Comparative Analysis of Wi-Fi Standards: 5, 6, 6E, 7, and 8

Antonio Perez

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Feature	**Wi-Fi 5**	**Wi-Fi 6**	**Wi-Fi 6E**	**Wi-Fi 7**	**Wi-Fi 8 (Projected)**
Standard	802.11ac	802.11ax	802.11ax (6 GHz)	802.11be	802.11bn
Release Year	2014	2019	2021	2024 (expected)	2028 (projected)
Frequency Bands	5 GHz only	2.4/5 GHz	2.4/5/6 GHz	2.4/5/6 GHz	2.4/5/6 GHz, mmWave (possible)
Simultaneous Band Usage	Dual-band routers possible	Optional hardware support	Tri-band: 2.4, 5, 6 GHz	Native MLO (multi-band links)	Native AI-driven multi-link
Max Channel Width	160 MHz	160 MHz	160 MHz (6 GHz)	320 MHz (6 GHz)	$\geq$320 MHz
Max Modulation	256-QAM	1024-QAM	1024-QAM	4096-QAM	$>$ 4096-QAM (expected)
Max Theoretical Speed	$\sim$3.5 Gbps	$\sim$9.6 Gbps	$\sim$9.6 Gbps	$\sim$46 Gbps	$>$ 100 Gbps (projection)
Latency	$\sim$10 ms	$\sim$2 ms	$\sim$2 ms	$<$1 ms	$\sim$0.1 ms or less
Key Technologies	MU-MIMO (downlink), Beamforming	OFDMA, MU-MIMO, TWT	Same as Wi-Fi 6 + 6 GHz access	Enhanced OFDMA, MLO, 16x16 MU-MIMO	AI-native optimization, deterministic networks
Protocols Supported	IPv4, IPv6, WPA2, 802.11ac	IPv4, IPv6, WPA3, 802.11ax	IPv4, IPv6, WPA3, 802.11ax	IPv4, IPv6, WPA3+, 802.11be	IPv4, IPv6, WPA4 (expected), TBD
Device Compatibility	Smartphones, laptops, media devices	Phones, laptops, IoT devices	Same as Wi-Fi 6 if 6 GHz supported	Premium: AR/VR, 8K streaming, cloud gaming	XR, metaverse, digital twins, Industry 5.0
Security Standard	WPA2	WPA3	WPA3	WPA3 with enhanced QoS security	WPA4 (expected), AI-driven security
Recommended Use Cases	Home networking, HD streaming, gaming	IoT, dense deployments, enterprise	High-density offices, VR/AR	Industrial IoT, VR/AR, cloud gaming	Hyperconnected smart industries, ultra-reliable communications
Main Advantage	Higher speed than Wi-Fi 4	Greater efficiency in crowded environments	Cleaner, interference-free 6 GHz spectrum	Ultra-high speed, low latency, multi-link	Adaptive, AI-optimized networks with extreme reliability