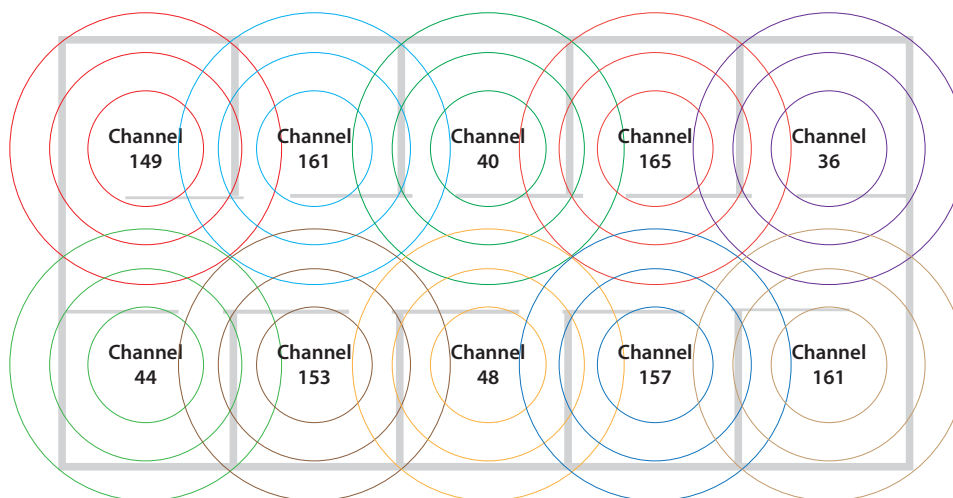




Wireless Network Design with Apple Devices

HCS Technology Group has developed the following Wireless Network best practices and recommendations to better the end user experience through technological steps. The document will serve as a useful reference for technical staff as well.

- Focus on 5GHz channels.
- Avoid using 2.4GHz channels. If 2.4GHz channels are required use channels: 1/6/11 ONLY.
 - Reduce the Radio Transmit Power (TX) to minimal levels as 2.4GHz has tremendous range.
 - 2.4GHz channels are pervasive and will cover a wider area than expected.
- If 2.4GHz channels are required, set the 2.4GHz channels on every other Access Point (A/P) and common areas to reduce the amount of RF pollution.
- If 2.4GHz channels are required, the 2.4GHz channels should be set 10 dBm cooler than your hottest 5GHz.
- Reduce the Radio Transmit Power (TX) to lowest possible so that you achieve a -80 to -90 dBm with an active Access Point (A/P).
 - Wi-Fi RSSI measuring -65dBm to -60dBm or better. Apple devices will not scan until their associated Access Point (A/P). RSSI drops below -70dBm.
- Use 20 MHz wide channels for both 2.4GHz and 5GHz.
- Using 20 MHz wide channels and 5GHz gives you more channels for strategic mapping and reduces the chances of overlapping.
 - If you require more bandwidth increase to 40MHz wide for 5GHz.
 - ◊ This will reduce available channels.
 - ◊ Proper channel mapping becomes critical.
- Use the full spectrum including Dynamic Frequency Selection (DFS) channels.
- Signal-to-noise ratio (SNR) should be 20 dB or better.
- Test for ground based radar channel changes at sites to see if you are in an at risk area.
 - Note: that these hops can be triggered by some Access Point (A/P) own sensitivity to RF radiation and not from actual radar.
- Turn off any Printers that may be broadcasting a Wi-Fi setup (typically in the 2.4GHz spectrum).
- Be aware that cell phone Hot Spots broadcast in the 2.4GHz spectrum.
- Avoid using Hidden SSID's (Service Set Identifier).
 - Use Wi-Fi authentication security protocols to protect all SSID's.
- Skip channels between adjacent Access Points (A/P).
 - This provides an extra buffer between adjacent channels reducing the risk for overlap and co-channel interference (CCI).





List of Wi-Fi recommendations:

- Decrease the total number of SSIDs that are being broadcasted by the Access Point (A/P).
- Use 20Mhz wide channels, which will allow for more unique 5GHz channels available on their Access Point (A/P).
- Use Dynamic Frequency Selection (DFS) Channels.
- Design for -65dBm cell edge for Primary SSID.
- Design for -65dBm cell edge for Secondary SSID.
- Scope Access Points (A/P) to have unique channels, and avoid channel overlapping in close proximity.
- Configure each Access Point (A/P) to not have the radios broadcast at 100% power (site survey will determine at what strength each Access Point (A/P) should be configured).
- Disable broadcasting on 5GHz 149 & 153 on Access Points (A/P) , to optimize peer-to-peer AirPlay from the Apple TVs, as documented here: <https://help.apple.com/deployment/ios/#/apd8fc751f59>.
- Strongly consider using 5GHz only for institution-owned devices (primary SSID).
- Strongly consider using 2.4GHz for Guest network SSID.
- Turn off any Printers that may be broadcasting a Wi-Fi setup (typically in the 2.4GHz spectrum).
- Be aware that cell phone Hot Spots broadcast in the 2.4GHz spectrum.

Cisco and Meraki specific suggestions for Apple Devices

- Set Minimum Data Rate to 12 Mbps.
- Enable 12 and 24 as Mandatory Rates.
- Design for signal-to-noise ratio of 25 dB or better.
- Keep Retry rates of less than 15%.
- Keep Layer 3 packet loss of less than 1%.
- Keep Jitter less than 100ms.
- Average Channel Utilization of less than 40% – target less than 30%.
- Turn on support for 802.11r – Fast Transition.
- Turn on support for 802.11k – Neighbor Reporting.
- Turn on support for 802.11v – BSS Transition Management.
- Apple devices will not scan until their associated Access Point's (A/P) RSSI drops below -70dBm.
- Set WMM On.
- Set AVC on – set Voice QoS to Platinum.

Determine if the Wi-Fi infrastructure is configured for “client-to-client” communications

Wi-Fi vendors have differing terminology for client-to-client communications, some examples include:

- Aerohive - Enable inter-station traffic
- Aruba - Deny InterUser Traffic
- Cisco - Peer-to-Peer Blocking
- Meraki - Bridge Mode
- Meru - Isolate wireless to wireless traffic
- Ruckus - Client Isolation
- Xirrus - Sta2Sta-Blocking

Apple TV and your Wireless network

Based on documented best practices, the following links provide Apple TV best practices with recommendations for Network design and implementation.

<http://help.apple.com/deployment/ios/#/apd8fc751f59>

<https://support.apple.com/en-us/HT204291>

<https://support.apple.com/en-us/HT202618>