Standard-related patent landscape: Wifi 5

Patent Mapping to the Wifi 5 standard in LexisNexis® IPlytics®

General Scope

WiFi 5, also known as 802.11ac, stands as a prominent wireless networking standard that builds upon the advancements of its predecessors. It aims to deliver faster data transfer rates, increased capacity, and improved performance in wireless communication. Operating in the 5 GHz frequency band, WiFi 5 is designed to provide enhanced throughput and efficiency, making it a crucial technology for meeting the demands of high-bandwidth applications such as streaming, online gaming, and multimedia content delivery. WiFi 5 plays a pivotal role in ensuring reliable and high-speed wireless connectivity for a wide array of devices in diverse environments.

References

- As defined by the Institute of Electrical and Electronics Engineers (IEEE), WiFi 5 (802.11ac) is positioned as a significant evolution in wireless networking technology. The IEEE emphasizes its focus on higher data rates and improved spectral efficiency, stating that it "provides substantial advancements in wireless communication, catering to the increasing requirements of modern applications and devices."
  Source: *ieee.org*

- The WiFi Alliance, responsible for certifying and promoting WiFi technologies, underscores the widespread adoption and impact of WiFi 5 in the realm of wireless connectivity. According to the WiFi Alliance, WiFi 5 "delivers faster speeds, improved coverage, and increased capacity," making it well-suited for supporting the growing number of connected devices and data-intensive activities in homes, businesses, and public spaces.
  Source: *wifi.org*

Wi-Fi generations

Generation/IEEE Standard	Maximum link rate	Standards development	Adopted	Frequency
Wi-Fi 7 (802.11be)	N.A.	2019-today	N.A.	2.4/5 and 6 GHz
Wi-Fi 6E (802.11ax)	600 to 9608 Mbit/s	2014-today	2019	6 GHz
Wi-Fi 6 (802.11ax)	600 to 9608 Mbit/s	2014-today	2019	2.4/5 GHz
Wi-Fi 5 (802.11ac)	433 to 6933 Mbit/s	2008-2013	2014	5 GHz
Wi-Fi 4 (802.11n)	72 to 600 Mbit/s	2003-2013	2008	2.4/5 GHz

Wifi 5 standard	Topics (positive concepts)
Relevant concepts	802.11ac, also known as Gigabit Wi-Fi, is a specification in the IEEE 802.11 family applicable to WLANs (wireless local area networks). 802.11ac represents an extension or update of the legacy 802.11a standard. 802.11ac sits between 802.11n and 802.11ax on the standards timeline and operates strictly in the 5 GHz spectrum. 802.11ac architecture: PHY Layer (Physical Layer): ▪ Utilizes advanced modulation schemes such as 256-QAM (Quadrature Amplitude Modulation) for higher data rates. ▪ Operates in the 5 GHz frequency band, providing more available channels and reducing interference compared to 2.4 GHz MIMO (Multiple Input Multiple Output): ▪ Supports Multi-User MIMO (MU-MIMO) for simultaneous communication with multiple devices. ▪ Utilizes beamforming technology to improve signal strength and coverage. Channel Bonding: ▪ Aggregates multiple channels together to increase the available bandwidth. ▪ Commonly uses 80 MHz or 160 MHz channel widths for higher data rates. Modulation and Coding Schemes: ▪ Employs a range of modulation and coding schemes to adapt to varying channel conditions and distances between devices. MAC Layer (Medium Access Control): ▪ Implements improvements in the MAC layer to enhance efficiency. ▪ Introduces features like the MU-MIMO, which allows multiple devices to be served simultaneously. Backward Compatibility: ▪ Designed to be backward compatible with previous Wi-Fi standards (802.11a/b/g/n). ▪ Devices supporting 802.11ac can communicate with older Wi-Fi devices. Spatial Streams: ▪ Supports a higher number of spatial streams, providing additional data paths for improved performance. Frame Aggregation: ▪ Uses frame aggregation techniques to reduce overhead and improve efficiency in data transmission. QoS (Quality of Service): ▪ Enhances QoS mechanisms to prioritize and manage data traffic efficiently. ▪ Supports features like WMM (Wi-Fi Multimedia) for improved multimedia streaming. Security: ▪ Utilizes WPA2 (Wi-Fi Protected Access 2) for robust security protocols. ▪ Provides encryption and authentication mechanisms to secure wireless communication.

Wifi 5 standard	Topics (negative concepts)
No relevant concepts	**While 802.11ac (Wi-Fi 5) is a robust and widely adopted wireless communication standard, there are features that it lacks, which may be present in other wireless standards. Here are some features that are not exclusive to 802.11ac but may be found in other standards:** Cellular Integration: ▪ Some cellular technologies, such as LTE (Long-Term Evolution) and 5G, have tighter integration with cellular networks, allowing seamless handovers between Wi-Fi and cellular connections. Wide-Area Coverage: ▪ LPWAN (Low Power Wide Area Network) technologies, such as LoRaWAN and Sigfox, are designed for low-power, wide-area coverage, making them suitable for IoT applications in areas where Wi-Fi coverage may be limited. Ultra-Low Power Consumption: ▪ Some IoT-focused protocols, like Zigbee and Z-Wave, prioritize ultra-low power consumption for devices with extended battery life. Mesh Networking: ▪ Mesh networking is supported by standards like Zigbee, Thread, and Bluetooth Mesh, enabling devices to relay data through a network of interconnected nodes. This can enhance coverage in areas where a direct connection to the central access point may be challenging. Deterministic Communication: ▪ Time-Sensitive Networking (TSN) is a set of standards designed to provide deterministic communication over Ethernet networks. It is often used in industrial applications where precise timing is critical. Satellite Communication: ▪ Satellite communication standards, such as DVB-S2 for satellite broadband, are used for long-distance, global communication. Wi-Fi standards, including 802.11ac, are designed for local wireless networking and are not intended for global-scale communication. Dynamic Spectrum Access: ▪ Cognitive Radio technologies, found in some versions of IEEE 802.22, enable devices to dynamically adapt and use available spectrum in real-time based on environmental conditions. This is different from traditional Wi-Fi, which operates in designated frequency bands. Licensed Spectrum Usage: ▪ Cellular standards like LTE and 5G operate in licensed spectrum bands, providing a level of control and quality of service that unlicensed spectrum technologies like Wi-Fi may not have. Regulatory Domain Considerations: ▪ Standards like IEEE 802.15.4 and Zigbee operate in the 2.4 GHz and sub-GHz frequency bands and may have specific regulatory considerations.

Wifi 5 standard	Topics (negative concepts)
No relevant concepts	**802.11ax Features (Not in 802.11ac):** Orthogonal Frequency Division Multiple Access (OFDMA): ▪ 802.11ax introduces OFDMA to efficiently manage and allocate sub-channels, allowing simultaneous communication with multiple devices in the same frequency band. MU-MIMO Enhancements: ▪ While 802.11ac introduced MU-MIMO, 802.11ax enhances this feature by supporting uplink MU-MIMO, allowing multiple devices to transmit data simultaneously to the access point. Target Wake Time (TWT): ▪ 802.11ax includes TWT, a feature that allows devices to schedule when they wake up and communicate with the access point, reducing power consumption and improving efficiency. Basic Service Set (BSS) Coloring: ▪ BSS Coloring helps differentiate between transmissions from different BSSs, improving spatial reuse and reducing interference in 802.11ax. Improved Modulation Schemes: ▪ 802.11ax supports more advanced modulation schemes, including 1024-QAM, for higher data rates. 1024-QAM (Quadrature Amplitude Modulation): ▪ 1024-QAM is a higher-order modulation scheme that allows more data to be transmitted per symbol. Up/Downlink Resource Management: ▪ 802.11ax introduces improved uplink and downlink resource management to enhance overall network efficiency. Basic Service Set (BSS) Coloring: ▪ Introduced in 802.11ax, BSS Coloring helps differentiate transmissions from different BSSs, improving spatial reuse and reducing interference. WPA3 (Wi-Fi Protected Access 3): ▪ While not exclusive to 802.11ax, WPA3 is supported and provides enhanced security over WPA2.