NCR Hospitality

Wireless Network Guidelines

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Table of Contents

Introduction

Is This Guide for You?

The purpose of this guide is to provide recommendations, best practices, and a checklist to help you determine the standards for your organization, as well as optimization practices to give you excellent service from the NCR products.

Audience

This guide is aimed toward answering wireless network guideline questions from NCR customers.

Summary

The nature of Wi-Fi networks in our businesses is changing. Wi-Fi was once a convenience, allowing occasional mobile internet and network usage for our staff and guests. Today, core business devices are moving to wireless technology. Wi-Fi infrastructure must be strengthened and built to protect the business processes that depend on it.

Wi-Fi Recommendations

This section provides the recommended requirements for NCR products to work optimally.

Item	Recommended
Wireless Standard	Wireless AC or AX (WiFi 6)
Band	5 GHz Primary (2.4 GHz required devices on same VLAN)
Channel Width	20 MHz in both 2.4 GHz Band and 5 GHz band.
Guest Network	Guests WiFi on 2.4 GHz or on a separate Wi-Fi system
Disable Mesh	Do not use wireless mesh networking
Wireless Controller	Cloud Managed Unified Wireless
Channel	Managed Channel Selection to minimize interference
Multimedia	WMM
Multiuser	MU-MIMO
Planning	Heat Map to ensure adequate coverage

Wireless AC and AX (WiFi 6)

Wireless AC was released in 2014 and is capable the network speeds that your business-critical devices require. There are several improvements that were introduced with Wireless AC which make it a robust platform for your business network. Through multiple technologies, potential speeds are increased to over a 1000 Mbit/s and the reality is often 256 Mbit/s or greater. Wireless AC relies on the 5 GHz network, so the network should be optimized for that band's requirements.

Wireless AX (WiFi 6) was released in 2019 and is backwards compatible, meaning that it can live in harmony with your older Wireless N and AC devices. While speeds continue to increase with Wireless AX, perhaps the biggest improvement is the significant reduction in latency. Typically, latency causes support and software performance issues, meaning an upgrade to Wireless AX can be worth the incremental increase in cost of deployment.

2.4 GHz vs. 5 GHz

Wi-Fi was initially broadcast over 2.4 GHz for a, b, g and N. This same frequency is also being used for cordless phones, baby monitors, doorbells, garage door openers, and many other devices. While there is a benefit to 2.4 GHz, which is the ability to travel longer distances, there are many problems with using 2.4 GHz. Due to the many products using the same frequency, there is increased interference. Devices are listening to all that "noise" while trying to pick out their conversation. This slows down the connection. Another issue with 2.4 GHz is that there are only 11 channels to use and there is significant channel overlap, realistically giving only channels 1, 6, and 11 as the only channels that have no overlap with each other. If you look at the 2.4 GHz band usage in a populated area, you will see a lot of competing signals and most of these are concentrated on these three channels. 2.4 GHz cannot broadcast in AC mode. WiFi 6 can use 2.4 GHz in a more selective manner, "colorizing" it's transmissions, so that they can be readily distinguished from neighboring transmissions.

5 GHz supports the three most modern WiFi standards, N, AC and AX. This band has 23 non-overlapping channels and allows far more flexibility for site channel design. Channel widths up to 160 MHz can be supported, giving the capacity to increase the bandwidth throughput on the channel.

There is the ability for Multi-User, Multiple Input, Multiple Output (MU-MIMO), which increases throughput and minimizes crosstalk. Using band-forming, the access point can direct the wireless traffic to the device location rather than just broadcasting blindly. Though the reduced distance is often viewed as a disadvantage, it works to the benefit of the business network, as it decreases interference from other businesses nearby and allows smoother transitions between APs.

5 GHz is the recommended band for your business WiFi network. Occasionally, you may have a piece of business equipment that is 2.4 GHz only. If this occurs, you can have both a 5 GHz SSID and 2.4 GHz SSID assigned to the same VLAN. DO NOT use band steering to accomplish this, as band steering is implemented differently between vendors and is not entirely reliable. We also want to ensure NCR equipment remains on the 5 GHz band when possible.

Channel Width

Wireless AC and AX can support 20, 40, 80 or 160 MHz channel width. The challenge is that increased channel width reduces the signal strength. We recommend staying with 20 mhz, as this narrow width creates increased stability of the wireless signal at speeds consistent with NCR requirements.

Guest Network Design

Caring for your hospitality guests is an important part of your customer service. Unfortunately, by adding guests on your network, you may create an environment that is not well suited for the business devices. At a minimum, place the guest network on a separate Service Set Identifier (SSID) with a separate virtual local area network (LAN)(VLAN) assigned to it, and with a firewall between the business and guest network. As all traffic, both guest and business, utilizes the same outbound internet connection, ensure you give priority to the business traffic, and limit the bandwidth for the guest network.

Many hospitality companies contract with a third party to provide guest network services to avoid combining the networks and the management overhead. If you decide to manage and provide the guest network yourself, you will gain speed and reduce congestion by having all guests connecting to an SSID on the 2.4 GHz band and having it run at a lower network priority than your business traffic. Your business network would remain on the 5 GHz band and be assigned a higher network priority. Consider limiting the number of guest connections per AP, as our recommended maximum connectivity would be 30 devices per AP. While some APs may be able to handle additional connections, it is not a best practice to have the AP at maximum capacity.

Disable Mesh

Do not use or implement a wireless mesh network. They introduce latency and reduce bandwidth, both of which are counterproductive. They also restrict channel usage to a shared channel, eliminating the best practice of separating channels used by AP's. Please ensure, even if you're not using mesh, that capability is disabled on your wireless system. Some vendors, like Ubiquiti, enable mesh capability by default.

Wireless Network Settings

Configure the Aloha mobile device and any wireless payment devices that you are using as full members of the POS network on the same VLAN, with same subnet and broadcast traffic access. While Meraki and other wireless systems can assign granular network access to Wi-Fi devices, the tablets and payment devices need to be treated from a network perspective just like a wired terminal.

This allows proper inter-terminal communication, as well as communications with the RAL controller and Kitchen devices.

Unified Wireless Controller (UWC) or Wireless Lan Controller (WLC)

A Unified Wireless Controller (UWC) or Wireless LAN Controller (WLC) controls all APs at a location and helps them function as a unit rather than a collection of separate APs. The UWC sets the various channels of the APs, the power levels, and the roaming characteristics. Assign a UWC to each location to coordinate wireless usage and policies. A cloud-based UWC, such as Meraki, moves the controller function to the cloud and reduces the amount of equipment you manage onsite. If Internet connectivity to the cloud controller is interrupted, the APs continue broadcasting with their most recent configuration setting.

Channel Selection

By having the wireless channel selection set to Auto, the APs poll the surrounding environment and decide its own optimal channel placement. While this sounds great, in practice it is less certain that you will get the best setup. A heat map with a listing of nearby signals can help the site designer pick a setup that is optimum. The challenge is that the surrounding Wi-Fi landscape changes over time. Typically, there is less of a challenge assigning 5 GHz channels than 2.4 GHz channels, due to their weaker signal, therefore, reducing competing signals from other businesses.

Wi-Fi MultiMedia (WMM)

WMM prioritizes voice, video, and other multimedia traffic to ensure a smooth flow of traffic over the wireless network. Apple recommends this feature be turned on for smooth network operations on iOS devices. Generally, we recommend this setting for all wireless networks.

MIMO vs MU-MIMO

Wireless traffic can only be sent or received at a given time. Using MIMO, the AP can create multiple connections for input and output, so that they can occur simultaneously on separate radios and speed up traffic. MU-MIMO adds a multi-user capability, providing this functionality to multiple client devices at the same time. This is moving from a round-robin style connection with each device trying to get a slot of time for communication, to a dedicated style communication between the AP and the devices. This greatly speeds the throughput and efficiency of the wireless traffic.

Create a Heat Map

Once you complete the setup of your wireless network, use a program like Netspot to create a heat map. At a minimum, use an iPad or other mobile device to test the network at various locations. Ensure that every area where you might use a mobile device has a strong signal and good throughput to the network. A simple test is to run Speedtest.net from each table and server area from your wireless device.

Best Practices

5 GHz Band for Business Network

Use the 5 GHz band for business devices. Occasionally, a business device that is 2.4 GHz only (Example: Luxe 6200) is needed. If both bands are required, use the 5 GHz band and SSID for all devices that support 5 GHz. Limit the 2.4 GHz band and SSID to only those devices that require it. By assigning the same VLAN for both SSID's, the traffic is combined into a unified business network.

Non-DFS 5 GHz Channels

5 Ghz has 9 non-DFS channels 36, 40, 44, 48, 149, 153, 157, 161 and 165 that are available for wireless use without competing with Radar and other uses. NCR recommends only the use of these 9 non-DFS channels and to avoid the DFS channels (52 – 144). Non- DFS channel use avoids delays in communication and roaming speeds experienced on DFS channels.

Guest Traffic Priority

Set up guest traffic to scavenger Quality of Service (QoS) priority to ensure business traffic has the priority or, at a minimum, increase business traffic QoS to a higher priority than guest traffic.

AP Density

Site design guidelines typically place an AP for every 1600 square feet (40' x 40'), with up to 30 connected clients per AP. If there are more clients connecting or a greater distance span, connectivity will be poor.

Band Steering

Disable band steering on your access point or direct all clients on the tablet SSID to the 5 GHz channel only. Ideally, clients should be able to directly choose the correct network frequency, whether 2.4 GHz or 5 GHz. This way tablets can choose 5 GHz while legacy devices can choose 2.4 GHz.

Disable DHCP Mandatory

DHCP Mandatory setting should be disabled, as it is incompatible with RAL assigned IP addresses for Aloha POS terminals.

Bit Rate

Disable legacy bit rates that allow devices to connect with 802.11b. Set your minimum bit rate at 12 Mbit/s to ensure devices are not connecting at lower speeds.

Outdoor Antennas

If you plan to use mobile equipment on an outdoor patio, install an outdoor antenna or use an outdoor AP.

Outdoor AP Placement

Install outdoor access points on an exterior wall with direct line of sight to the area of tablet or wireless payment device usage. The AP should be mounted 10-15' above the ground. Corner mounts can help extend line-of-sight across two sides of the building.

Avoid Metal

Do not install the AP on a metal menuboard, near a metal door or adjacent to metal pipes. The metal reflects the signal causing timing issues with the wireless communications and will create connection instability.

Channel Width

Enable 20 MHz channel width to give each device the ability to connect at required speeds while retaining a strong signal strength.

SSID Use

Do not use more than three SSIDs on an AP within a single band (2.4 GHz or 5 GHz). Tag every SSID to a separate VLAN.

DHCP Lease Time

Use longer lease times for your business devices that use DHCP. Assign equipment that does not change an infinite or weeklong lease, to remove the risk of losing the IP address. This minimizes traffic, overhead, and potential for issues with leases.

uAPSD (unscheduled Automatic Power Save Delivery)

Enable uAPSD, as it can greatly reduce your wireless battery consumption by up to 75%. This works in conjunction with WMM to turn off the wireless power usage when not needed. This is particularly important in wireless tablets and other portable battery powered devices. This greatly reduces latency over previous power save modes.

Disable Multicast to Unicast Conversion (qos-directed-threshold 0)

Some wireless AP companies, including Ruckus, include a function which converts multicast traffic to unicast traffic. This interferes with Aloha's communication systems. On Ruckus systems, you will need to enter the AP by Command Line Input and enter the SSID configuration and enter the command "**qos directed-threshold 0"** to turn off that feature.

Radio Power

Reduce the radio power of the APs to reduce the amount of signal overlap with adjacent APs. This allows for smoother handoff for the wireless devices between APs while keeping bandwidth maximized. Ensure there is only a 10-15% overlap in signal, so the APs are can hand off to each other for device transfer.

Fast Roaming

Enable 802.11r, 802.11k, and 802.11v. Fast roaming utilizes 801.11r to facilitate Fast Transition (FT) roaming. There is a significant difference in roaming transition speeds between enabled devices. Ensure the equipment supports these protocols within the recommendations.

FlexConnect (Cisco/Meraki Products)

FlexConnect allows for centralized management of APs, while data traffic switching and client authentication occurs locally. This speeds connection times and assists in quicker transitions between access points.

Disable Multicast Filtering

Aloha uses multicast for communicating with devices throughout its ecosystem. Often wireless systems have 'Multicast Filtering' enabled by default. **Disable** 'Multicast Filtering' to ensure the traffic on which Aloha relies is available to the wireless part of the network.

Disable IGMP Snooping (Cisco/Meraki Products)

IGMP Snooping does not allow RAL to talk with the tablet, if the tablet initially has a different IP subnet than your network. This option is on by default in Meraki/Cisco equipment. ***Please disable IGMP snooping on your Meraki/Cisco network***.

Broadcast Suppression Limiting

NCR devices rely on broadcast traffic for discovery. Confirm on the AP or controller that broadcast suppression/limiting is disabled. This may be a global setting or found on the SSID.

Inter-User Bridging

NCR devices on the NCR SSID need to be able to communicate with each other. Make sure the SSID is not configured to deny inter-user bridging.

Device Inactivity Timeout

NCR devices may enter a power-save state when they are not in use. To speed up the time it takes a device to recover from this state, ensure the device inactivity timeout window is set for an hour or higher. This prevents a device from having to re-associate with the wireless network when it comes out of a stand-by state.

Update your AP firmware

Most AP devices improve over time, as updates and fixes are applied to the devices. To ensure that you are getting the full benefit of your AP devices, while minimizing potential issues that may exist in older firmware, you should keep aware of firmware updates and apply those with benefits for your network.

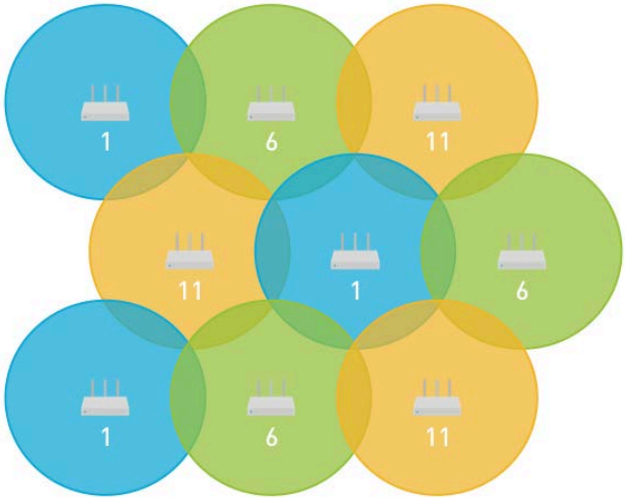
Checklist

Ensure you have a clear business case for any items not selected and that you realize non-implementation may negatively affect wireless equipment performance.

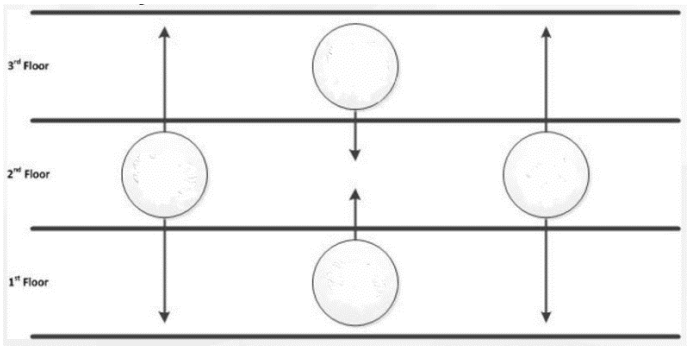
Installation:

- ☐ AP's are at AC or AX (WiFi 6) capability
- ☐ AP's have been verified to be part of a unified cloud managed system, meaning one management change is pushed to all AP's and all AP's are aware of each other rather than each AP configured independently.
- ☐ There is a minimum of 1 AP per 1600 sq ft of indoor building space. Building size _____sqft Indoor AP's installed _____ (example, a 6000 sq ft building should have a minimum of 4 AP's installed. 6000/1600=3.75)
- ☐ AP's are installed 10-15 ft off the ground.
- ☐ Indoor AP's should be ceiling mounted or drop mounted below the ceiling level to 10' – 15' if the ceiling is greater than 15' high.

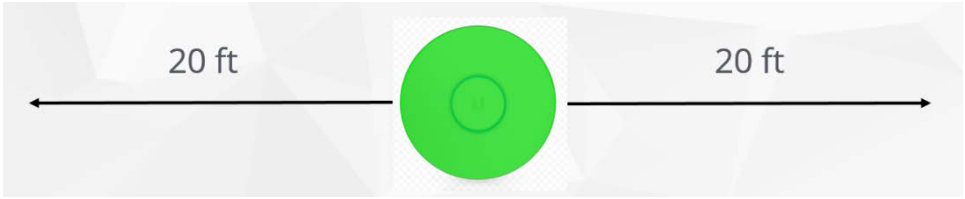
- ☐ Outdoor AP's should be wall mounted 10-15' high on the wall facing the usage area or on the corner of the building.
- ☐ The AP's are at least 5 feet from metal objects.
- ☐ If there are multiple rows of AP's in the facility, they are staggered in position.



- [ ] In facilities with outdoor usage planned, there are outdoor AP's installed to cover the area.
- [ ] AP's installed outdoors are rated for outdoor usage.
- [ ] If there are multiple floors in the building, the AP's are not directly above each other on the floor above/below.



- [ ] Every area where the equipment will be used, has an AP in **direct line of sight** and within 20-25' of the units being used.



- [ ] The units have been verified as up and working properly by network management.
- [ ] Office / Management area has WiFi coverage.
- [ ] Storage area for tablets or other mobile order devices has WiFi coverage.
- [ ] Drink station or other kitchen area where servers visit has WiFi coverage.

Configuration:

- [ ] Bandwidth Steering is disabled or all clients are required to be on 5 GHz.
- [ ] DHCP Mandatory is disabled.
- [ ] Guest network is on different AP system or on 2.4 GHz.
- [ ] Business network is on 5 GHz (2.4 GHz devices like Luxe 6200 can share VLAN with 5 GHz devices but be on a 2.4 GHz SSID).
- [ ] Wireless network for tablets and mobile payment devices are on same subnet and have same access as wired POS devices.
- [ ] Band Steering is turned off. 2.4 GHz and 5 GHz networks are on separate SSID's.
- [ ] Channel width is set to 20 MHz.
- [ ] There are no more than 3 SSIDs on the 2.4 GHz or 5 GHz band.
- [ ] Each SSID is assigned a separate VLAN.
- [ ] Each AP is broadcasting on a different wireless channel.

- [ ] The channels being broadcast by each AP are non-overlapping.
- [ ] If a Cisco/Meraki Cloud UWC is being used, FlexConnect has been enabled.
- [ ] 802.11r, 802.11i and 802.11k are enabled and fast roaming has been enabled.
- [ ] NCR devices (server, terminal, printers, etc.) have a reserved DHCP address assigned that remain constant.
- [ ] Wi-Fi MultiMedia (WMM) is enabled.
- [ ] uAPSD is enabled if you have battery powered wireless devices.
- [ ] MIMO and MU-MIMO are enabled, if available.
- [ ] AP density is adequate to ensure less than 30 clients (including guests) on each AP.
- [ ] AP density is adequate to ensure overlapping signal area.
- [ ] Radio power has been adjusted to give 10% - 15% overlapping signal area.
- [ ] DHCP lease time has been set to one day or greater for business devices.
- [ ] Outdoor service areas are covered by an outdoor grade AP or antenna (if applicable).
- [ ] Minimum wireless bit rate has been set between 12 Mbit/s to 24 Mbit/s.
- [ ] Business network traffic is assigned a higher QOS than any guest traffic.

Common Errors

The following are the most common errors seen in Wi-Fi installations.

- **Inadequate AP coverage indoors** (not enough AP's for square footage, or due to blockage)
    - Kitchen and Office are the most common areas that are inadequately or not covered.
    - Back Stairwell was used by servers to move from upstairs to downstairs but had no coverage.
    - Only outdoor patio covered by Wi-Fi, because "tablets were only going to be used outdoors." Servers come inside for drinks, food pickup, discussions with manager, close out, etc.
    - Some dining rooms covered and not others. Often installations are hoping for bleed over of Wi-Fi from adjoining rooms. Ensure that there is at minimum, one per 1600 sq ft.
    - Basement area of a restaurant where network was based.
- **Improperly mounted Indoor AP**
    - Outdoor AP mounted upside down, causing water damage to the AP
    - AP installed behind TV, causing distortion and reduction of signal
    - AP installed at ground level rather than 10-15' above ground
    - AP installed above 15'
    - Indoor AP installed wall mounted when best practices due to RF pattern is ceiling mount.
    - Indoor AP's mounted above ceiling tiles. No line of sight and signal loss.
- **No AP installed outdoors**
    - when patio requires it because of outdoor usage
    - Bleed over from indoors is NEVER adequate
- **Improperly mounted outdoor AP**
    - Outdoor AP mounted on a metal menu board, causing signal distortion. AP was unusable until moved to a nearby wall.
    - Outdoor AP was mounted on the roof (25' high), behind the wall. No line of sight and too high.
    - Outdoor AP mounted underneath metal canopy.
    - Indoor AP's mounted outdoors in NEMA enclosure. Always use outdoor rated AP for outdoors.
    - Usage areas with no direct line of sight to access point.

Reference Documentation

Refer to the documents below for additional information.

- Apple Recommended settings for Wi-Fi routers and access points
- Channel Planning Best Practices
- Fast Transition Roaming
- FlexConnect
- Minimum Bitrate Settings
- Multi-SSID Deployment Consideration
- Optimized Wi-Fi Connectivity and Prioritized Business Apps
- Disable Ruckus Multicast to Unicast Conversion