

AP Co-Channel Interference and High Density Troubleshooting

—"More is Less": Mitigating Co-Channel Interference in High-Density Environments

1 Introduction

In campus wireless network deployments, a common paradox is: the more APs deployed, the slower the network becomes. The root cause of this phenomenon is often Co-Channel Interference (CCI). When multiple APs use the same channel, signals compete for airtime resources, leading to data collisions, skyrocketing retransmissions, and plummeting throughput.

This guide focuses on the identification and resolution of co-channel interference. Leveraging the Wi-Fi Scan capability and RRM (Radio Resource Management) mechanisms of the Asterfusion OpenWiFi Controller, it helps engineers automatically detect and optimize co-channel interference without relying on manual channel assignment.

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Figure 1 OpenWiFi Controller Dashboard

2 Comparison of Co-Channel Interference Characteristics: 2.4GHz vs. 5GHz

2.1 The 2.4GHz Band: Naturally Congested

The 2.4GHz band has only 3 non-overlapping channels. Additionally, a large number of non-Wi-Fi devices (microwave ovens, Bluetooth devices, wireless mice) also operate in this band. Therefore, 2.4GHz is inherently a high-interference environment. Co-channel interference is the norm rather than the exception in this band.

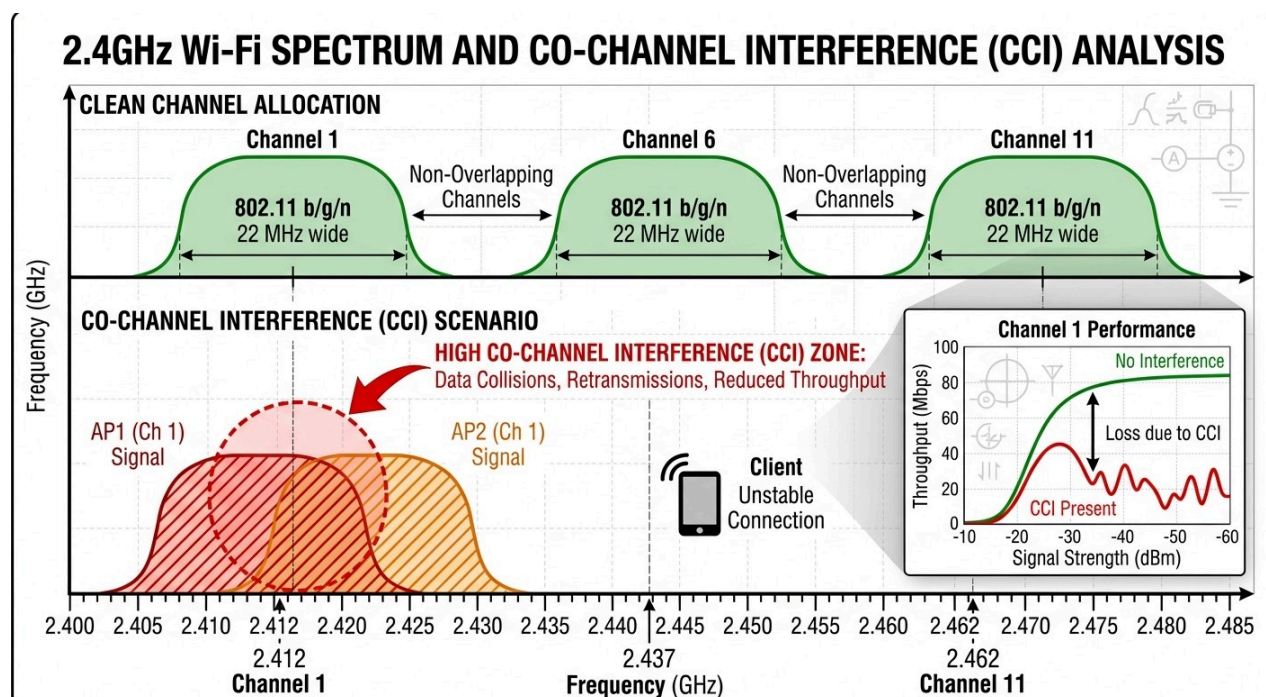


Figure 2 2.4G channel

Typical manifestations of co-channel interference in the 2.4GHz band include:

- Channel utilization persistently above 70%
- Noise floor higher than -85dBm
- Frequent client disconnections or unstable data rates

For 2.4GHz, the troubleshooting strategy should focus on "avoidance" rather than "optimization." This means guiding high-bandwidth traffic to the 5GHz band whenever possible, while strictly controlling the transmit power and deployment density of 2.4GHz APs.

2.2 The 5GHz Band: The "Invisible Killer" Often Overlooked

The 5GHz band has significantly more channel resources and wider channel spacing. Theoretically, co-channel interference should be less likely. However, in real-world deployments, the following scenarios can still cause severe 5GHz co-channel interference:

- In large-scale deployments, the number of APs exceeds the number of available channels, forcing channel reuse
- Non-Wi-Fi devices such as wireless screen-sharing devices and wireless cameras occupy the 5.8GHz band
- Poor 5GHz channel planning for adjacent APs, leading to high-signal-strength channel overlap
- Client terminals concentrate on specific channels, causing local channel overload

The typical manifestation of 5GHz co-channel interference is: the client signal strength appears good, but the user experience is extremely poor. This is because 5GHz co-channel interference manifests more as "channel congestion" rather than "signal attenuation."

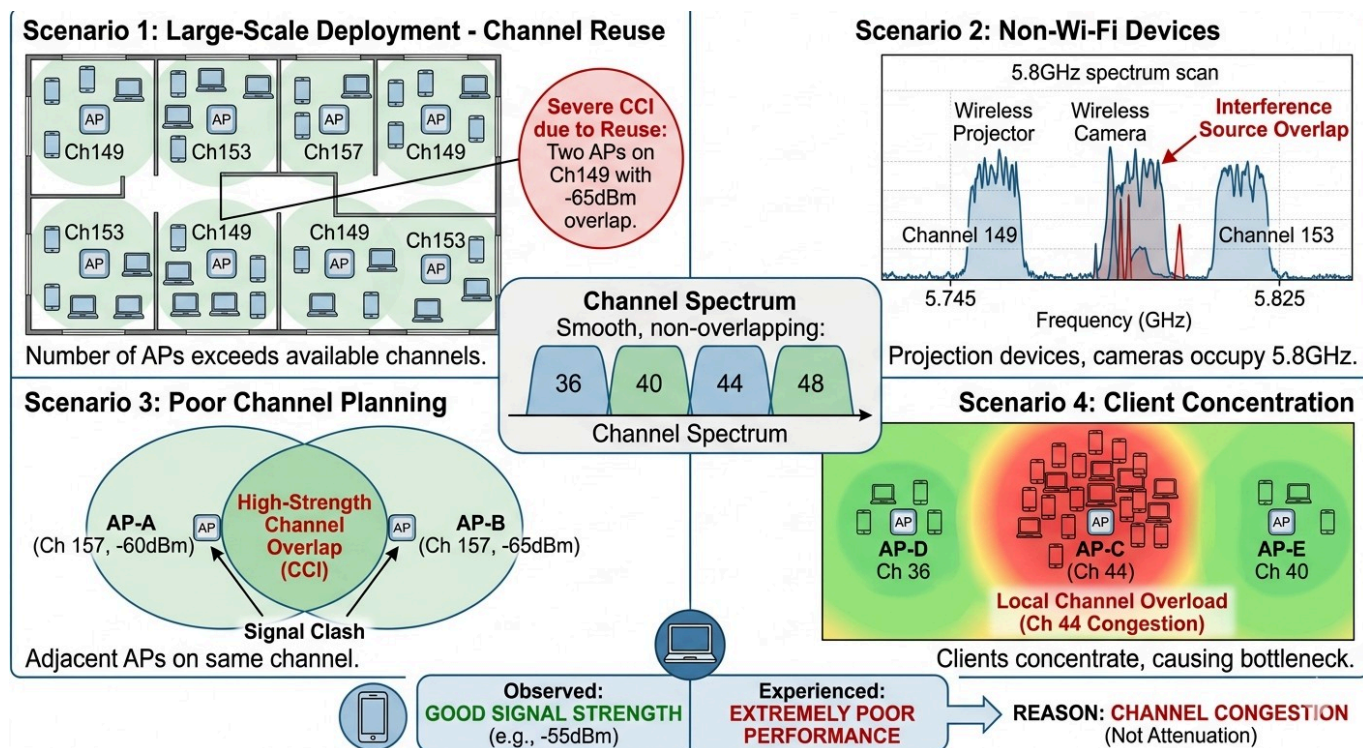


Figure 3 5G Channel

3 Methods for Identifying Co-Channel Interference

3.1 Dimension One Identifying Channel Congestion via Wi-Fi Scan

Navigation Path: Controller -> [Devices] -> [AP] -> Select Target AP -> [Details] -> [Wi-Fi Scan]

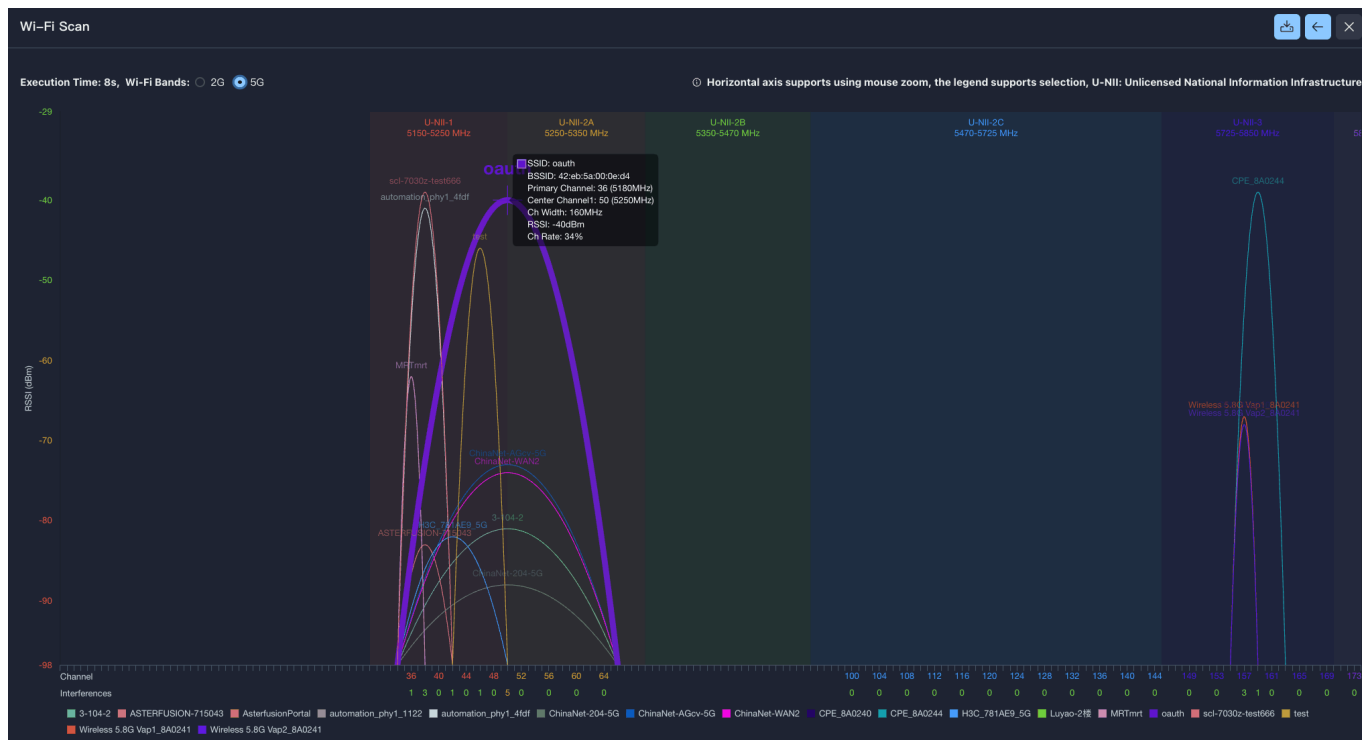


Figure 4 5G Scan

After initiating a scan, focus on the following metrics:

- **Channel Utilization:** Should normally be below 60%. A value exceeding 70% is a warning; above 80% indicates severe channel overload.
- **Noise Floor:** Should normally be below -95dBm. A value higher than -85dBm indicates the presence of interference.
- **Neighbor Count:** The number of neighboring APs on the same channel. If there are more than 3 APs with signal strength higher than -70dBm, it indicates co-channel interference.

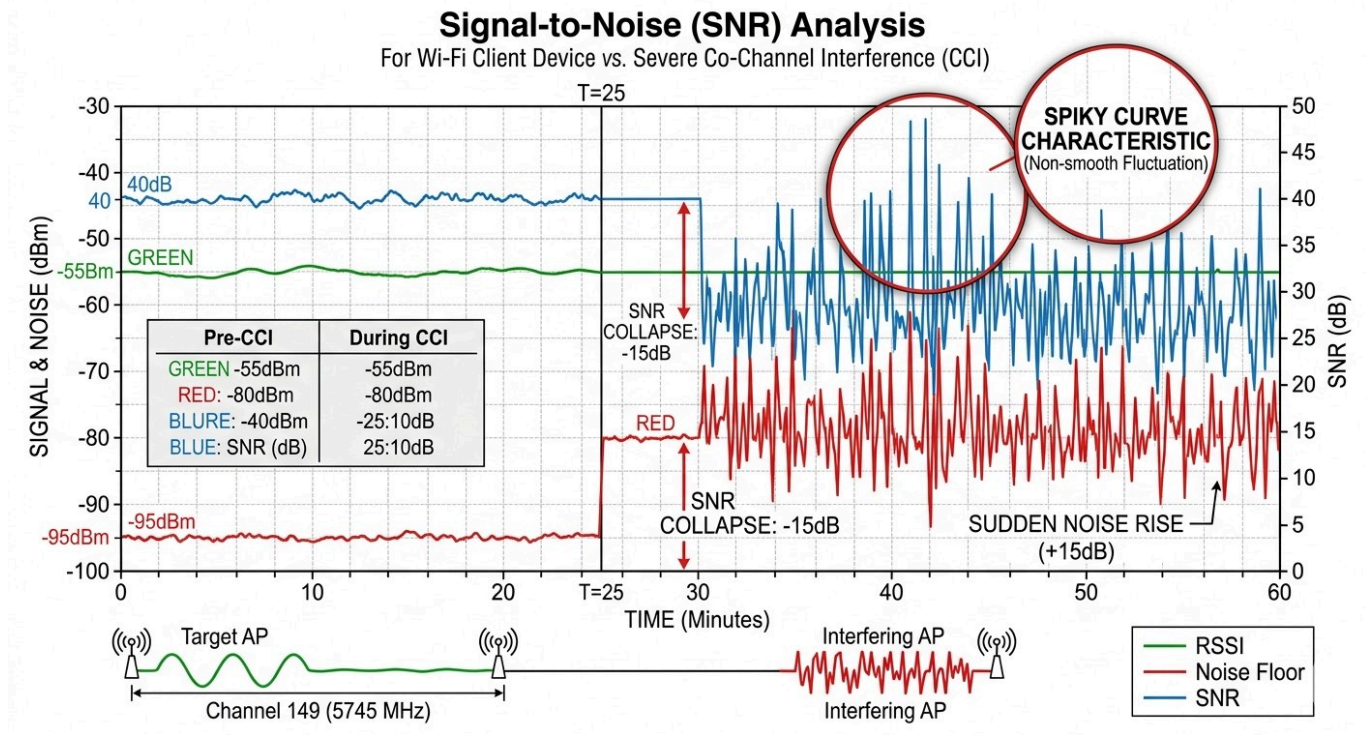


Figure 5 5G CCI

3.2 Assessing Interference Impact via Client SNR Trend

Navigation Path: Controller -> [Client] -> Select Target Client -> [SNR Trend]



Figure 6 Client SNR

When co-channel interference occurs, the client's SNR curve will exhibit the following

characteristics:

- RSSI remains stable, but noise suddenly rises
- SNR drops sharply, typically by more than 10dB
- The curve shape appears "spiky" rather than showing smooth fluctuations

4 Strategies for Resolving Co-Channel Interference

4.1 Specialized Strategies for the 5GHz Band

Given the naturally congested nature of the 2.4GHz band, this guide focuses on strategies for resolving co-channel interference in the 5GHz band.

Strategy 1: Channel Avoidance

For co-channel interference in the 5.8GHz band, common interference sources include wireless screen-sharing devices and wireless cameras. These devices typically occupy frequencies around Channel 149.

Action: In [Configuration] -> [Wi-Fi Configuration] -> [Radio Configuration], manually fix the affected 5GHz AP to a less congested channel, such as Channel 157, 159, or 161. For the 5.1GHz band, channels like 52 or 56 can be selected, avoiding channels subject to dynamic radar signal frequency hopping.

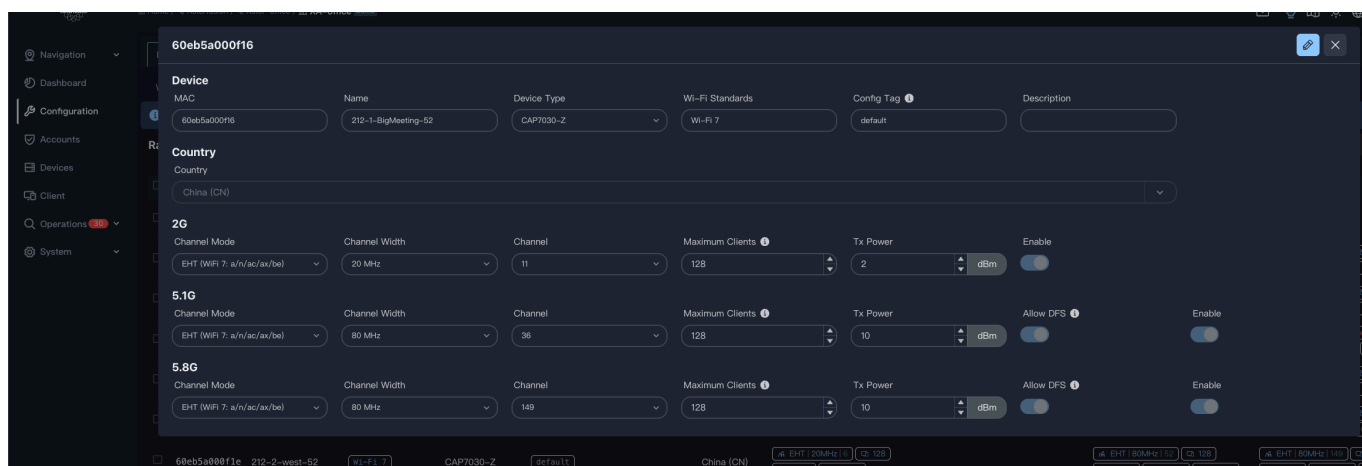
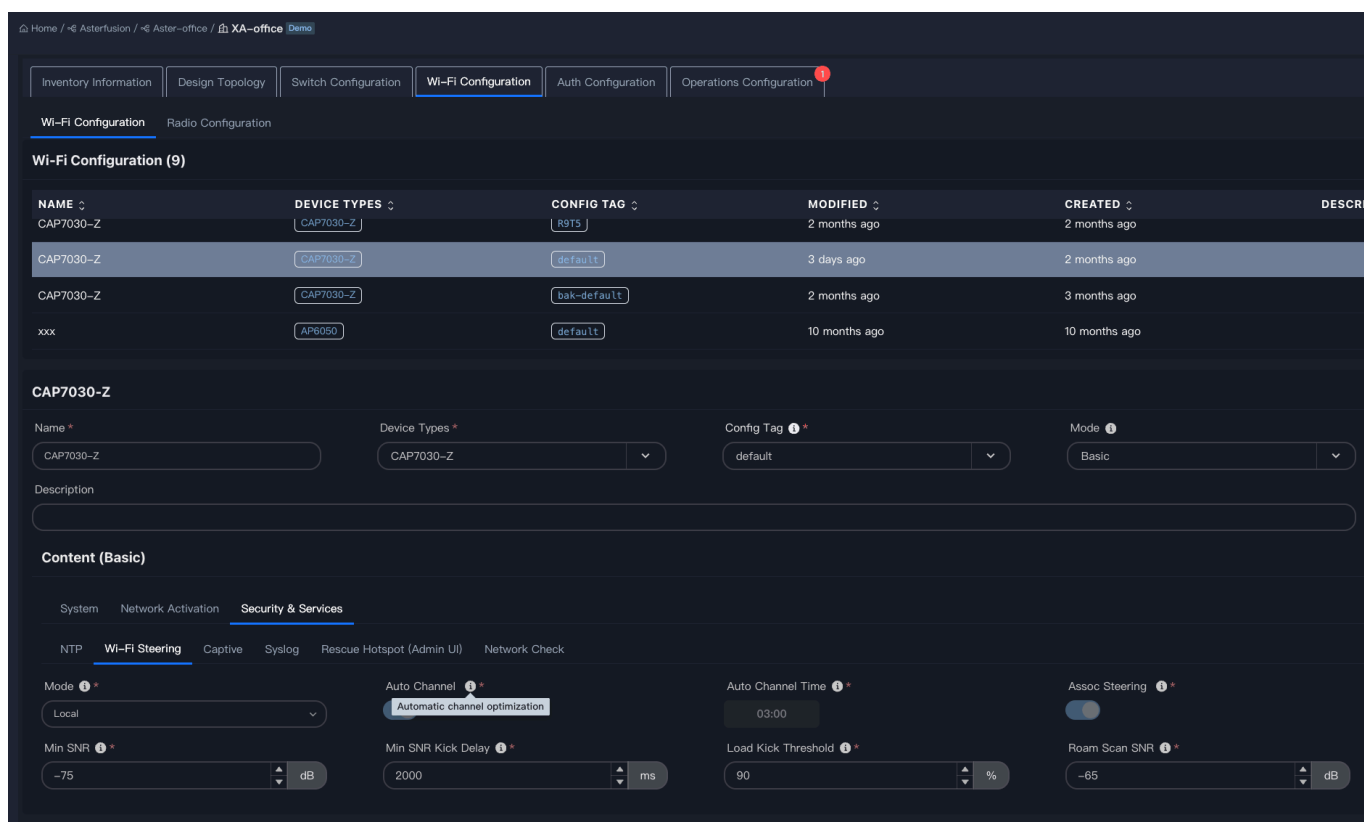


Figure 7 Radio Config

Strategy 2: RRM Automatic Channel Optimization

Navigation Path: Controller -> [Configuration] -> [Wi-Fi Configuration] -> [Security & Services] -> [Wi-Fi Steering], enable Advanced Mode.

Once enabled, RRM will automatically select the optimal channel for each AP based on environmental data collected by Wi-Fi Scan. The system comprehensively considers factors such as channel utilization, noise floor, and neighboring AP density, avoiding the inefficiency and error-proneness of manual channel assignment.



The screenshot displays the Asterfusion web interface for Wi-Fi Configuration. The top navigation bar includes tabs for Inventory Information, Design Topology, Switch Configuration, Wi-Fi Configuration (selected), Auth Configuration, and Operations Configuration. Below the navigation bar, the 'Wi-Fi Configuration (9)' section shows a table of configured devices. The table has columns for NAME, DEVICE TYPES, CONFIG TAG, MODIFIED, CREATED, and DESCRIPTION. The first three rows show devices named CAP7030-Z with various configurations. Below the table, the 'CAP7030-Z' configuration details are shown, including fields for Name, Device Types, Config Tag, and Mode. The 'Content (Basic)' section is expanded, showing the 'Security & Services' tab. Under 'Wi-Fi Steering', the 'Auto Channel' option is selected, and the 'Auto Channel Time' is set to 03:00. Other settings like Min SNR, Min SNR Kick Delay, Load Kick Threshold, and Roam Scan SNR are also visible.

NAME	DEVICE TYPES	CONFIG TAG	MODIFIED	CREATED	DESCRIPTION
CAP7030-Z	CAP7030-Z	RST5	2 months ago	2 months ago	
CAP7030-Z	CAP7030-Z	default	3 days ago	2 months ago	
CAP7030-Z	CAP7030-Z	bak-default	2 months ago	3 months ago	
xxx	AP6050	default	10 months ago	10 months ago	

CAP7030-Z Configuration Details:

- Name: CAP7030-Z
- Device Types: CAP7030-Z
- Config Tag: default
- Mode: Basic

Content (Basic) - Security & Services:

- Wi-Fi Steering:
 - Mode: Local
 - Auto Channel: Automatic channel optimization
 - Auto Channel Time: 03:00
 - Assoc Steering: Enabled
 - Min SNR: -75 dB
 - Min SNR Kick Delay: 2000 ms
 - Load Kick Threshold: 90 %
 - Roam Scan SNR: -65 dB

Figure 8 Channel Auto Config

4.2 Specialized Strategies for the 2.4GHz Band

Since the 2.4GHz band has only 3 non-overlapping channels, co-channel interference is difficult to eliminate completely. The following auxiliary strategies are recommended:

Strategy 1: Reduce 2.4GHz Transmit Power

In [Radio Configuration], reduce the 2.4GHz transmit power to 10dBm or lower. This shrinks the 2.4GHz coverage radius, reduces signal overlap between adjacent APs, and thus lowers the

probability of co-channel interference.

Strategy 2: Disable 2.4GHz Low Basic Rates

In the SSID advanced settings, disable low data rates on 2.4GHz, such as 1Mbps and 2Mbps. This effectively limits the 2.4GHz coverage range, preventing distant, weak-signal clients from associating with the 2.4GHz band and forcing them to connect to the 5GHz band.

 This configuration option is only available in the Advanced WiFi Configuration Template. It is disabled by default in the Basic Configuration Template.

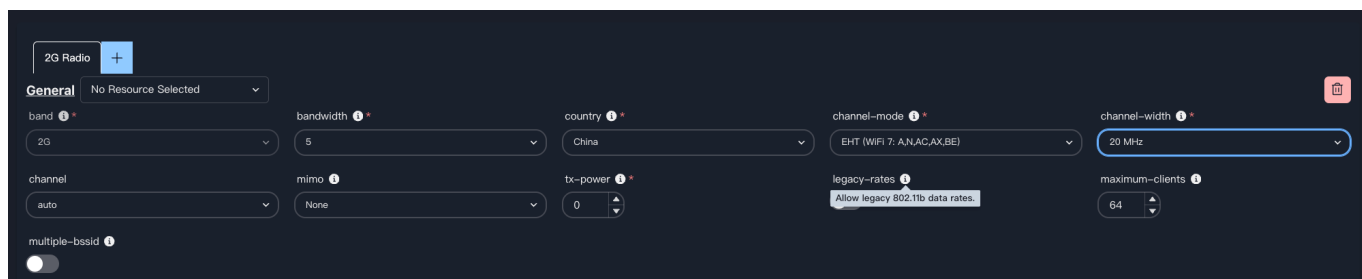


Figure 9 2G Config

Strategy 3: Steer Clients to 5GHz

Combining "Strategy 1" and "Strategy 2," in a dual-band, same-SSID deployment scenario, leverage the signal advantage of the 5GHz band to encourage clients to associate preferentially with 5GHz, thereby alleviating the load on the 2.4GHz band.

5 Final Troubleshooting Checklist

Check Phase	Controller Navigation Path	Normal Reference Value	Recommended Action for Anomaly
Channel Utilization Check	[Devices]->[AP]->[Wi-Fi Scan]	CH RATE below 60%	Enable RRM or Channel Planning to adjust channel
Neighbor AP Density Check	[Devices]->[AP]->[Wi-Fi Scan]	Fewer than 3 APs on same channel	Reassign APs to other channels
Noise Floor Check	[Client]->[SNR Trend]	Noise below -95dBm	Investigate non-Wi-Fi interference sources; change channel
Client SNR Check	[Client]->[SNR Trend]	SNR above 30dB	Check signal quality between AP and client
RRM Policy Effectiveness Check	[Configuration] -> [Wi-Fi Configuration] -> [Security & Services] -> [Wi-Fi Steering]	Status normal, auto-avoidance active	Reconfigure or restart RRM policy

6 Summary and Recommendations

Co-channel interference is the most common performance bottleneck in high-density AP deployments, but its identification and resolution are not complex. The key is to:

- **Rely on the controller's automation capabilities:** Use RRM and Channel Planning features to avoid manual channel assignment.
- **Differentiate interference characteristics between 2.4GHz and 5GHz:** For 2.4GHz, the primary strategy is "avoidance"; for 5GHz, the primary strategy is "optimization."
- **Establish a closed-loop verification mechanism:** Use Wi-Fi Scan to identify problems, use RRM and Channel Planning to resolve them, and use client SNR trends to verify the effectiveness of the solution.

By following this methodology, co-channel interference can be effectively mitigated even in high-density AP deployment scenarios, ensuring the stability of the wireless network and the quality of the user experience.