Enabling Wi-Fi 6E/7 in the 6 GHz Band: Spectrum-Sharing, and Deployment Lessons from Pakistan

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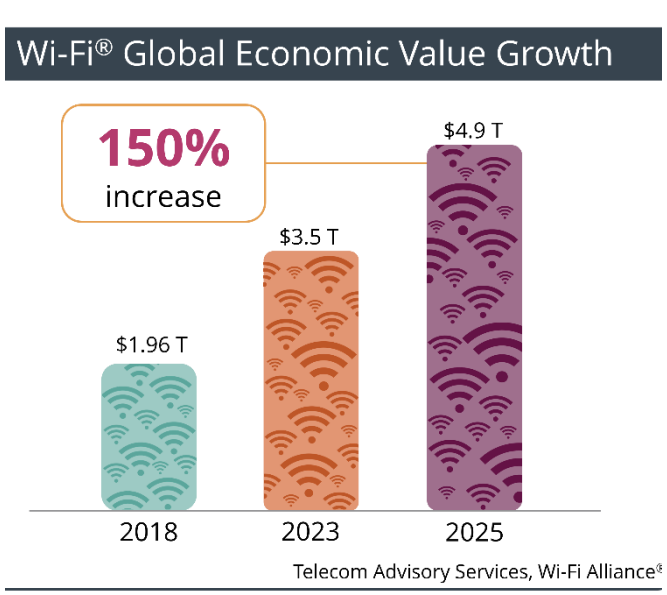
Wi-Fi Importance : Revisited

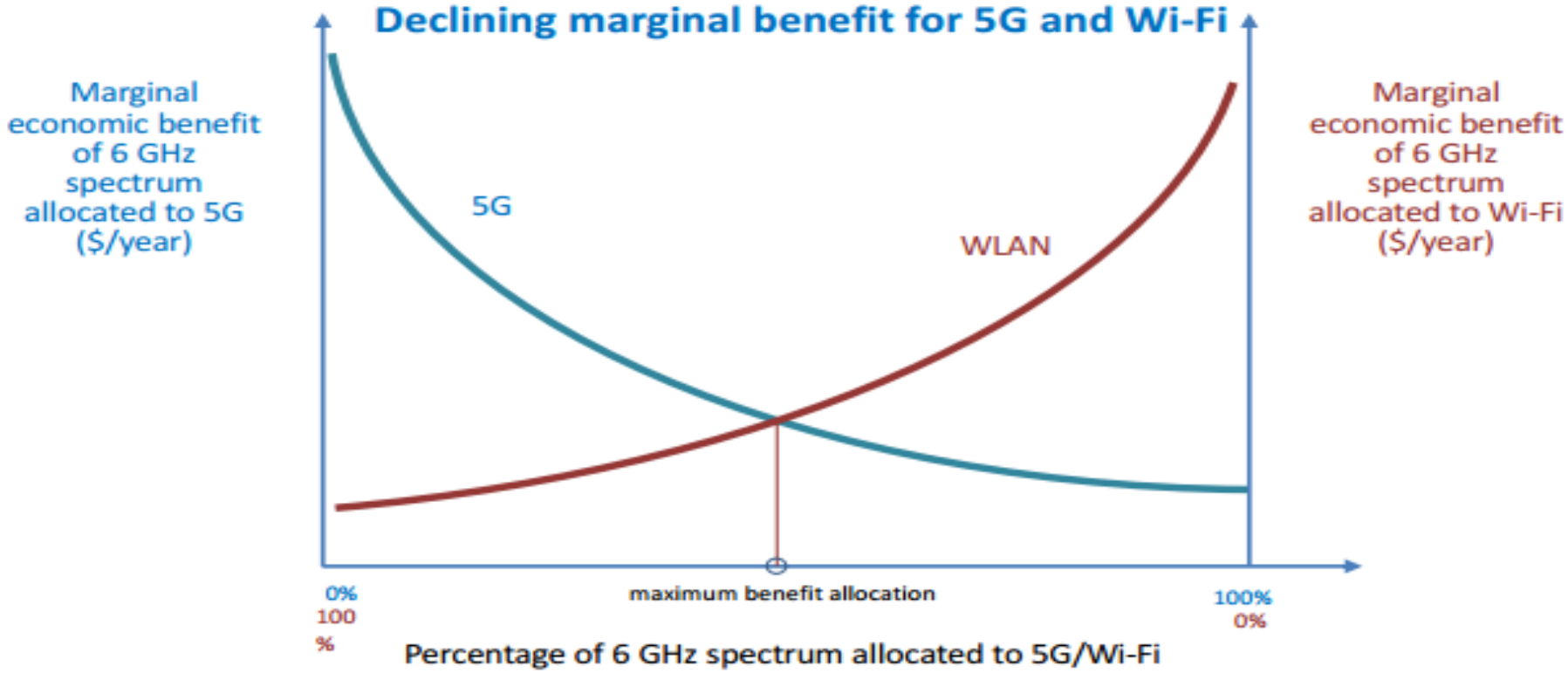
- One of most ubiquitous but for granted technologies
  - Available, Better User experience, Fast
  - Inter-operable, sufficiently secure
  - Transformed the way we work, live & interact
- RLAN / WLAN Technology, though most popular
  - Wi-Fi is trademark owned by Wi-Fi Alliance (>900 companies)
- Based on IEEE 802.11 standard
  - Last "Deca-Meter" technology
- >21B Wi-Fi devices in use today (mobile devices >17B)
- Economic Value of Wi-Fi – 3.5T $ *(2023)*
- Complimentary to cellular technologies (3G, 4G, 5G)
  - 63% mobile traffic off-loads to Wi-Fi *(source: Wi-Fi Alliance)*



The compelling case for 6GHz band partition in Asia Pacific

Why the approach in Asia-Pacific to the 6 GHz band should be customized for the region

Likely economic benefits are maximized with the shared allocation of the 6 GHz band to IMT and Wi-Fi services.



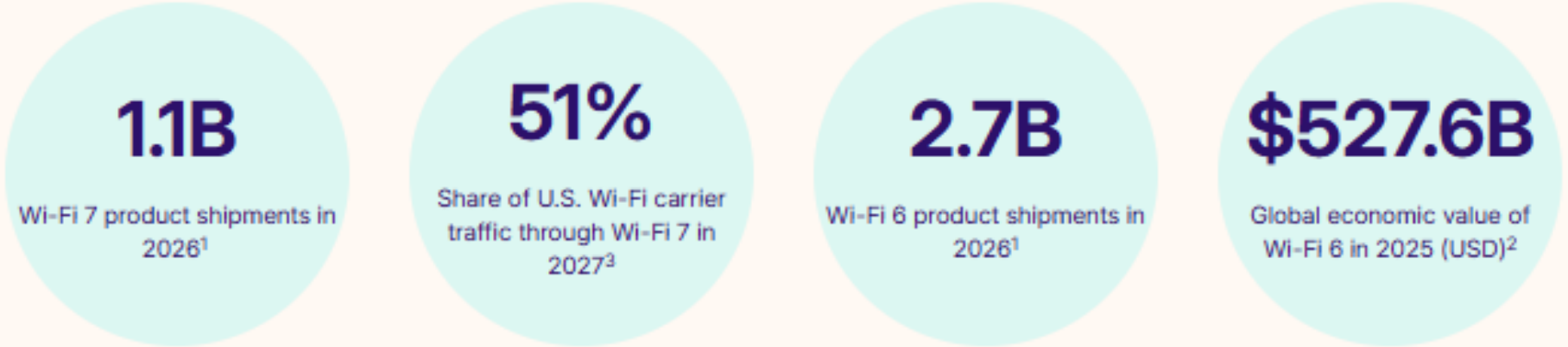
Slide Courtesy of Scott W Minehane (WPC),

Wi-Fi by the numbers

Wi-Fi will see significant growth in shipments and economic value in 2025.

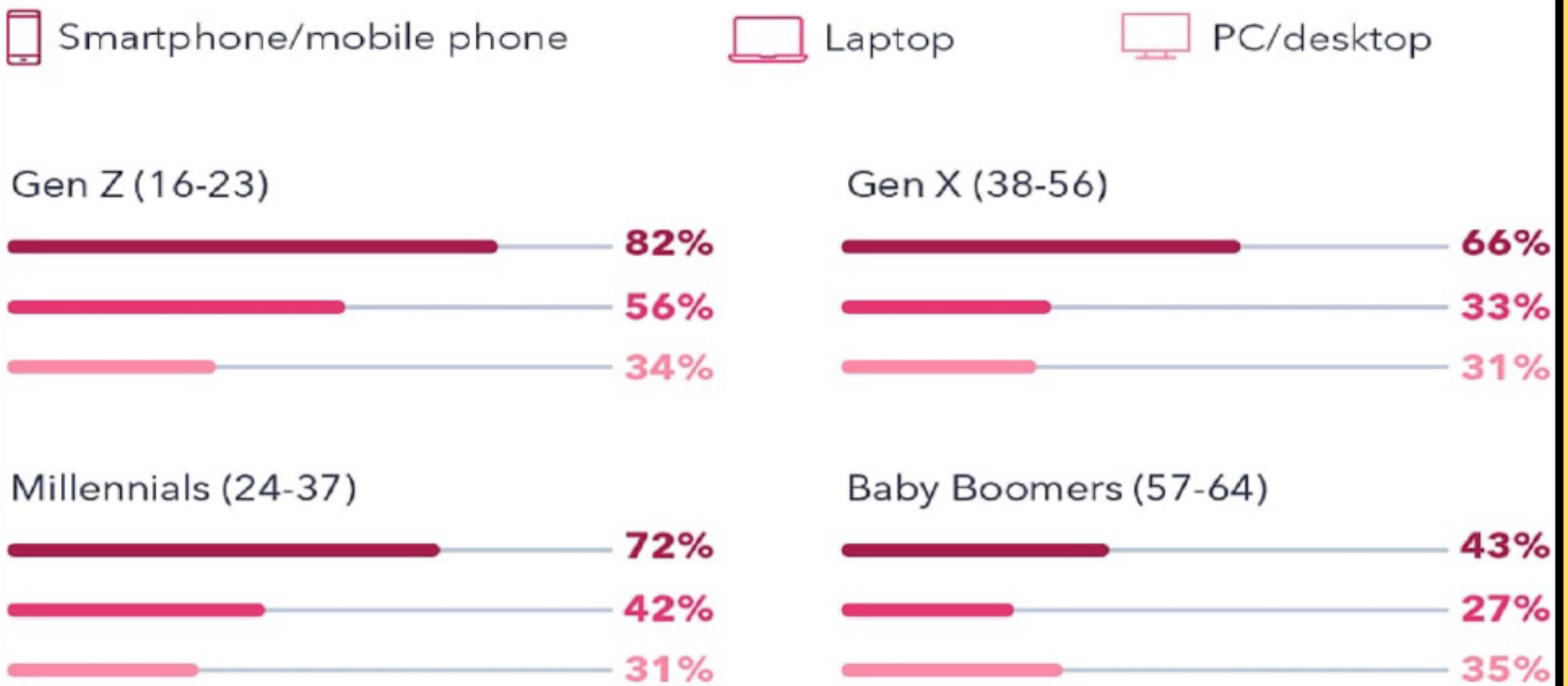
Wi-Fi 6 & Wi-Fi 7 impact

The latest generations of Wi-Fi will continue to have a substantial impact on Wi-Fi markets and the economy.



[1] IDC Research, 2025
[2] Telecom Advisory Services, 2021
[3] Telecom Advisory Services, 2024

USE OF WI-FI has almost doubled during COVID-19



A recent Wi-Fi Alliance study" found that the **Wi-Fi traffic increased by over 80%** and there was a **70% to 94% increase in Wi-Fi use during the day**

Everyone is on one or the other device most of the time on a home Wi-Fi network - Even the mobile
In many cases 6-7 devices on the same network – all on a VC

Existing Wi-Fi (4 & 5)

Existing Frequency Allocations (Unlicensed - ISM Bands)

- 2.4 - 2.5 GHz (100MHz)
- 5.725 – 5.875 GHz (150MHz)

- Channel size: 20, 40 & 80 MHz
- Limited number*

**2.4 (3x20, 1x40 MHz), 5 (5x20, 2x40, 1x80 MHz)*

Radio Interference

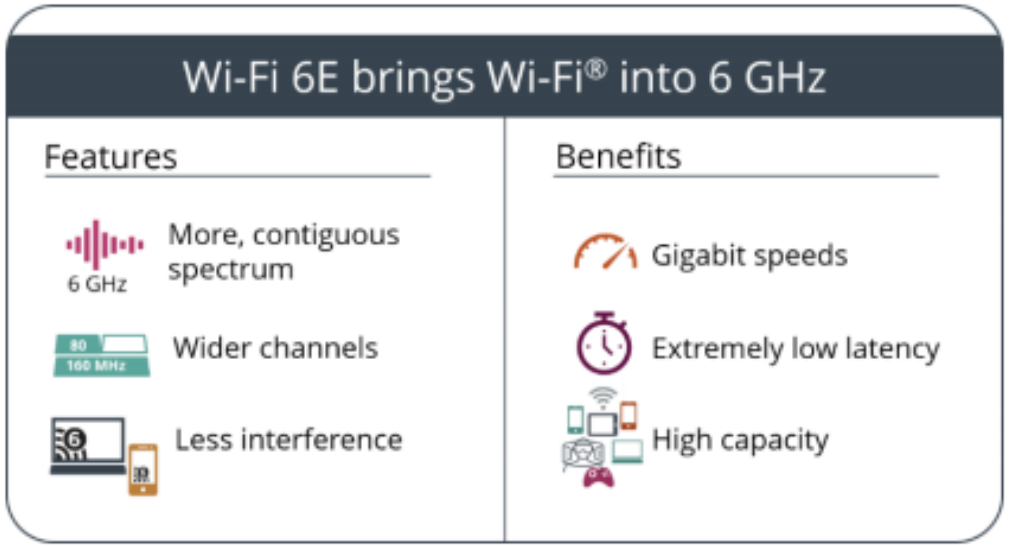
Industrial, Scietific & Medical (ISM) - Applications

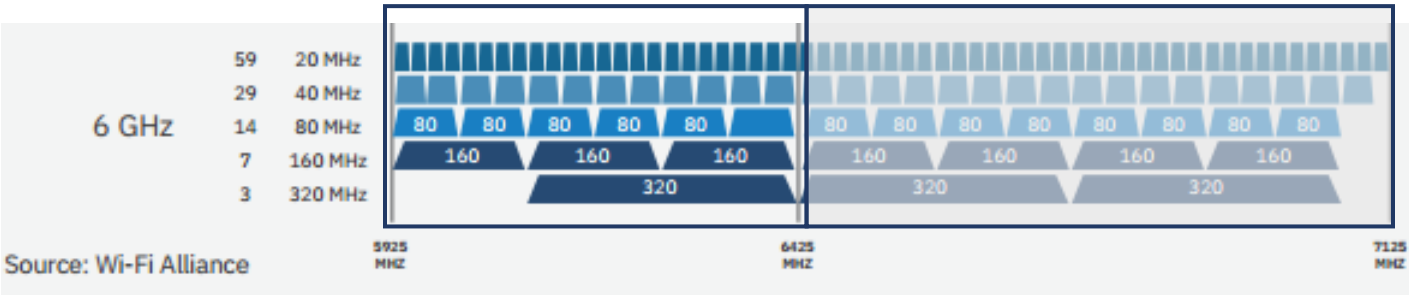
- Microwave Oven
- Plasma Lamps
- Induction Heating
- Cordless phones,
- Medical (Diathermy)
- Bluetooth
- Radio Control (RC)
- Communication Links

Current Wi-Fi spectrum was inadequate to meet the demand

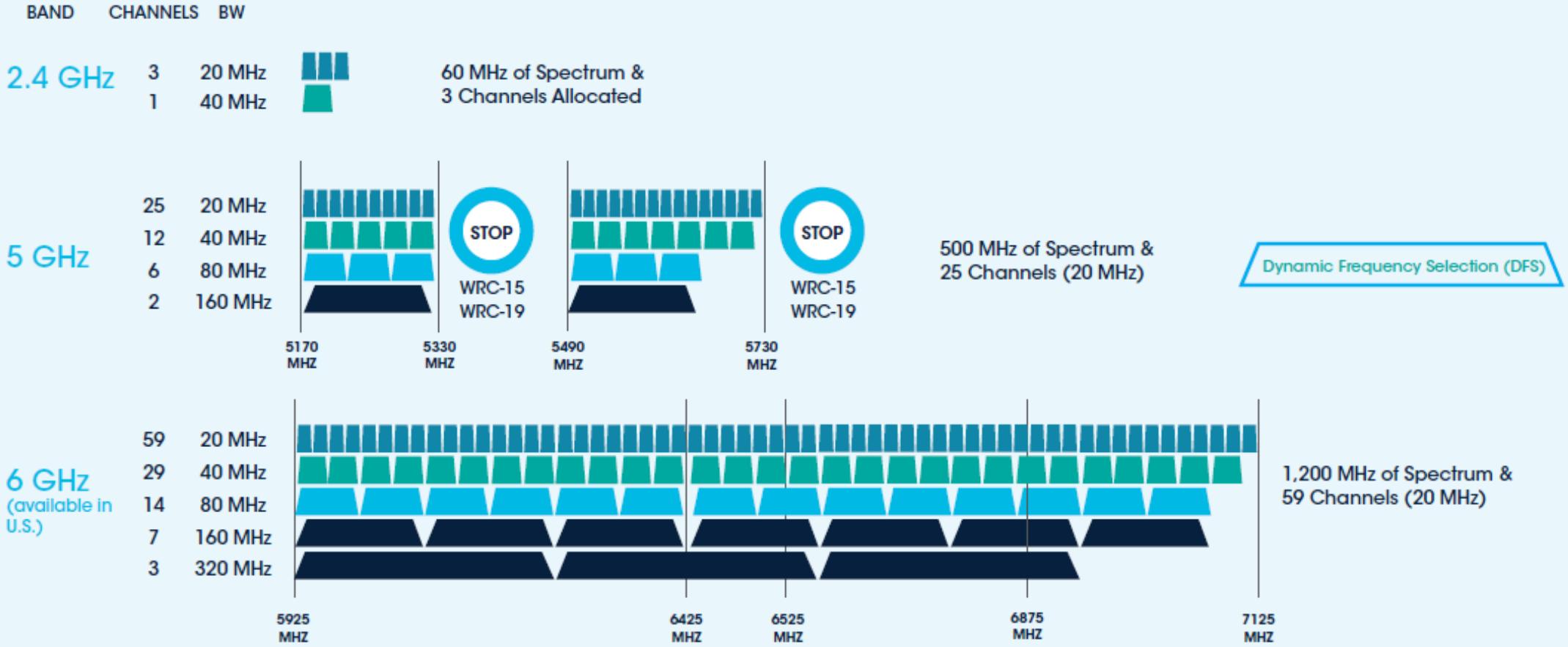
Wi-Fi Evolution

Wi-Fi Gen	Wi-Fi 4	Wi-Fi 5	Wi-Fi 6	Wi-Fi 6E	Wi-Fi 7
Launch	2007	2013	2019	2021	2024
IEEE standard	802.11n	802.11ac	**802.11ax**		**802.11be**
Min data rate	600 Mbps	1.3/3.6 Gbps	**9.6 Gbps**		**46 Gbps**
Bands	2.4 GHz	5 GHz	2.4 & 5GHz	6GHz	1.000-7.125 GHz
Security	WPA 2	WPA 2	WPA 3		WPA3
Channel size	20, 40 MHz	20, 40, 80, 80+80, 160 MHz	20, 40, 80, 80+80, 160 MHz		Up to **320 MHz**





THE 6 GHZ BAND CAN ACCOMMODATE MULTIPLE 160 MHZ & 320 MHZ CHANNELS



Source: Broadcom

Coexistence of FSS and Wi-Fi 6E

a) ECC and CEPT carried out series of studies and published reports on harmonized technical conditions for Co-existence of Radio Local Area Networks (RLAN) and incumbent Fixed Satellite Service & Fixed Services in the 5925-6425 MHz band.

b) Studies Involved:

- Various WAS (Wireless Access Services) /RLAN scenarios attempted with power up to 1Watt E.I.R.P., indoor and outdoor devices

a) Scenarios were conducted to check if High power WAS/RLAN devices and outdoor WAS/RLAN devices could present a risk of harmful interference to FSS.

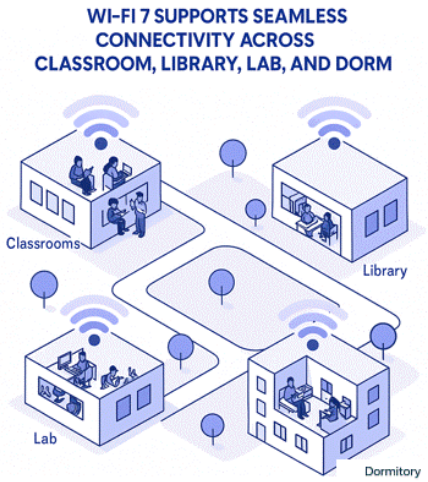
b) ECC Decision

- Decision was made on Technical Assessment (CEPT Report 73 and 75) that, Coexistence between WAS/RLAN with existing services and systems (Fixed Satellite Service) is technically feasible under certain conditions, i.e the following limitations on outdoor and indoor output power.
    - Indoor: 23 dBm
    - Outdoor: 14dBm

Barriers in Adoption of Wi-fi 6E / 7

First of All frequency above 5.9GHz are used in Satellite uplink communication which bring concerns to the regulators to put a halt for a time being.

Existing Wi-Fi, Bluetooth and cellular only supported frequencies up to 5.9 GHz. Therefore, components and equipment used for design and manufacturing had historically been optimized for frequencies below 6 GHz. Retooling for support up to 7.125 GHz has a major impact to the full product lifecycle from product design and validation all the way to manufacturing.



Wi-Fi 6E delivers these advanced capabilities

Multi-user multiple input multiple output (MU-MIMO): allows more data to be transferred at once and enables an access point to transmit data to a larger number of devices concurrently

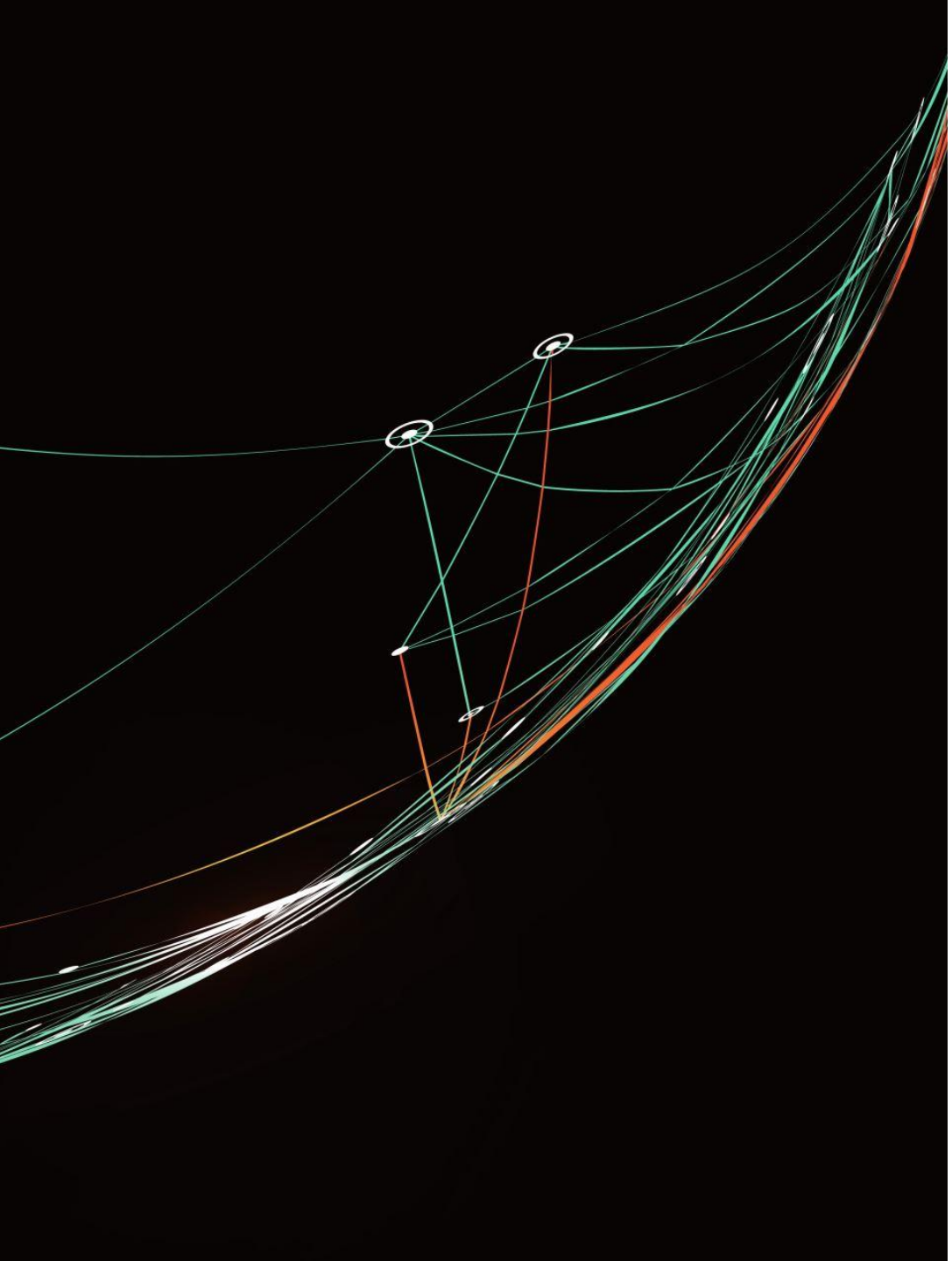
- **160 MHz channels:** increases bandwidth to deliver greater performance with low latency

- **Target wake time (TWT):** significantly improves battery life in Wi-Fi devices, such as Internet of Things (IoT) devices

- **1024 quadrature amplitude modulation mode (1024-QAM):** increases throughput in Wi-Fi devices by encoding more data in the same amount of spectrum

- **Transmit beamforming:** enables higher data rates at a given range resulting in greater network capacity

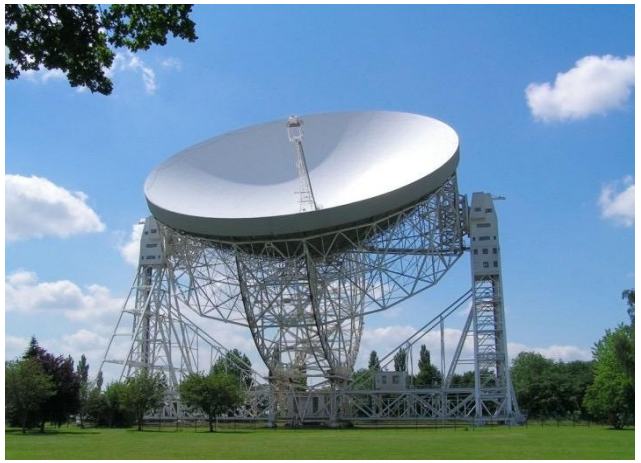
- **Orthogonal frequency division multiple access (OFDMA):** effectively shares channels to increase network efficiency and lower latency for both uplink and downlink traffic in high demand environments



WiFi 6E: Expanding to 6 GHz

- **WiFi 6E builds on WiFi 6 by expanding into the 6 GHz frequency band, offering more channels and reduced interference.**
- **This extra bandwidth supports higher speeds and lowers latency, particularly for bandwidth-intensive applications like 4K/8K streaming and virtual reality (VR).**
- **By leveraging the 6 GHz spectrum, WiFi 6E reduces congestion in the already saturated 2.4 GHz and 5 GHz bands, improving capacity and data throughput in dense environments.**
- **WiFi 6E is ideal for homes, offices, and businesses using many IoT devices, and it is backward compatible with WiFi 6 devices, ensuring smooth upgrades without disrupting your network.**

Sharing between low power Wi-Fi with Satellite uplink and Point to Point microwave links is possible



This Band Will increase the efficiency of WLAN networks 4x the throughput of 802.11ac

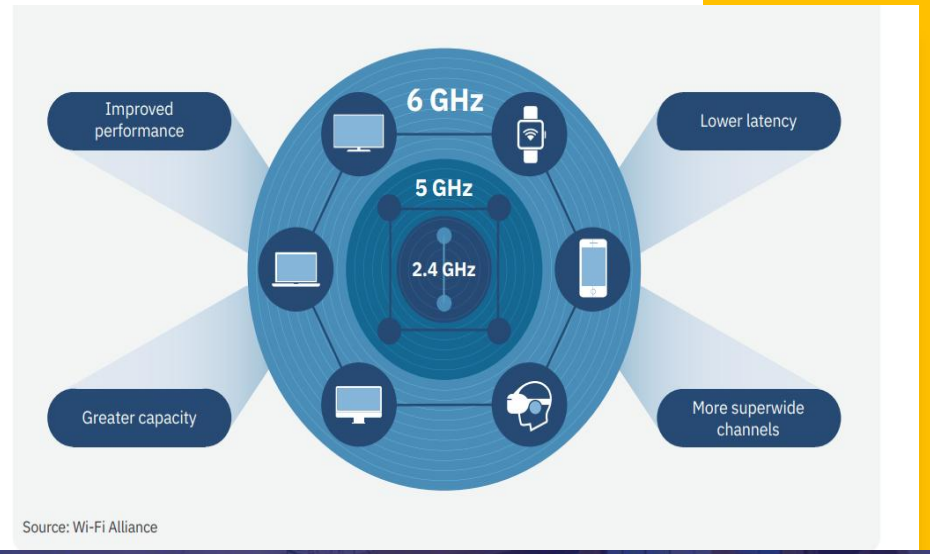
- FSS studies indicate that allowing for up to 2% outdoor usage with max EIRPs up to 1W, sharing with satellites was feasible .

However unrestricted outdoor usage would cause interference to FSS. Therefore it is not possible to allocate this band to IMT as already agreed at WRC-23

- Based on the results of studies, sharing between the FS and Wi-Fi is feasible with appropriate technical conditions and regulatory models.

Pakistan Regulatory Perspective

- PTA allowed unlicensed use of 5925-6425 MHz band (6 GHz) in 2024.
- Pakistan became the 10th Asia-Pacific country to do so → aligns with APT recommendation APT/AWG/REP-104.
- Max EIRP limits: Indoor 23 dBm, Outdoor 14 dBm (mention “same as ETSI”).
- Objective: promote next-gen Wi-Fi and IoT in smart homes, SMEs, education campuses.
- The 2024 Permission was specific for Wi-Fi 6E. In September 2025, The Pakistan Telecommunication Authority (PTA) has granted approval for the adoption of Wi-Fi 7 and subsequent Wi-Fi generations within the 6 GHz band (5925–6425 MHz), in line with parameters earlier approved for Wi-Fi 6E.
- Pakistan embraces 6 GHz Wi-Fi as a catalyst for Digital Transformation and Spectrum Efficiency



Source: Wi-Fi Alliance

PTA Propels Pakistan Towards Next-Generation Connectivity with Wi-Fi 7 Approval in 6 GHz Band

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Islamabad (26th September, 2025): The Pakistan Telecommunication Authority (PTA) has granted approval for the adoption of Wi-Fi 7 and subsequent Wi-Fi generations within the 6 GHz band (5925–6425 MHz), in line with parameters earlier approved for Wi-Fi 6E. This milestone positions Pakistan among the early adopters in Asia-Pacific, underscoring its commitment to digital innovation and leadership.

Wi-Fi 7 delivers ultra-high data rates, low latency, and robust reliability, enabling 8K streaming, AR/VR, and industrial automation. By easing congestion in legacy bands and reducing broadband delivery costs, it will strengthen connectivity for households, SMEs, campuses, healthcare, and smart cities.

This milestone underscores PTA's commitment to bridging the digital divide, enhancing resilience, and advancing Pakistan's inclusive digital economy.

PTA Announces Unlicensed RLAN Operation (Wi-Fi 6E) in 6 GHz Band in Pakistan

Announcements › Press Releases

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Recent Updates

Islamabad (16th May 2024): Chairman PTA, Maj Gen (R) Hafeez ur Rehman addressing at the event "Unlocking Pakistan's Connectivity: Enablement of Next Geneneration Wi-Fi in 6 GHz Band" at a local hotel in Islamabad.

PTA Publishes Framework for Wireless Local Area Network (WLAN)

FRAMEWORK FOR WIRELESS LOCAL AREA NETWORK - 2024

Policy Context: PTA, under *Section 5(2)(c) of the Pakistan Telecommunication (Re-organization) Act, 1996*, enabled unlicensed operation in the **5925–6425 MHz** band for Wireless LANs.

Approval Timeline: Framework finalized in **September 2024**, following *Rolling Spectrum Strategy 2020-2023* Clause 3.2 mandate.

Regulatory Parameters:

Indoor: ≤ 23 dBm EIRP, 10 dBm/MHz PSD

Outdoor: ≤ 14 dBm EIRP, 1 dBm/MHz PSD

Operation on **non-interference, non-protection basis**

Regional Standing: Pakistan became the **10th Asia-Pacific country** to open the 6 GHz band for unlicensed RLANs — aligning with **APT and ETSI models**.

Expected Impact: Enables high-capacity Wi-Fi 6E/7 routers, promotes digital inclusion, IoT innovation, and smart-campus connectivity.

The Power Limits adopted

- The adopted limits by Pakistan are as per ETSI Standards.
- Also they are aligned with CEPT ECC Decision.

CEPT ECC
Electronic Communications Committee

ECC Decision (20)01

On the harmonised use of the frequency band 5945-6425 MHz for Wireless Access Systems including Radio Local Area Networks (WAS/RLAN)[1]

approved 20 November 2020

amended 8 November 2024

ETSI EN 303 687 V1.1.1 (2023-06)

6 GHz WAS/RLAN;
Harmonised Standard for access to radio spectrum

Key Wi-Fi 7 Features*

User Experience Data Rate

Spectrum Efficiency

Network Energy Efficiency

Connection Density

Key Enhancements

320 MHz channels
4096-QAM
16 spatial streams

Multi-link operation
Multi-AP operation
Deterministic low latency

Multi-RU (puncturing)

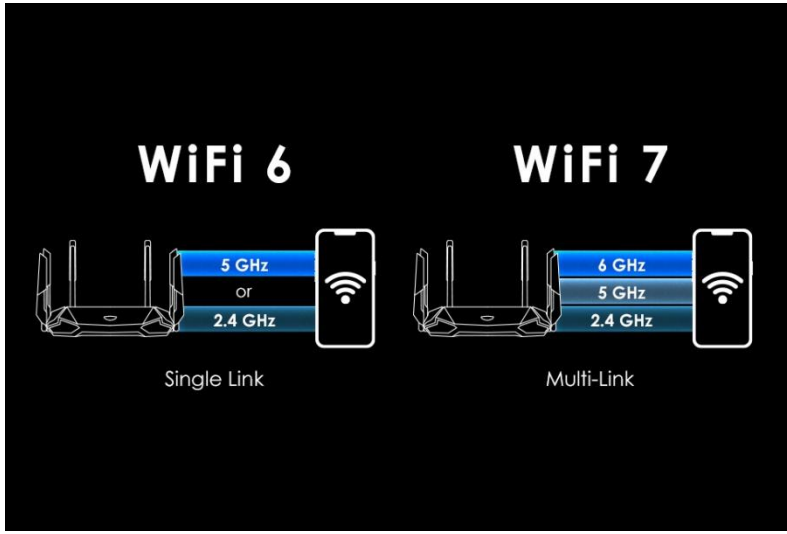
Peak Data Rate

Cost Effective

Area Capacity

Low Latency

* Accurate as of June/2020. Feature set and their specification are subject to change.



Wi-Fi CERTIFIED 7™: Advanced performance for next generation Wi-Fi®

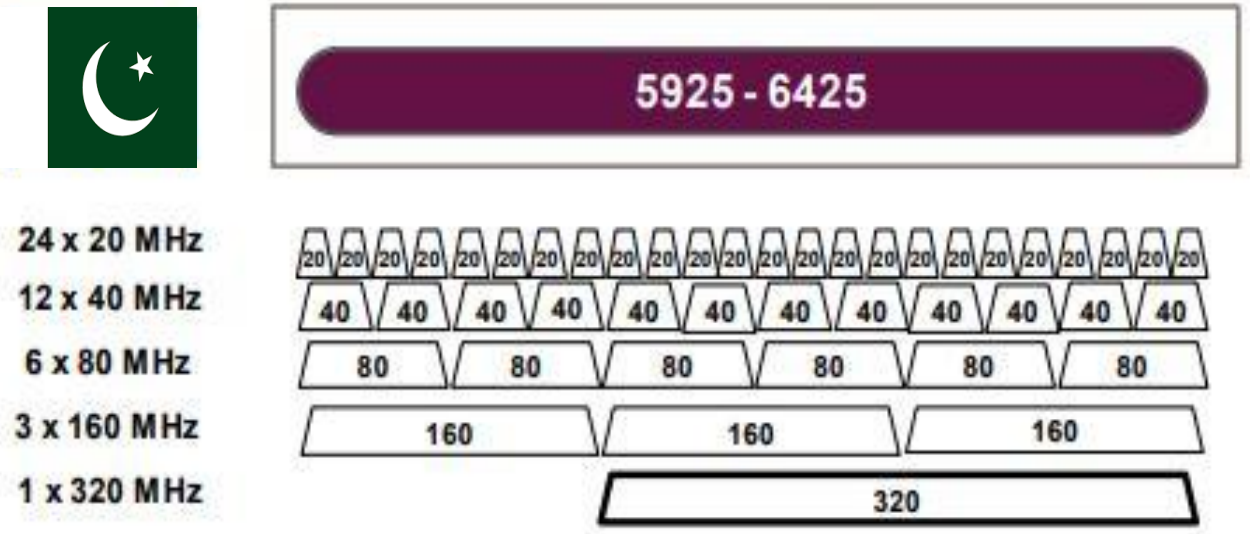
Features	Benefits
320 MHz channels	2X higher throughput
Multi-link Operation (MLO)	Deterministic latency, increased efficiency, greater reliability
4K QAM	20% higher transmission rates
512 Compressed Block Ack	Reduced transmission overhead
Multiple RUs to a single STA	Enhanced spectral efficiency

Wi-fi 7 Advanced features include:

- **320 MHz channels:** available in countries that make the 6 GHz band available to Wi-Fi, ultra-wide channels double today's widest channel size to facilitate multigigabit device speeds and high throughput
- **Multi-Link Operation (MLO):** allows devices to transmit and receive data simultaneously over multiple links for increased throughput, reduced latency, and improved reliability
- **4K QAM:** achieves 20% higher transmission rates than 1024 QAM
- **512 Compressed block-ack:** improves efficiency and reduces overhead
- **Multiple RUs to a single STA:** improves flexibility for spectrum resource scheduling to enhance spectrum efficiency
- **Triggered Uplink Access:** optimizes Wi-Fi 6 defined triggered uplink access to accommodate latency sensitive streams and satisfy QoS requirements
- **Emergency Preparedness Communication Services (EPCS):** provides a seamless National Security & Emergency Preparedness (NSEP) service experience to users while maintaining the priority and quality of service in Wi-Fi access networks

RLAN (Wi-Fi 6E/ 7) – 500MHz Bandwidth in 6GHz

Wi-Fi 7 Devices: Over **1,200** device models had been released.
Total 6 GHz-capable: Over **5,000** device models released.



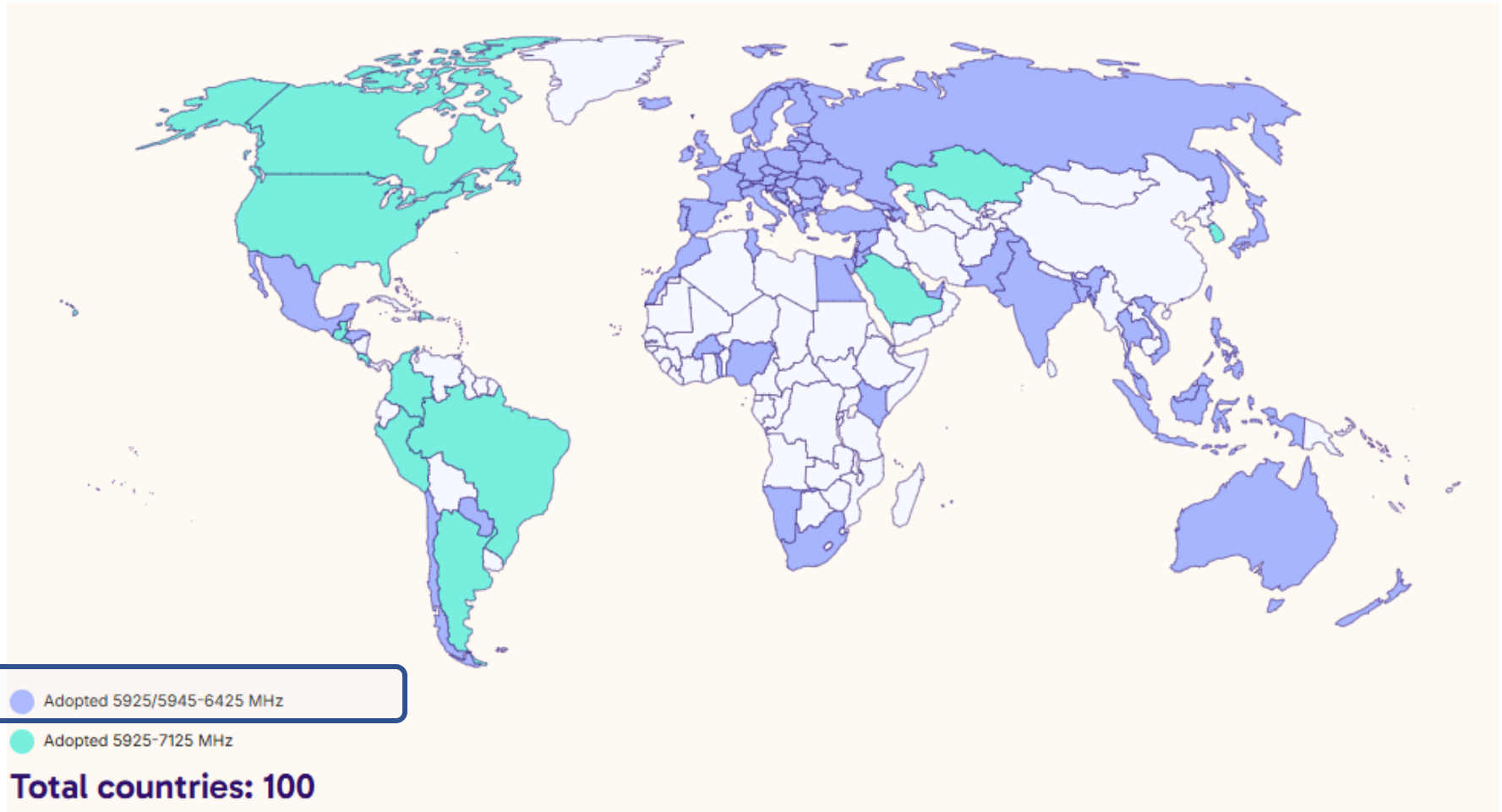
Bandwidth – 500MHz
Unlicensed RLAN (Wi-Fi 6E)
Non-protection & non-interference basis
Max EIRP: Indoor – 23 dBm
Outdoor – 14 dBm

Wi-Fi 6E Ecosystem

4300+ Devices available

- Samsung: S22 Ultra & beyond
- Apple: iPhone 15, iPad Pro
- Google: Pixel 6 & Pro
- Gaming: Xbox Series X
- Headsets - multiple
- Laptops: Mac Book Air, Lenovo, hp

Wi-Fi in 6GHz – Global Adoption

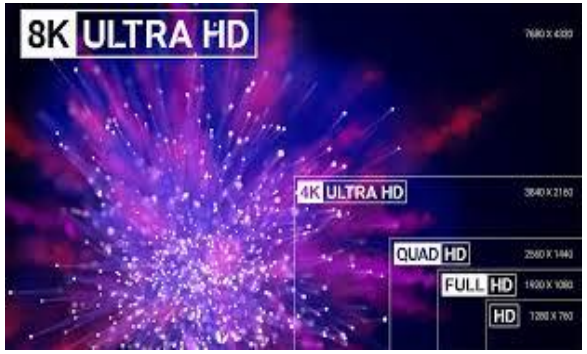


Myanmar may open the 6 GHz band (5925–7125 MHz) for unlicensed use. This band is crucial for the "Extremely High Throughput" that defines Wi-Fi 7.

Applications & Use Cases

Immersive Reality (AR/VR/XR) Multi-User
Remote Learning / 3D Training

Home Server & Office Intranet / Screen Mirroring



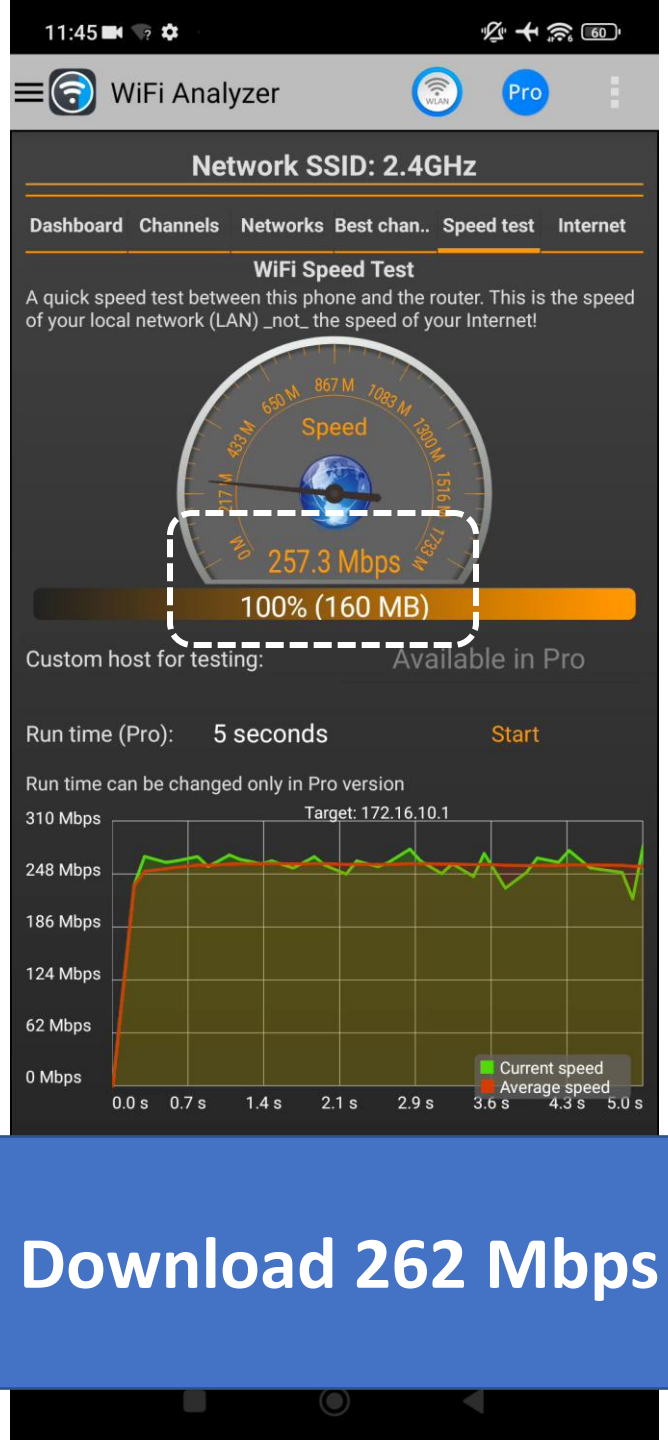
HD Video (8K & beyond)

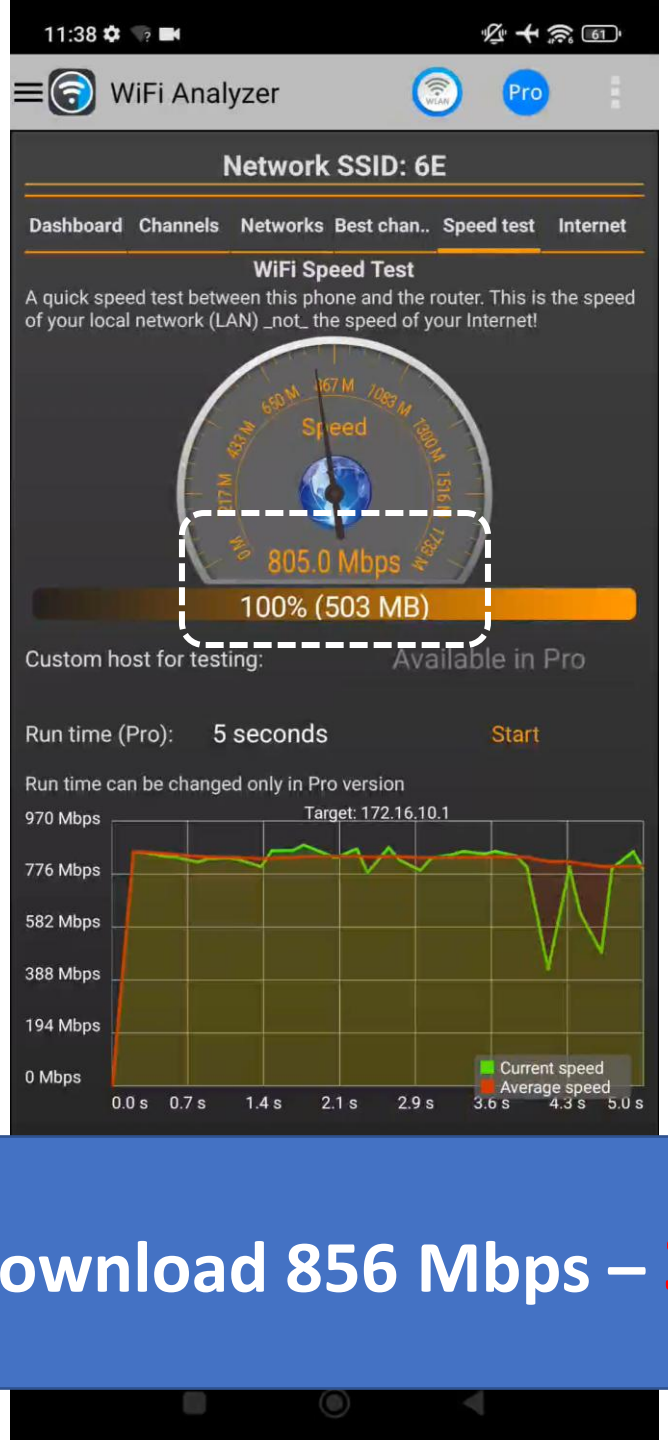
Online Real-time Gaming

Real Time Trading –
Financial Markets

Cellular Off-Loading &
VoWiFI

Wi-Fi 6E : Speed Comparison





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Questions

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