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The Leader in Digital Solutions

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Aileen Chia (Ms)
Director-General (Telecoms & Post)
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Dear Ms. Aileen Chia,

Subject - Public Consultation on Proposed Allocation of 6 GHz Band in Singapore

I would like to thank IDMA for allowing H3C to provide feedback and comments on the Proposed Allocation of the 6GHz Band in Singapore.

Introduction of H3C

H3C is an industry leader in the provision of digital solutions and is committed to becoming the most trusted partner of its customers in their quest for business innovation and digital transformation. We offer a full portfolio of digital infrastructure products, spanning across compute, storage, networking, Wi-Fi, 5G, security, terminal, and related domains, and provide a comprehensive one-stop digital platform that includes cloud computing, big data, artificial intelligence (AI), industrial internet, information security, intelligent connectivity, and edge computing, as well as end-to-end technical services.

Please see our website at https://www.h3c.com/en/

Adoption of WiFi 7 instead of WiFi 6E Standard

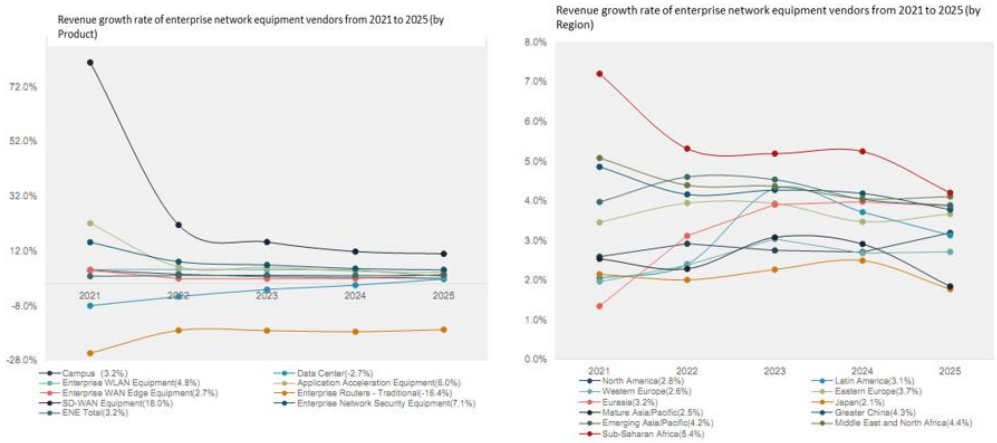
【reference】 https://iotbusinessnews.com/download/2022-TSR-Wireless-Connectivity-Market-Report-Summary.pdf

According to the results of the 2022 wireless connection market analysis report, four trends can be seen from the Wi-Fi market forecast and smartphone market forecast:

1. Chip manufacturers have successively released their own Wi-Fi 7 chipsets in 2023, and will improve Wi-Fi 7 chipsets in 2024
2. Various Wi-Fi manufacturers have successively released their respective Wi-Fi 7 flagship models in 2023, and will complete the Wi-Fi 7 product family in 2024
3. All mobile phone manufacturers will successively release smart terminals supporting Wi-Fi 7 in 2023, and complete the Wi-Fi 7 terminal family in 2024
4. Wi-Fi7 products will usher in rapid growth in 2024 and explosive growth in 2025, and Wi-Fi6E products will be quickly replaced by Wi-Fi 7 products

From the perspective of customers' long-term investment and return, Wi-Fi 7 will be the mainstream, and Wi-Fi6 E is only a transition

WLAN Market Trend

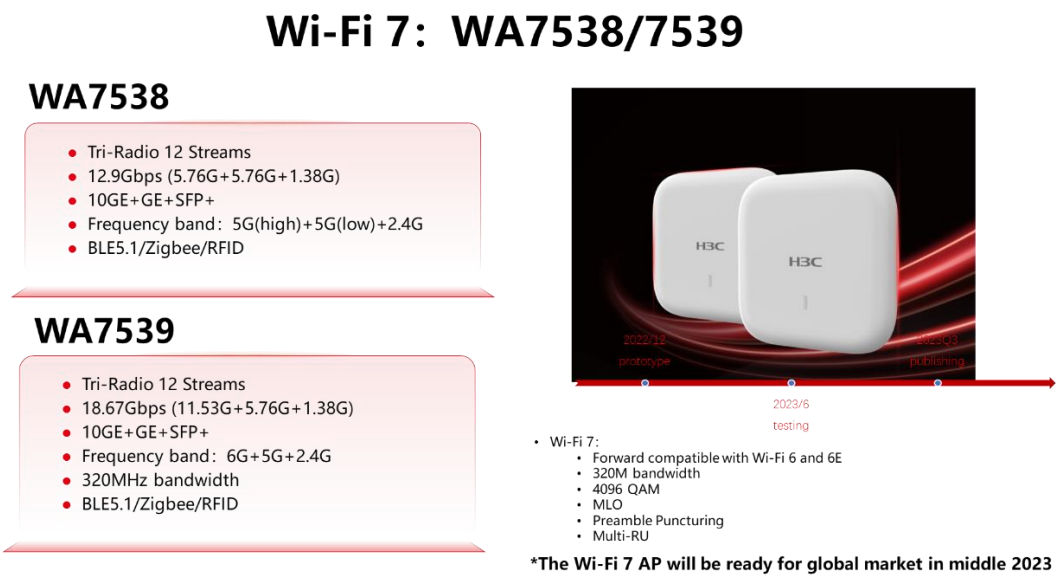


Wi-Fi 6 revenue nearly tripled year-on-year, accounting for more than half of AP revenue. Wi-Fi 6 shipments accounted for 39% of the market. Some companies have already begun to release Wi-Fi 6E products. For example, HPE Aruba announced that Qualcomm-based tri-band 2X2 6E APs are about 25% more expensive than Wi-Fi 6. Wi-Fi 7 consumer-grade products will appear around 2023, and enterprise-grade products will appear around 2024. This means that

Wi-Fi 6E will have a shorter life cycle like 801.11ac Wave 1 (the peak is reached in four years, followed by a sharp decline)

Now that the Wi-Fi 7 protocol is here, breakthroughs have been made again in terms of frequency band, bandwidth, MIMO, and modulation. The rate is 4.8 times that of WiFi 6, and the delay is less than 5ms. With the introduction of the 6GHz frequency band, the number of usable channels has increased, and the concurrent terminal access capability has increased. The maximum bandwidth support has been increased from 160Mhz to 320MHz, and the maximum transmission rate has been increased by more than 2 times. Using high-order 4096-QAM modulation technology, the rate can be increased by 20%. New technologies such as MLO\MRU\multi-AP collaboration\Preamble Puncturing that only available in WiFi 7 can improve the utilization efficiency of spectrum resources and reduce delay to increase the rate.

H3C WiFi 7 Access Point



H3C Comments to IMDA 6GHz Allocation

1. In the IMDA's consultation document, "6 GHz band (5,925 MHz – 7,125 MHz, or parts thereof) has recently been identified for the deployment of Radio Local Area Networks ("RLAN"). H3C WiFi 7 Access Point comply to 6 GHz band (5,925 MHz – 7,125 MHz) frequency band.
2. H3C WiFi 7 Access Point comply to backward compatibility to WiFi 6E, 6, 5, 4 devices.
3. In the IMDA's consultant document, "In this regard, Wi-Fi 6E's (i.e., Wi-Fi on 6 GHz band) theoretical maximum speeds of up to 9.6 Gbps would make it on par with the potential 10 Gbps speeds offered by the next-generation technology upgrade for NBN, i.e., 10 Gbps passive optical network ("10G-PON") technology. Without Wi-Fi 6E, end-users will not be able to get the full experience and benefit that 10G-PON" H3C WiFi 7 Access point supports 10Gbps ethernet interface meet the 10 Gbps speeds offered by the next-generation technology upgrade for NBN. This may also consider having more than 10Gbps for WiFi 7 or future standard.
4. In the IMDA's consultant document, "Given the above considerations, IMDA proposes to allocate the lower 500 MHz of the 6 GHz band, i.e., 5,925 MHz – 6,425 MHz, for RLAN / Wi-Fi use, for a start" H3C WiFi 7 Access Point able to support the lower 500 MHz of 6GHz band and the upper 700 MHz (6,425 MHz – 7,125 MHz) for future deployment.
5. In the IMDA's consultant document, "Currently, the 2.4 GHz and 5 GHz bands are the two most commonly used frequency bands in Singapore for RLAN, e.g., Wi-Fi, with maximum allowable output power between 100 mW EIRP and 1W EIRP". As the high frequency band 6GHz is prone to interference. It would be beneficial to increase the EIRP for VLP and LPI.

Table 1: IMDA's proposed technical requirements for RLAN use in the lower 500 MHz

Use Case	RF Power Requirements	Remarks
Very Low Power (VLP)	Max EIRP: 14 dBm (25 mW) Max EIRP density: 1dBm/MHz or 10dBm/MHz for narrowband usage	For use indoor and outdoor Use on unmanned aircraft systems/drones is prohibited
Low Power Indoor (LPI)	Max EIRP: 24 dBm (250mW) Max EIRP density: 11 dBm/MHz	For use indoor only

6. In the IMDA's consultant document, "According to the IEEE's 802.11ax standard's channel set for 6 GHz band, the first channel for the various operating classes to support channel spacing of 20, 40, 80 and 160 MHz typically starts from 5,945 MHz. In this regard, IMDA intends to designate 5,925 MHz – 5,945 MHz as the guard band with the possibility to allocate 5,925 MHz – 5,935 MHz for urban rail intelligent transport systems in future, taking reference from the Electronic Communications Committee (ECC)'s decision. Such arrangement would have minimal impact to the deployment of RLAN in the remaining 480 MHz, i.e., 5,945 MHz – 6,425 MHz, and would still enable up to 3 x 160 MHz channels for Wi-Fi 6E/7." We could explore the

upper 700MHz to support more non-overlapping channel on 160 MHz or 320 MHz.

7. In the IMDA's consultant document, "For the use of standard power devices to facilitate fixed outdoor deployment at higher power, as such use is still nascent and yet to be widely adopted globally," For the 6GHz usage for outdoor, Automated Frequency Coordination may be considered to enable unlicensed access to the 6 GHz band by coordinating shared spectrum between Standard Power Access Points (SP) and incumbent Point-to-Point microwave

Conclusion

Wi-Fi 6E expands on the existing Wi-Fi 6 (802.11ax) standard and allows access to a new 6 GHz band. Wi-Fi 6E has the same features with Wi-Fi 6 like OFDMA, WPA3, and Target Wake Time. The keyword of Wi-Fi7 is EHT (Extremely High Throughput), and the primary feature is ultra-high throughput. In terms of transmission rate, by introducing 320MHz bandwidth and 4K-QAM modulation, MIMO16X16 makes the maximum theoretical rate of a single link reach 46Gbps. In terms of spectral efficiency improvement, technologies such as Multi-RU, Hybrid Automatic Repeat Request (HARQ), and multi-AP collaboration are introduced to make resource utilization more reasonable and efficient. In terms of interference suppression, technologies such as Preamble Puncturing, Cooperative OFDMA (C-OFDMA), Cooperative Spatial Reuse (CSR), and Multi-Link Synchronous Channel Access will be adopted to make the interference between APs smaller and the coverage more balanced. Technologies such as guaranteed low latency, multi-AP joint transmission (JXT), dynamic link switching, timing and synchronization, and new access categories are being discussed and incorporated.