

Singapore

02 — 03 August 2022

Spectrum in 6 GHz

The future of 5G ecosystem,
expansion and innovation





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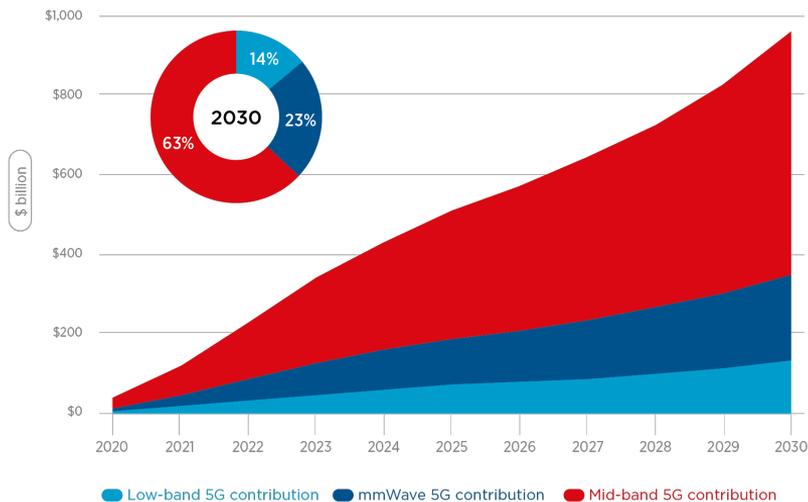
The Future of the 6 GHz Ecosystem

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

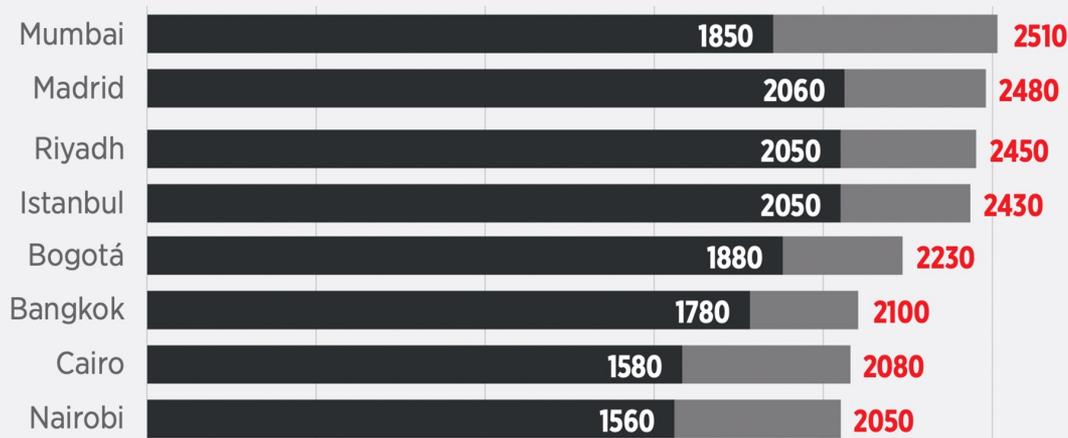
The Socio-Economic Benefits of Mid-band 5G GSMA Intelligence 2022

#MOBILE360

**2 GHz of
mid-band
spectrum are
needed for 5G in
each market**

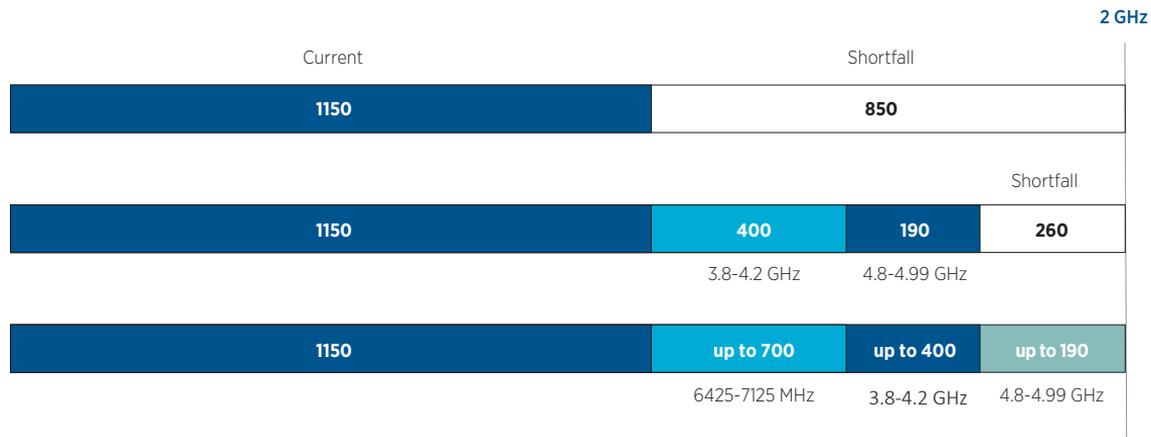


Mid-band Needs



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

Mid-band Options



2 GHz

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

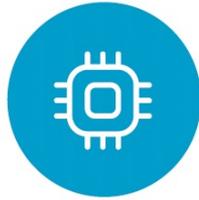
This is challenging to achieve without 6 GHz.



6 GHz Ecosystem



**Network
vendors**



**Chipset
developers**



**Radio front-end
suppliers**



**Device
manufacturers**



**Mobile network
operators**





6 GHz development principles



Technical barriers

There are no technical barriers to developing, and commercialising, 6 GHz IMT solutions. Device and infrastructure solutions can operate in the band, just like any other.



Ecosystem readiness

Key players in device component and network infrastructure ecosystems are ready to develop 6 GHz IMT products in line with customer demand.



Development triggers

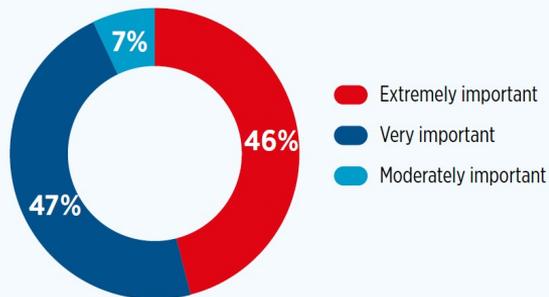
The main trigger for the commencement of product development will be operator demand, driven by WRC-23 and national regulatory decisions.



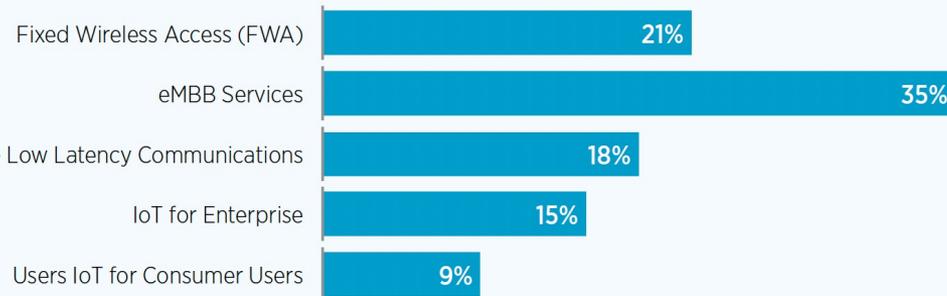
Development timeline

From the start of development, ecosystem players expect that they could have solutions ready in 6 to 12 months.

How important is 6 GHz spectrum to the future quality and capabilities of your IMT networks?



Which use cases do you plan for 6 GHz IMT?



The Success of 6 GHz

No technical barriers to 6 GHz IMT

There are no significant technical barriers to 6 GHz IMT solutions and services. On-going lab and field trials confirm this view⁸

3.5 GHz grid reuse

Simulations and trials indicate that 6 GHz IMT could effectively expand network capacity using the same infrastructure of 3.5 GHz IMT services, enabling cost-effective deployment.

Demand triggers exist

1. Operator demand is a pivotal trigger for economy of scale.
2. 3GPP standardisation momentum is a significant milestone in shaping up the scale of the 6 GHz IMT ecosystem.
3. Decisions taken at WRC-23 and by individual national regulators will influence how operator demand develops.

NR band 104 as part of Release 17 (6425-7125 MHz). New work item for Release 18 (5925-6425 MHz).

Administrations in all three ITU Regions have expressed support for all or part of the 6 GHz band for IMT.

The Timeline



Regulatory approval



Device and infrastructure R&D



Operator demand

2025-2030

Commercial roll-out of 6 GHz networks by MNOs

2021

Prototyping, simulation, testing

2022

3GPP Rel. 17 specification NR Band 104 6425-7125 MHz completed

2023

IMT identification of 6425-7125 MHz at WRC-23

2024

3GPP Rel. 18 specification for NR Band 5925-7125 MHz

2025

Product development and first wave of equipment availability

6 GHz IMT devices and infrastructure available at scale



Mobile360
Asia Pacific

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The 6 GHz IMT Ecosystem

Demand Drives Scale

July 2022



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Hai Thoo Cheong
VP Mobile Engineering
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An Operator's view IMT in 6 GHz

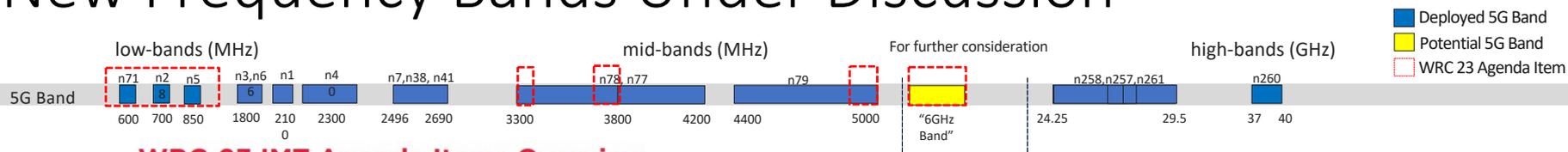


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6 GHz

New Frequency Bands Under Discussion



WRC-23 IMT Agenda Items Overview



Bands	470-960 MHz	3300-3400MHz	3600-3800MHz	4800-4990 MHz	6425-7025 MHz	7025-7125 MHz	10-10.5 GHz	IMT FS
Region 1	AI 1.5 (IMT)	AI 1.2 (IMT)	AI 1.3 (MS)	AI 1.1 (IMT)	AI 1.2 (IMT)	AI 1.2 (IMT)		9.1.c
Region 2		AI 1.2 (IMT)	AI 1.2 (IMT)	AI 1.1 (IMT)		AI 1.2 (IMT)	AI 1.2 (IMT)	9.1.c
Region 3				AI 1.1 (IMT)		AI 1.2 (IMT)		9.1.c

Mid-band spectrum needs

2 GHz of mid-bands spectrum needed for 2025-2030 *

IMT-2020 citywide
“speed coverage”



Densely populated cities need, on average, a total of 2 GHz of mid-band spectrum.

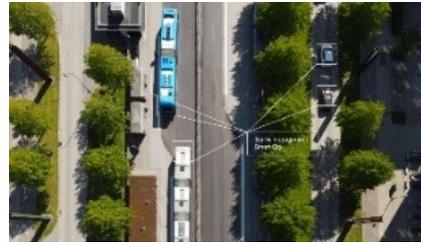
ITU-R IMT2020: 100 Mbit/s DL and 50 Mbit/s UL experienced data rate across the city

5G Economics



5G requirements and economics will be at risk with less spectrum, and more base stations would be needed, networks would be 3-5x higher

Reduce carbon footprint



Additional base stations will generate a carbon footprint 1.8-2.9x higher without sufficient spectrum. This can be avoided through the timely availability of the right spectrum.

Industry 4.0



Extending IMT from consumer to industry

Mid-band spectrum to address the spectrum needs: 3.3-4.2 GHz, 4.8 GHz and **6 GHz**

Facts to consider when allocating the 6 GHz spectrum

1. Cost-Benefit Analysis of 6 GHz Allocation
2. Wi-Fi offload is decreasing
3. Use cases to be delivered by the relevant technologies



1. Cost-Benefit Analysis of 6 GHz Allocation –

all 6 GHz band assigned to unlicensed use was found to be the least beneficial allocation

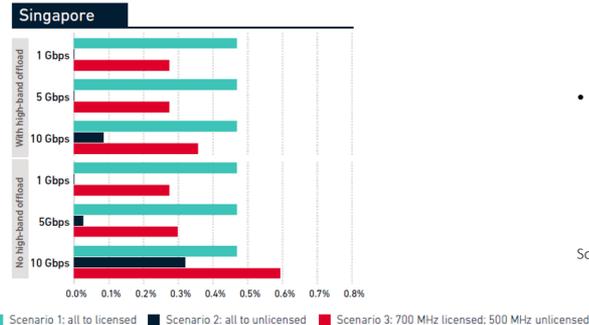


Cost-Benefit Analysis of 6 GHz band allocation

Allocation scenarios

GSMA Intelligence carried out a cost-benefit analysis of three scenarios in 24 markets for three FTTP speeds (1, 5 and 10 Gbps), with and without 60 GHz Wi-Fi.

- Scenario 1 (all of 6 GHz assigned to licensed use)
- Scenario 2 (all of 6 GHz for Wi-Fi / licence exempt)
- Scenario 3 (700 MHz assigned to licensed use; 500 MHz for unlicensed use)

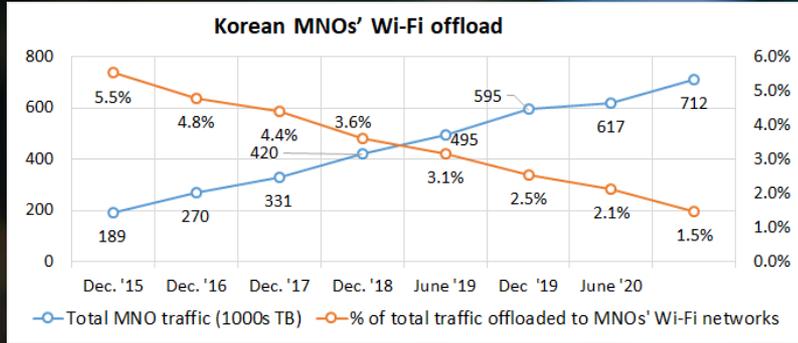


Key findings

- Scenario 2 (all 6 GHz band assigned to unlicensed use) was not found to be the most beneficial allocation across all markets considered under any fibre speed scenario.
- For Singapore, Scenario 1 will drive the greatest benefit over the 2021-2035 period (at \$2.9 billion or 0.47% of GDP by 2035) – if FTTH users cannot access speeds greater than 5 Gbps, OR if FTTH users have speeds of 10 Gbps AND Wi-Fi can utilise 60 GHz spectrum to meet 30% of Wi-Fi traffic demand.
- Scenario 3 will drive the greatest benefit over the 2021-2035 period (at \$3.7 billion or 0.59% of GDP in 2035), if FTTH users have speeds of 10Gbps AND if 60 GHz spectrum is not utilised for Wi-Fi.

Source: [The socioeconomic benefits of the 6 GHz band \(gsmaintelligence.com\)](https://www.gsma-intelligence.com/research/the-socioeconomic-benefits-of-the-6-ghz-band)

2. Actual WiFi usage



Source: Ministry of Science and ICT, the Republic of Korea

20%

On average, 20 percent of 5G users claim they have decreased Wi-Fi usage at home and other locations

10%

claim they have stopped using Wi-Fi on smartphones after upgrading to 5G in lead 5G markets

Source: Five Ways to a Better 5G, Ericsson ConsumerLab



3. Use cases to be delivered by the relevant technologies

5G NR use cases

Mobile Broadband



ITU-R IMT2020: 100 Mbit/s DL and 50 Mbit/s UL experienced data rate across the city

Smart cities



Key to IOT applications and Smart cities/nations visions

Wide Area Network



High speed and high reliability 5G network required to support wide area operations

Industry 4.0

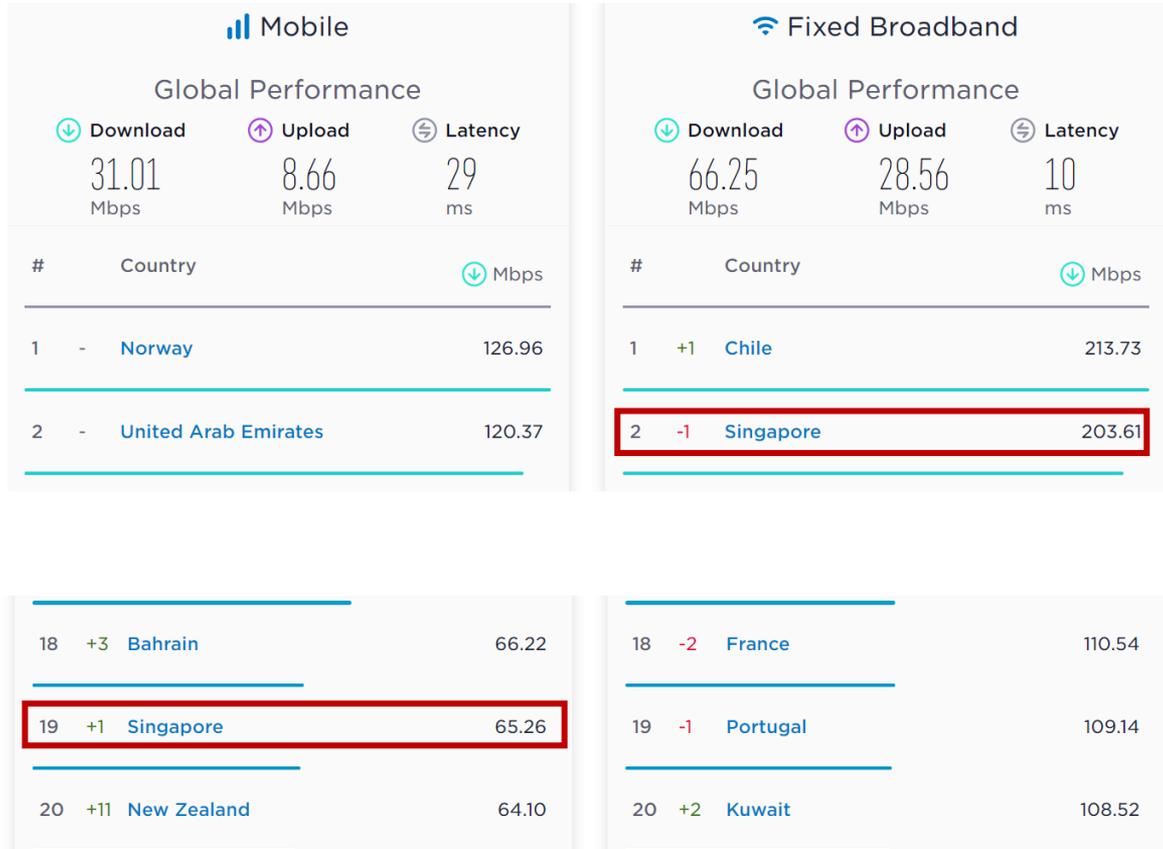


WiFi is suited to address best effort use cases

Licensing (5G NR) is required for QoS, high reliability, low latency for mission critical operations

Singapore

Singapore were leading in 4G Speed Performance



5G Spectrum Policy re-instate Singapore at the forefront of 5G

Singapore is first in the world for nationwide 5G coverage



Singapore Singtel says it has reached more than 95% 5G coverage nationwide

Singtel's 5G network now covers more than 1,300 outdoor locations and provides signal in **THE STRAITS TIMES** **TECH**  

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By Liu Hongzuo · on 22 Jul 2022, 1:23pm



Image courtesy of Singtel.

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SUGGESTED READS

- Singtel brings fully underground 5G network to MRT's North East Line (NEL)
- Ookla: Apple

Singtel reaches 95% outdoor 5G coverage



Singtel's 5G network now covers more than 1,300 outdoor locations and over 400 in buildings and train tunnels. PHOTO: ST FILE

By **Aaron Raj** | 22 July, 2022

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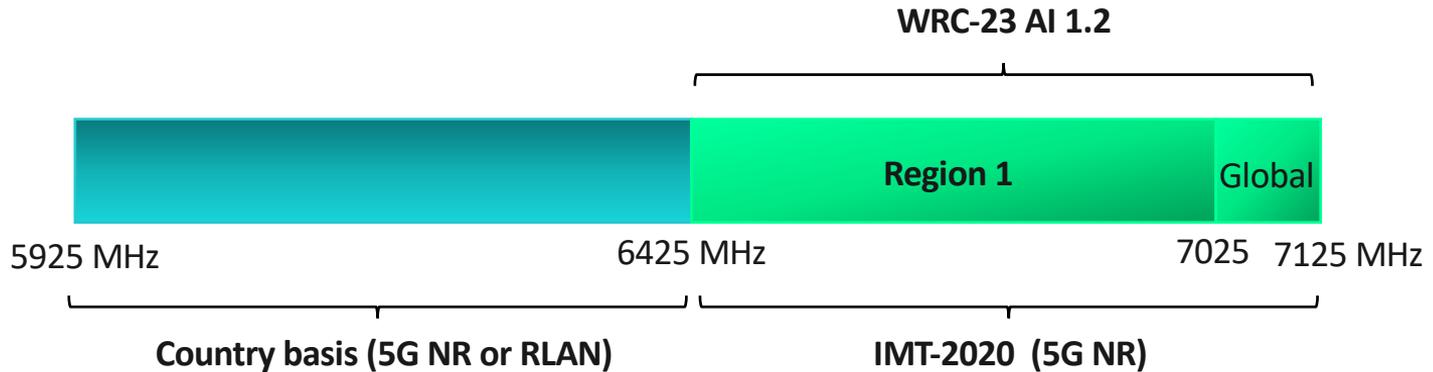
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Recommendation: Balanced approach



- Additional allocations will be needed in the timeframe 2025-2030 (average 2 GHz of mid-band spectrum)
- 6 GHz is key to secure future capacity needs citywide. 6425 – 7125MHz to be identified for IMT at WRC-23 and harmonized globally. Consider the lower part of the band on a national basis, depending on needs, home broadband capabilities , etc



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Thank
you!

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