**Wi-Fi**

**IEEE:**

The Institute of Electrical and Electronics Engineers is a professional association that develops and publishes standards for a wide range of industries, including information technology, telecommunications, power and energy.

802.1 – Bridging

802.3 – Ethernet

802.6 – Distributed queue dual bus

802.11 – Wi-Fi

802.15 – Wireless PANs

802.15.1 – Bluetooth

802.15.3a – Ultra wideband

802.15.4 – Zigbee

802.15.5 – Mesh network

802.18 – Radio Regulatory Technical Advisory Group

802.19 – Wireless coexistence

802.24 – Vertical Applications Technical Advisory

**IEEE 802.11 divisions:**

1) Wi-Fi 1 (802.11b) – Introduced in 1999. Operates in the 2.4 GHz frequency band. Offers maximum speeds of 11 Mbps. Short range and susceptible to interference from other devices.

2)Wi-Fi 2 (802.11a) – Introduced in 1999. Operates in the 5 GHz frequency band. Offers higher speeds than 802.11b, up to 54 Mbps. Less crowded band than 2.4 GHz, but shorter range.

3) Wi-Fi 3 (802.11g) – Introduced in 2003. Combines elements of 802.11b and 802.11a. Operates in the 2.4 GHz band. Offers speed up to 54 Mbps, but generally slower than 802.11a due to interference.

4) Wi-Fi 4(802.11n) – Introduced in 2009. Operates in both 2.4 GHz and 5 GHz bands. Offers speeds up to 150 Mbps on 2.4 GHz and 300 Mbps on 5 GHz.

5) Wi-Fi 5 (802.11ac) – Introduced in 2013. Uses wider channels up to 80 MHz. Operates in the 5 GHz band only. Offers speeds up to 1.3 Gbps

6) Wi-Fi 6 (802.11ax) – Latest generation, introduced in 2019. Designed for improved efficiency and performance in crowded environments. Offers higher speeds (up to 9.6 Gbps)

7) 802.11d – Enhancement to 802.11a and 802.11b that enables global roaming.

8) 802.11e – Enhancement to 802.11 that includes quality of service features.

9) 802.11h – Enhancement to 802.11a that resolves interference issues.

10) 802.11i – Enhancement to 802.11 that offers additional security for wireless LAN applications.

11) 802.11j – Japanese regulatory extensions to 802.11a specification. Frequency range of 4.9 GHz to 5GHz.

12) 802.11k – Radio resource measurements for networks using 802.11 family specifications

13) 802.11m – Maintenance of 802.11 family specifications.

**Wi-Fi Bands:**

I) 2.4 GHz Band:

Frequency range – 2.400 GHz to 2.4835 GHz.

Range – Higher up to 30 meters

Speed – Up to 54 Mbps

Advantages – Longer range compared to 5 GHz. Better at penetrating through walls and obstacles.

Common Standards – 802.11b, 802.11g, 802.11n and some early versions of 802.11ac.

II) 5 GHz Band:

Frequency range – 5.150 GHz to 5.825 GHz.

Range – Lower up to 15 meters

Speed – Up to 9.6 Gbps

Advantages – Less crowded than 2.4 GHz, reducing interference. Higher data rates and greater capacity for multiple devices. Shorter range compared to 2.4 GHz.

Common standards – 802.11a, 802.11n, 802.11ac and 802.11ax

III) 6 GHz Band (Wi-Fi 6E):

Frequency range – 5.925 GHz to 7.125 GHz

Advantages – More available channels, reducing congestion and improving performance.

Common Standards – Primarily associated with Wi-Fi 6E (802.11ax devices operating in the 6 GHz band.)

**Key Words:**

Dual Bands – 2.4 GHz and 5 GHz

Frequency – Frequency is for wireless network’s performance. Wi-Fi uses specific frequencies to transmit data in the air.

Formula – No of cycles per second.

f = v / λ

This formula calculates the frequency (f) of a wave, considering its speed (v) and wavelength (λ).

Wavelength – Wavelength plays a role in understanding and optimizing Wi-Fi performance. It measures the distance between corresponding points in a wave cycle.

Formula – The distance between two success cycle.

λ = v / f

This formula calculates the wavelength (λ) of a wave, considering its speed (v) and frequency (f).

**Key Points:**

1. Choose the 2.4 GHz band for better range in larger spaces with moderate data requirements.
2. Choose the 5 GHz band for higher data rates and less interference in areas with multiple networks.
3. Choose the 6 GHz band for enhanced performance, especially in high-capacity and low-latency applications, where supported and available.