Grandstream Networks, Inc.

GWN76xx Series

WiFi Troubleshooting Guide

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WIFI PERFORMANCE

Signal Strength issue

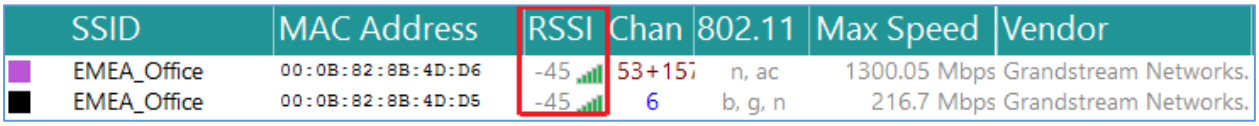
Symptoms:

- I can connect to my WiFi, but my WiFi speed is much slower than supposed to be!
- Signal level indicator shows a weak reception . WiFi scan tools can help measuring signal strength (**Ex:** WiFi Analyzer for Android™).

Troubleshooting

For diagnosis, users need to verify the signal strength on both directions (AP to Client, and Client to AP).

1) Check the AP signal strength detected at the client station.
   ⇨ You can run a protocol analyzer, Ex: Acrylic, for PC.



SSID	MAC Address	RSSI	Chan	802.11	Max Speed	Vendor
EMEA_Office	00:0B:82:8B:4D:D6	-45	53+157	n, ac	1300.05 Mbps	Grandstream Networks.
EMEA_Office	00:0B:82:8B:4D:D5	-45	6	b, g, n	216.7 Mbps	Grandstream Networks.

Figure 1: RSSI Values

***RSSI (Received Signal Strength Indicator)** is a term used to measure the relative quality of a received signal at a wireless device. Below are some reference values:

Table 1: RSSI Reference Values

Level (dBm)	Description
-30	Excellent
-67	Good
Between -80 and -70	Acceptable

2) Check the client's signal strength detected at the AP.
   ⇨ View client's signal strength detected by the AP on GWN web GUI under **Access Point→Edit→User**, and check user RSSI level. For GWN, it's 0-60, and the larger the better.

Solution

1) In case of multiple AP deployment, we recommend adding more APs for more coverage.
2) In case of single AP deployment, make sure to verify that TX power is set to **High** which is the default.

GWN Settings

Under the menu **Access Point→Edit→Configuration**, users can:

- Increase the Radio Power to have more coverage around the area.

- Set the Channel Width (Lower channel width usually lead to better coverage, but usually device with auto-negotiate to lower width when signal is weak).

Interference Issue

Because WiFi is using unlicensed bands, Interference can be a serious issue which affects the signal transmission quality and performance. we can distinguish two sources of interference:

Non-WiFi Transmitters

For example, some HDMI wireless transmitters utilize almost 100% of the 2.4G channel, which makes it unusable.

Troubleshooting

User detects low performance and can confirm the existence of a neighboring interference source using spectrum analyzer.

Solution

1) Check if possible to remove the offending device or change its location.
2) Try to change your AP operating channel(s) (5Ghz band is cleaner and less vulnerable to interference).

Other WiFi Networks

WiFi operates on two standard bands (2.4Ghz and 5Ghz), APs using the 2.4Ghs band are more prone to co-channel interference when multiple access points are using the same channel at the same time.

Troubleshooting

Run a WiFi Analyzer (Ex: Acrylic), on PC at the problem location to find the list of APs using same channels.

SSID	MAC Address	RSSI	Chan	802.11	Max Speed	Vendor
GWN8B4E24	00:0B:82:8B:5D:65	-45	6	b, g, n, ac	144.4 Mbps	Grandstream Networks.
GS_Training	06:0B:82:8B:4D:D5	-45	6	b, g, n	216.7 Mbps	
EMEA_Office	00:0B:82:8B:4D:D5	-45	6	b, g, n	216.7 Mbps	Grandstream Networks.

Figure 2: List of Channels Used By APs

Solution

1) Rearrange WiFi channels to use less crowded channels (better use 5Ghz band if supported).
2) Reduce the transmission power of each AP in high density deployment.

GWN Settings

From the web GUI menu **Access Point→Edit→Configuration**. Users can:

- Reduce the Radio Power.

- Reduce channel width (because large channels have more chance of interference.)
- Set Channel selection to auto. This way, the AP will choose the least crowded channel when wireless interface boots up.
- Disable Short Guard Interval. SGI should be used only in good and clean RF (*Radio*) environment.

Congestion Issue

WiFi has no congestion detection, and its mechanism is designed for avoiding collisions. That is when a unit hears a packet exceeding its strength threshold on same transmission channel, even if it doesn't belong to its connecting SSID, this client will always wait until it detects a clear air interface to transmit data. And if the wireless network is crowded then this waiting time can become long.

Troubleshooting

Users could compare ping results between wired and wireless parts of a network. And if the ping on the wired network is good then frequent ping loss or long response time could indicate that the wireless part of the network is suffering from congestion and some adjustments are required to alleviate the problem.

Solution

Users can reduce the density of the devices on one single transmission channel with few ways:

1) Enable band steering, this way the access point will send dual-band clients *(WiFi clients that support both 2.4Ghz and 5Ghz frequencies)* to connect via 5Gh channels which are less congested.

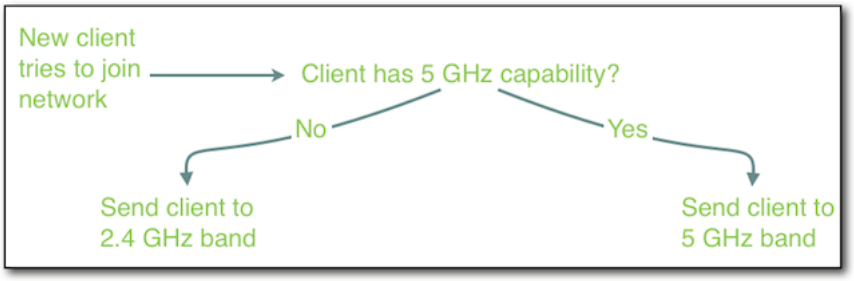


Figure 3: Band Steering

2) Increase the number of APs in the area and set them to none overlapping (i.e. channels *1, 6 & 11*).
3) Limit the number of clients that are allowed to connect to one access point (if supported on the AP).

GWN Settings

The above suggestions can be activated from GWN as follow:

1) Enable band steering under **Access Point→Edit→Configuration→Band steering**.
2) Users can limit the number of stations that can connect to one AP under **Network Group→Edit→WiFi→ Wireless Client Limit.**

Low Data Rates Issue

Since its beginning, the WiFi standard was developed over the years to support more speed with the following amendments:

Table 2: Data Rates for WiFi Standards

WiFi Standard	Average data rate
802.11 (legacy)	1 Mbps
802.11b	11 Mbps
802.11g	54 Mbps
802.11n	600 Mbps
802.11ac	1300 Mbps

Legacy protocol devices, or low data rate devices take longer time when transmitting same amount of data. Also, when the access point supports legacy clients, it will need to broadcast signaling beacon frames on low speed protocol *(ex: 802.11b)* and lower the whole network performance.

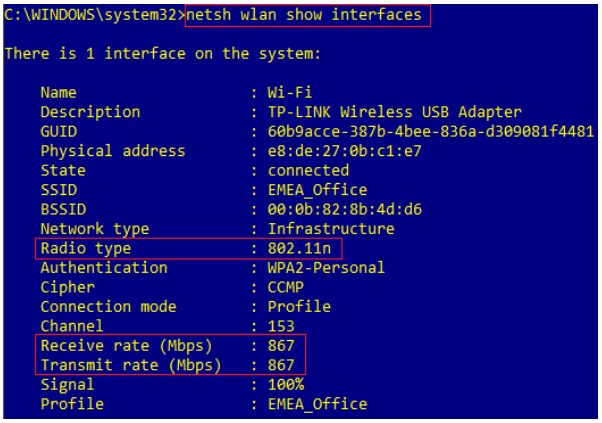
Troubleshooting

To avoid this problem is more like to optimize your network environment other than Troubleshooting the problem.

You can probably use a packet sniffer to check negotiated data rates or you can use the following commands:

Windows command: *netsh wlan show interfaces*

Linux command: *iwconfig*



Solution

1) Disable legacy protocols like 802.11b (disabled by default on GWN).
2) Disable low data rates and select higher standards.

GWN Settings

User can select which norm to enable on the GWN as follow:

1) Make sure the option **Access Point→Edit→Configuration→Allow Legacy devices (802.11b)** is disabled (default setting).
2) Users can manage Upstream and Downstream bandwidth:
   - Per SSID under **Network Group→Edit→WiFi→Upstream Rate/Downstream Rate**
   - Per client under **Client→Edit→Bandwidth Rules**.

WIFI CONNECTION PROBLEM

Phenomenon:

I cannot connect to WiFi, there is an exclamation mark on my WiFi icon  , or I am connected to my WiFi, but cannot get onto the internet or a local network resource such as a local mail server.

Cannot Connect to WiFi

This issue is usually a less common in connection problem but it can be due to one of the following problems.

- Interference / signal strength. ➔ check sections ***[Interference Issue]*** and ***[Signal Strength issue]***
- Misconfiguration.
- Security settings / wrong credential. ➔ double check the authentication credentials.
- Firmware problem. ➔ make sure to always upgrade to latest fw version.

Cannot Connect to Network Resources

This issue usually happens with your wired network simultaneously, and is not related with your WiFi network. We recommend that you troubleshoot your wired network first!

- Confirm that there are no client IP issues (DHCP problem, IP pool depletion) (most common)
- DNS issues (DNS server not reachable or not responding).
- Routing problem (Gateway is down).

ANALYSIS TOOLS

Packet Capture

GWN comes with built-in packet capture tool which can be accessed under **Maintenance→Debug→Capture**, and users will need to plug a USB device to one of the USB ports on the backside of GWN AP. Using this menu you can start, stop and list the captured files along with the possibility to filter the captured traffic.

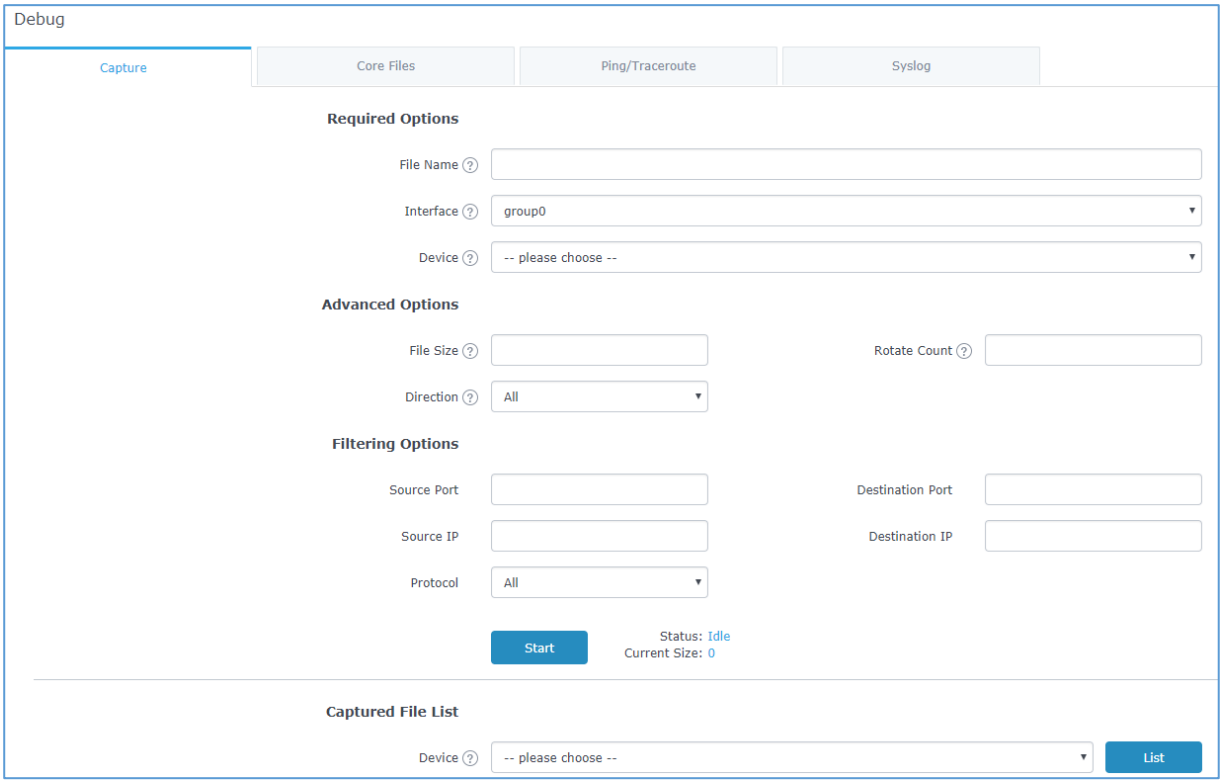


Figure 4: Maintenance→Debug→Capture

Traceroute/Ping

GWN has built-in ping and traceroute utilities to verify network connectivity, this can be accessed under **Maintenance→Debug→Ping/Traceroute.**

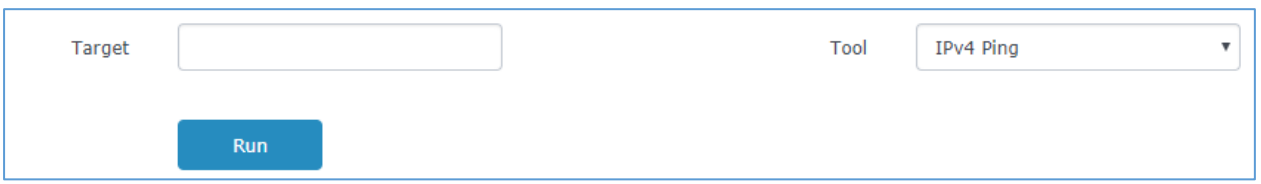


Figure 5: Maintenance→Debug→Ping/Traceroute

Syslog

Please collect syslog for development/product engineer to analyze. You can use one of the two following methods:

Syslog on Web GUI

Users can get updated syslog messages from GWN76xx Web GUI under **System Settings→Debug→Syslog**. Syslog messages are by default refreshed each 15 second.

Using External Syslog server

Another option would be to point the GWN access point to send syslog messages to your syslog server, to do so you can simply point it under the menu **Maintenance→Syslog**.

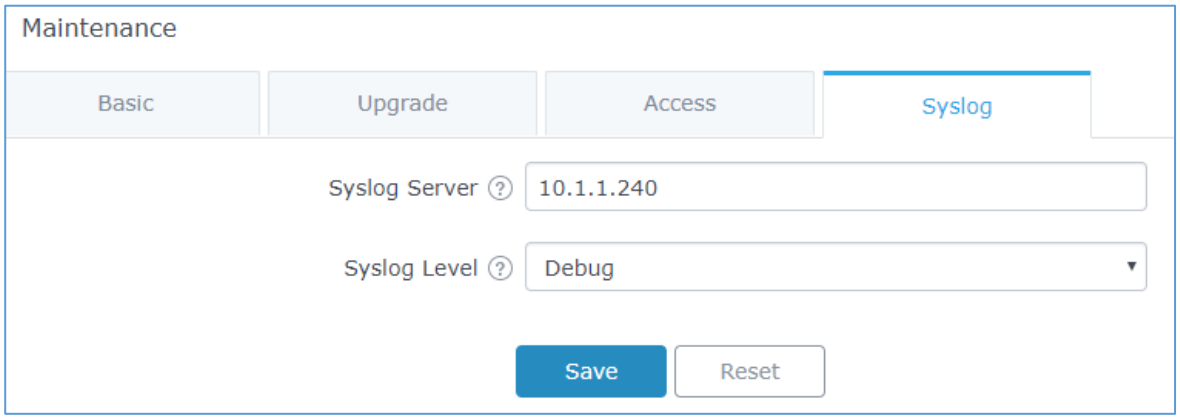


Figure 6: Maintenance → Syslog

GWN core dump file

In most of the cases, when a system crash happens on GWN AP. A core dump will be generated, and its naming rule is ***core.$binary.$mac.$model.$fw_version.$hash.gz***.

$binary part will usually tell the crashed process.

Please help collect and send this file under **System Settings→Debug→Core Files** along with syslog to development/product engineer for analysis purposes.

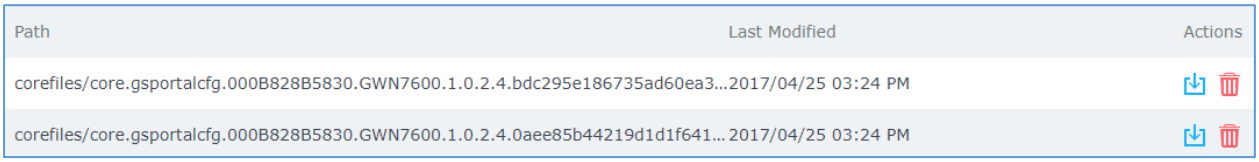


Figure 7: Core Dump Files

Protocol Analyzers

Acrylic WiFi Pro

This tool will help you to capture and analysis your network environment.

Make sure you enable the channel hooping for both 2.4G and 5G and capture long enough for your environment analysis. You can also set it to capture on designated channel to only capture continues packet on that channel.

Saved pcap file can be imported by acrylic pro. If you need help with Troubleshooting, make sure you saved the pcap file, so you can pass to others to review.

Below is a reference guide for Acrylic WiFi sniffer:

https://www.acrylicwifi.com/en/wlan-software/wifi-analyzer-acrylic-professional/wifi-network-scanner-windows/

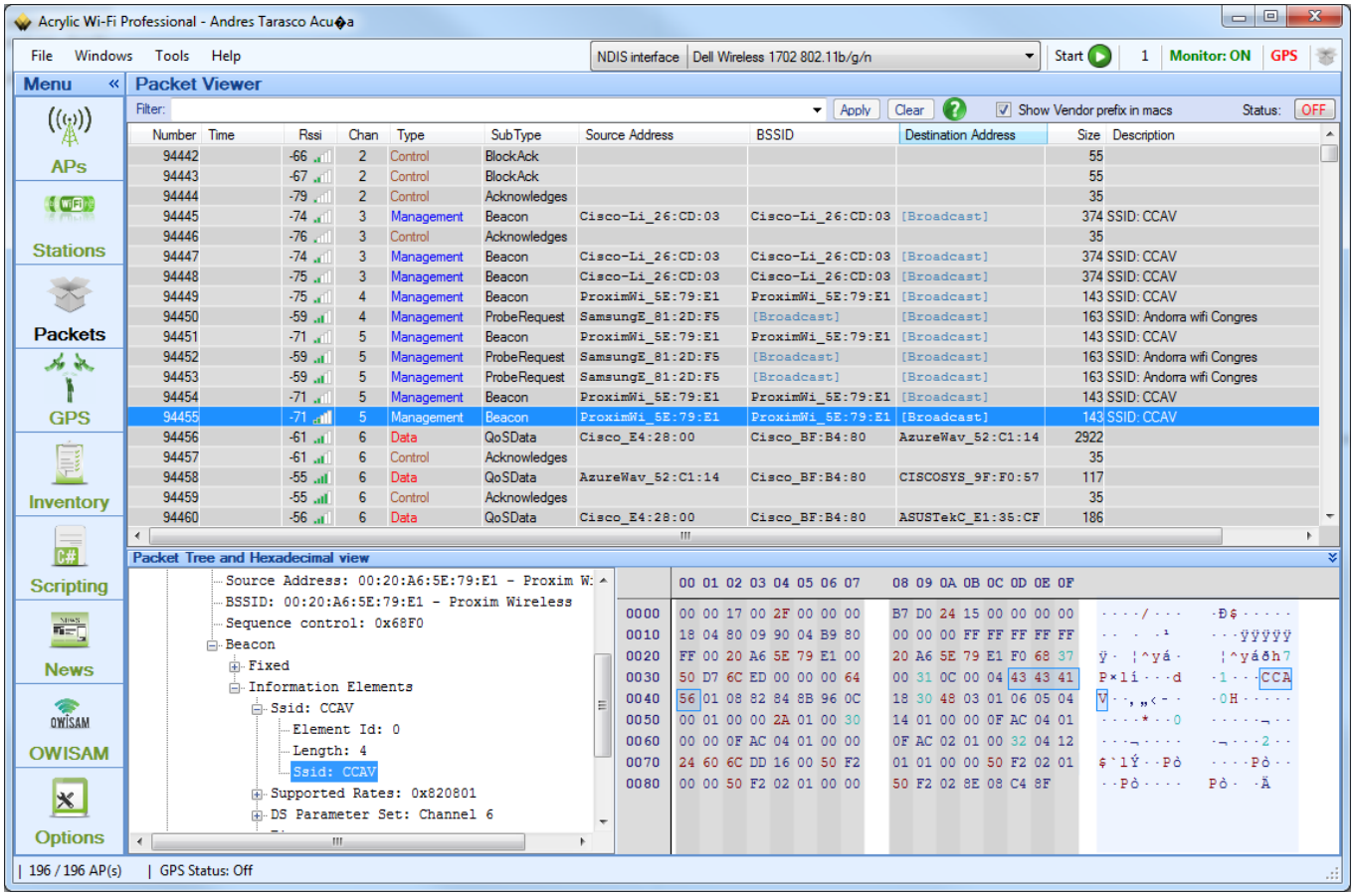


Figure 8: Acrylic WiFi Pro for Network Environement Analysis

Wireshark

Wireshark is the well know packet sniffer which helps troubleshoot network issues in depth, by checking in details the traffic between the network components, below is a list of useful filters that can be used for WiFi:

Table 3: Wireshark WiFi Filters

Frame type	Filter
Management frames	wlan.fc.type eq 0
Control frames	wlan.fc.type eq 1
Data frames	wlan.fc.type eq 2
Frame subtype	**Filter**
Association request	wlan.fc.type_subtype eq 0
Association response	wlan.fc.type_subtype eq 1
Probe request	wlan.fc.type_subtype eq 4
Probe response	wlan.fc.type_subtype eq 5
Beacon	wlan.fc.type_subtype eq 8
Authentication	wlan.fc.type_subtype eq 11
De-authentication	wlan.fc.type_subtype eq 12

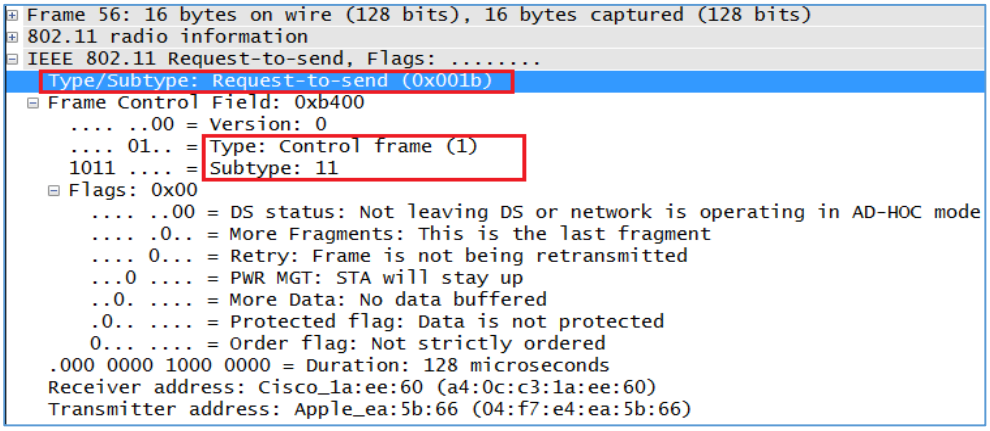


Figure 9: Wireshark Wifi Trafic

RF Analyzers

Suggested Device: http://nutsaboutnets.com/models/ WiFi Combo for $270 USD

Reference

WLAN channels: https://en.wikipedia.org/wiki/List_of_WLAN_channels
Wireshark 802.11 filters: wireshark_802.11_filters_-_reference_sheet