** 15 years (which may be renewable).
- **Remaining balance liability:** paid on account of initial spectrum fee before the end of 5 years without pre-payment penalties
- **Two-stage spectrum award:** (1) applicants submit an application form, sealed-bid form and pre-bid deposit; (2) Electronic Auction Stage (Clock Auction) for 1800 MHz and a Simultaneous Multi-Round Ascending Auction for 2100 MHz.
- Existing MNOs, new entrants subject to **spectrum cap** of 40 percent in complete 1800 MHz band.

	Spectrum band	No. Of Lots	Lot size	Base Price per lot
Base price and size of spectrum bands	1800 MHz - Blocks in Product 1	39	2x0.2 MHz	USD6.2 million
	1800 MHz - Blocks in Product 2	1	2x5.0 MHz	USD155 million
	2100 MHz Blocks	3	2x5.0 MHz	USD145 million

Source: Information Memorandum, Spectrum Auction for NGMS in Pakistan, August 2021

Policy directive for the Spectrum Auction in 1800 MHz and 2100 MHz bands

- Spectrum assignment to be **'Technology Neutral'** and usable for all existing, upcoming advanced generations/technologies.
- PTA to provide MNOs with opportunity to **acquire additional spectrum enabling it to hold spectrum in multiples of standard 5 MHz paired spectrum blocks.**
- Post auction, MNOs required to comply with **the rationalisation plan** ensuring optimal utilization of contiguous spectrum holdings in 1800 MHz band.

Results of the Auction

- In September 2021, **Ufone was successful in acquiring 2 x 9 MHz of 1800 MHz (ie one lot of 2 x 5 MHz and 20 lots of 2 x 0.2 MHz) for a price of USD279 million** paid in instalments.
- Ufone was the only bidder. 2 x 3.8 MHz of 1800 MHz and 2 x 10 MHz of 2100 MHz spectrum left unsold.

Case studies: Thailand's spectrum 5G auction

Auction Overview

- Thailand's telecoms regulator, NBTC, held the country's **5G spectrum auction in February 2020, raising 100.52 billion baht (USD3.2 billion) with 48 licenses grabbed** ahead of the 5G commercial rollout.
- **Auction results are summarised below.**

700 MHz acquired	2.6 GHz TDD acquired	mmWave 26 GHz
CAT: 2 x 10 MHz AIS: 2 x 5. MHz	AIS: 100 MHz True: 90 MHz	AIS: bought maximum 1200 MHz True: 800 MHz TOT: 400 MHz DTAC: 200MHz

6 GHz price	700 MHz price	26 GHz price	Total
37,164 Million THB (USD1.2 billion)	51,462 Million THB (USD1.6 billion)	11,570 Million THB (USD373 Million)	100,196 Million THB (USD3.23 billion)

Source: www.bangkokpost.com/business/1857749/nbtc-gears-up-for-5g-auction

Auction Terms

- 5G Spectrum reserve prices: 5% of previous 900 MHz spectrum final price and 15% of 1800 MHz reserve price to motivate 5G investment.

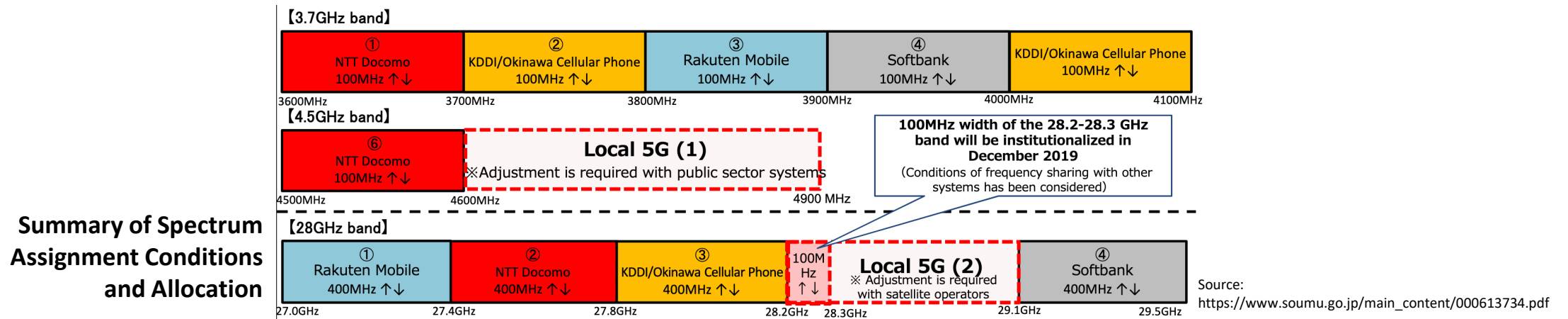
Obligations to facilitate MNO making investments include:

- Grace Period: no need for payment for 3 years
- License Period: 15 Year
- 1st Year: 10%
- 2nd-4th Year: Grace Period
- 5th - 10th Year: 15%
- Those who won 2.6 GHz spectra were to provide 5G network coverage for at least 50 percent of the Eastern Economic Corridor (EEC) one year after the auction, by February 2021.

Case studies: Japan - 5G Spectrum Allocation Commitments

Spectrum Assignment Overview: No Upfront Fee for Spectrum

- In 2019, NTT DoCoMo, KDDI, Softbank, and Rakuten awarded radio frequencies and licences to rollout 5G services, which were rolled out from 2020.
- 5G spectrum allocations were **without upfront fees**.
- The ministry attached **multiple conditions to build out 5G infrastructure widely**
- **MNOs applied for spectrum via scoring** (site number, coverage and investment commitments, current spectrum utilization ratio)



Spectrum Award Conditions

- **Minimum coverage requirement:** serving all prefectures within two years, at least 50% of the whole country within five years.
- Aim to deploy as many specified base stations as possible across the country, ensuring **diversity of services**.
- **Multiple granting conditions** including commitments to expand optical fibre networks, improve safety measures, prevent interference of existing radio licensees etc.
- **Tax incentives for companies investing in Japan's 5G wireless network:** 15% tax exemption or 30% write-down on the value of the companies' qualifying 5G investments (capped at 20% of the corporate tax liability in any year).

Key learnings from ITU IMT ASP Spectrum Assignment Study

KEY LESSONS FROM THE STUDY

1

Get ahead of the spectrum demand curve



Release IMT spectrum early, not when demand is acute or is holding back economic growth

2

Support transition to 4G and 5G NR



Needs larger contiguous blocks of spectrum and 5 MHz increments so facilitate restacking, refarming and trading

3

Commence refarming to ensure clear IMT spectrum sooner



Start refarming of possible bands earlier as required. Establish a spectrum refarming fund

4

Be technology neutral



Support investment and improved spectral efficiency by removing technology specific restrictions on spectrum

5

Facilitate industry change like FWA & legacy switch off



Support growth of 5G FWA and legacy 2G/3G network switch off with additional spectrum and flexibility

6

Make IMT spectrum more affordable in terms of price per MHz per pop



Need to manage auction expectations and consider beauty contests or lower reserve prices

7

Maintain and facilitate strong mobile competition



Make additional IMT spectrum available to ALL MNOs at reasonable terms to support competition

8

Appreciate the increasing use of TDD spectrum

TDD

Acknowledge TDD adoption with support on synchronisation, frame structure and cross-border rules

Thank you

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