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Different Wi-Fi Protocols and Data Rates

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Documentation

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> **IEEE 802.11 Wi-Fi protocol summary**

⌄ **802.11ax (Wi-Fi 6)**

- Supports both 2.4 & 5 GHz

Mode	Maximum rate	Antenna transmit / receive arrangements
1x1 20 MHz	143 Mbps	1 TX (Transmit, Upload) 1 RX (Receive, Download)
2x2 20 MHz	287 Mbps	2 TX 2 RX
1x1 40 MHz	287 Mbps	1 TX 1 RX
2x2 40 MHz	574 Mbps	2 TX 2 RX
1x1 80 MHz	601 Mbps	1 TX 1 RX
2x2 80 MHz	1.2 Gbps	2 TX 2 RX

1x1 160 MHz	1.2 Gbps	1 TX 1 RX
2x2 160 MHz	2.4 Gbps	2 TX 2 RX

⌄ 802.11ac wave2

- Released in June 2016.
- Key New Features for Wi-Fi clients:
  - Multi-User MIMO
  - 160 MHz channels

Mode	Maximum rate	Antenna transmit / receive arrangements
1x1 40 MHz	200 Mbps	1 TX (Transmit, Upload) 1 RX (Receive, Download)
2x2 40 MHz	400 Mbps	2 TX 2 RX
1x1 80 MHz	433 Mbps	1 TX 1 RX
2x2 80 MHz	866 Mbps	2 TX 2 RX
1x1 160 MHz	866 Mbps	1 TX 1 RX
2x2 160 MHz	1.73 Gbps	2 TX 2 RX

⌄ 802.11ac wave1

- Released in January 2014.
- Data rates varying modulation types and number of spatial streams; 200 Mbps, 400 Mbps, 433 Mbps, 600 Mbps, 867 Mbps. See table below.
- 24 non-overlapping unlicensed national information infrastructure (UNII) channels in 5 GHz frequency band.

Mode	Maximum rate	Antenna transmit / receive arrangements
1x1 40 MHz	200 Mbps	1 TX 1 RX
2x2 40 MHz	400 Mbps	2 TX 2 RX
1x1 80 MHz	433 Mbps	1 TX 1 RX
2x2 80 MHz	866 Mbps	2 TX 2 RX

⌄ 802.11n

- Data rates with varying modulation types: 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, 54 Mbps (see table below)
- Orthogonal frequency-division multiplexing (OFDM) using multiple-input/multiple-output (MIMO) and channel bonding (CB)
- Three non-overlapping channels in industrial, scientific, medical (ISM) frequency band at 2.4 GHz

- 12 non-overlapping unlicensed national information infrastructure (UNII) channels in 5 GHz frequency band with and without CB

Note	We recommend channel bonding for the 5 GHz because there are a limited number of non-overlapping channels available in the 2.4 GHz band.

Mode	Maximum rate	Antenna transmit / receive arrangements
1x1 20 MHz	72.2 Mbps	1 TX 1 RX
1x1 40 Mhz	150 Mbps	1 TX 1 RX
2x2 20 MHz	144.4 Mbps	2 TX 2 RX
2x2 40 MHz	300 Mbps	2 TX 2 RX
3x3 20 MHz	216.7 Mbps	3 TX 3 RX
3x3 40 MHz	450 Mbps	3 TX 3 RX

⌄ 802.11g

- Released in 2003.
- Data rates with varying modulation types: 6, 9, 12, 18, 24, 36, 48 and 54 Mbps; can revert to 1, 2, 5.5, and 11 Mbps using DSSS and CCK.
- Orthogonal frequency-division multiplexing (OFDM) with 52 subcarrier channels; backwards compatible with 802.11b using DSSS and CCK.
- Three non-overlapping channels in industrial, scientific, medical (ISM) frequency band at 2.4 GHz.

⌄ 802.11a

- Released in 1999.
- Data rates with varying modulation types: 6, 9, 12, 18, 24, 36, 48 and 54 Mbps.
- Orthogonal frequency-division multiplexing (OFDM) with 52 subcarrier channels.
- 12 non-overlapping unlicensed national information infrastructure (UNII) channels in 5 GHz frequency band.

⌄ 802.11b

- Released in 1999.
- Data rates with varying modulation types: 1, 2, 5.5 and 11 Mbps.
- High-rate direct-sequence spread spectrum (HR-DSSS).
- Three non-overlapping channels in industrial, scientific, medical (ISM) frequency band at 2.4 GHz.

⌄ Legacy 802.11

- Released in 1997.
- Two raw data rates of 1 and 2 Mbps.
- Frequency hopping spread spectrum (FHSS) or direct-sequence spread spectrum (DSSS).
- Three non-overlapping channels in industrial, scientific, medical (ISM) frequency band at 2.4 GHz.
- Originally defined carrier sense multiple access with collision avoidance (CSMA-CA).