

WiFi Analytics Configuration Guide

Introduction

WiFi Analytics is a built-in diagnostic feature of the CONTROL ACS platform that evaluates the quality of a CPE's WiFi network. After triggering a neighboring-WiFi scan from the device's Diagnostics tab, the engine collects radio, client, and neighbor data from the CPE and produces a structured score report.

The evaluation covers six quality factors: **Signal**, **Noise**, **SNR**, **Interference**, **Standard**, and **Speed**. Each factor is scored on a scale of 1-10 and then combined into a single **Overall Score** using configurable weights. This lets you tune the scoring model to reflect the conditions of your own network — for example, increasing the Interference weight for dense urban deployments.

The engine supports both **TR-181** and **TR-098** CPEs. For standard TR-181 devices with sequential radio indexes, the engine can auto-discover the radio configuration without any additional setup. For TR-098 or vendor-specific devices with non-standard parameter paths, an explicit **Service** configuration is required to supply the correct path templates and JSON key names.

Prerequisites

Before configuring WiFi Analytics, ensure the following conditions are met:

Requirement	Details
Managed CPE	The device must be connected to CONTROL and actively reporting via TR-069/CWMP.
WiFi parameters in device Type	The Type profile must include parameters for periodic collection: Channel, OperatingFrequencyBand, AssociatedDevice tables, Noise, TX power, and supported standards.
ServiceType 23 present	The "CWMP WiFi Neighbor test" ServiceType must exist in CONTROL Settings. This is included in the default platform fixtures and should already be present.



Note: If ServiceType 23 is missing, contact your platform administrator to load the WiFi Analytics fixtures.

Configuration Steps

Step 1: Create a Service for WiFi Analytics

A **Service** instance of ServiceType 23 holds all the configuration that tells the engine how to map radio and client parameters for a specific device model.

1. Navigate to **Settings > Services > Add**
2. Set the **Service Type** field to `CWMP WIFI Neighbor test` (ServiceType 23)
3. Give it a descriptive name, for example: `WiFi Diagnostic Score - Model XYZ`
4. Check **Active** and **Public**
5. Save the Service

The screenshot shows the Zequence admin portal interface. The main content area is titled 'CHANGE SERVICE' and displays the configuration for a service named 'WiFi Diagnostic Score ZTE v1' (ID: 2). The service was created on April 14, 2026, at 04:48:18.416 PM and last changed on April 16, 2026, at 04:01:49.125 PM. The configuration is shown in the 'General settings' tab, which includes the following fields and options:

- Name:** WiFi Diagnostic Score ZTE v1
- ID:** 2
- Short-name / code:** wifi_diag_zte_v1 (Note: To be used in reports, charts and whenever a short-name or description is required.)
- Organization:** Root
- Type:** CWMP WIFI Neighbor test
- Is active:**
- Is public:** (Public services will be available on sub-organizations too.)
- Log details:** (When this option is set the system will include additional details on the service transaction logs.)
- No logs:** (This option will disable the transaction logs for all operations related with this service. Use with care.)
- Description:** (Empty text box)
- Last change:** April 16, 2026, 4:01 p.m.

At the bottom of the configuration form, there are buttons for 'Save', 'Delete', 'Close', 'Save and close', and 'Save and add another'.

After saving, the Service will display four parameter groups:

Parameter Group	Purpose
2.4 GHz Band Configuration	Radio and client configuration for the 2.4 GHz band
5 GHz Band Configuration	Radio and client configuration for the 5 GHz band
6 GHz Band Configuration	Radio and client configuration for the 6 GHz band

Parameter Group	Purpose
Score Weights	Relative importance of each quality factor (must sum to 100%)

Configure only the bands that are relevant to the device model. Bands that are left disabled are excluded from scoring.

Step 2: Configure Band Parameters

Each band group (2.4 GHz, 5 GHz, 6 GHz) contains the same set of fields. Repeat this configuration for every band the device supports.

Band Enable and Index Fields

Field	Description
Enabled	Enable or disable analysis for this band. Disabled bands are ignored entirely.
Radio index	The value substituted for the <code>{i}</code> placeholder at runtime. For TR-181, this is the <code>Device.WiFi.Radio.{i}</code> object index (e.g., <code>1</code> for 2.4 GHz, <code>2</code> for 5 GHz). For TR-098, this is the <code>WLANConfiguration</code> index.
SSID indexes	Comma-separated list of SSID object indexes to read SSID-level data from.
AP indexes	Comma-separated list of AccessPoint object indexes. These are iterated when collecting connected-client data.

“ **Important:** The `{i}` placeholder is the **only** token substituted by the engine. All other numbers in path templates (e.g., `LANDevice.1`) are treated as literal strings and are never modified.

Variable Override Fields

These fields allow you to supply explicit TR-181 or TR-098 parameter paths. Leave them **blank** for standard TR-181 devices — the engine uses the correct `Device.WiFi.*` defaults automatically.

For TR-098 or vendor-specific devices, enter the full path template using `{i}` where the radio index should appear.

Field	TR-181 default (auto)	TR-098 example
Channel	<code>Device.WiFi.Radio.{i}.Channel</code>	<code>InternetGatewayDevice.LANDevice.1.WLANConfiguration.{i}.Channel</code>
Possible channels	<code>Device.WiFi.Radio.{i}.PossibleChannels</code>	<code>InternetGatewayDevice.LANDevice.1.WLANConfiguration.{i}.PossibleChannels</code>

Field	TR-181 default (auto)	TR-098 example
Radio noise	Device.WiFi.Radio.{i}.Stats.Noise	InternetGatewayDevice.LANDevice.1.WLANConfiguration.{i}.Stats.Noise
Bandwidth	Device.WiFi.Radio.{i}.CurrentOperatingChannelBandwidth	Supply vendor-specific path
Standards	Device.WiFi.Radio.{i}.OperatingStandards	InternetGatewayDevice.LANDevice.1.WLANConfiguration.{i}.Standard
TX power	Device.WiFi.Radio.{i}.TransmitPower	Supply vendor-specific path

zequence CONTROL admin portal

CHANGE SERVICE Home > Settings > Services

ipena@zequence.com org: Root

Enabled: Enable this band's analysis. Disable to skip scoring when the CPE does not operate on it.

Radio index: Number substituted for (i) in the path templates below. Example: value = 1 with template "Device.WiFi.Radio.(i).Channel" resolves to "Device.WiFi.Radio.1.Channel". For TR-098 templates such as "InternetGatewayDevice.LANDevice.1.WLANConfiguration.(i).Channel", the LANDevice.1 stays literal (you type it yourself) and only (i) is replaced. Rule: ONLY (i) is substituted; every other index in the path is literal.

SSID indexes: Comma-separated SSID indexes (e.g. 1 or 1,2,3). TR-181: indexes of Device.WiFi.SSID.(i). TR-098: usually matches the radio index since SSID is collocated inside WLANConfiguration.

AP indexes: Comma-separated indexes iterated when collecting clients; each value replaces (i) in 'Clients table path'. TR-181: AccessPoint indexes. TR-098: WLANConfiguration indexes (e.g. 1, or 1,5 for multi-SSID).

Channel variable: Override for the current channel variable. (i) is replaced by the radio index. Default: Device.WiFi.Radio.(i).Channel. TR-098: InternetGatewayDevice.LANDevice.1.WLANConfiguration.(i).Channel.

Possible channels variable: Override for the list of channels this radio may operate on. Default: Device.WiFi.Radio.(i).PossibleChannels. TR-098: InternetGatewayDevice.LANDevice.1.WLANConfiguration.(i).PossibleChannels.

Radio noise variable: Override for the radio-level noise floor; fallback when per-client noise is absent. Default: Device.WiFi.Radio.(i).Stats.Noise. Vendor example: InternetGatewayDevice.LANDevice.1.WLANConfiguration.(i).X_ALU-COM_Noise.

Bandwidth variable: Override for the read-only actual bandwidth. Default: Device.WiFi.Radio.(i).CurrentOperatingChannelBandwidth. TR-098: InternetGatewayDevice.LANDevice.1.WLANConfiguration.(i).CurrentOperatingChannelBandwidth.

bandwidth variable: Override for the writeable (configured) bandwidth used in computation. Default: Device.WiFi.Radio.(i).CurrentOperatingChannelBandwidth. TR-098: InternetGatewayDevice.LANDevice.1.WLANConfiguration.(i).CurrentOperatingChannelBandwidth.

Save Delete X Close Save and close Save and add another

Client Field Override Fields

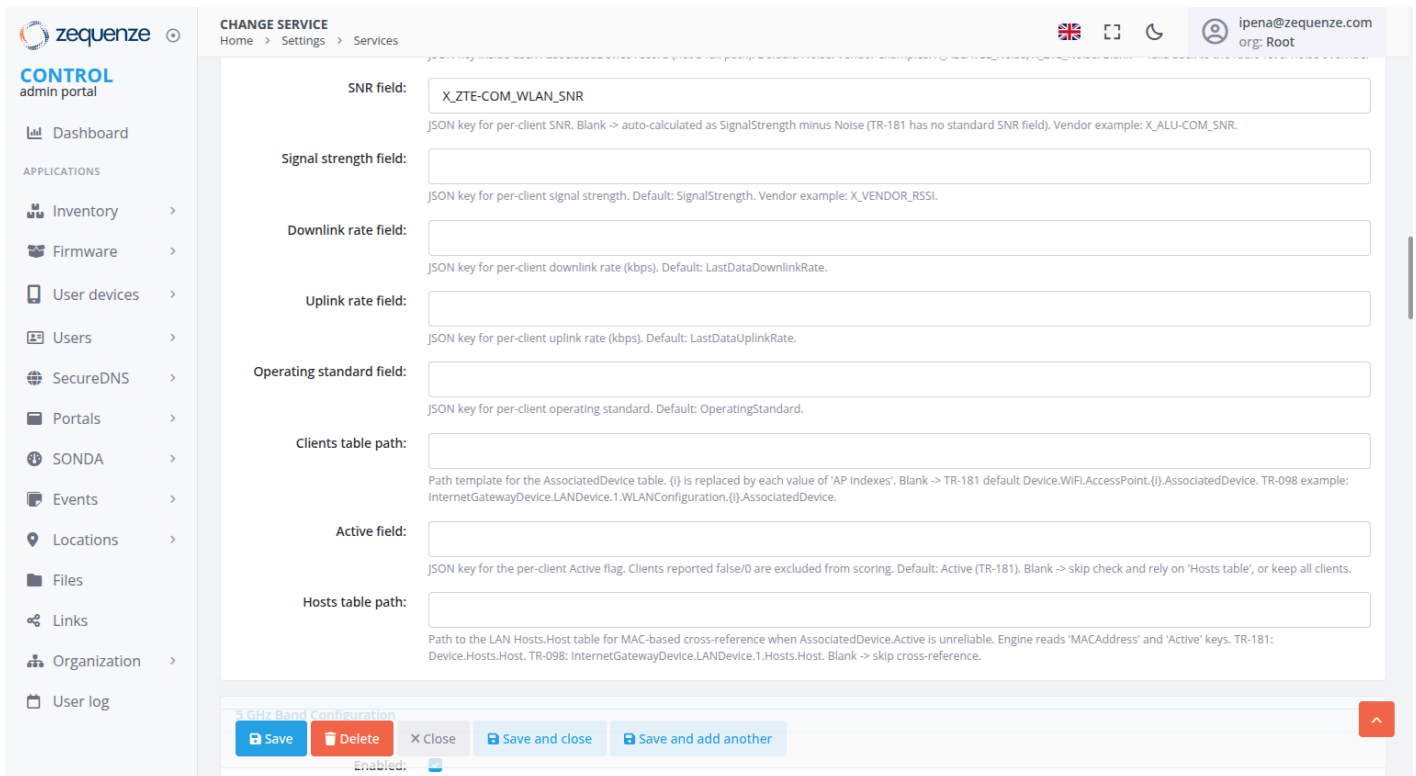
These fields specify the **JSON key names** used to read per-client metrics from the AssociatedDevice table entries. These are short key names, **not full parameter paths**.

Leave them blank for standard TR-181 devices. For TR-098 or vendor devices, enter the vendor-specific key name.

Field	TR-181 default	Vendor example
Noise field	Noise	X_ALCATEL_Noise
SNR field	(auto-calculated)	X_ALU-COM_SNR
Signal field	SignalStrength	X_VENDOR_RSSI
Downlink rate	LastDataDownlinkRate	—
Uplink rate	LastDataUplinkRate	—
Standard field	OperatingStandard	—

Clients Table Path and Active Filter

Field	Description
Clients table path	Template path for the AssociatedDevice table. Leave blank for TR-181 default. TR-098 example: <code>InternetGatewayDevice.LANDevice.1.WLANConfiguration.{i}.AssociatedDevice.</code>
Active field	JSON key for active-client filtering. Default: <code>Active</code> . Leave blank to skip filtering.
Hosts table path	LAN Hosts table for MAC-based cross-reference when AssociatedDevice.Active is unreliable.



Step 3: Configure Score Weights

The **Score Weights** parameter group controls how much each quality factor contributes to the Overall Score. The six weights must add up to **100%**.

Quality Factor	Default Weight	What it measures
Signal	24%	Client signal strength (RSSI in dBm)
Noise	19%	Background noise level on the radio channel
SNR	4%	Signal-to-noise ratio per client
Standard	14%	WiFi standard in use (802.11n, ac, ax, etc.)

Quality Factor	Default Weight	What it measures
Speed	9%	Per-client uplink and downlink rates
Interference	30%	Neighboring network congestion on the channel

Adjust these values to match your deployment environment. For example, increase Interference weight to 40–50% for dense urban areas, or increase Signal weight if coverage is the primary concern.

The screenshot shows the 'CHANGE SERVICE' configuration page in the Zequence admin portal. The 'Score Weights' section is expanded, showing the following settings:

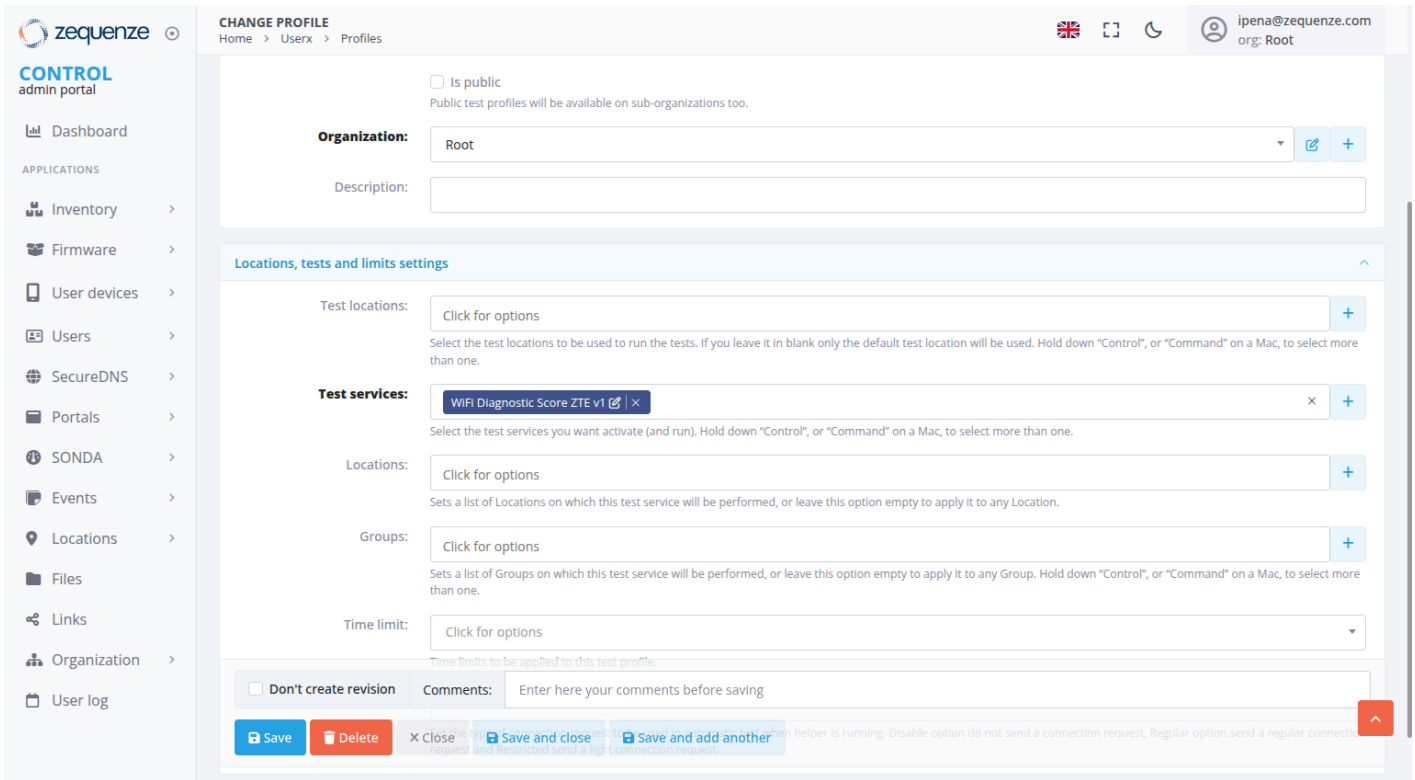
- Signal weight (%):** 24 (Weight for signal strength factor. Default: 24. All weights must sum to 100.)
- Noise weight (%):** 19 (Weight for noise level factor. Default: 19. All weights must sum to 100.)
- SNR weight (%):** 4 (Weight for signal-to-noise ratio factor. Default: 4. All weights must sum to 100.)
- Standard weight (%):** 14 (Weight for WiFi standard (n/ac/ax/be) factor. Default: 14. All weights must sum to 100.)
- Speed weight (%):** 9 (Weight for throughput/speed factor. Default: 9. All weights must sum to 100.)
- Interference weight (%):** 30 (Weight for channel interference factor. Default: 30. All weights must sum to 100.)

At the bottom of the form, there are buttons for 'Save', 'Delete', 'Close', 'Save and close', and 'Save and add another'.

Step 4: Create a Test Profile

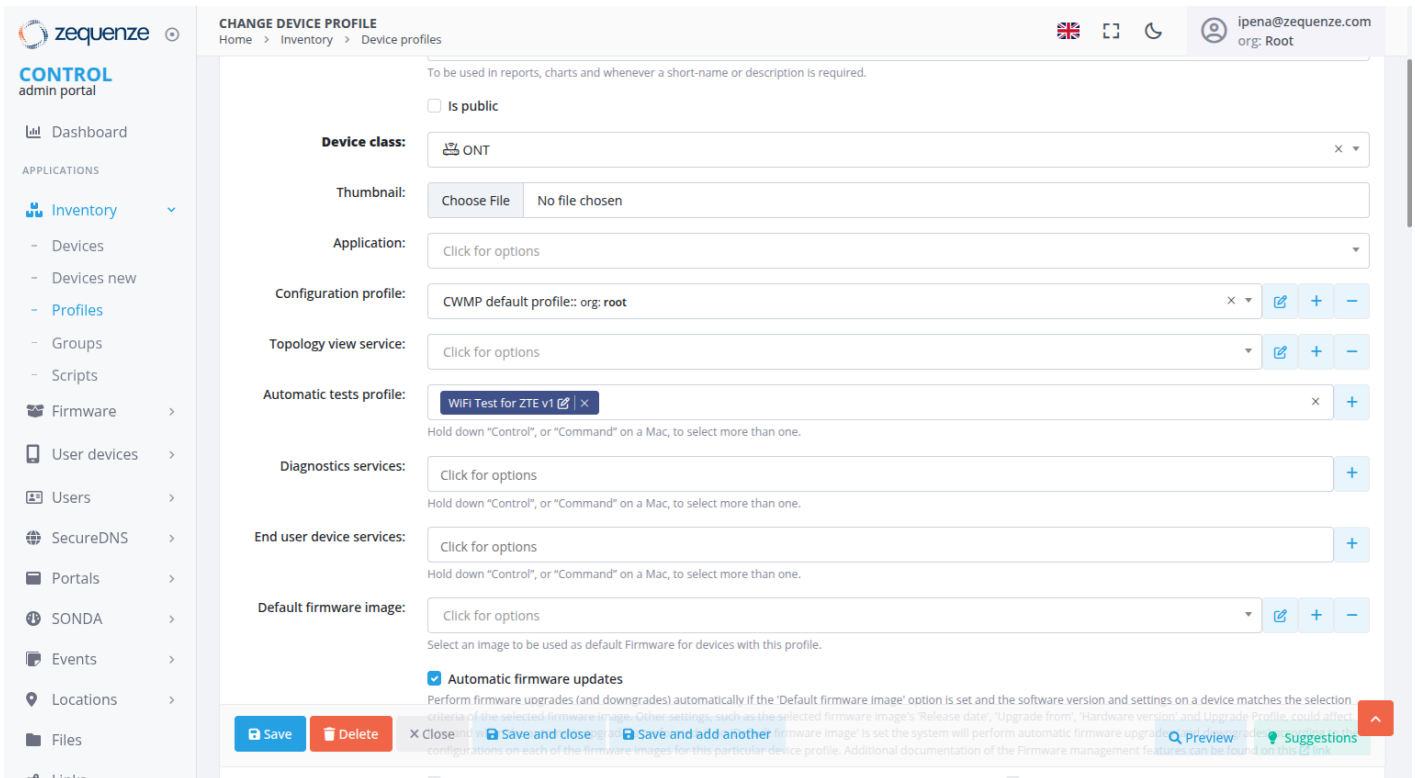
A **Test Profile** links the Service to a device Type, so the engine knows which Service configuration to use when running a diagnostic.

1. Navigate to **Userx > Profiles > Add**
2. Give it a descriptive name (e.g., `WiFi Analytics – Model XYZ`)
3. Check **Is active**
4. In the **Locations, tests and limits settings** section, add the Service created in Step 1 to the **Test services** field
5. Save the Test Profile



Step 5: Assign the Test Profile to a Device Type

1. Navigate to **Inventory > Profiles** and select the device **Type** for the target CPE model
2. Locate the **Automatic tests profile** field
3. Select the Test Profile created in Step 4
4. Save the Type



From this point on, any device of this Type will use the configured Service when a WiFi diagnostic is run.

Running the WiFi Diagnostic

1. Navigate to the target device's **Diagnostics** tab
2. From the **Operation** dropdown, select **WiFi neighbor diagnostics**
3. The **Parameter name** field defaults to `.WiFi.NeighboringWiFiDiagnostic`. The engine automatically prefixes this with `Device.` for TR-181 or `InternetGatewayDevice.` for TR-098
4. Click **Proceed**
5. Wait for the CPE to scan neighboring networks (typically **10-30 seconds**)

The screenshot shows the 'DIAGNOSTICS: CPE-ZEQUENZE' page in the 'CONTROL admin portal'. The breadcrumb trail is 'Home > Inventory > Devices > CPE-ZEQUENZE > Diagnostics'. The device status is 'Up' with ID '1' and MAC 'F689V9'. The 'Operation' dropdown is set to 'WiFi neighbor diagnostics'. The 'Parameter name' field contains '.WiFi.NeighboringWiFiDiagnostic'. A note below the field states: 'The "." at the beginning of the specified parameter name will be replaced by 'Device.' or by 'InternetGatewayDevice.' for devices with TR-181 or TR-098 based data models, respectively.' A 'Proceed' button is visible. At the bottom of the form area are 'Copy', 'Clear', and 'Close' buttons. The footer includes '2026 © zequence' and 'CONTROL admin portal v1.2.19_4ac1b2df-dev'.

Understanding the Results

Once the diagnostic completes, a **WiFi Analytics mini-dashboard** appears below the form.

Header Summary

Element	Description
Bands	Number of active bands analyzed
Clients	Total WiFi clients across all bands

Element	Description
Overall	Weighted average score as a colored badge (Green ≥ 8 , Yellow ≥ 5 , Red < 5 , Gray = N/A)

Band Cards

Each band displays its current channel, bandwidth, connected client count, a score progress bar, and a quality label (Excellent / Fair / Poor).

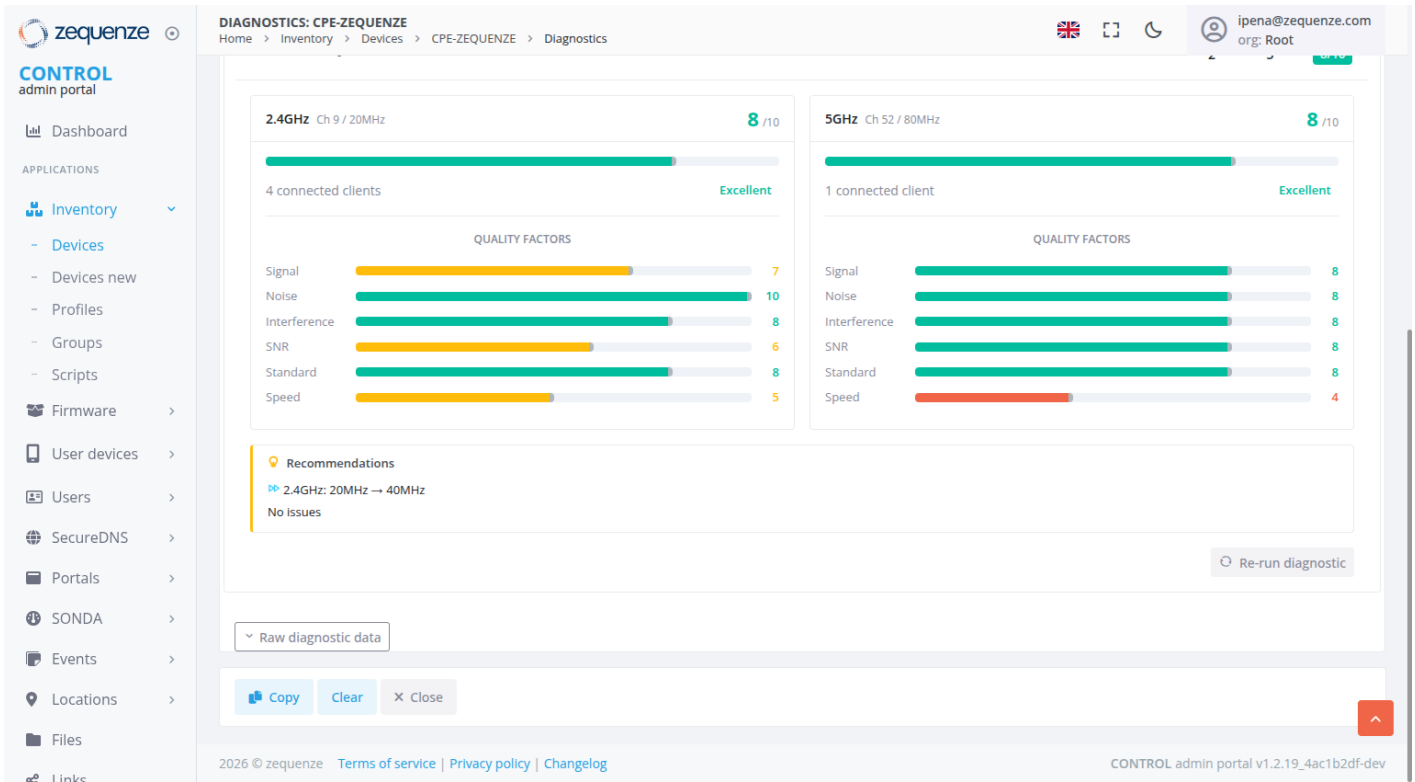
The screenshot displays the Zequence admin portal interface. On the left is a sidebar with navigation options: Dashboard, Inventory (with sub-items: Devices, Devices new, Profiles, Groups, Scripts), Firmware, User devices, Users, SecureDNS, Portals, SONDA, Events, Locations, Files, and Links. The main content area is titled 'DIAGNOSTICS: CPE-ZEQUENZE' and shows the device status as 'Up' with ID: 1 and F689V9. The 'Diagnostics' tab is active, showing the 'WiFi neighbor diagnostics' operation. A parameter name field contains '.WiFi.NeighboringWiFiDiagnostic' with a note: 'The '.' at the beginning of the specified parameter name will be replaced by 'Device.' or by 'InternetGatewayDevice.' for devices with TR-181 or TR-098 based data models, respectively.' A 'Proceed' button is visible. Below, the 'WiFi neighbor diagnostics - Results' section shows a progress bar at 100%. The 'WiFi Analytics' section displays two band cards:

Band	Channel / Bandwidth	Clients	Score	Quality
2.4GHz	Ch 9 / 20MHz	4	8 / 10	Excellent
5GHz	Ch 52 / 80MHz	1	8 / 10	Excellent

Summary statistics: BANDS: 2, CLIENTS: 5, OVERALL: 8/10.

Recommendations and Tips

- **Recommendations** (yellow accent): Channel changes, bandwidth suggestions, or "No issues" when optimal
- **Tips** (blue accent): Missing parameters, discovery suggestions, or vendor contact recommendations
- **No clients:** When no WiFi clients are connected, Overall shows N/A with an info message



How the Overall Score is Calculated

The Overall Score is a **weighted average** of all available factor scores across all bands:

1. Each client's 6 factors are scored individually
2. Factors with N/A are excluded; remaining weights are **renormalized** to sum to 100%
3. The weighted average produces a per-client score (1-10)
4. All client scores within a band are averaged to produce the **band score**
5. All band scores are averaged to produce the **Overall Score**

The default weight distribution emphasizes **Interference (30%)** and **Signal (24%)** as the highest-impact factors for typical residential WiFi environments.

Quality Factors — Detailed Breakdown

Below each band card, six horizontal bars show the individual factor scores. Each factor is scored 1-10 based on specific inputs from the CPE. When a factor cannot be calculated, it shows **N/A** and its weight is redistributed proportionally across the remaining factors.

Signal Factor

Measures the received signal strength (RSSI) of each connected WiFi client.

Input: `SignalStrength` from the `AssociatedDevice` table (or the vendor-specific JSON key configured in the `Service`).

Signal strength (dBm)	Score
≥ -50	10 (Excellent)
≥ -60	9
≥ -70	8
≥ -80	7
≥ -90	6
< -90	4 (Poor)

The final Signal score for the band is the **average** across all connected clients.

Noise Factor

Measures the background noise floor on the radio channel.

Input: Per-client `Noise` field from `AssociatedDevice`, or fallback to `Device.WiFi.Radio.{i}.Stats.Noise` (radio-level noise).

Noise level (dBm)	Score
< -90	10 (Very quiet)
< -80	8
< -70	6
≥ -70	4 (Noisy)

Lower noise is better — a value below -90 dBm indicates a very clean radio environment.

SNR Factor (Signal-to-Noise Ratio)

Measures the gap between signal and noise for each client. Higher SNR means clearer communication.

Input: Either a vendor-specific SNR field (e.g., `X_ALU-COM_SNR`) or **auto-calculated** as `SignalStrength - Noise` when no dedicated SNR field is available.

SNR (dB)	Score
≥ 35	10
≥ 30	9

SNR (dB)	Score
≥ 25	8
≥ 20	7
≥ 15	6
≥ 10	5
≥ 5	4
≥ 0	3
≥ -5	2
< -5	1

Interference Factor

Evaluates how much congestion the CPE experiences from neighboring WiFi networks on the same or adjacent channels.

Inputs:

- `Device.WiFi.Radio.{i}.Channel` — the CPE's current operating channel
- `Device.WiFi.Radio.{i}.CurrentOperatingChannelBandwidth` — channel width (affects adjacency range)
- **Neighboring networks** — the full list of detected WiFi neighbors from the NeighboringWiFiDiagnostic scan

How neighbors are scored:

Each detected neighbor contributes to a raw interference accumulator based on two criteria: whether it is on the **same channel** or an **adjacent channel**, and its **signal strength**:

Neighbor position	Strong signal (≥ -60 dBm)	Medium (≥ -80 dBm)	Weak (< -80 dBm)
Same channel	+5.0	+3.0	+1.0
Adjacent channel	+2.5 × proximity	+1.5 × proximity	+0.5 × proximity
Non-overlapping	0	0	0

- **Proximity** is a value between 0 and 1 based on how close the neighbor's channel is within the adjacency range
- **Adjacency range** depends on the CPE's channel bandwidth: 20 MHz covers ~4 channels, 40 MHz covers ~8, 80 MHz covers ~16, 160 MHz covers ~32 (for 5 GHz / 6 GHz)
- A **bandwidth multiplier** is applied to the accumulated raw score based on the CPE's own bandwidth (40 MHz × 1.5, 80 MHz × 2, 160 MHz × 3)

The raw accumulator is then mapped to a score:

Raw interference	Score
0 (no neighbors on channel)	10
≤ 10	8
≤ 20	6
≤ 30	4
> 30	1 (Severe congestion)

“ **N/A condition:** If the CPE's Channel parameter is missing from DeviceSettings, the engine cannot determine which neighbors overlap — the Interference factor shows N/A.

Standard Factor

Evaluates the WiFi standard (protocol generation) used by the CPE's radio.

Input: `Device.WiFi.Radio.{i}.OperatingStandards` — the active standard(s) for this radio.

The score depends on the band:

2.4 GHz band:

Standard	Score
WiFi 7 (be) / WiFi 6 (ax)	10
WiFi 4 (n)	8
WiFi 3 (g)	6
WiFi 1 (b)	4

5 GHz band:

Standard	Score
WiFi 7 (be) / WiFi 6 (ax)	10
WiFi 5 (ac)	8
WiFi 4 (n)	6
WiFi 2 (a)	4

Newer standards support higher throughput, better modulation, and features like OFDMA and MU-MIMO, which directly improve network quality.

Speed Factor

Measures actual throughput as a percentage of the theoretical maximum for the current standard and bandwidth combination.

Inputs:

- `LastDataDownlinkRate` and `LastDataUplinkRate` from each client (in kbps)
- `OperatingStandards` and `CurrentOperatingChannelBandwidth` from the radio

The engine calculates: $\text{average_speed} = (\text{downlink} + \text{uplink}) / 2$, then compares it against a reference throughput table:

Standard	20 MHz	40 MHz	80 MHz	160 MHz
n	300 Mbps	600 Mbps	—	—
ac	437 Mbps	875 Mbps	1750 Mbps	3500 Mbps
ax	574 Mbps	1148 Mbps	2402 Mbps	4804 Mbps
be	690 Mbps	1380 Mbps	2880 Mbps	5760 Mbps

Actual / Max ratio	Score
≥ 80%	10
≥ 60%	8
≥ 40%	6
< 40%	4

“ **N/A condition:** If downlink or uplink rate data is missing for all clients, Speed shows N/A.

Additional Notes

- **Without a Service/TestProfile**, the system auto-discovers radios from DeviceSettings (works for standard TR-181 CPEs with sequential indexes 1, 2)
- **For TR-098 or vendor-specific CPEs**, explicit Service configuration is required
- **Score weights** are per-Service — you can create multiple Services with different weight profiles for different environments

- The `{i}` placeholder is the **only** substitution the engine performs. All other numbers in paths are literal

TR-098 Quick Reference

Field	Example value
Radio index	<code>1</code>
AP indexes	<code>1</code>
Clients table path	<code>InternetGatewayDevice.LANDevice.1.WLANConfiguration.{i}.AssociatedDevice.</code>
Channel override	<code>InternetGatewayDevice.LANDevice.1.WLANConfiguration.{i}.Channel</code>
Noise override	<code>InternetGatewayDevice.LANDevice.1.WLANConfiguration.{i}.Stats.Noise</code>
Hosts table path	<code>InternetGatewayDevice.LANDevice.1.Hosts.Host.</code>
SNR client field	<code>X_ALU-COM_SNR</code> (<i>vendor-specific</i>)

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