Mobile360 Asia Pacific

Singapore
02 — 03 August 2022

Spectrum Vision 2030

Ensuring digital inclusion through affordable connectivity

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Luiz Felippe Zoghbi
Senior Spectrum Policy Manager
GSMA

Welcome Remarks

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Senior Spectrum Policy Manager
GSMA

5G Spectrum Needs Vision 2030

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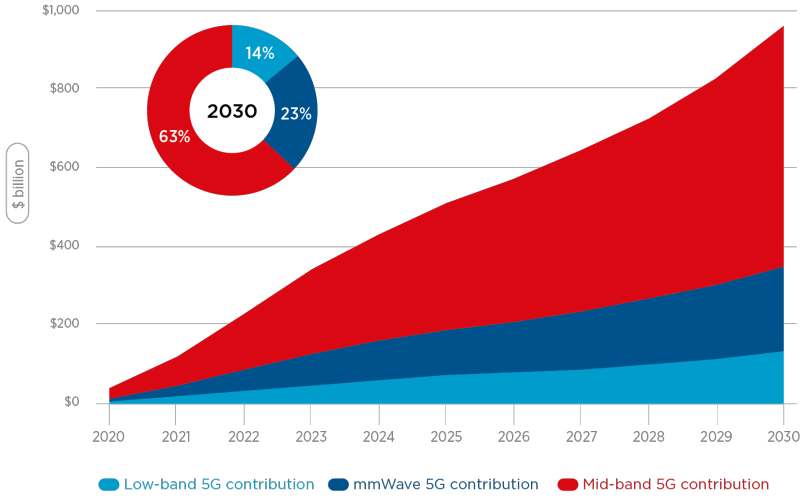
Economic Power of 5G

5G

CAN IMPACT GLOBAL ECONOMY IN 2030 BY

$961BN...



... BUT SPECTRUM CONSTRAINTS RESTRICT VALUE

Optimal Scenario

$961bn
0.68% of GDP

Constrained Scenario

$594bn
0.42% of GDP

The Socio-Economic Benefits of Mid-band 5G GSMA Intelligence 2022

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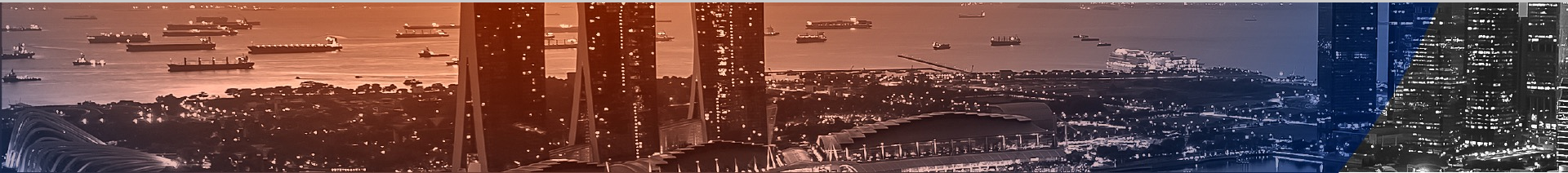
Low-band Needs

Benefits of low-band spectrum:

- Reduce cost of covering roads for 5G-connected vehicles
- Improve digital equality with 5G speed in rural areas
- Consistent speeds: deep indoors and in hard-to-reach urban areas
- Improve the business case for 5G fixed wireless access (FWA)
- Enable smart agriculture, notably precision farming
- 5G capacity solution for areas where mid-bands do not reach



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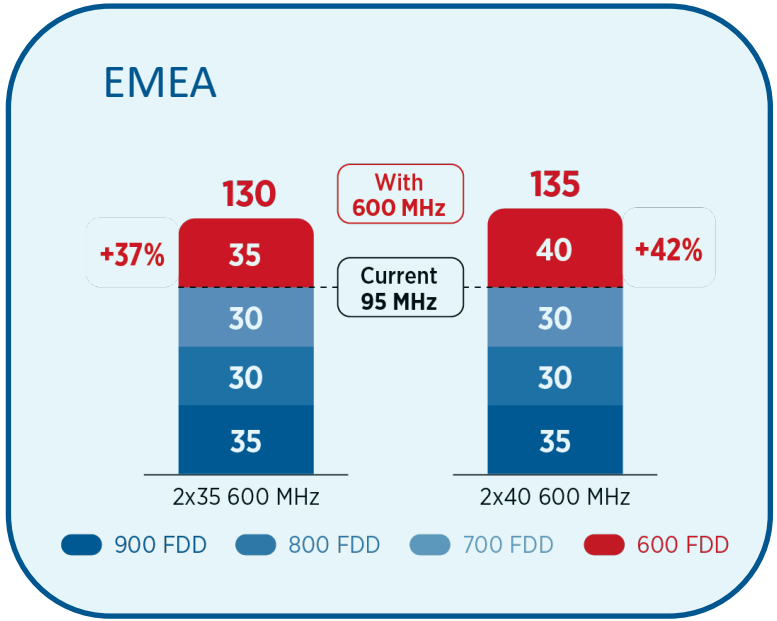
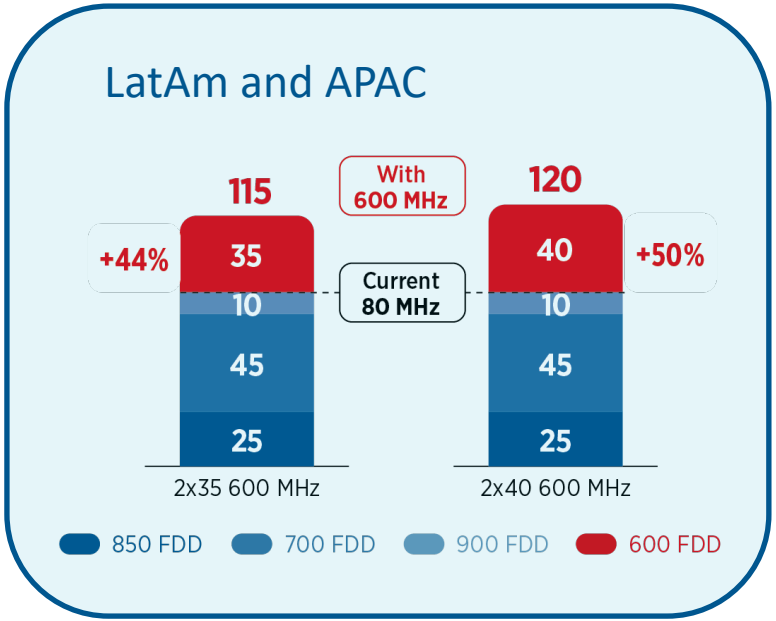
600 MHz Development





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2 GHz of mid-band

spectrum are needed for 5G in each market

Mid-band Needs

1. On a global basis, an average of 2 GHz of mid-band spectrum will be required for 5G
2. Cities require similar amounts everywhere in the world
3. With less spectrum, IMT-2020 requirements are under risk or 5x more base stations are needed
4. Agenda Item 1.1, 1.2 and 1.3 will all help raise harmonised mid-band capacity

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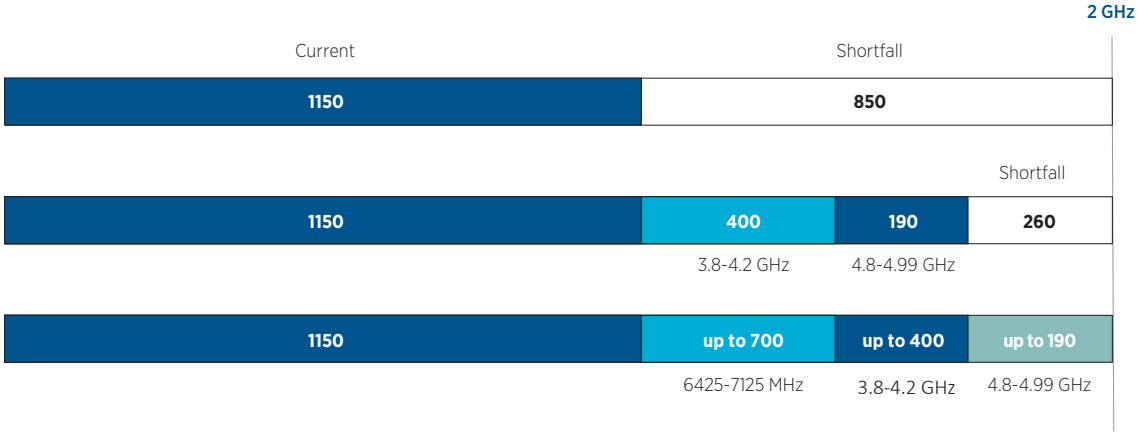
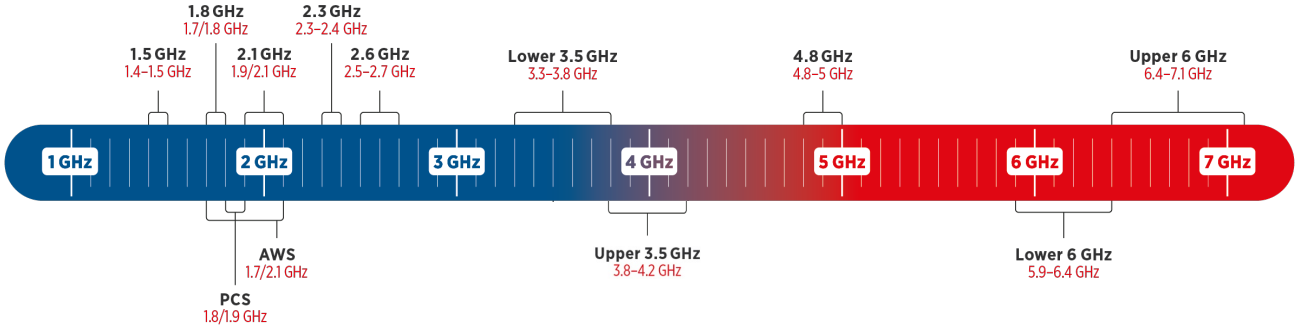
Mid-band Options



2 GHz

of mid-band are required for 5G by 2030.

This is challenging to achieve without 6 GHz.



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5 GHz of mmWave

spectrum are required per market for eMBB, FWA and enterprise

eMBB

Dense urban area deployment to complement low bands and mid-bands

FWA

FWA deployment to complement low bands and mid-bands in urban, suburban and rural areas

Enterprise networks

mmWave-only enterprise network deployment on large Industry 4.0 factory floors to enable high-bandwidth, low-latency applications

eMBB
4.5 GHz

FWA
350 MHz - 1.2 GHz

Enterprise networks
150 MHz

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Impacts on mmWave Needs

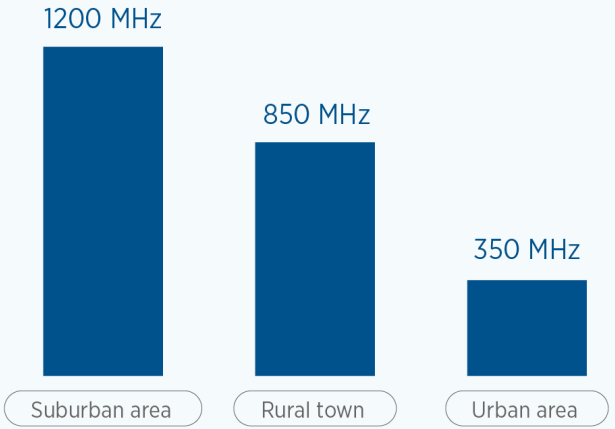
eMBB

Expected amount of mmWave spectrum needed for 5G eMBB based on 5G adoption and expected data consumption growth

Early adopter countries[1]	Other countries
4.5 GHz	3 GHz

FWA

Expected amount of mmWave spectrum needed for 5G FWA based on environment



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5G can deliver economic growth, social development and industrial agility… but will require timely access to spectrum in low-, mid- and high-bands.

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Chee Kheong FOONG
Group Head of Regulatory Affairs
Axiata

An Operator's View Spectrum for 5G

Spectrum Vision 2030 – Ensuring digital inclusion through affordable connectivity

CK Foong
Group Head of Regulatory Affairs

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02/08/2022

One of the largest telco groups in ASEAN & South Asia

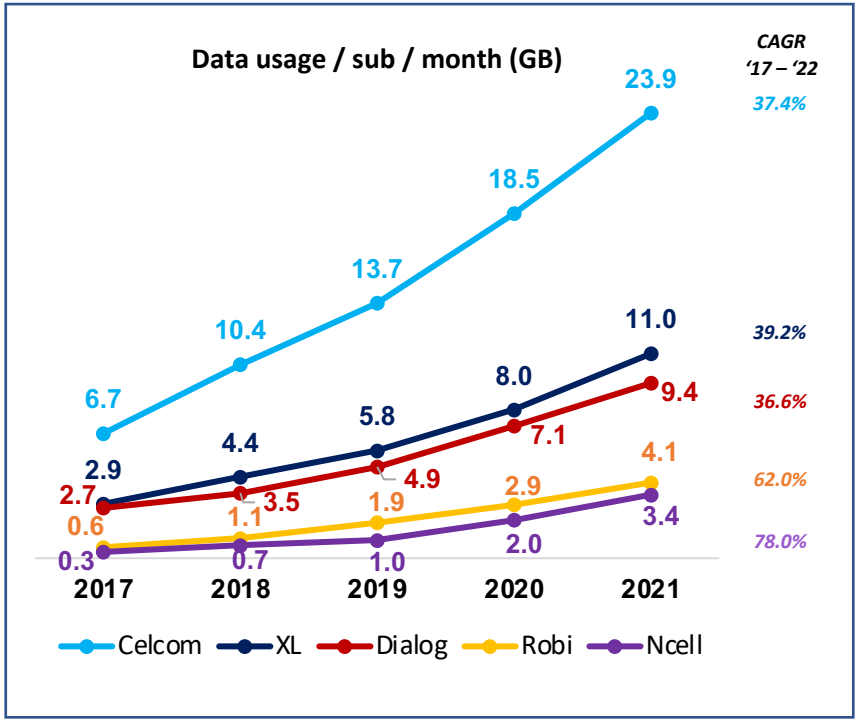
Digital Telco	celcom MALAYSIA	XL axiata / Linknet INDONESIA	robi BANGLADESH
	Smart CAMBODIA	Ncell NEPAL	Dialog SRI LANKA
Digital Businesses	Boost	ada	apigate
Infrastructure	eco enabling connectivity	MALAYSIA CAMBODIA THAILAND LAOS PHILLIPINES MYANMAR	BANGLADESH SRI LANKA PAKISTAN

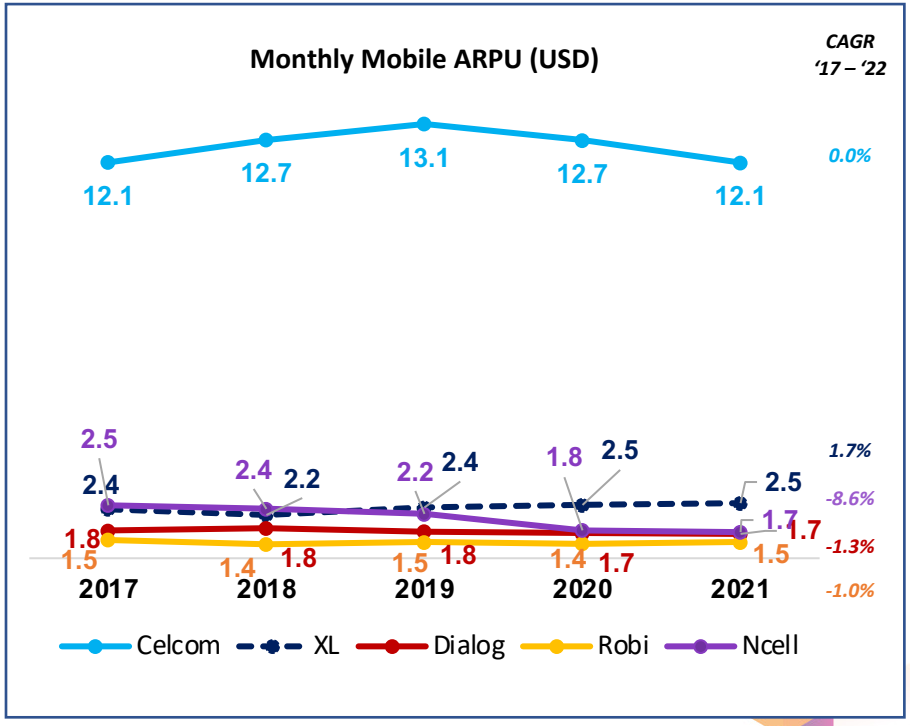
2021 RESULTS

REVENUE	MYR 25.9 B
PAT	MYR 1.3 B
CUSTOMERS	Over 163 M
EMPLOYEES	Over 13,181
MARKET CAP*	MYR 38.2 B
COUNTRIES*	11

** As at 31 Dec 2020*

Exponential mobile traffic growth in recent years, but ARPU has been flattish or declining

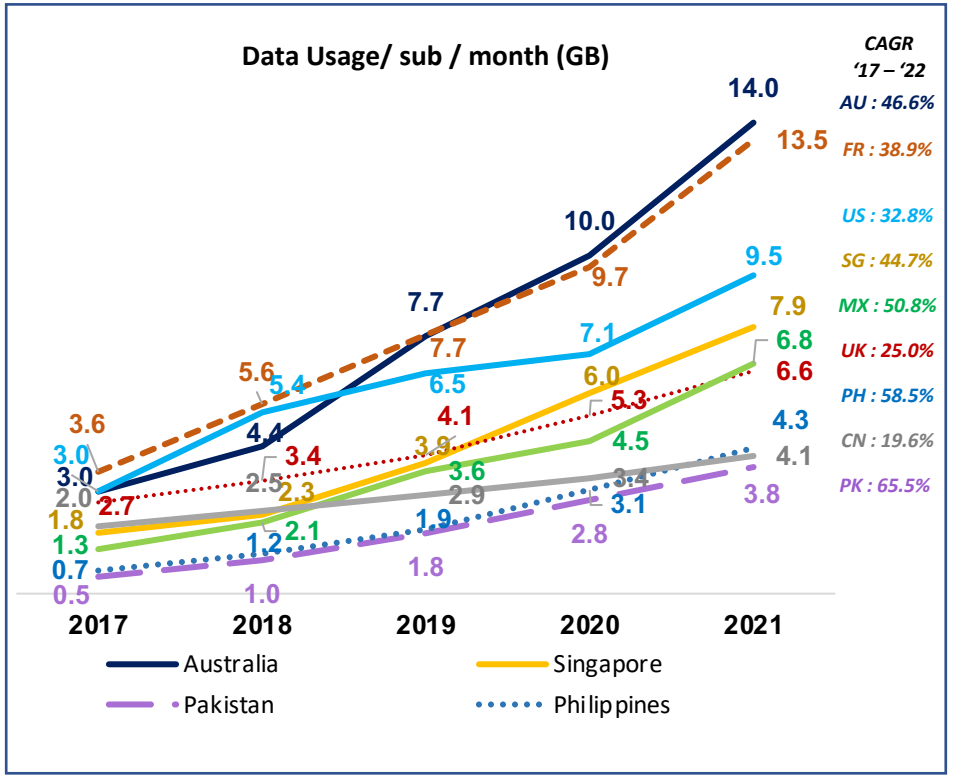


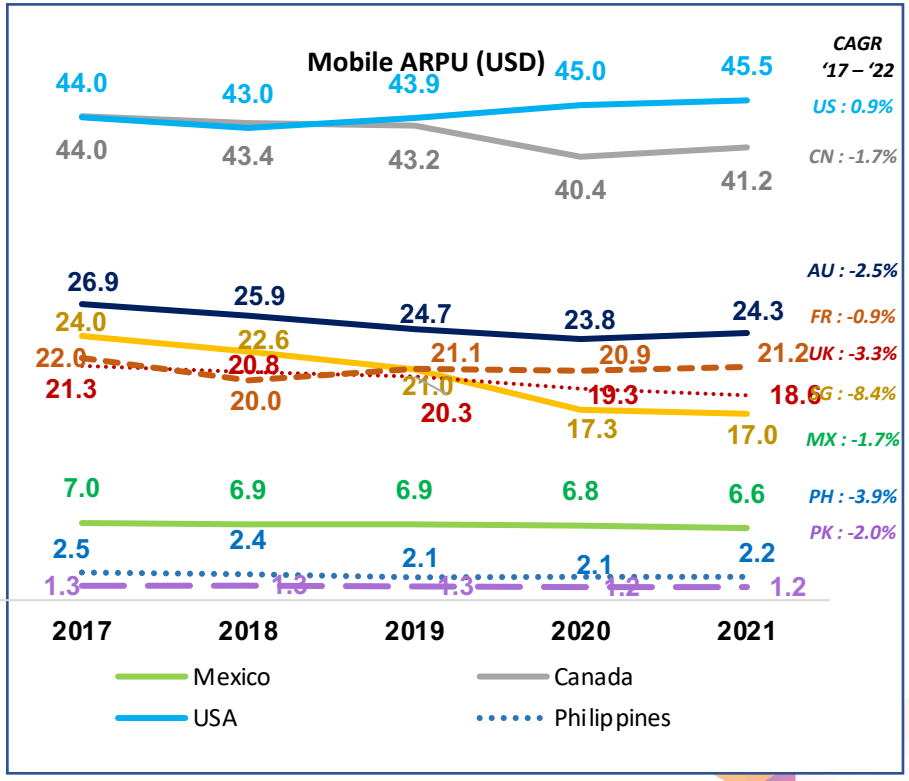


Source : Axiata IR disclosures
Data usage for Smart Axiata (Cambodia) is not disclosed

Source : GSMA Intelligence

Not just an issue in Axiata's footprint alone, the same trends also observed elsewhere



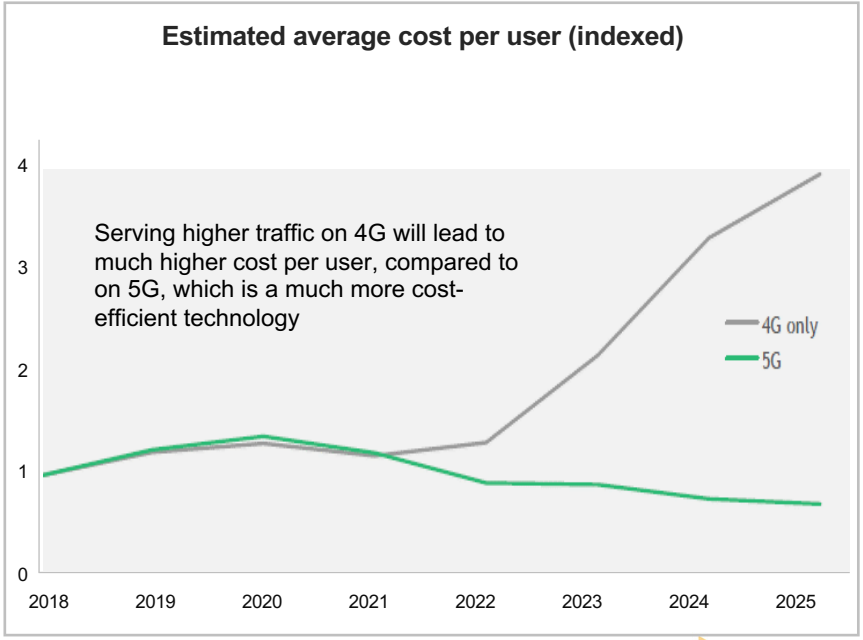


Source : OECD Database & Analysys Mason datahub

Source : GSMA Intelligence

To cope with the increased traffic and optimize networks, several strategies are normally deployed

- **Site densification**
  - *Limited effectiveness in urban/metro areas*
  - *Site-to-site minimal distance reached*
  - *Higher energy/carbon footprint*
- **2G/3G Shutdowns**
  - *Optimizes technology*
  - *Proven but likely short-term solution*
  - *Consumer readiness is key concern*
- **Shifting to 5G can allow a step-change in lowering cost of production**
- **Build more layers on new spectrum**
  - *Higher capex and complexity managing multiple RAN layer*
  - *Ensure all harmonized IMT spectrum is made available*

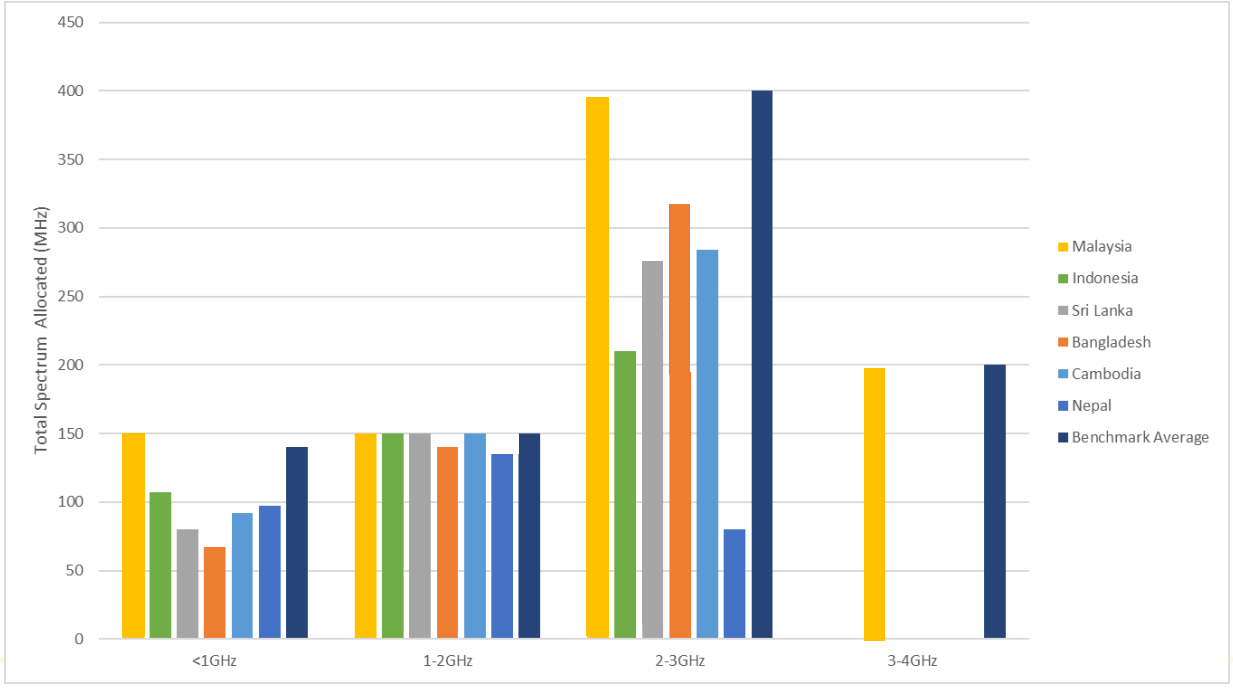


Note : Graph represents three-year moving average network spend

Source: Analysys Mason, Internal analysis, BCG Network Model

Availability of harmonized IMT spectrum: Axiata markets generally have lesser spectrum than benchmarks

Comparison of the total assigned spectrum in each Axiata market versus the average amount in the 10 benchmark countries in APAC.

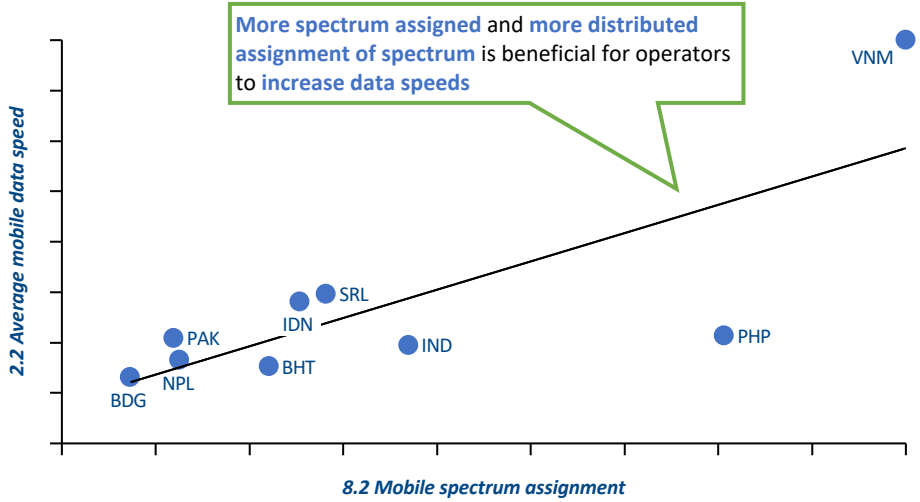


Source: LS Telecom, Axiata Group Spectrum Review, Mar 2022

LS telecom
Smart Spectrum Solutions

More spectrum assigned facilitates increased data speeds for operators

Avg. mobile data speed[1] vs. Mobile spectrum assignment[2]

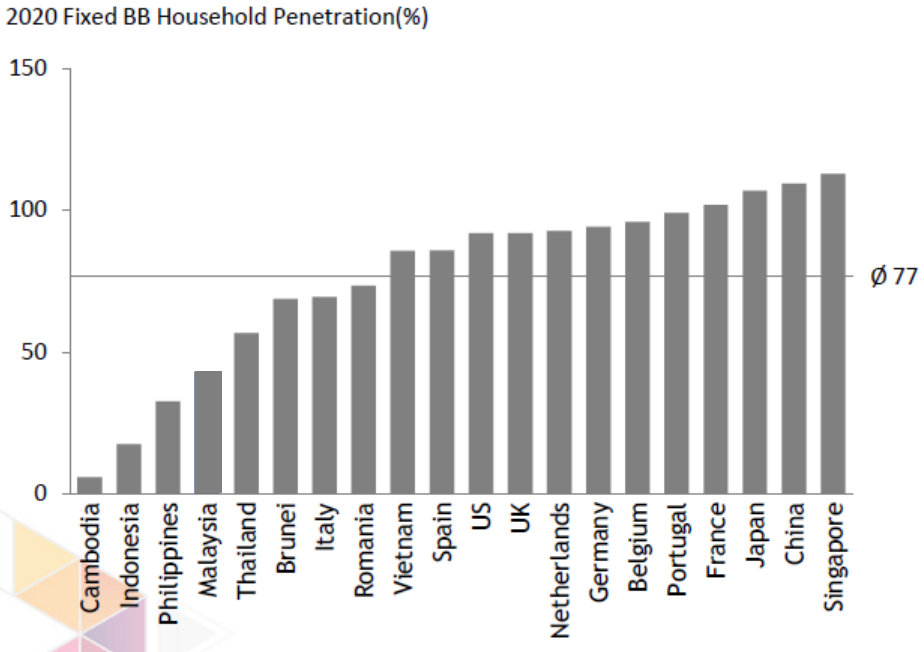


More spectrum assigned, distributed assignment of spectrum is highly beneficial to increase data speed

Source: Arthur D. Little analysis

1) Avg. mobile data speeds is measured using avg. mobile download speed, 2) Mobile spectrum assignment measures both amount of spectrum assigned and distribution of spectrum across operators

In mobile-first emerging markets, more spectrum, including for 5G could potentially enable cost-efficient fibre-like connectivity to homes and businesses



Source: WBIS, Informa

ASIA

Telstra weaponizes 5G against NBN

Telstra has thrown down the gauntlet on 5G – and NBN Co has picked it up. After months of foreshadowing a move into fixed wireless, the big operator unveiled its first 5G home service three months ago, promising to progressively expand its availability.

With downlink speeds of between 50Mbps and 300Mbps at around A$85 ($65.60), it's highly competitive against the copper-centric NBN (see Telstra launches 5G fixed wireless).

News Analysis
ROBERT CLARK
1/19/2021

Now it's signaled it will double down. Regulator ACMA will hold its first mmWave auction in April, allowing each bidder to acquire up to 1GHz of the 26GHz band.

NBN v 5G: The broadband battle is about to heat up

By Supratim Adhikari and Zoe Samios
September 26, 2020 – 12.00am

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Source: Light Reading (19/1/21), SMH (11/12/21)

Thank You

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Sean Xu
CMO Carrier Business Group
Huawei APAC

Ecosystem and 5G developments

Harmonious Spectrum Strategy to Unlock the 5G Benefit

HUAWEI

5G Era Has Come With Large-scale Networks And Mature Terminal Ecosystem

70+ countries have launched 5G service

220+ 5G networks

700+ Mi 5G users

2.2+ Mi 5G base stations

960 Bi 5G economy in 2030

Source: GSA & GSMA & Huawei MI, 2022

Mid-band become the preferred spectrum for 5G deployment

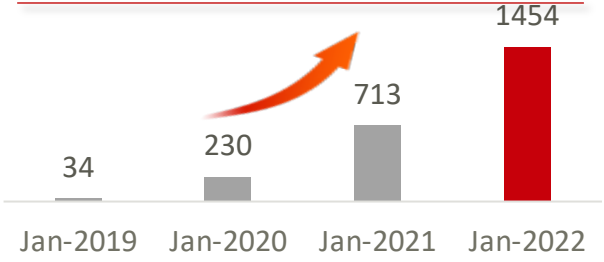
~85%

Mid-bands proportion

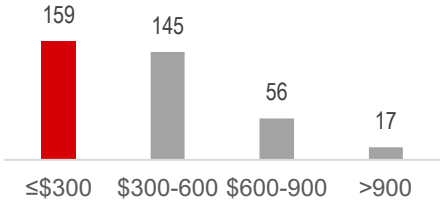
Source: GSA, 2022

Mature ecosystem supports the rapid development of 5G

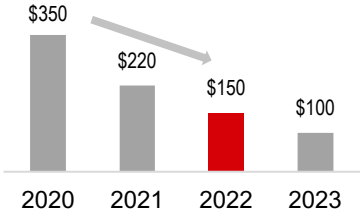
1400+ 5G devices available



~160 models of smartphones at below $300

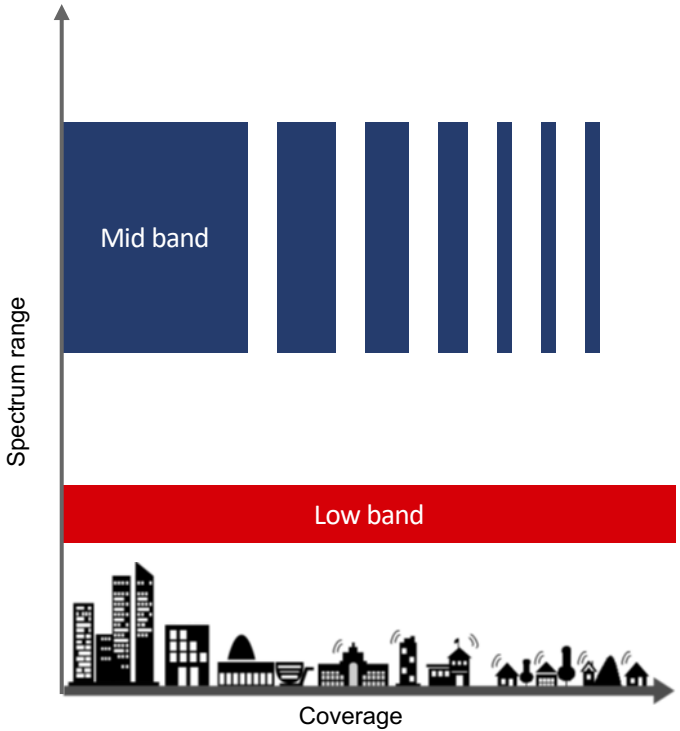


5G CPE average price drop to $150



Source: GSA & Huawei MI, 2022

Spectrum Strategy Helps Accelerate 5G Deployment and Usage



TDD Mid-band (3.5/2.6/2.3GHz)

Inter-generational experience

- 80~100 MHz contiguous bandwidth per network.
- balance between capacity and coverage
- One-network dual-use, on-demand evolution

FDD Mid-band (2.1/1.8GHz)

Quick availability and enhanced experience

- To achieve quick availability of 5G by existing networks
- To improve experience by F+F / F+T CA

Sub-1GHz (700MHz)

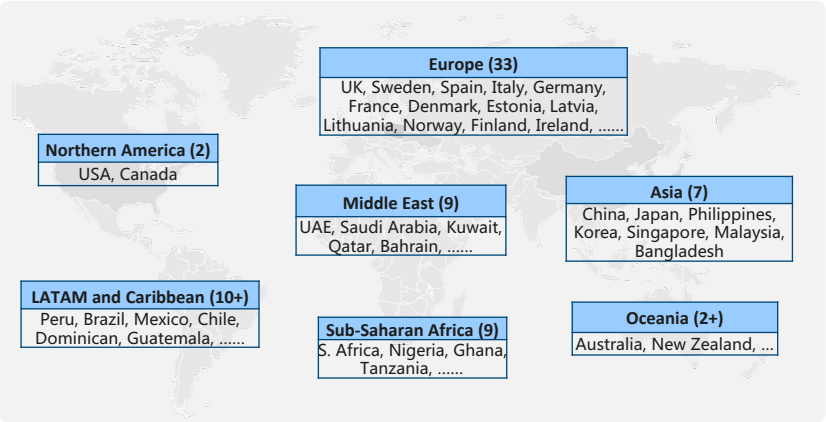
National wide and deep coverage

- Ubiquitous 5G connectivity / indoor scenario
- Service: mMTC, VoNR, eMBB

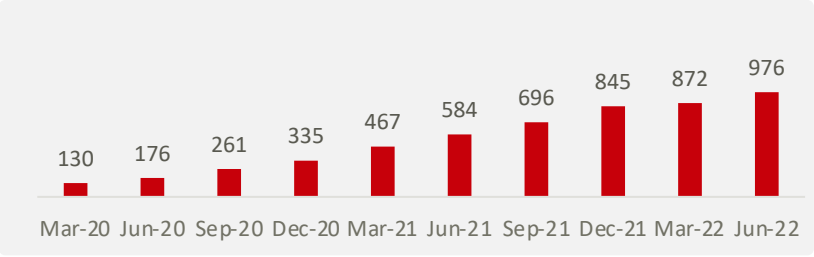
Coordination of Mid-band and Low-band is the prime spectrum strategy for high-quality and ubiquitous 5G

C-band is the Most Selected Mid-Band for 5G Capacity

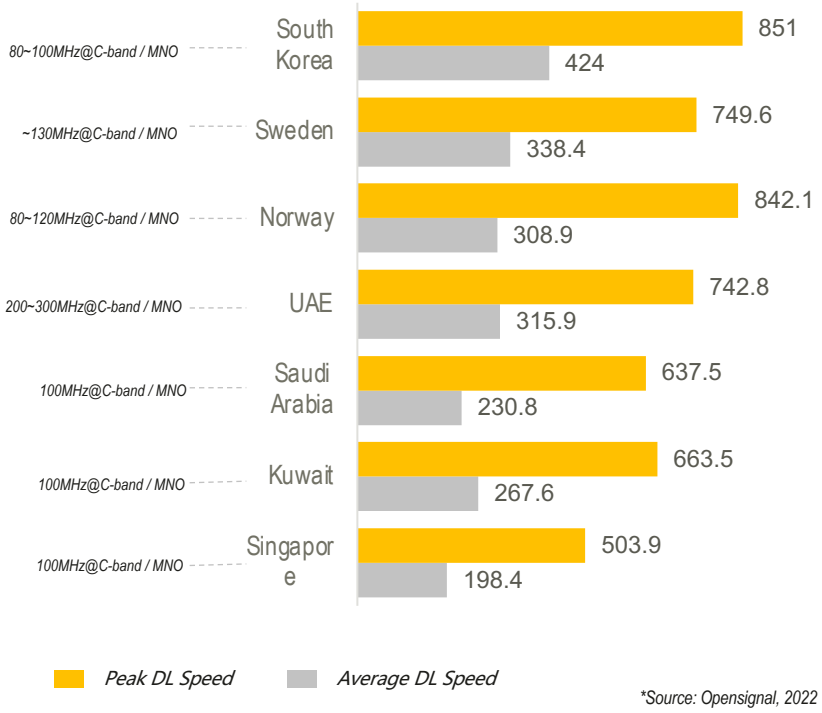
70+ countries/territories allocated C-band spectrum
209 5G networks deployed on C-band



976 devices support C-band (N78/N77), providing the most mature device ecosystem



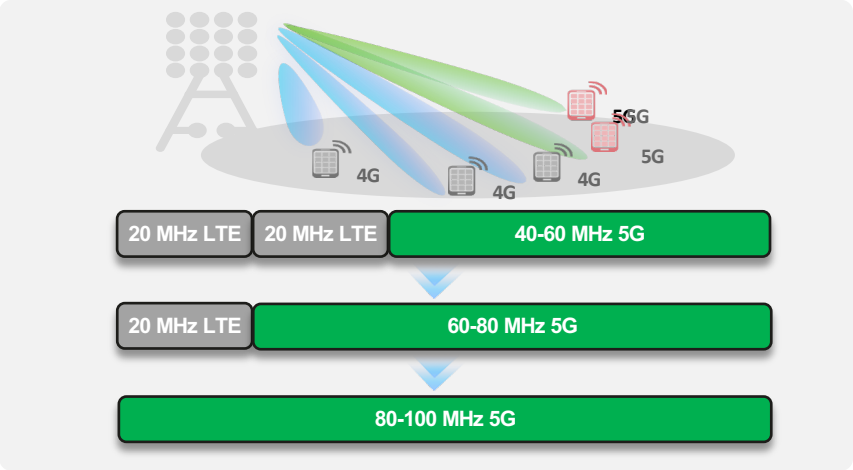
Intergenerational experience
based on 80-100MHz + M-MIMO



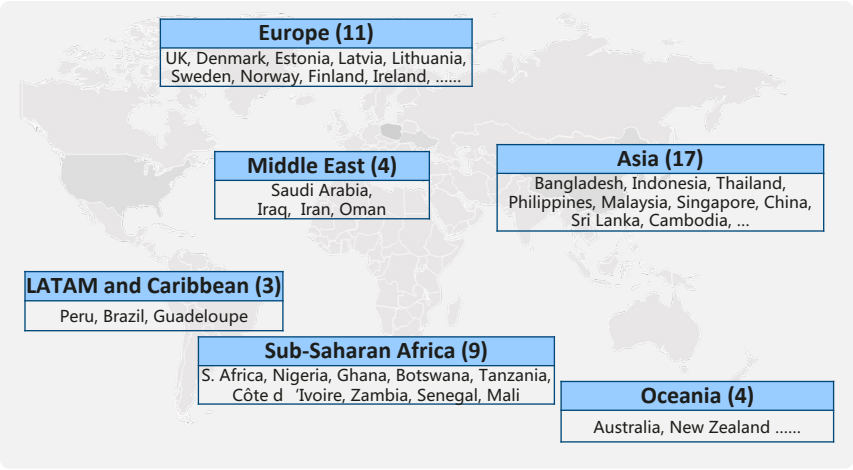
*Source: Opensignal, 2022

2.3 & 2.6GHz TDD are Primary with Advantages of 4/5G Sharing and Evolution

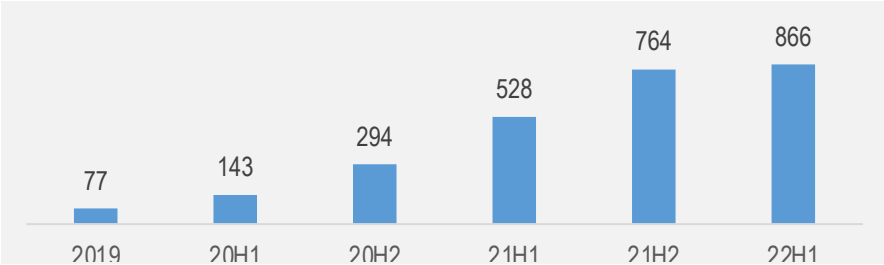
2.6/2.3GHz: DUAL services via ONE network



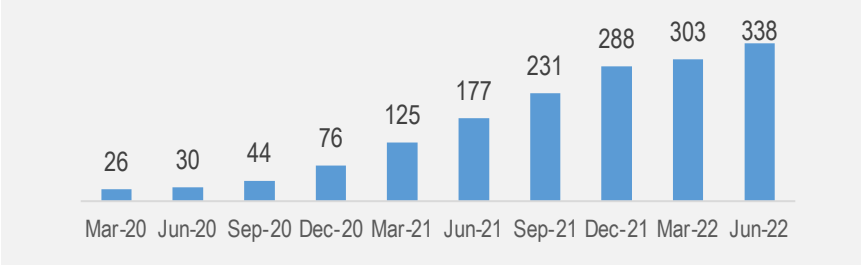
2.3G: **73** operators in **49** countries/Areas acquired and deployed



N41 2.6GHz has the similar scale of supporting devices with C-Band

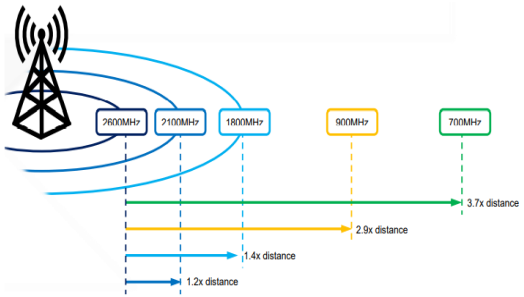


N40 2.3GHz devices grow fast with live network penetration of ~80%



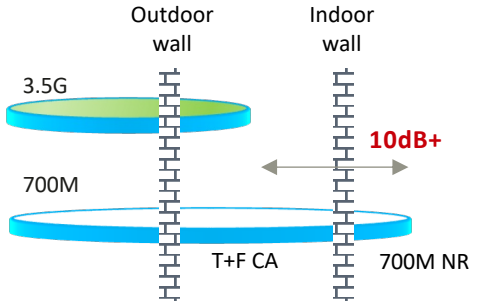
700MHz for Wide & Deep Coverage; 2.1/1.8GHz for 5G Quick ON

Wide Coverage



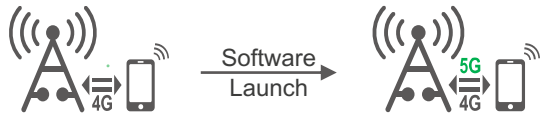
700MHz: ~3x coverage range v.s. mid-band

Deep Coverage



5G Quick On

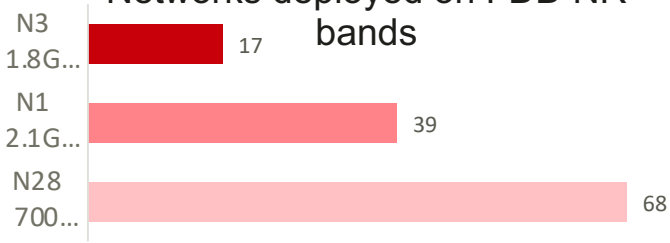
Spectrum neutrality to activate 5G on existing networks



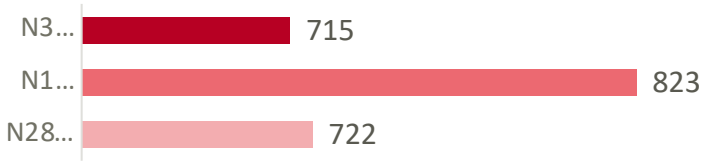
Sites equipped with 5G

Sites activating 5G

Networks deployed on FDD NR bands



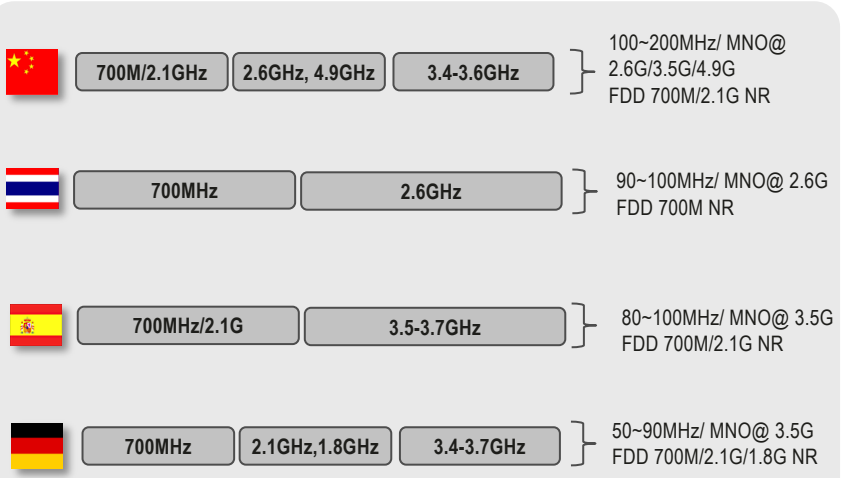
Terminal Devices that support FDD NR bands



Source: GSA, July 2022

Harmonious Spectrum Strategy to Unlock the 5G Benefit

Combinate band solution for both coverage and capacity



- **3.5/2.6/2.3GHz** act as capacity band in 85% 5G countries
- **700MHz** enables nationwide connectivity and deep coverage
- **2.1/1.8GHz** help 5G quick-on and enhances performance

Suggestions on 5G Spectrum Provisioning

1. Primary bands: TDD **3.5/2.6/2.3GHz,** FDD **700MHz** which are most supported by devices
2. At least **80-100 MHz/MNO contiguous** spectrum @ mid-band for capacity
3. **Technology neutrality** for smooth evolution to 5G
4. **Affordable** spectrum **cost,** giving full play to the enabling role of 5G for socio-economic benefit

Thank you.

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每个组织，构建万物互联的智能世界。

Bring digital to every person, home, and organization for a fully connected, intelligent world.

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YiShen Chan
Spectrum Director, APAC
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Panel Introduction

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Panel

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Head of Nationwide Operations and Support Business Unit

AIS, Thailand

John Blakemore

Director of European Regulatory Affairs

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