

Radio Spectrum and Technical Standards Advisory Committee

SSAC Paper 6/2024

Overview of Wi-Fi 7 and its Regulatory Regime



Office of the Communications Authority
24 July 2024

Use of Wi-Fi

Client Devices











Wi-Fi
Access Points
("APs")











Internet



Wi-Fi APs

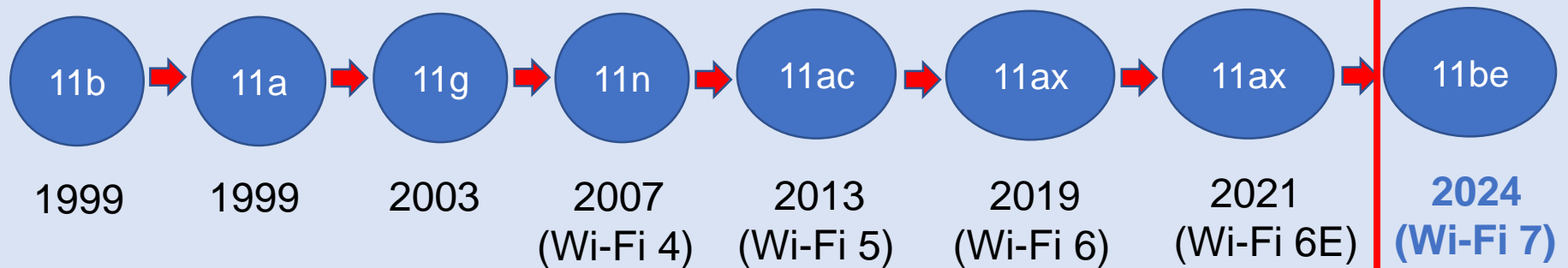
Wi-Fi APs	Examples		
Wi-Fi Routers			
Pocket Wi-Fi / Wi-Fi Eggs			
Bridges / Repeaters / Extenders			

Wi-Fi Client Devices

Wi-Fi Client Devices	Examples
 <p>Smartphones</p>	
 <p>Tablets / Notebooks</p> 	
 <p>Wearable Devices</p> 	
 <p>Smart Home Appliances with Wi-Fi Connectivity</p>	

Development of Wi-Fi Technology

Wi-Fi technology has been widely used for over 25 years and has evolved for several generations



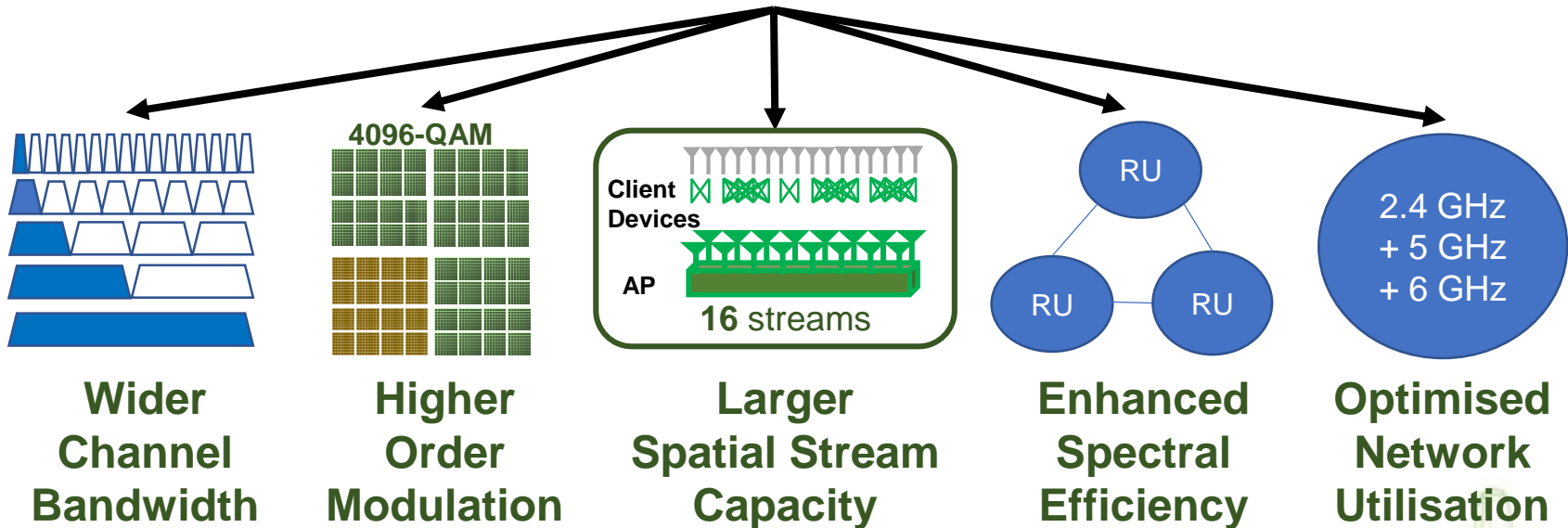
> Wi-Fi Alliance introduced **Wi-Fi CERTIFIED 7** for certification of Wi-Fi 7 equipment in January 2024¹



Overview of Wi-Fi 7

Wi-Fi 7

Supporting the 6 GHz band² (in addition to the conventional 2.4 GHz³ and 5 GHz⁴ bands)



² 6 GHz band refers to the 5.925 – 7.125 GHz band

³ 2.4 GHz band refers to the 2.4 – 2.4835 GHz band

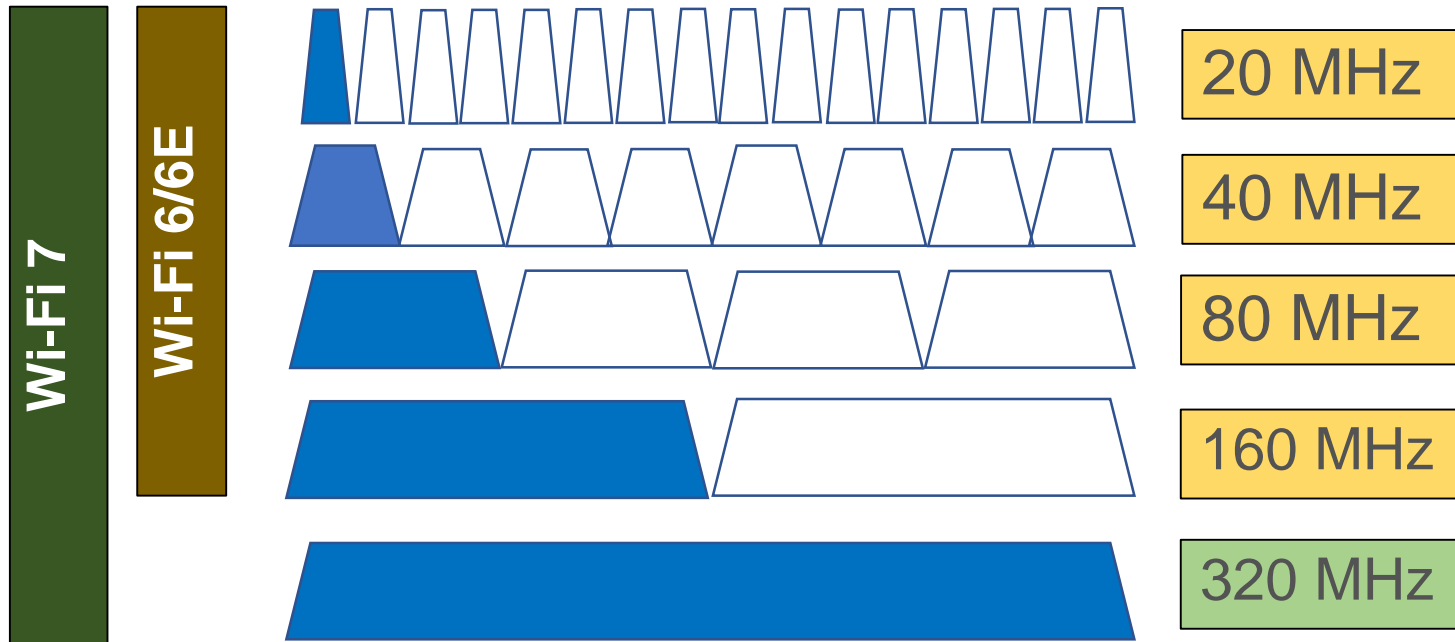
⁴ 5 GHz band refers to the 5.15 – 5.35 GHz and 5.47 – 5.85 GHz bands

Comparison of Different Wi-Fi Generations

	Wi-Fi 4	Wi-Fi 5	Wi-Fi 6	Wi-Fi 6E	Wi-Fi 7
IEEE Standard	802.11n	802.11ac	802.11ax	802.11ax	802.11be
Launch year	2007	2013	2019	2021	2024
Operating bands	2.4 GHz, 5 GHz	5 GHz	2.4 GHz, 5 GHz	2.4 GHz, 5 GHz, 6 GHz	2.4 GHz, 5 GHz, 6 GHz
Max channel Bandwidth	40 MHz	160 MHz	160 MHz	160 MHz	320 MHz
Highest modulation	64-QAM	256-QAM	1024-QAM	1024-QAM	4096-QAM
Max MIMO streams	4x4	4x4	8x8	8x8	16x16
Theoretical single user peak data rate	1.2 Gbps	3.5 Gbps	9.6 Gbps	9.6 Gbps	46 Gbps

Sources: <https://6ghz.info/wp-content/uploads/2022/07/SenzaFili-IntelTB-Wi-Fi7-The-next-generation-in-the-evolution-of-Wi-Fi.pdf>

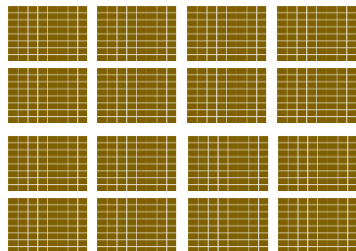
Key Features of Wi-Fi 7 (1) - Wider Channel Bandwidth: Maximum Channel Size of 320 MHz



Key Features of Wi-Fi 7 (2) - Higher Order Modulation: 4096-QAM⁵

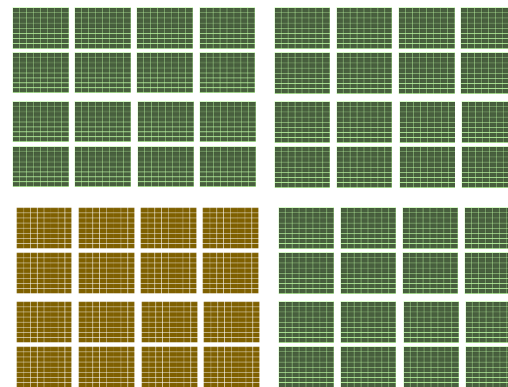
Wi-Fi 6/6E

1024-QAM
(10 bits/symbol)



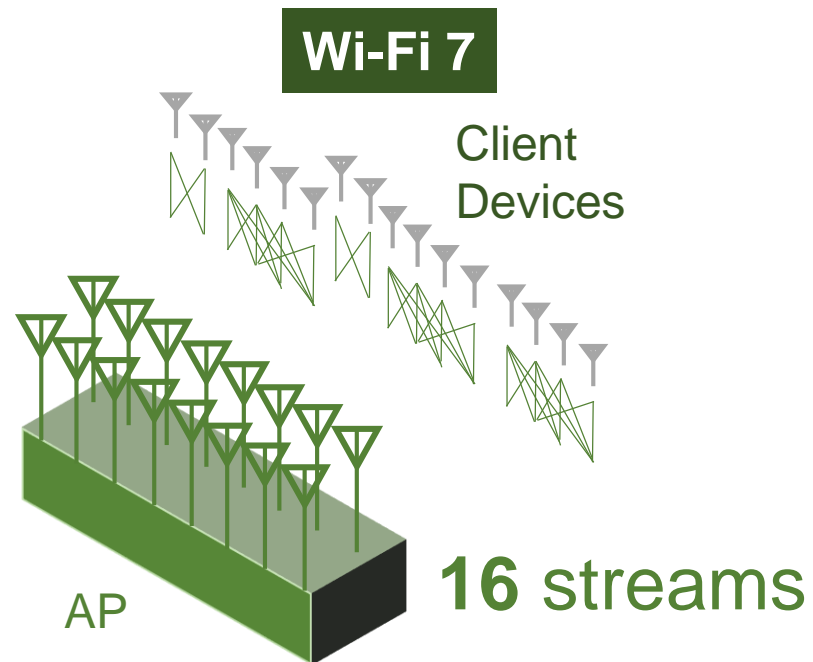
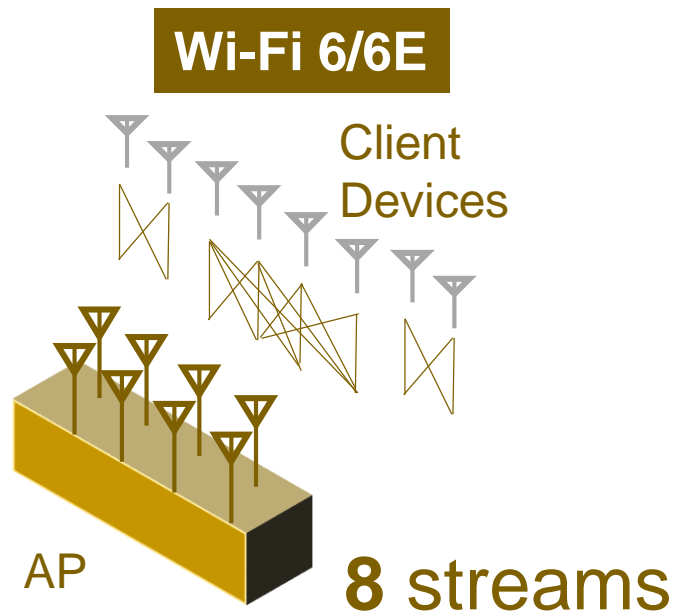
Wi-Fi 7

4096-QAM
(12 bits/symbol)



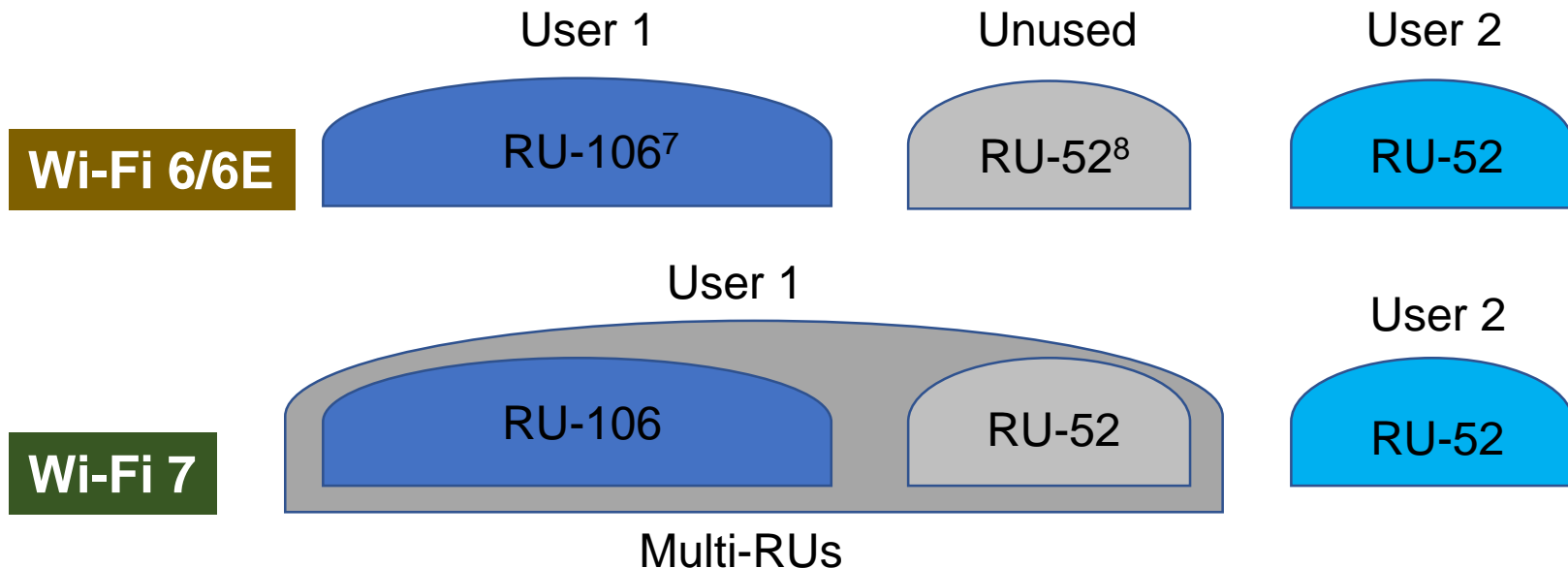
- **4096-QAM** in Wi-Fi 7 raises the data rate per symbol by 20% compared to 1024-QAM in Wi-Fi 6/6E without any increase in bandwidth
 - Enables higher data transmission rate and improves spectral efficiency
 - Allows more devices to efficiently share and operate in the same spectrum, particularly beneficial in densely populated areas

Key Features of Wi-Fi 7 (3) - Larger Spatial Stream Capacity: 16x16 MU-MIMO⁶



- **16x16 MU-MIMO** in Wi-Fi 7 doubles the spatial multiplexing capacity compared to 8x8 MU-MIMO in Wi-Fi 6/6E
 - Enables APs to handle concurrent data streams for up to 16 client devices
 - Doubles the data transmission rate compared to Wi-Fi 6/6E

Key Features of Wi-Fi 7 (4) – Enhanced Spectral Efficiency: Multiple Resource Units (RU)



- RU was introduced since Wi-Fi 6/6E for orthogonal frequency division multiple access (OFDMA) while only ONE RU can be allocated to a device
- Wi-Fi 7 allows the allocation of multiple RUs to each device, providing better spectral efficiency

Key Features of Wi-Fi 7 (5) - Optimised Network Utilisation: Multi-Link Operation

Single link



2.4 GHz,
5 GHz or
6 GHz



Wi-Fi 6E

- All existing Wi-Fi standards, including Wi-Fi 6E establishes a connection between two devices on a single band (i.e. using 2.4 GHz, 5 GHz or 6 GHz band)

Multi-link



2.4 GHz



and/or
5 GHz



and/or
6 GHz



Wi-Fi 7

- Increased Data Rate
- Improved Reliability
- Reduced Latency
- Increased Link Efficiency
- Intelligent Load Balancing



Optimised Network Utilisation

Wi-Fi 7 Benefits

- Wi-Fi 7's **high throughput, high bandwidth and low latency** features help improve user experiences and productivity in use cases –



Immersive gaming,
entertainment and 3-D
training



Streaming ultra-high
definition video



Hybrid work and
rich telepresence



Multi-user AR/VR/XR⁹



Automotive (vehicular
audio/visual applications)



Industrial
Internet-of-Things
(requiring low latency)

Wi-Fi CERTIFIED 7 by the Wi-Fi Alliance



- **Wi-Fi CERTIFIED** is an internationally recognized approval for products meeting industry-agreed standards for interoperability, security, and a range of application specific protocols
- Only Wi-Fi Alliance members may apply for product certifications in the **Wi-Fi CERTIFIED** program
- Wi-Fi Alliance introduced **Wi-Fi CERTIFIED 7** for certification of Wi-Fi 7 products on 8 January 2024
- **Wi-Fi CERTIFIED 7** products must demonstrate interoperability for one or more of the current 802.11 MAC/PHY certification programs, such as **Wi-Fi CERTIFIED 6** which is for Wi-Fi 6/6E products

Regulation of Wi-Fi 7 in Hong Kong



Regulation of Wi-Fi 7

The relevant legislation and licences are:

Private Use

- Telecommunications (Telecommunications Apparatus) (Exemption from Licensing) Order (Cap. 106Z) (“**Exemption Order**”)
- Class Licence for 6 GHz Device

Provision of Service

- Class Licence for Provision of Public Wireless Local Area Network Services (“**PWLAN Service Class Licence**”)
- Unified Carrier Licence (“**UCL**”)

Regulation of Wi-Fi 7 - Exemption Order (1)

- Use of Wi-Fi devices operating in the 2.4 GHz and/or 5 GHz bands are exempted from licensing under the Telecommunications (Telecommunications Apparatus) (Exemption from Licensing) Order (Cap. 106Z) (“Exemption Order”)¹⁰

Wi-Fi Generation	Operating Frequency	Maximum RF Output Power (e.i.r.p.)	Eligible Users	Certification & Labelling Requirements	Scope
Wi-Fi 4 Wi-Fi 5 Wi-Fi 6 Wi-Fi 6E Wi-Fi 7	(a) 2.400 – 2.4835 GHz (b) 5.150 – 5.350 GHz* (c) 5.470 – 5.725 GHz (d) 5.725 – 5.850 GHz (See Schedule 2 of the Exemption Order for details)	(a) 4W (b) 200mW (c) 1W (d) 4W	General public	For APs and client devices, voluntary certification against HKCA 1039 and voluntary labelling	<ul style="list-style-type: none"> Private use and sale/trade of Wi-Fi devices Provision of public Wi-Fi services requires an appropriate licence
	* Restricted to indoor operations				

Regulation of Wi-Fi 7 - Exemption Order (2)

- Wi-Fi devices operating in the 2.4 GHz and/or 5 GHz bands shall comply with HKCA 1039 specification¹¹ prescribed by the CA:

Frequency Band	Reference Specifications (shall meet at least one of the international standards)
2.400 - 2.4835 GHz	(a) ETSI Standard EN 300 328 “Wideband transmission systems; Data transmission equipment operating in the 2.4 GHz band; Harmonised Standard for access to radio spectrum” (b) Federal Communications Commission, Part 15 Radio Frequency Devices (“FCC Part 15”); Section 15.247
5.725 – 5.850 GHz	FCC Part 15; Section 15.247
5.15 – 5.35 GHz 5.470 – 5.725 GHz 5.725 – 5.850 GHz	FCC Part 15; Subpart E - Unlicensed National Information Infrastructure Devices (i.e. Sections 15.401 – 15.407)
5.15 – 5.35 GHz 5.470 – 5.725 GHz	ETSI Standard EN 301 893 “5 GHz RLAN; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU”
5.725 – 5.850 GHz	ETSI Standard EN 302 502 “Wireless Access Systems (WAS); 5.8 GHz fixed broadband data transmitting systems; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU”

Regulation of Wi-Fi 7

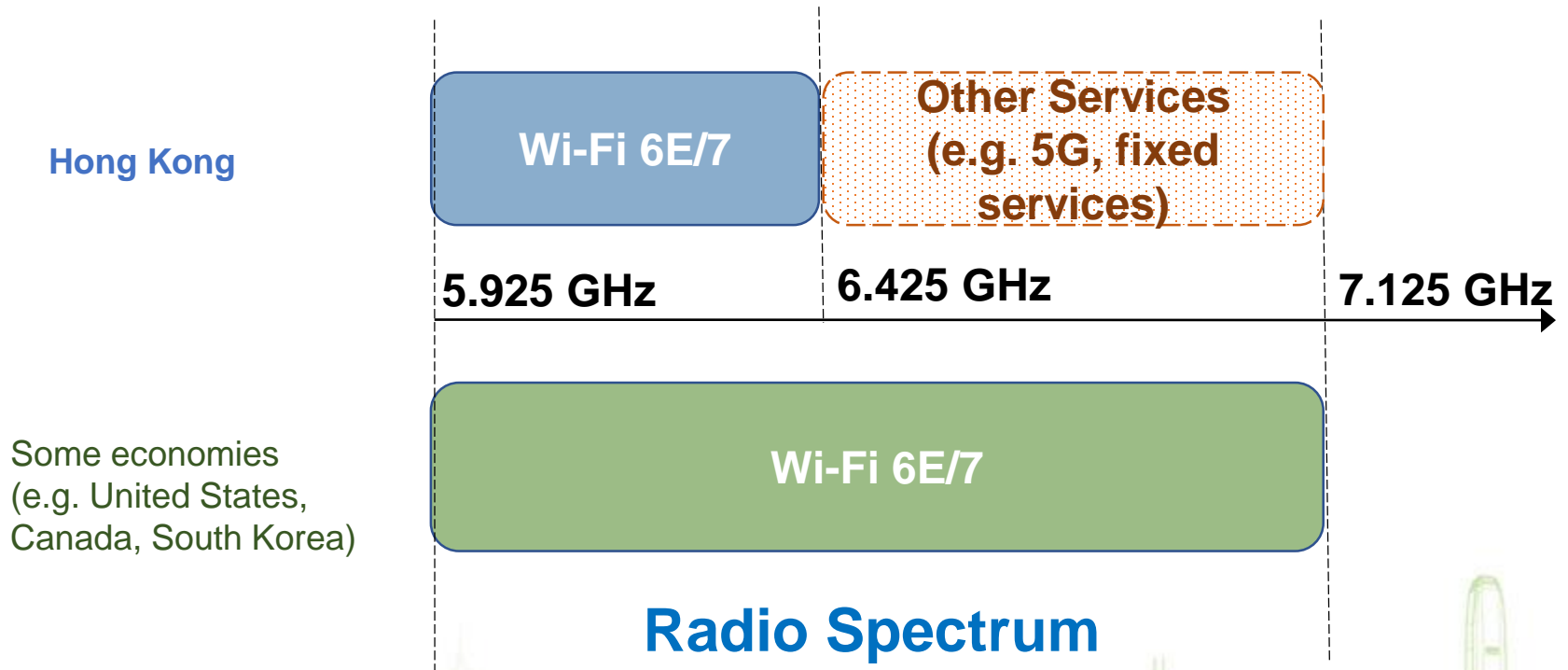
- Class Licence for 6 GHz Device (1)

- Wi-Fi 6E/7 devices operating in the 5.925 – 6.425 GHz band are authorised under the [Class Licence for 6 GHz Device](#)¹² introduced by the Communications Authority (“CA”) in [April 2022](#)

Frequency Range	5.925 – 6.425 GHz
Maximum EIRP	<ul style="list-style-type: none">• 24 dBm for indoor use• 14 dBm for outdoor use
Specification	Access Points and Client Devices shall comply with HKCA1081 prescribed by the CA
Certification & Labelling	Access Points shall be certified against HKCA 1081 and affixed with a label prescribed by the CA
Scope	<ul style="list-style-type: none">• Private use and sale/trade of Wi-Fi devices• Provision of public Wi-Fi service is not allowed

Regulation of Wi-Fi 7 - Class Licence for 6 GHz Device (2)

- In Hong Kong, Wi-Fi Devices are allowed to operate in part of the 5.925 – 7.125 GHz band only (i.e. 5.925 – 6.425 GHz band)







Regulation of Wi-Fi 7

- Class Licence for 6 GHz Device (3)

- Wi-Fi 6E/7 devices operating in the **6.425 – 7.125 GHz** band for use in other economies are **not** permitted in Hong Kong
- Consumers can possess and use Wi-Fi devices covered under the **Exemption Order** and the **Class Licence for 6 GHz Device** without the need to apply for an individual licence and pay for a licence fee

	2.4 GHz band	5 GHz band	5.925 – 6.425 GHz	6.425 – 7.125 GHz
Wi-Fi 4	✓	✓	---	---
Wi-Fi 5	---	✓	---	---
Wi-Fi 6	✓	✓	---	---
Wi-Fi 6E	✓	✓	✓	✗
Wi-Fi 7	✓	✓	✓	✗

	Exempted from licensing		Not permitted in Hong Kong
	Covered under the Class Licence for 6 GHz Device		Frequency band not supported

Regulation of Wi-Fi 7 - Class Licence for 6 GHz Device (4)

- To prevent illegal Wi-Fi 6E/7 devices operating in the 6.425 – 7.125 GHz band to be sold and used in Hong Kong, compulsory certification & labelling are required for APs under the Class Licence of 6 GHz Device –


- Wi-Fi 6E/7 APs permitted and offered for sale in Hong Kong **must** be affixed with the **CA label** demonstrating that they have been **certified** to meet HKCA1081
- Consumers should look for the **CA label** when buying **Wi-Fi 6E/7 APs**



Regulation of Wi-Fi 7

- Class Licence for 6 GHz Device (5)

- Certification & labelling of Wi-Fi 4/5/6 devices and Wi-Fi 6E/7 client devices are voluntary, such devices may not bear the CA label. Nevertheless, consumers are encouraged to purchase certified Wi-Fi devices



	Certification and Labelling of Access Points	Certification and Labelling of Client Devices
Wi-Fi 4/5/6 devices	Voluntary	Voluntary
Wi-Fi 6E/7 devices	Compulsory	Voluntary



A list of certified equipment models is available on :

<https://app1.ofca.gov.hk/apps/cte/content/listEquip.asp?lang=E>



Regulation of Wi-Fi 7

- Class Licence for 6 GHz Device (6)

- As at 30 Jun 2024, the numbers of Wi-Fi 6E/7 APs and client devices certified in Hong Kong are:

	Wi-Fi 6E	Wi-Fi 7
APs	61	32
Client Devices	43	3

Regulation of Wi-Fi 7 - PWLAN Service Class Licence (1)

- Provision of public Wi-Fi services using the 2.4 GHz, 5 GHz and the 5.925 – 6.425 GHz bands at private premises is authorised by the **Class Licence for Provision of PWLAN Services**¹³
 - introduced by the CA in 2003 and updated in Apr 2022

Wi-Fi Generation	Operating Frequency	Maximum RF Output Power (e.i.r.p.)	Eligible Users	Remark
Wi-Fi 4	(a) 2.400 – 2.4835 GHz	(a) 4W	Wi-Fi service providers	Provision of public Wi-Fi services at unleased Government land and public streets requires a UCL
Wi-Fi 5	(b) 5.150 – 5.350 GHz*	(b) 200mW		
Wi-Fi 6	(c) 5.470 – 5.725 GHz	(c) 1W		
Wi-Fi 6E	(d) 5.725 – 5.850 GHz	(d) 4W		
Wi-Fi 7	(e) 5.925 – 6.425 GHz	(e) 24dBm for indoor use 14dBm for outdoor use		
* Restricted to indoor operations				

¹³ [https://www.coms-auth.hk/filemanager/common/licensing/Wireless Local Area Network Services \(Eng\).pdf](https://www.coms-auth.hk/filemanager/common/licensing/Wireless_Local_Area_Network_Services_(Eng).pdf)

Regulation of Wi-Fi 7 - PWLAN Service Class Licence (2)

- According to PWLAN Service Class Licence, APs must be registered with OFCA¹⁴

Registered WiFi Access Points Enquiry

Please input as much information about the search criteria as you can. If no search criterion is given, all registered WiFi access points will be listed.

[Link to GeoInfo Map](#)

Type of WiFi Access Points

For Vehicles / Vessels / Aircrafts Only For Fixed Locations

Name of Service Provider

- Please select -

Location of WiFi Access Points

District

- Please select -

Area

- Please select -

Hong Kong Government Wi-Fi Service

Yes No All

Search **Reset**

Note: Location information of WiFi access points contained in this section is provided by the service providers and produced for public reference.

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Service Provider	Area	District	Location of WiFi Access Points	Hong Kong Government Wi-Fi Service (Yes/No)	Freq. Band In Use			
					2.4GHz	5.1GHz	5.4GHz	5.7GHz
A.L.S.Gateway Company Limited	Hong Kong	Central & Western	G/F_Caine Road_No 111	No	✓			
Aberdeen Kai-Fong Welfare Association Limited	Hong Kong	Southern	G/F_Wah Oi House_Wah Kwai Estate_3 Wah Kwai Road	No	✓	✓	✓	✓

Regulation of Wi-Fi 7 - UCL

- Subject to approval of the CA, holders of UCL¹⁵ may use the 2.4 GHz, 5 GHz and the 5.925 – 6.425 GHz bands for provision of public Wi-Fi services in unleased government land and public streets

Wi-Fi Generation	Operating Frequency	Maximum RF Output Power (e.i.r.p.)	Eligible Users	Remark
Wi-Fi 4 Wi-Fi 5 Wi-Fi 6 Wi-Fi 6E Wi-Fi 7	(a) 2.400 – 2.4835 GHz (b) 5.150 – 5.350 GHz* (c) 5.470 – 5.725 GHz (d) 5.725 – 5.850 GHz (e) 5.925 – 6.425 GHz * Restricted to indoor operations	(a) 4W (b) 200mW (c) 1W (d) 4W (e) 24dBm for indoor use 14dBm for outdoor use	Holders of UCL	<ul style="list-style-type: none"> The relevant frequency assignments will be recorded in the UCL after obtaining the CA's approval Public Wi-Fi services may be provided at unleased government land and public streets

Thank You

