

# Wireless LAN (IEEE 802.11) Technologies

**IEEE 802.11**, denotes a set of Wireless LAN/WLAN standards developed by IEEE. The 802.11 family currently includes *six over-the-air* modulation techniques that use the same protocol. The most popular techniques are those defined by the b, a, and g amendments to the original standard; security later enhanced by the r amendment. 802.11n is another modulation technique that has been developed.

Other standards in the family (c-f, h, j) are service enhancements and extensions or corrections to previous specifications.

802.11b and 802.11g standards use the 2.4 gigahertz (GHz) band and may incur interference from microwave ovens, cordless telephones, Bluetooth devices, and other wireless appliances. The 802.11a standard uses the 5 GHz band.

Before a wireless client device can communicate on your network using an access-point, it must **authenticate** to the AP using open (WEP keys for data passing) or shared authentication. Open authentication allows any WiFi device to communicate, shared authentication requires a challenge text string. Both open and shared don't rely on a RADIUS server like Extensible Authentication Protocol (EAP). WPA2 uses **mutual** authentication, a **session key** from the wired RADIUS server to the access-point and a **broadcast key** from the access-point to the wireless clients. If you have multiple wireless devices with the same access-point, you can configure multiple SSIDs.

Wi-Fi Protected Access, **WPA**, is derived from IEEE 802.11i standard. WPA leverages **TKIP** (Temporal Key Integrity Protocol) cipher encryption for data passing over EAP over a wired or wireless LAN) for authenticated key management. WPA key management supports two mutually exclusive management types: WPA Personal uses a key scheme based on "RC4" algorithm (stream cipher), but unlike WEP, TKIP provides per-packet key mixing, a **message integrity** check and a **sequence number** is sent with its own unique encryption key. Each packet transmitted using TKIP has a unique **48-bit serial number** that is incremented every time a packet is sent. **Vector** and part of the key.

**WPA2** requires authentication in two phases; the first is an open system authentication and the second uses 802.1X and an Extensible Authentication Protocol (EAP) without a RADIUS infrastructure, WPA2 Personal supports the use of a preshared key (PSK).

WPA2 requires support for the Advanced Encryption Standard (**AES**) using the Counter Mode-Cipher Block Chaining (CBC)-Message Authentication Code (CMAC) cipher that encrypts 128-bit blocks of data at a time with a 128-bit encryption key.

## Physical Layer (PHY)

2.4 Gigahertz (GHz)**		5 Gigahertz (GHz)
Frequency-Hopping Spread Spectrum (FHSS) 802.11 1 / 2 Mbps	Direct Sequence Spread Spectrum (DSSS) 802.11 1/2 Mbps	High-Rate (HR/DSSS) Complementary code keying (CCK) modulation 802.11b 11/5.5 Mbps
Legacy – released 1997		released 1999

\* Due to the **CSMA/CA** protocol overhead, in practice the maximum 802.11b throughput is approximately 5.5 Mbps.

\*\* The 2.4 GHz spectrum is divided into 14 overlapping, staggered channels.

\*\*\* 802.11a uses 12 non-overlapping channels, 8 dedicated to indoor and 4 dedicated to outdoor use.

Wireless access point devices have a default **SSID** (Service Set Identifier) and can be up to 32 characters per IEEE 802.11 standards. Beacons are transmitted every 100 ms, an adjustable value - beacons are transmitted every 100 ms. The manufacture will set this value to a default which you can change.

## Spread Spectrum

Spread spectrum is a technique trading bandwidth for power to reduce the impact of localized interference. It spreads the peak power but keeping total power constant.

## Frequency Hopping Spread Spectrum

Frequency Hopping utilizes a spread spectrum technique where the frequency band is divided into many narrow channels in a cyclic pattern. The 802.11 Frequency Hopping Spread Spectrum (FHSS) PHY uses the 2.4 GHz radio frequency band.

## Direct Sequence Spread Spectrum

The primary purpose of Direct Sequence Spread Spectrum (DSSS) PHY also uses the 2.4 GHz radio frequency band.

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