WiFi Explorer Pro 3

"The Definitive User Guide"

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WiFi Explorer Pro 3: The Definitive User Guide (Screenshots)

Contents

Introduction

No Screenshots.

Chapter 1 - WiFi Explorer Pro 3 Product Overview

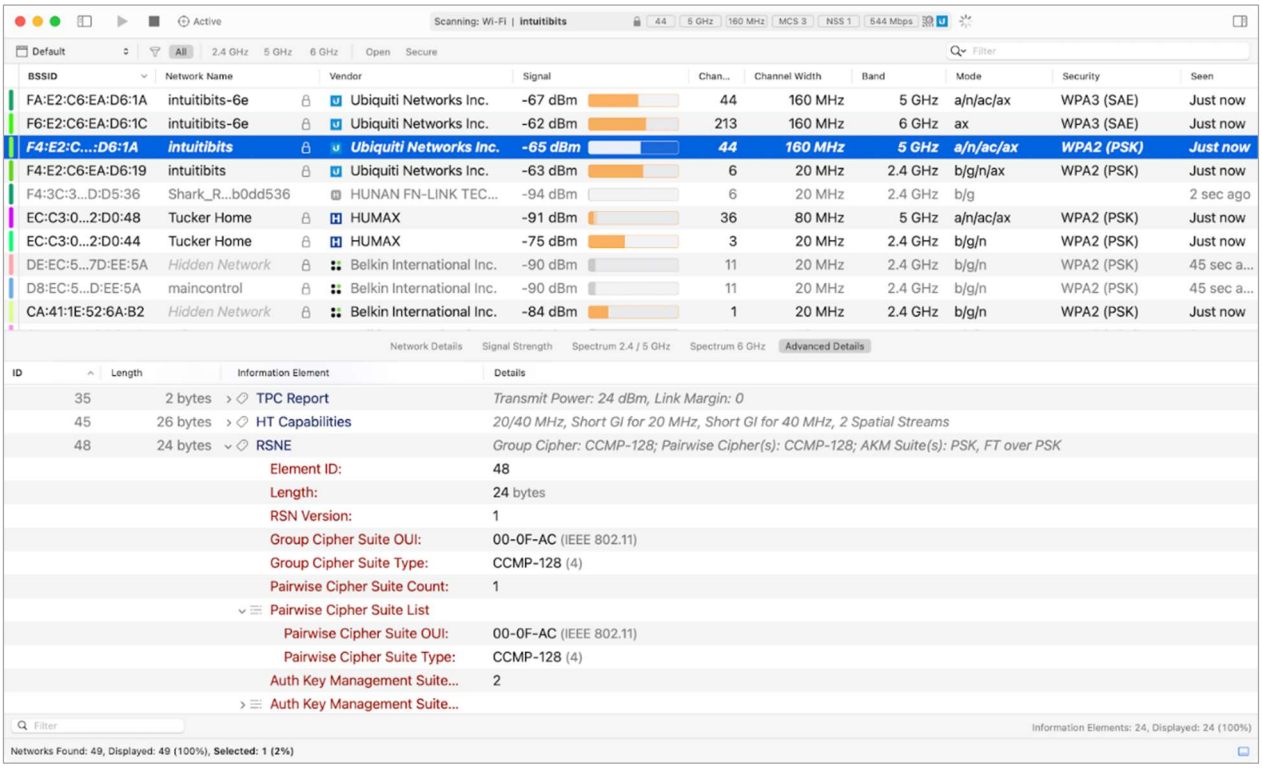

Figure 1-1 - WiFi Explorer Pro 3 User Interface

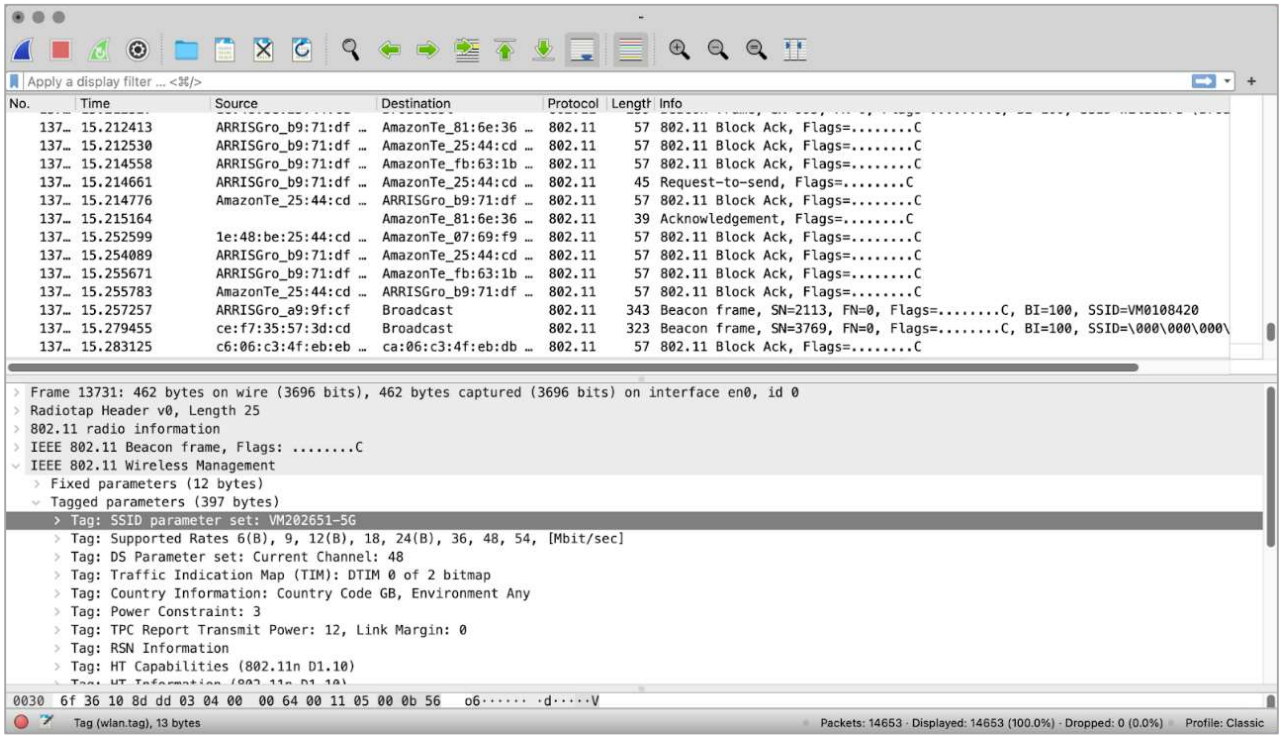

Figure 1-2 - Wireshark User Interface

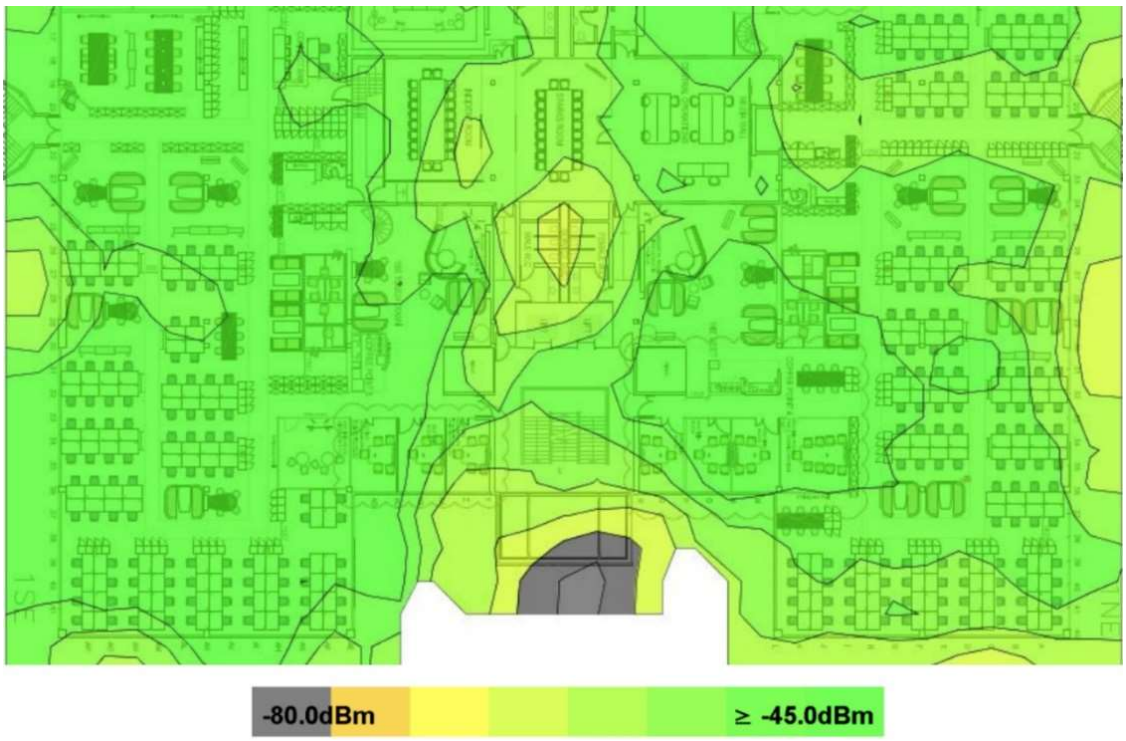

Figure 1-3 - Sample heatmap from a survey tool showing the projected signal levels of a new WLAN

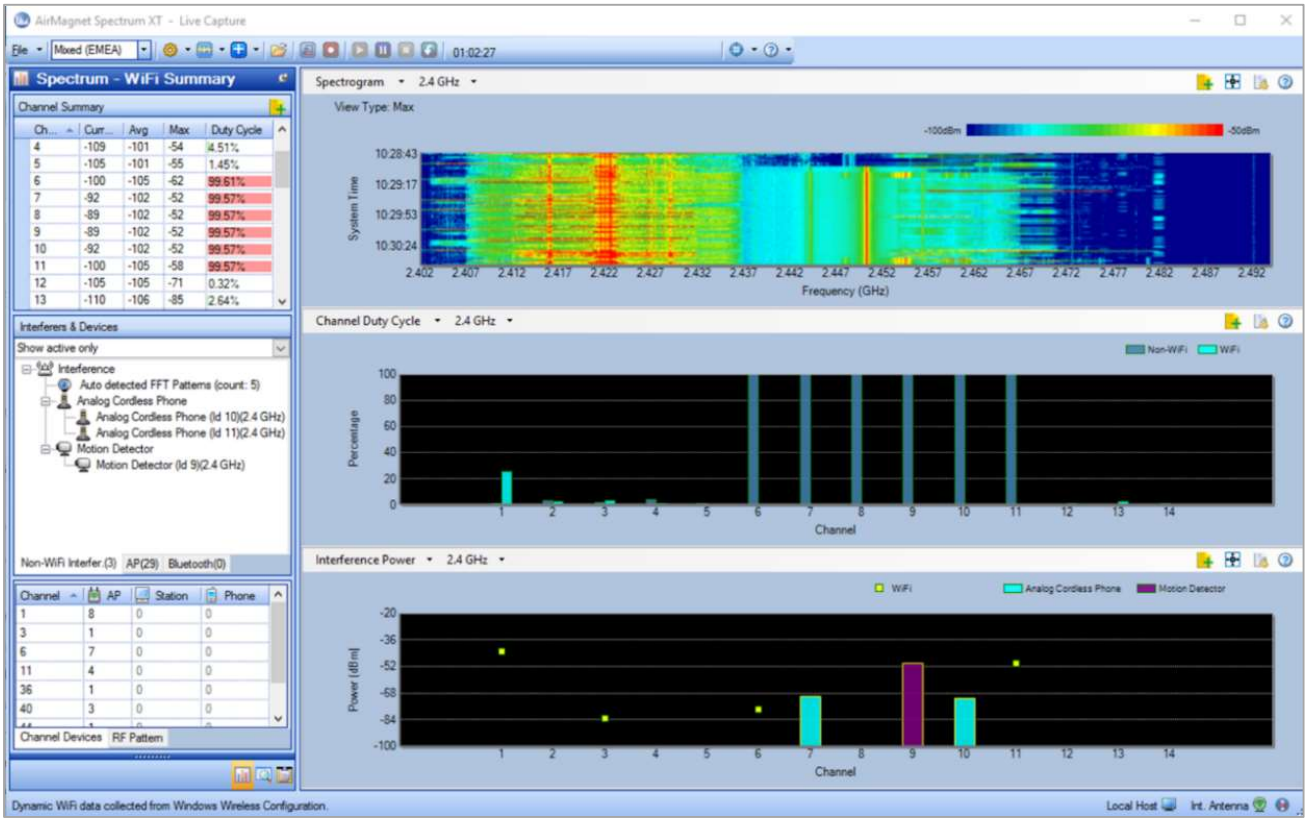

Figure 1-4 - Spectrum Analyzer screenshot

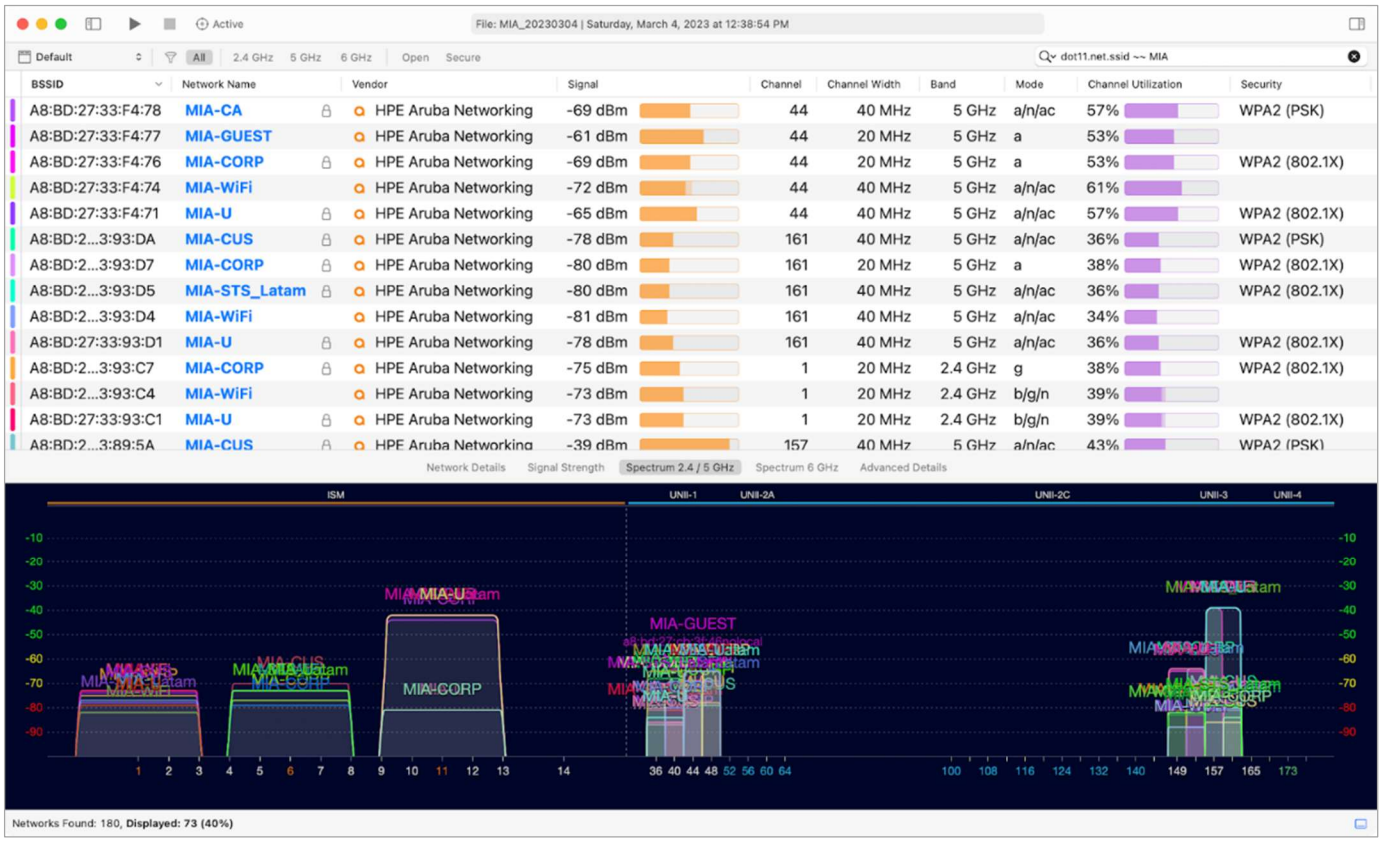

Figure 1-5 - Screenshot of WiFi Explorer Pro 3 (the premiere Wi-Fi scanner!)

Chapter 2 - WLAN Scanning Theory

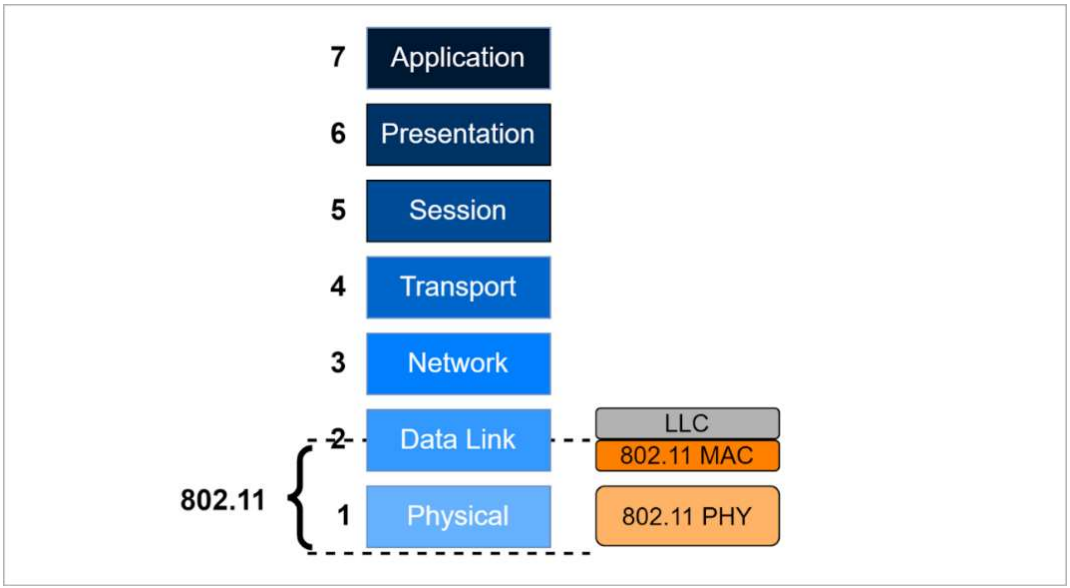

Figure 2-1 - OSI 7-layer model with 802.11 layer mapping

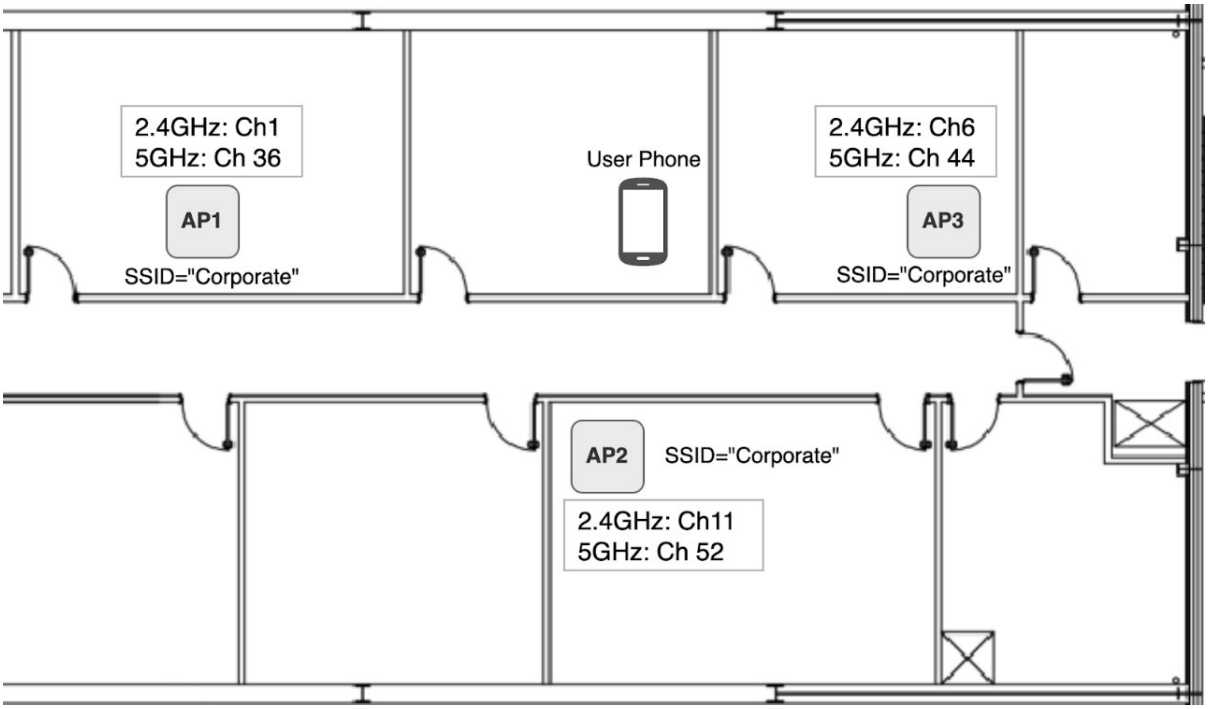

Figure 2-2 - AP channel allocations

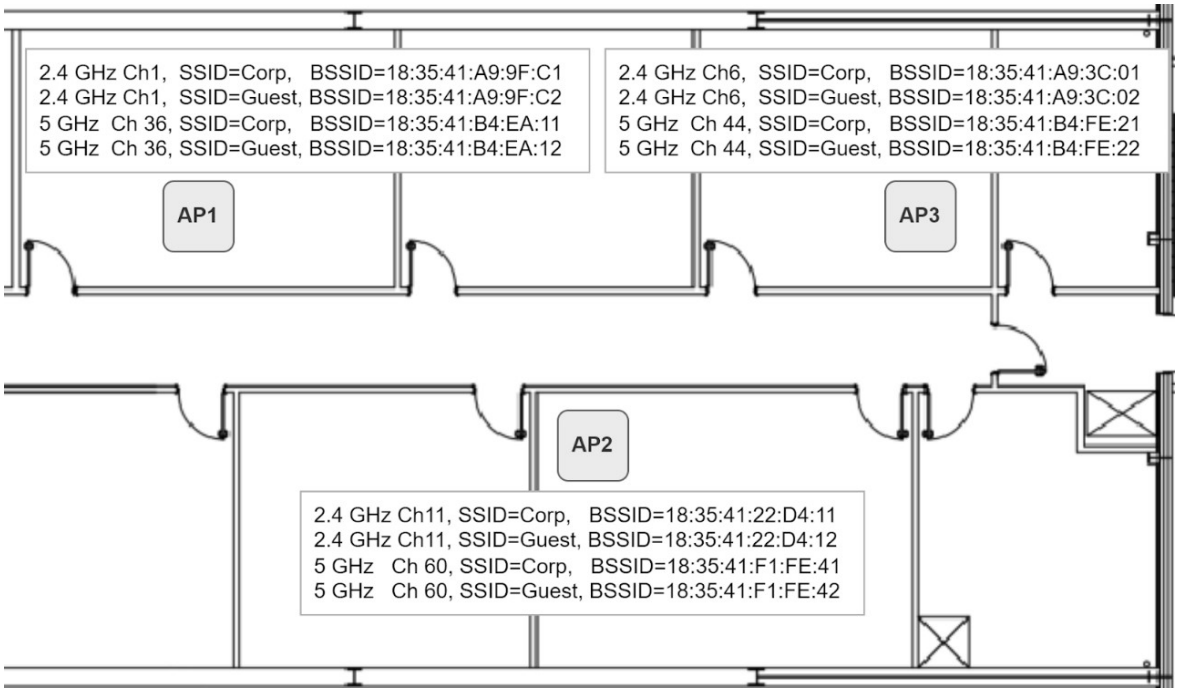

Figure 2-3 - BSSIDs for two SSIDs across the 2.4 GHz and 5 GHz radios

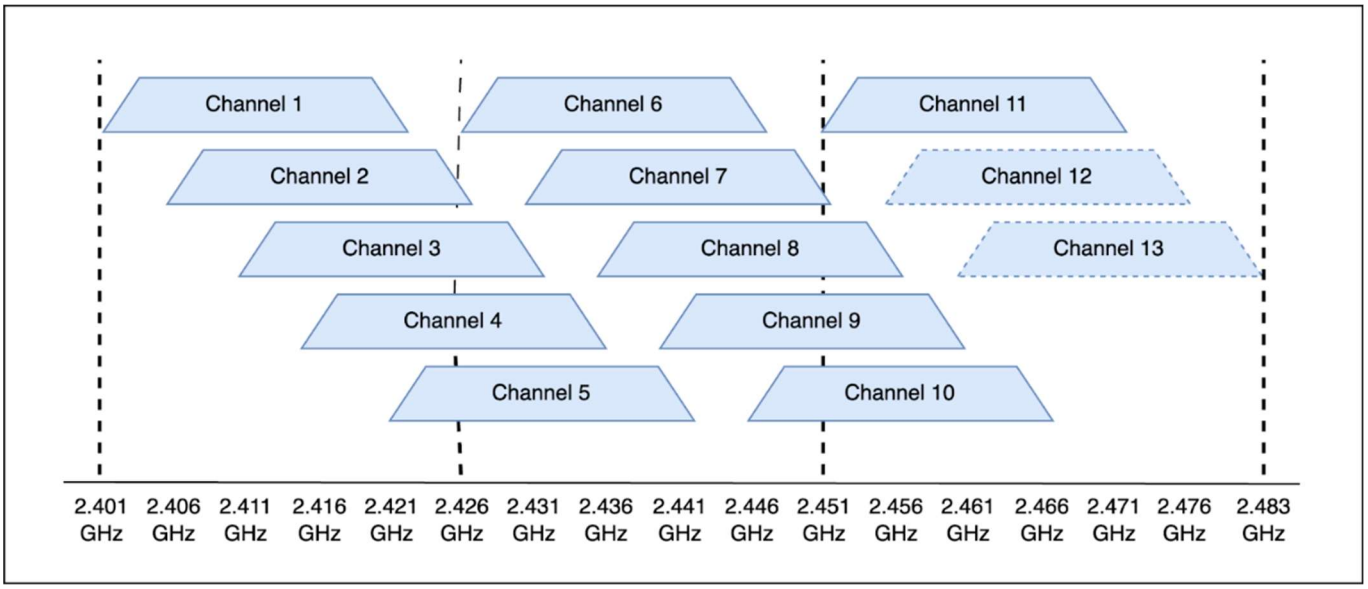

Figure 2-4 - 2.4 GHz band

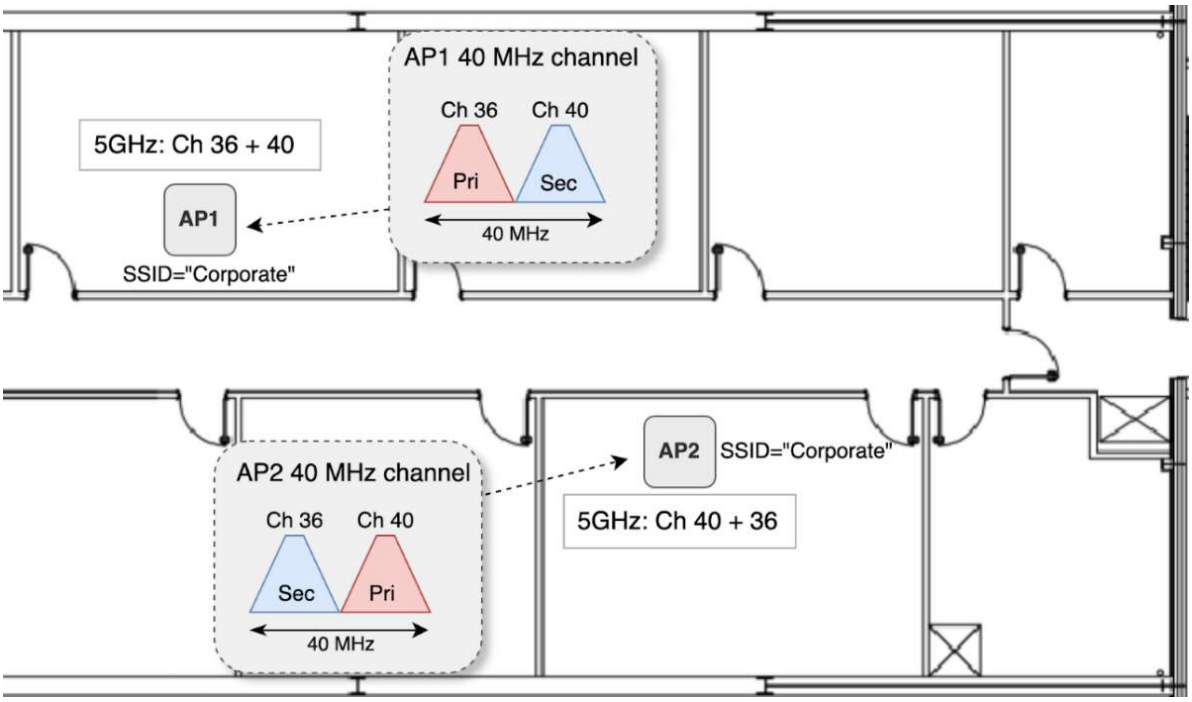

Figure 2-5 - OBSS when using bonded channels

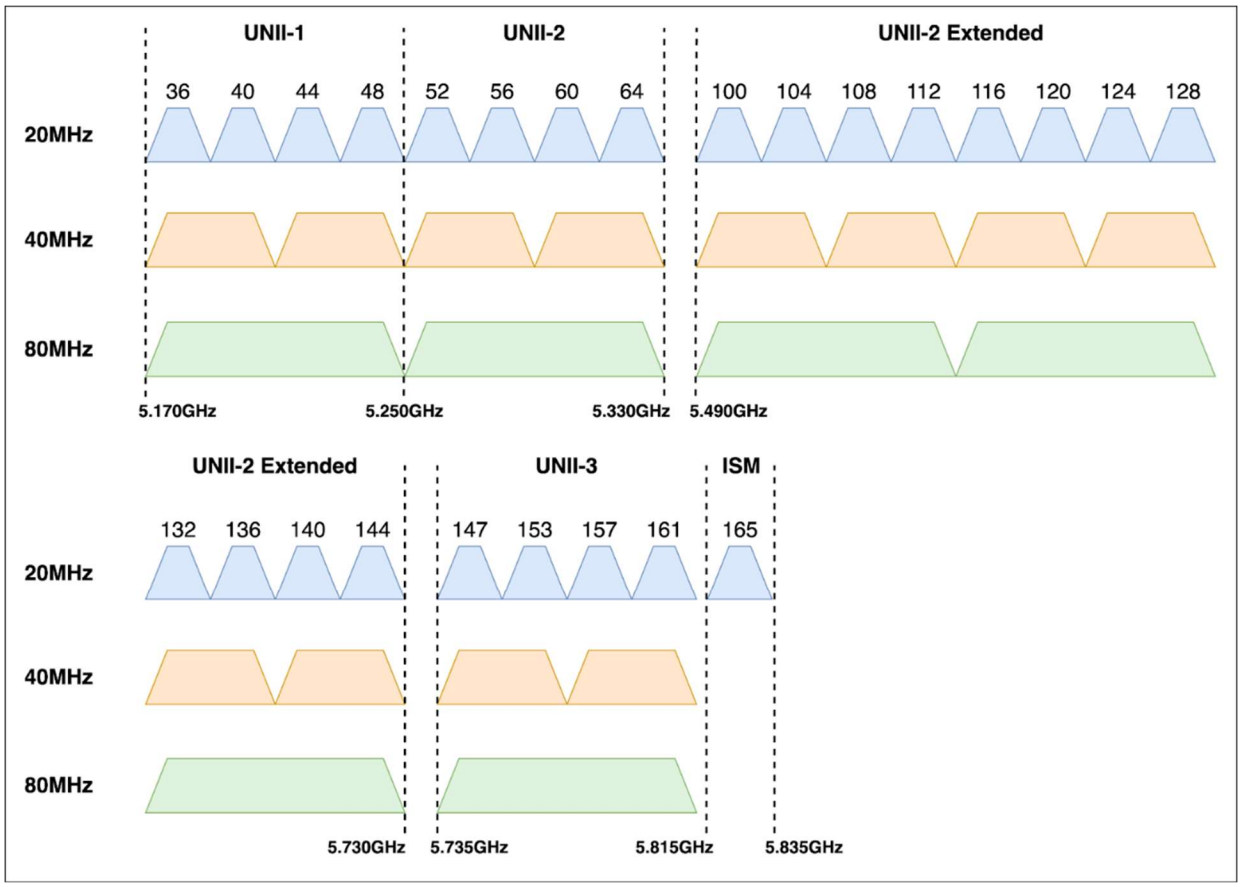

Figure 2-6 - 5 GHz Band

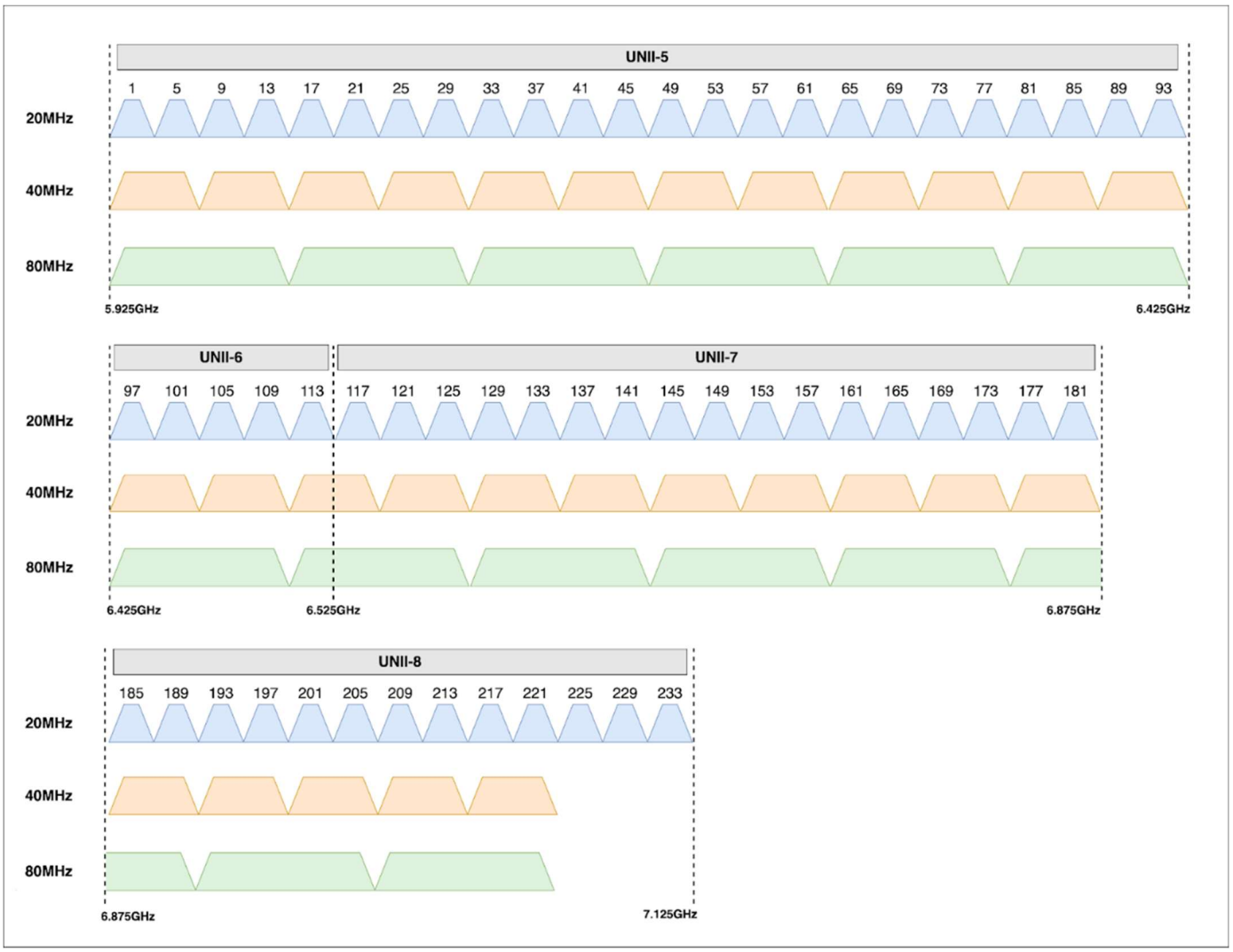

Figure 2-7 - 6 GHz band

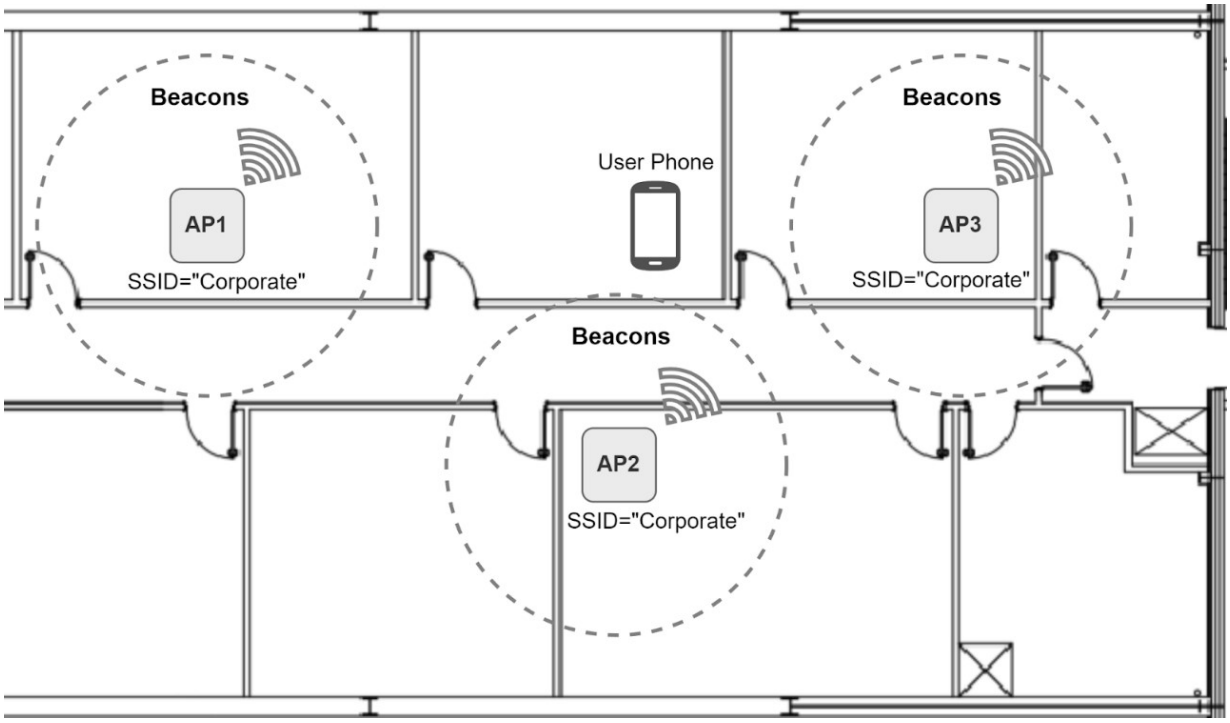

Figure 2-8 - APs broadcasting beacon frames

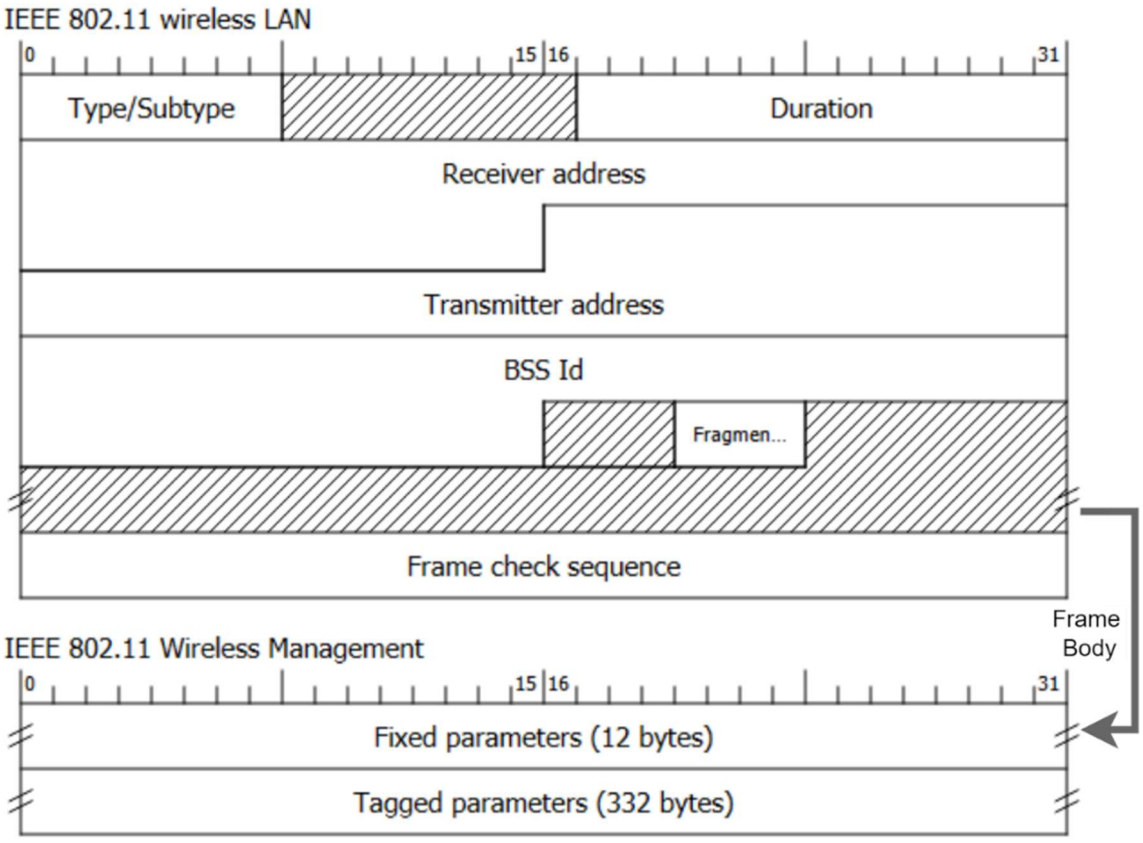

Figure 2-9 - Beacon frame format

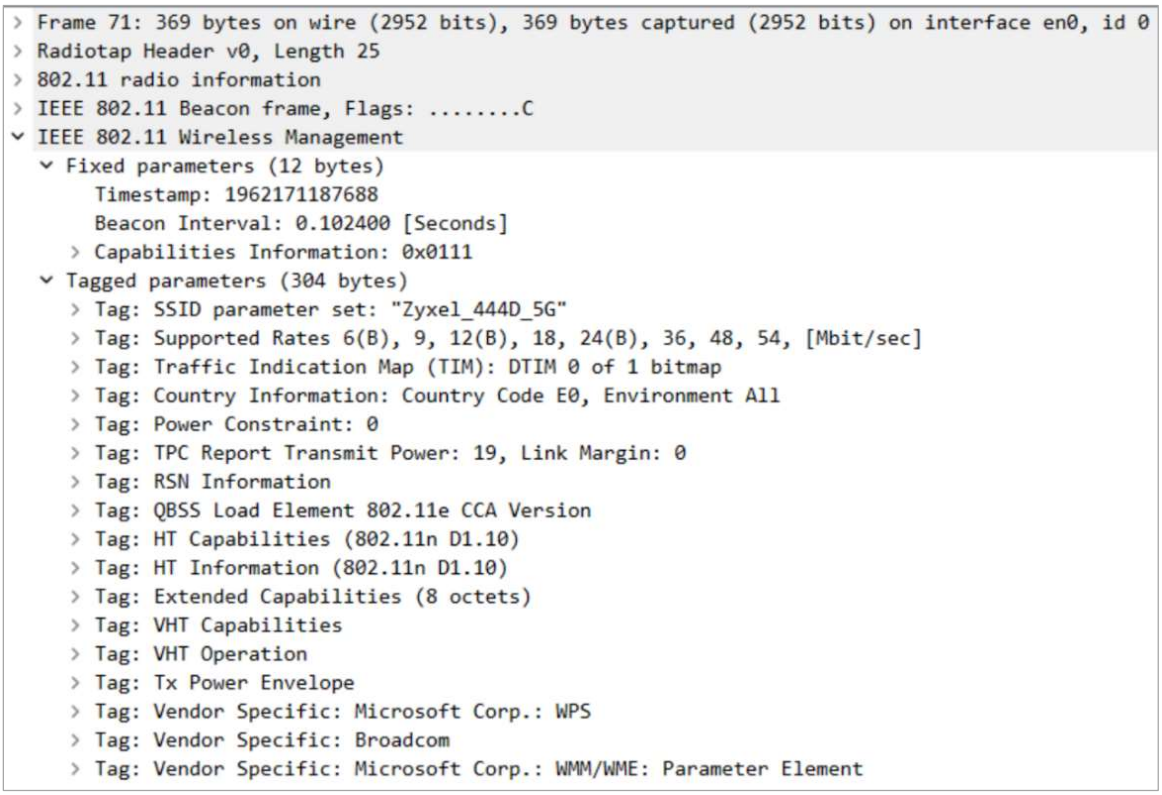

Figure 2-10 - Beacon frame tag summary

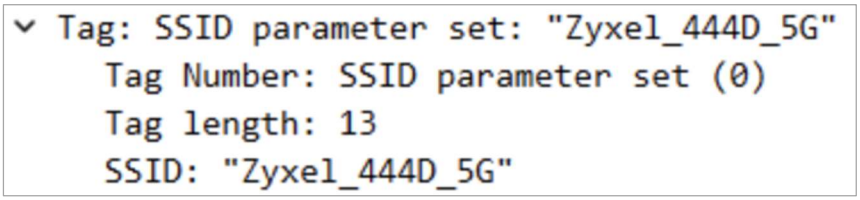

Figure 2-11 - SSID element

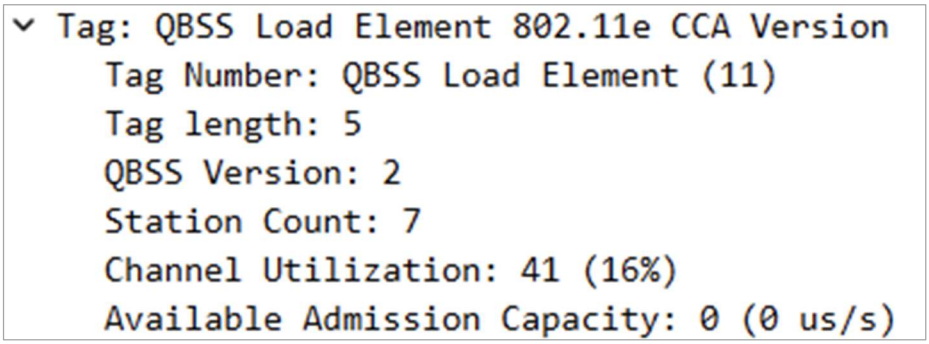

Figure 2-12 - BSS load element

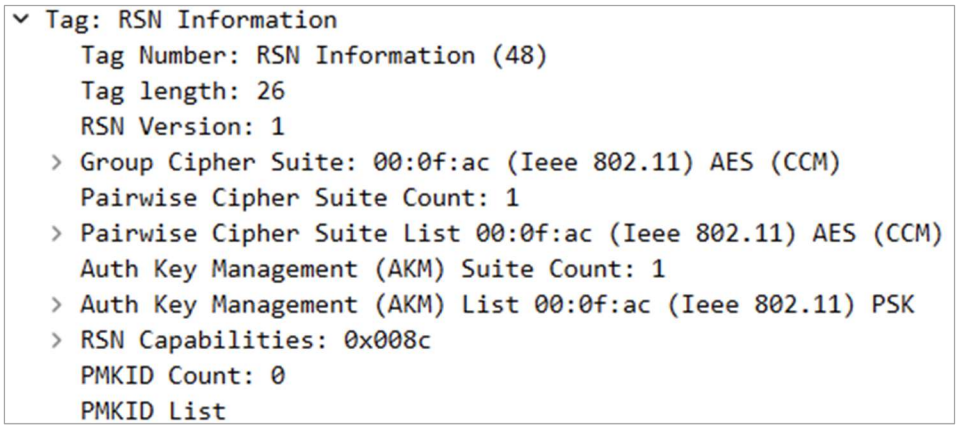

Figure 2-13 - RSN information

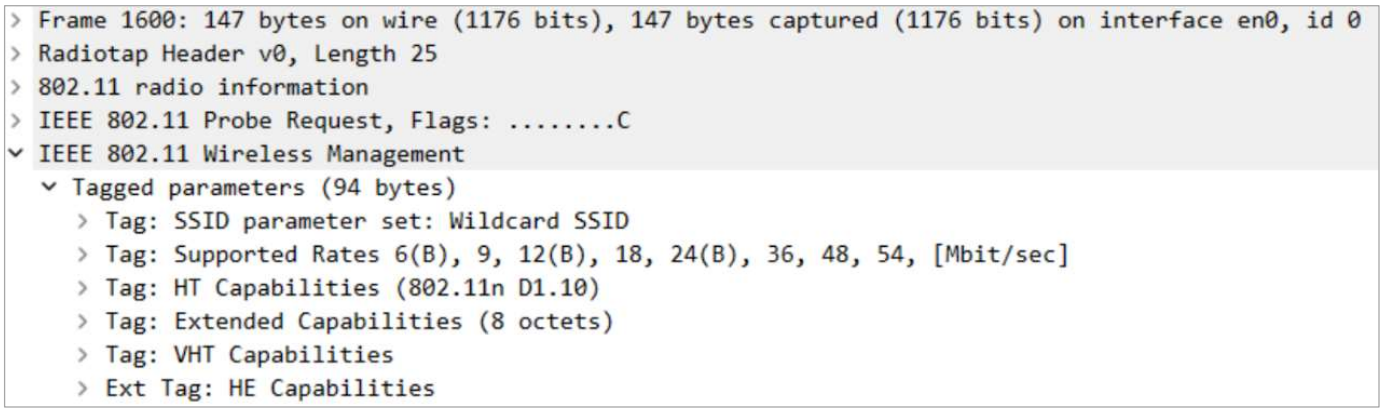

Figure 2-14 - Null probe request

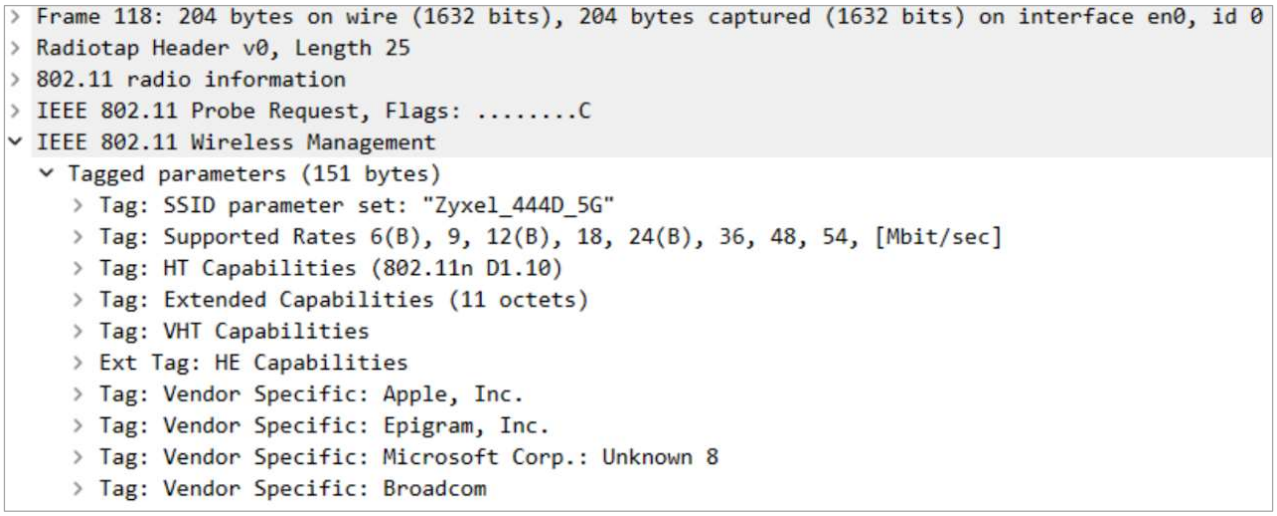

Figure 2-15 - Directed probe request

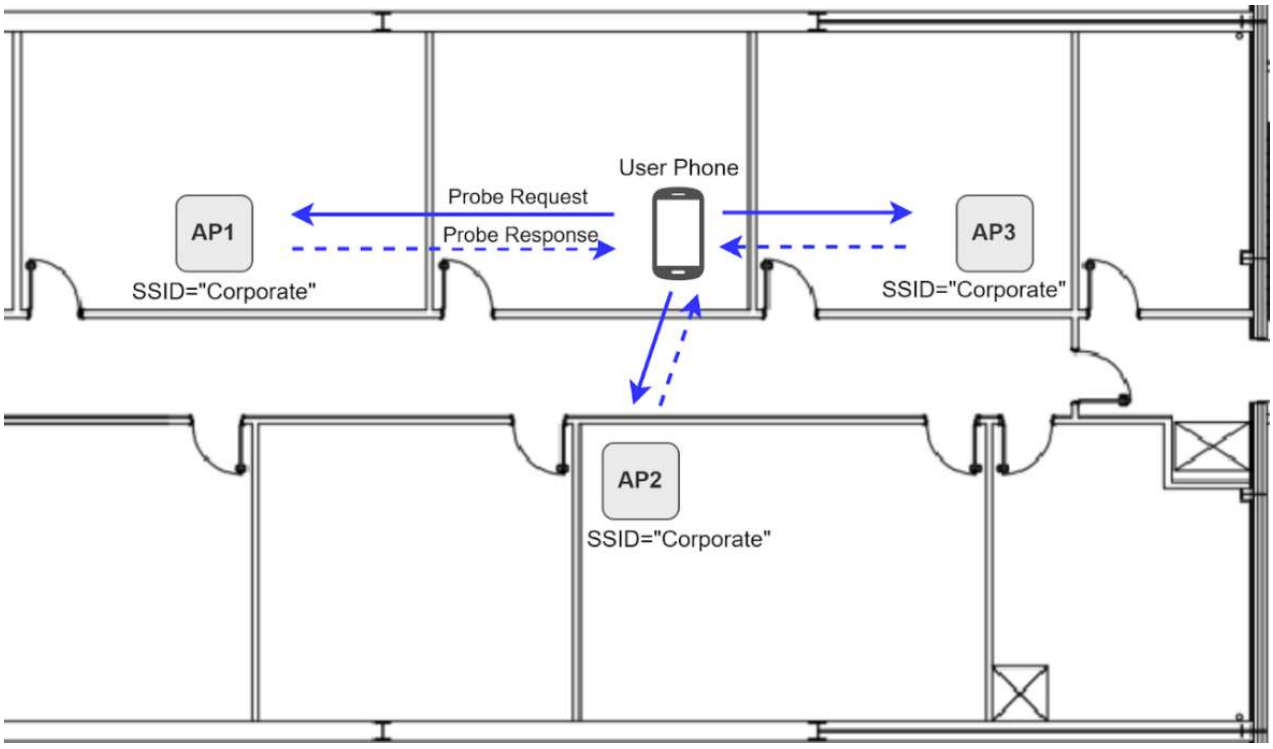

Figure 2-16 - Probe request and probe responses

```
> Frame 119: 462 bytes on wire (3696 bits), 462 bytes captured (3696 bits) on interface en0, id 0
> Radiotap Header v0, Length 25
> 802.11 radio information
> IEEE 802.11 Probe Response, Flags: ........C
v IEEE 802.11 Wireless Management
  > Fixed parameters (12 bytes)
  v Tagged parameters (397 bytes)
    > Tag: SSID parameter set: "Zyxel_444D_5G"
    > Tag: Supported Rates 6(B), 9, 12(B), 18, 24(B), 36, 48, 54, [Mbit/sec]
    > Tag: Country Information: Country Code E0, Environment All
    > Tag: Power Constraint: 0
    > Tag: TPC Report Transmit Power: 19, Link Margin: 0
    > Tag: RSN Information
    > Tag: QBSS Load Element 802.11e CCA Version
    > Tag: HT Capabilities (802.11n D1.10)
    > Tag: HT Information (802.11n D1.10)
    > Tag: Extended Capabilities (8 octets)
    > Tag: VHT Capabilities
    > Tag: VHT Operation
    > Tag: Tx Power Envelope
    > Tag: Vendor Specific: Microsoft Corp.: WPS
    > Tag: Vendor Specific: Broadcom
    > Tag: Vendor Specific: Microsoft Corp.: WMM/WME: Parameter Element
```

Figure 2-17 - Probe response

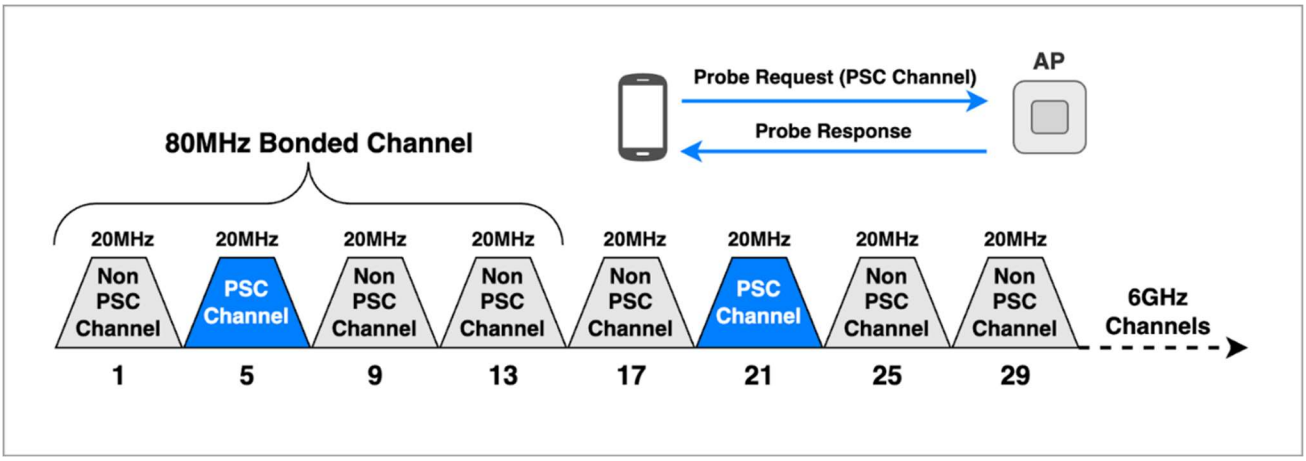

Figure 2-18 - PSC channel probes

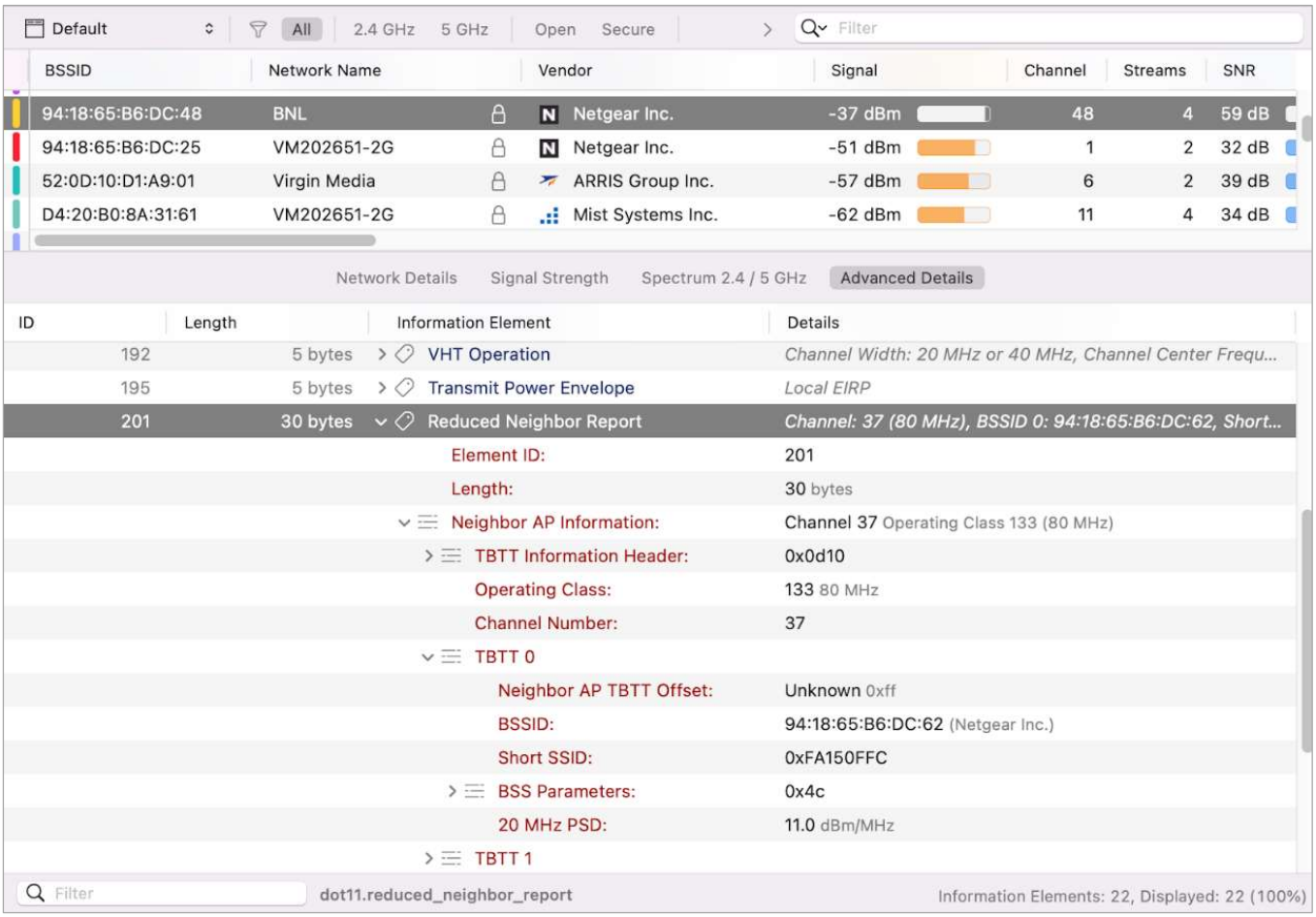

Figure 2-19 - Reduced Neighbor Report data

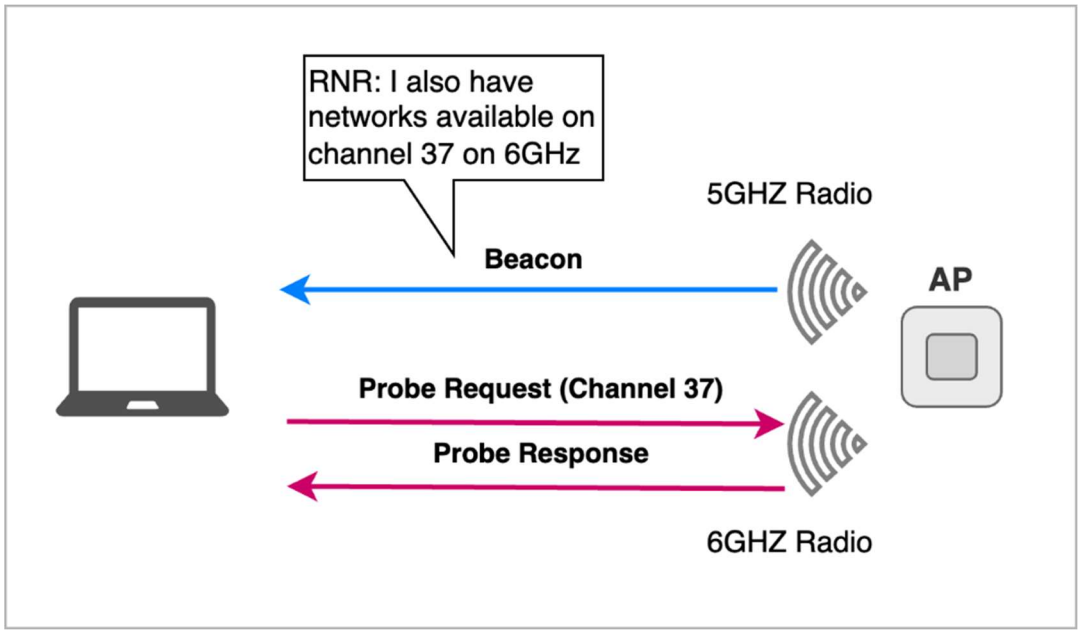

Figure 2-20 - RNR operation

Chapter 3 - Local Data Acquisition

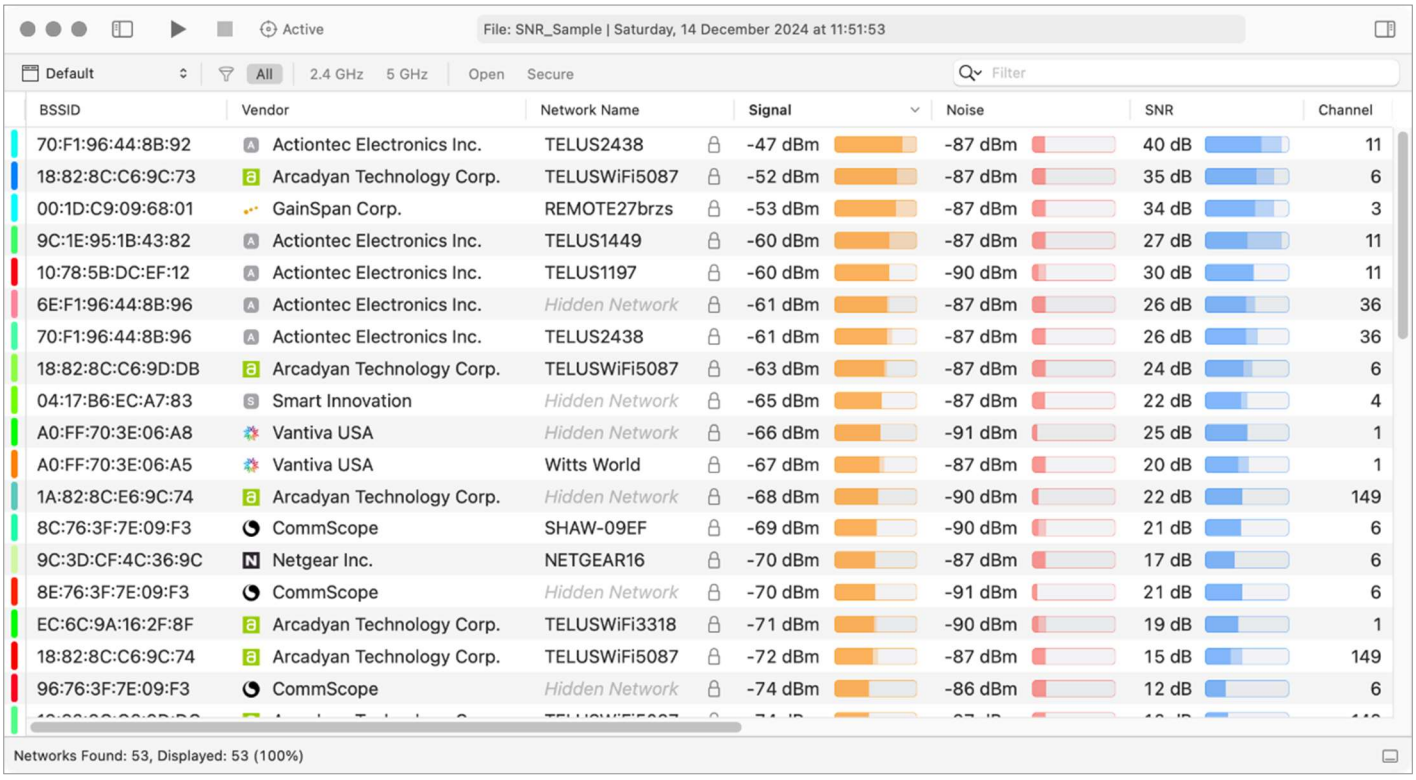

Figure 3-1 - WFE Pro 3 showing signal, noise & SNR data

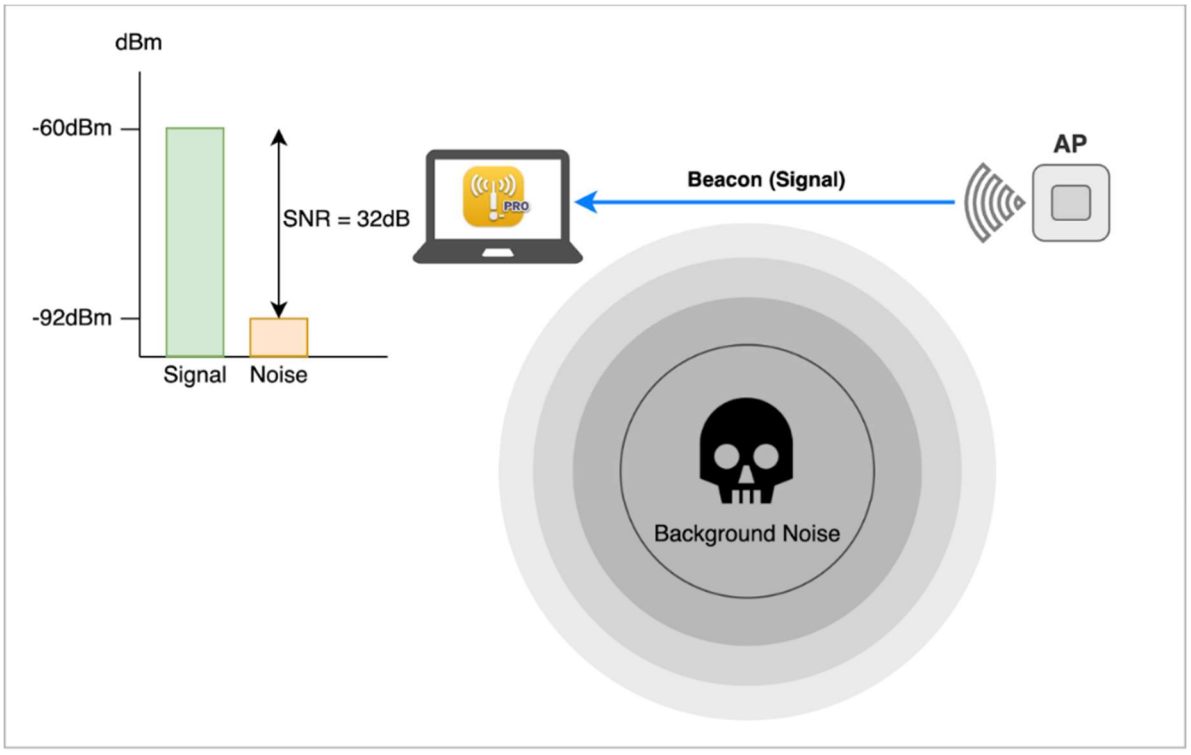

Figure 3-2 - SNR calculation

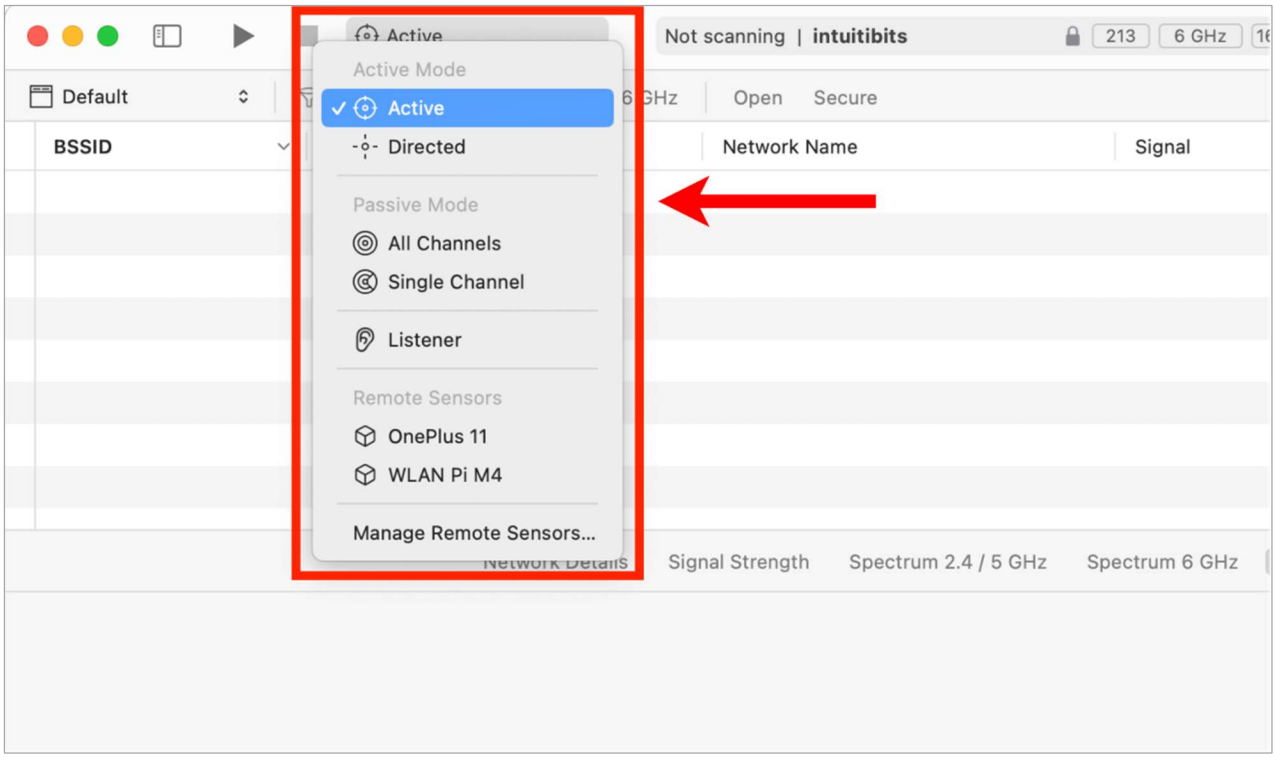

Figure 3-3 - WFE Pro 3 scanning options

Chapter 4 - Data Acquisition Using Sensors

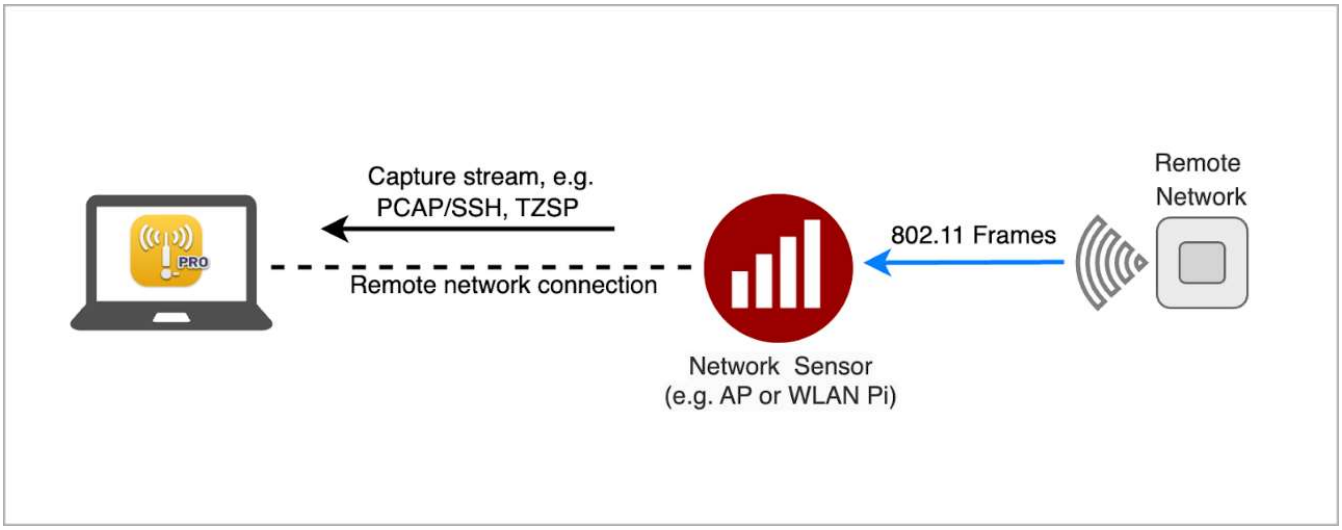

Figure 4-1 - Remote sensor operation

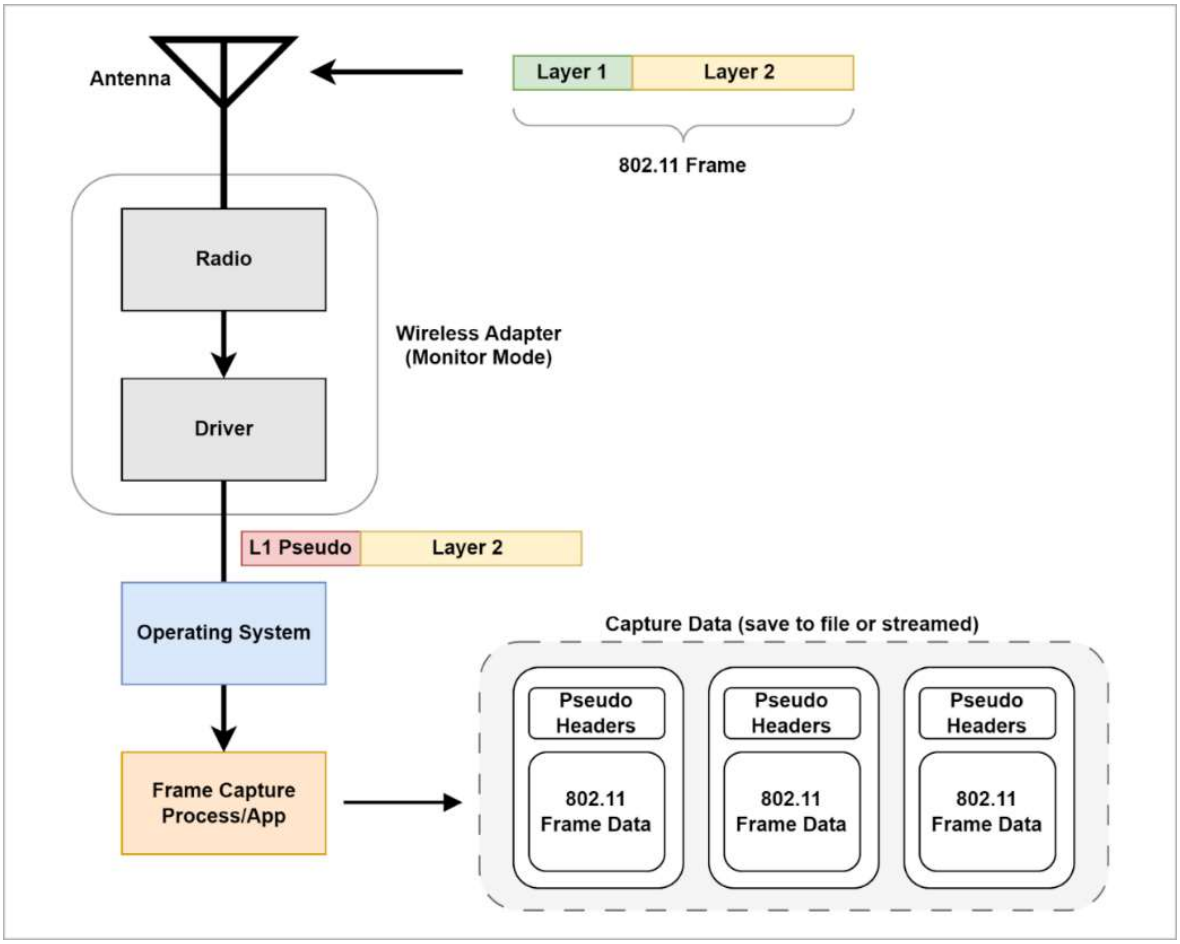

Figure 4-2 - Pseudo-header injection

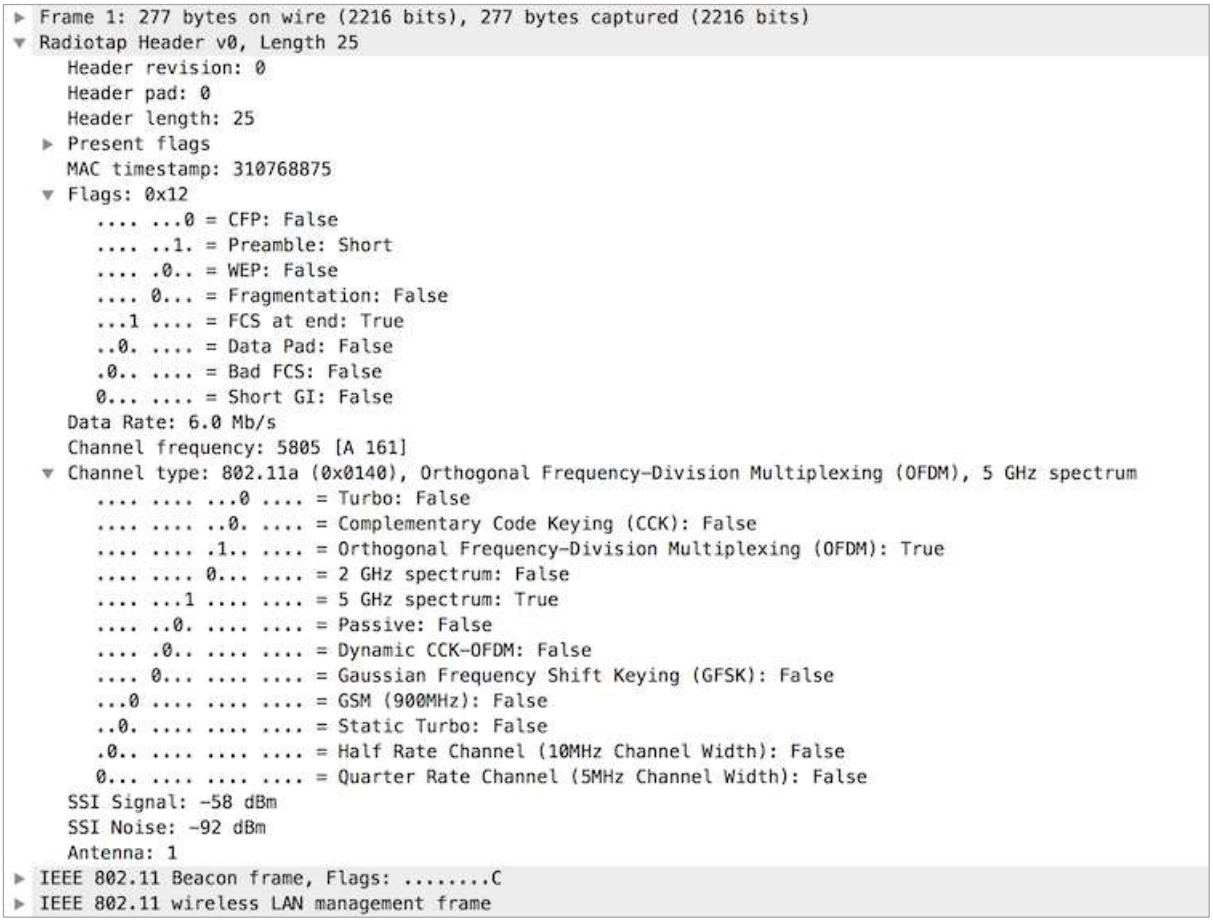

Figure 4-3 - Radiotap pseudo-header data example

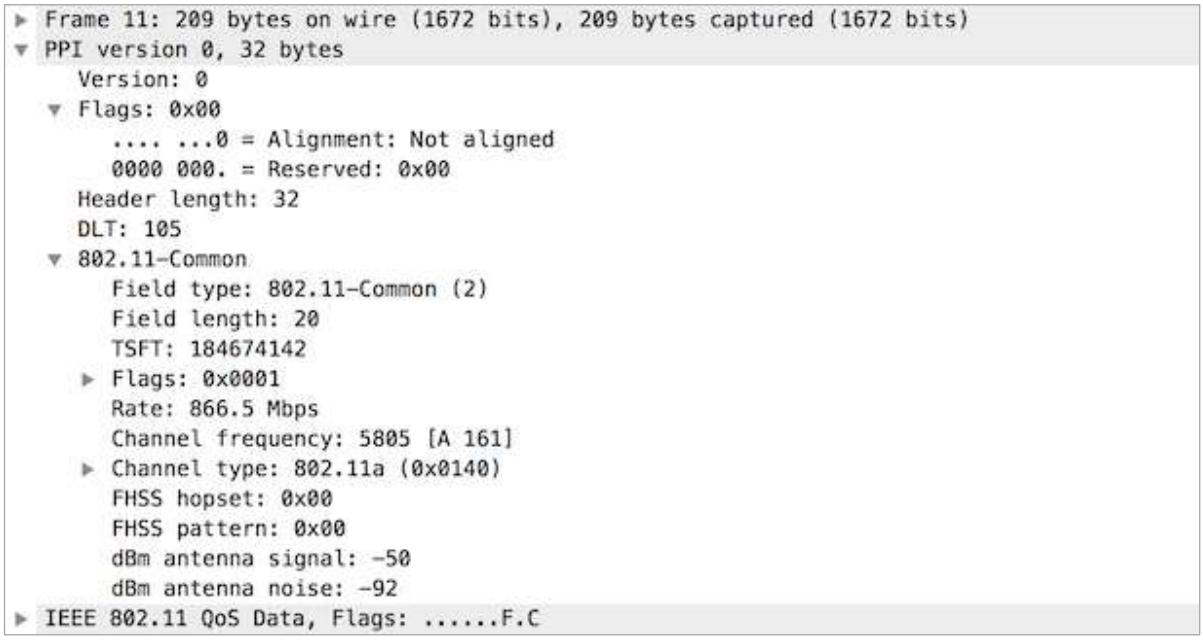

Figure 4-4 - PPI pseudo-header data example

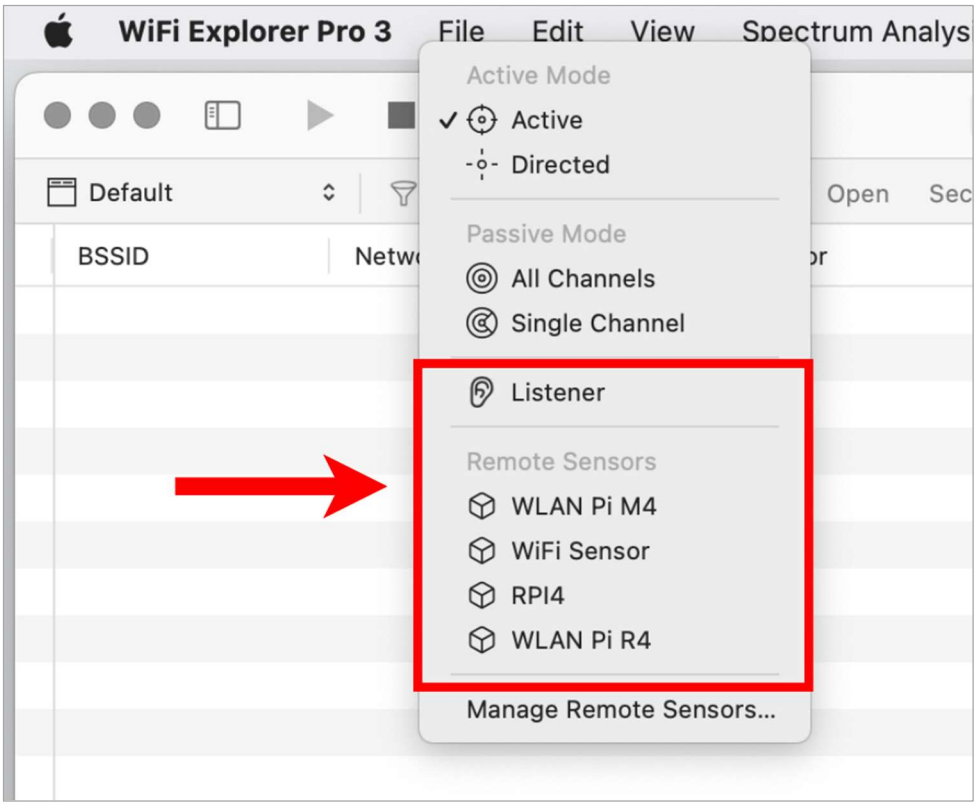

Figure 4-5 - Network sensor options

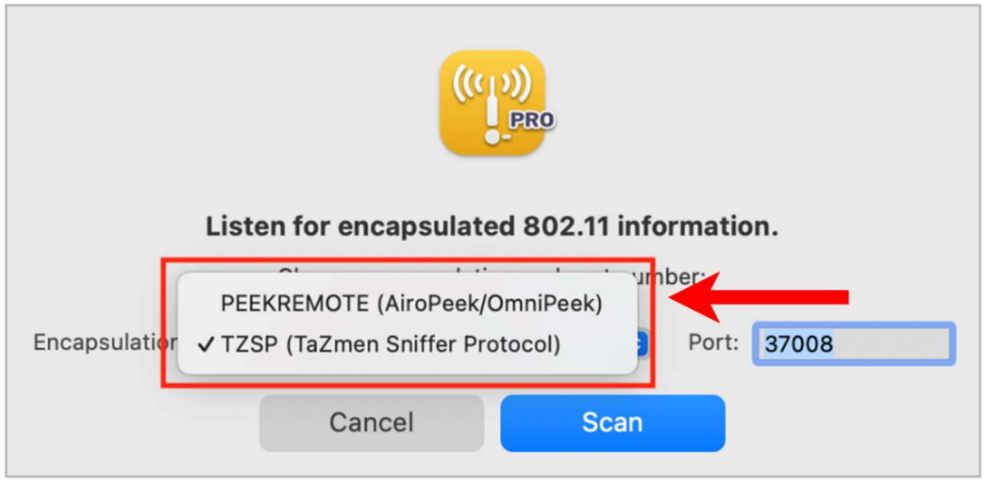

Figure 4-6 - Listener mode options available in WFE Pro 3

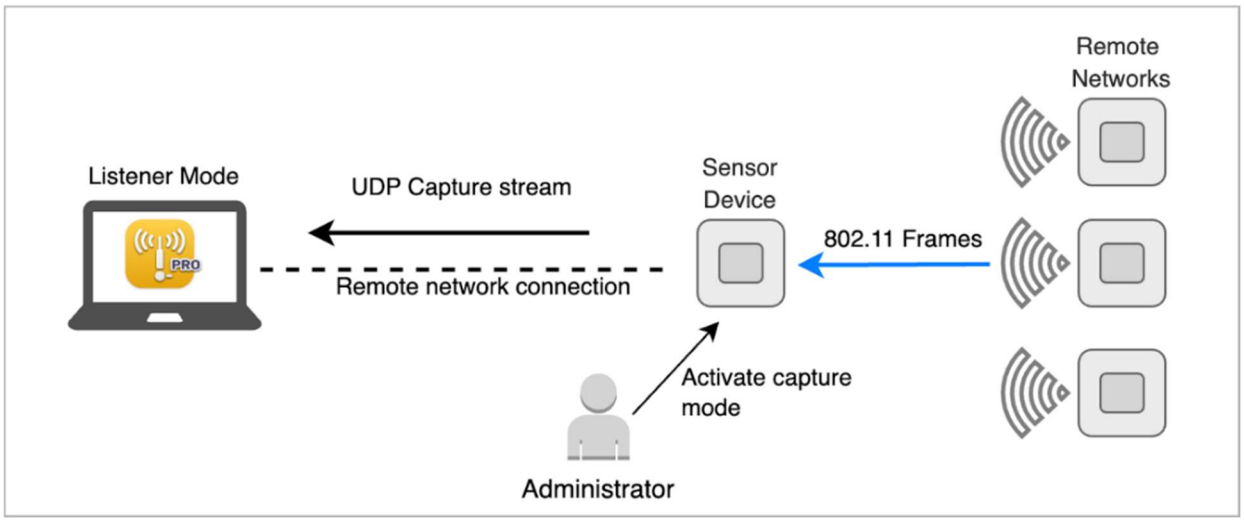

Figure 4-7 - Listener mode operation

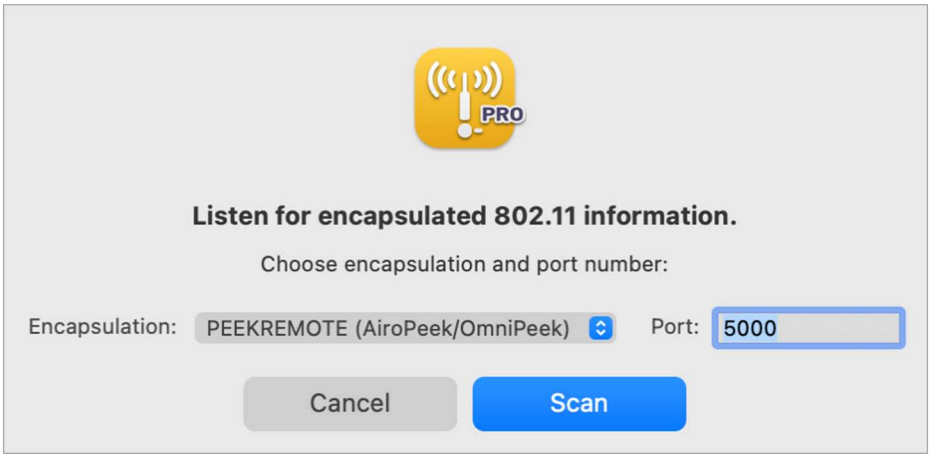

Figure 4-8 - Listener mode: PEEKREMOTE

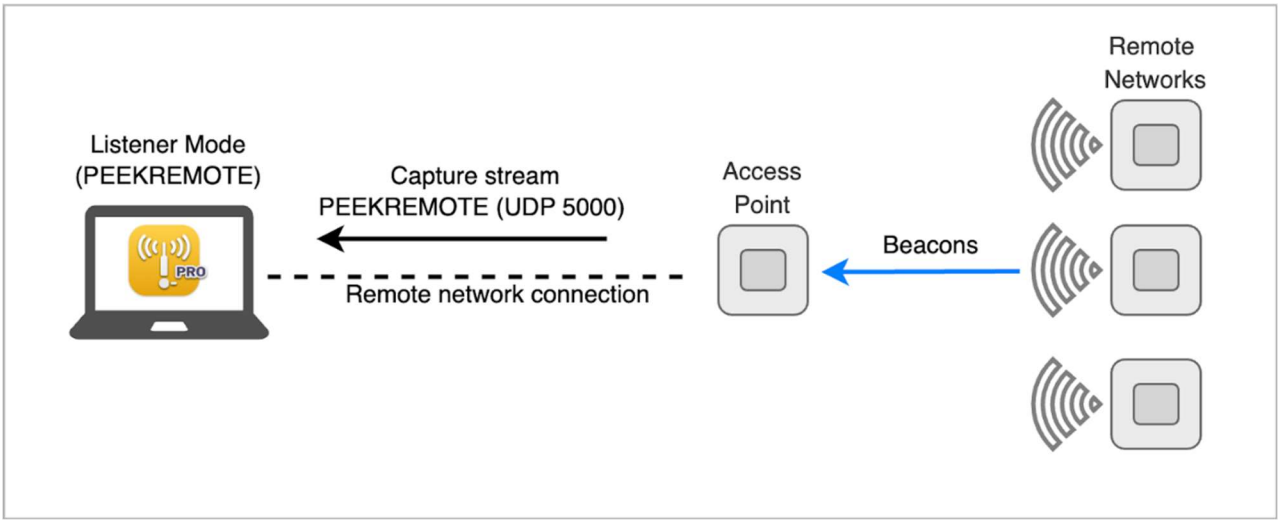

Figure 4-9 - PEEKREMOTE capture stream from an access point

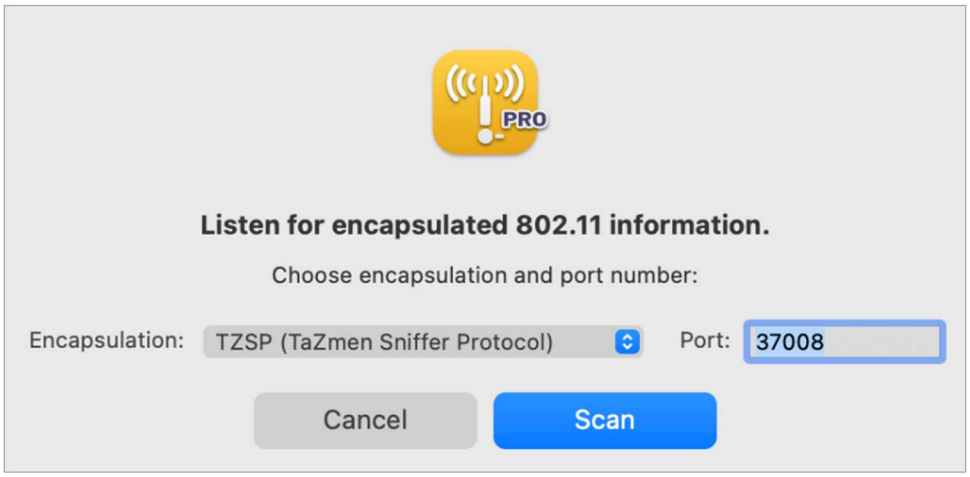

Figure 4-10 - Listener mode: TZSP

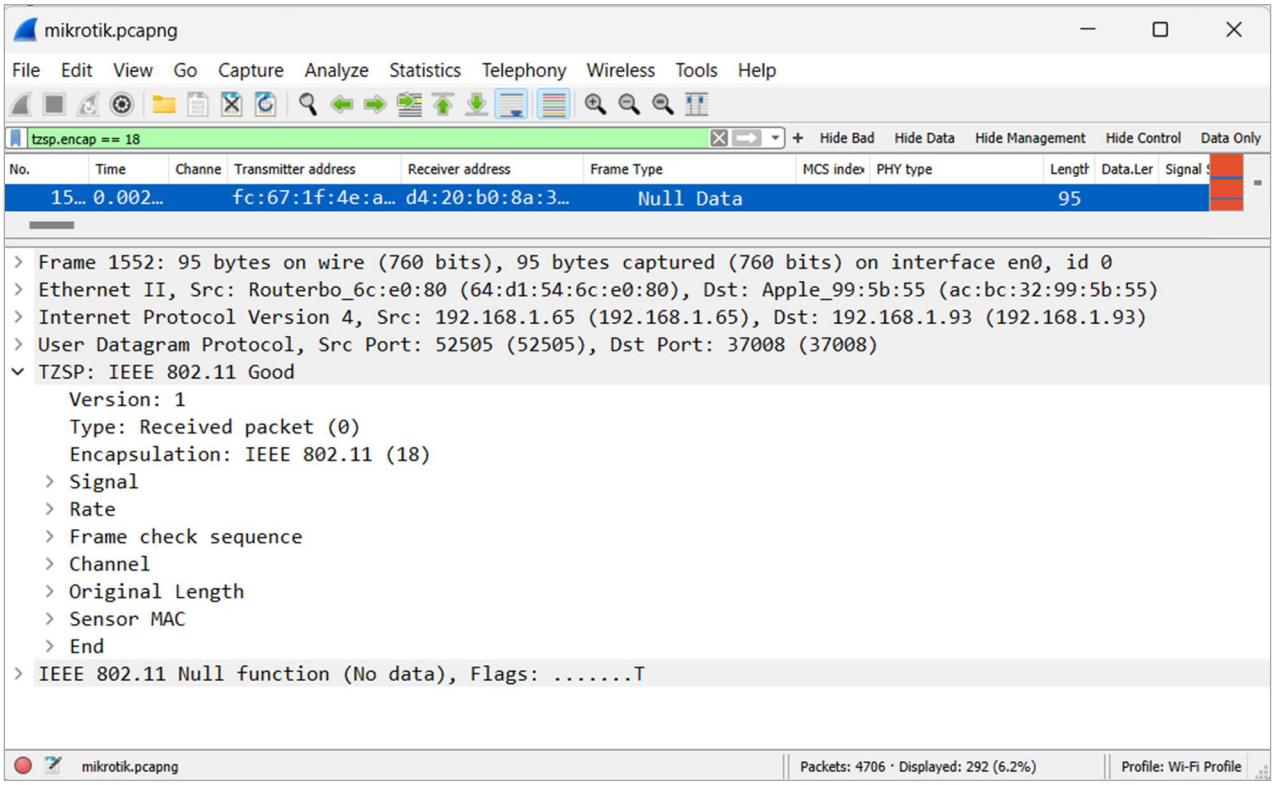

Figure 4-11 - TZSP header data example

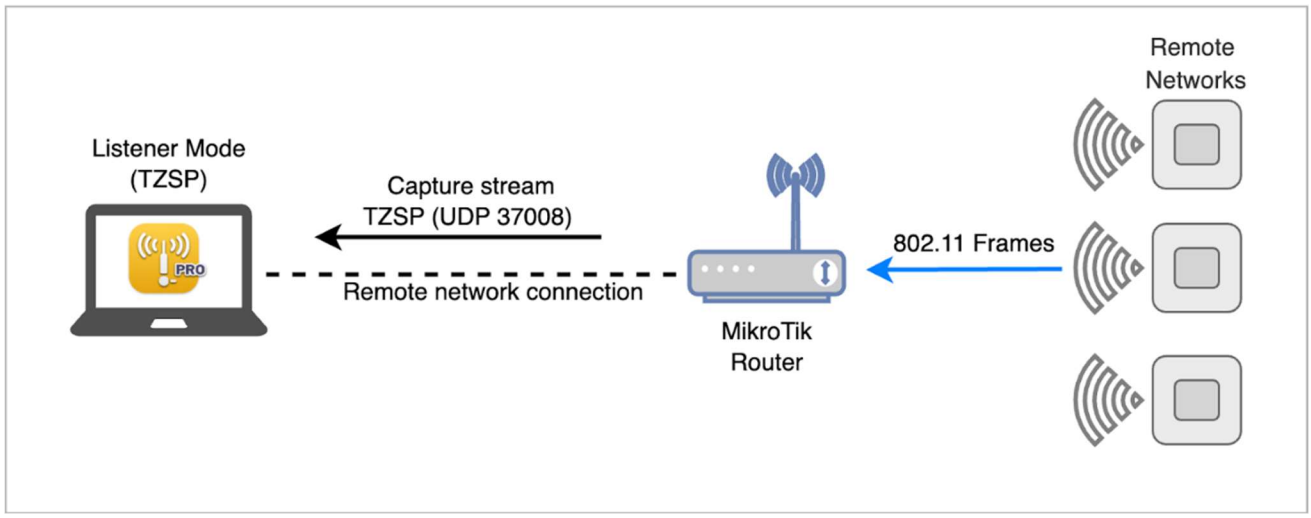

Figure 4-12 - TZSP capture stream from MikroTik device

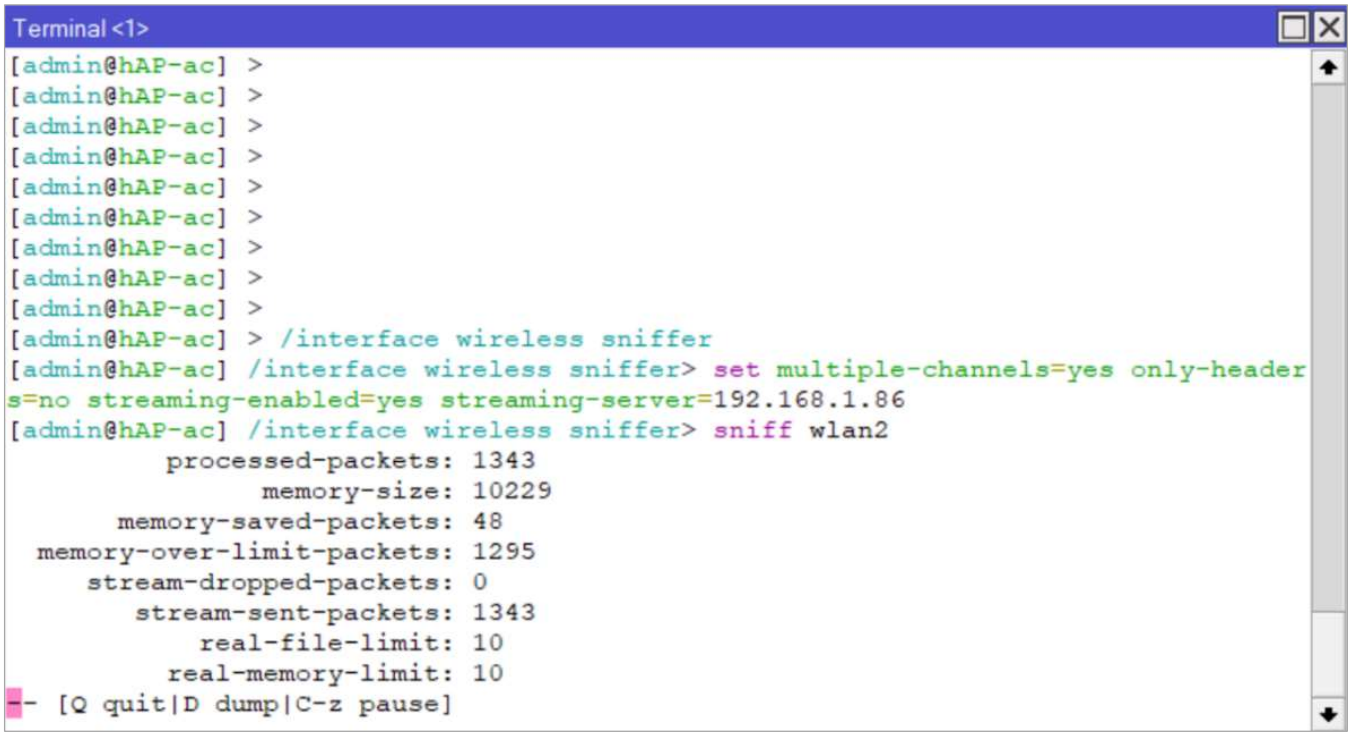

Figure 4-13 - MikroTik device capture

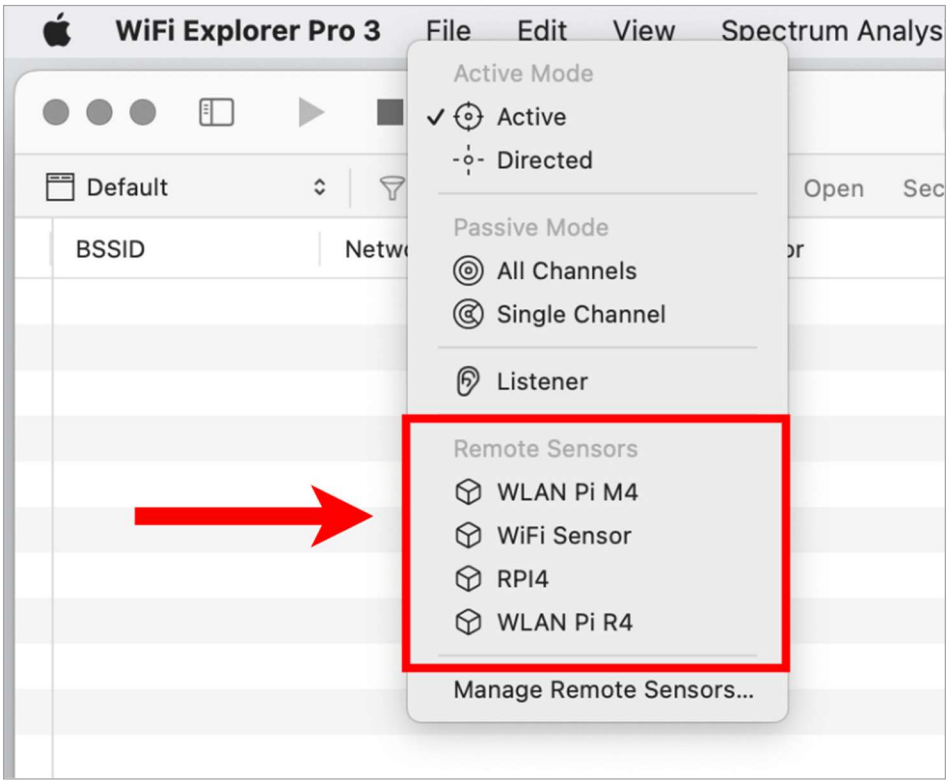

Figure 4-14 - Remote sensors selection and management options

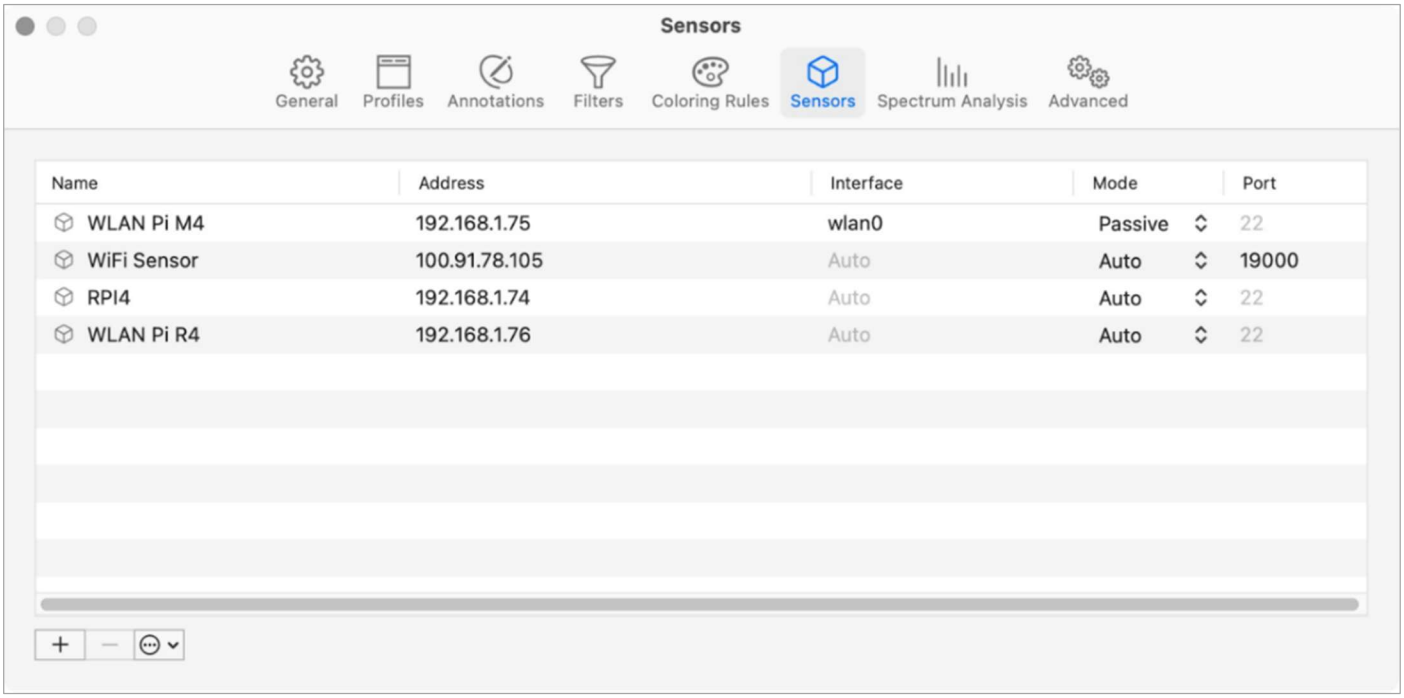

Figure 4-15 - Remote sensor management

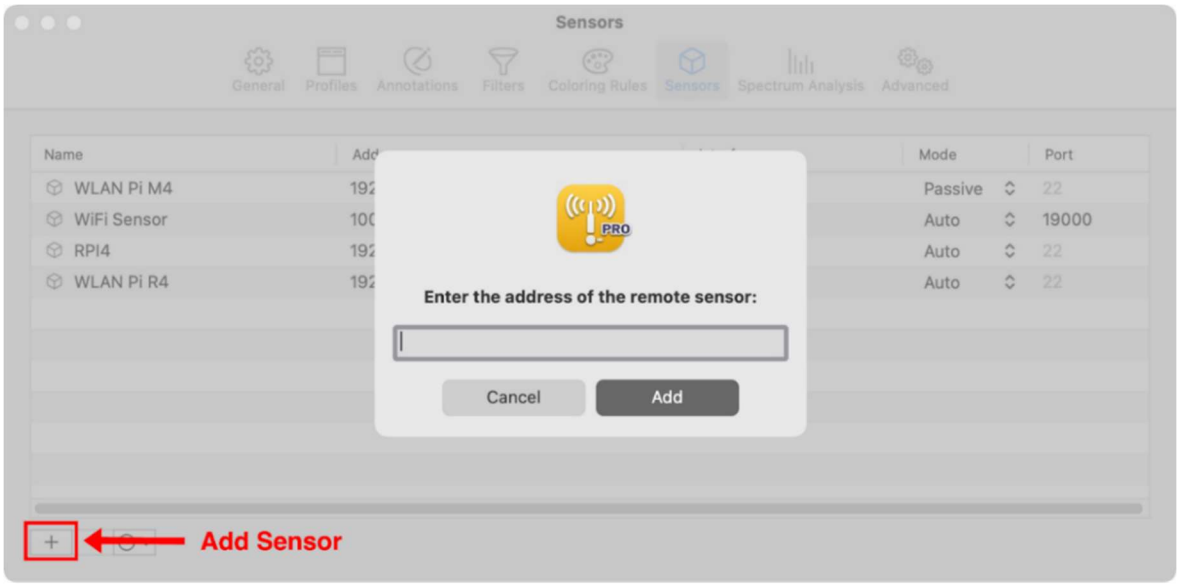

Figure 4-16 - Adding a new sensor

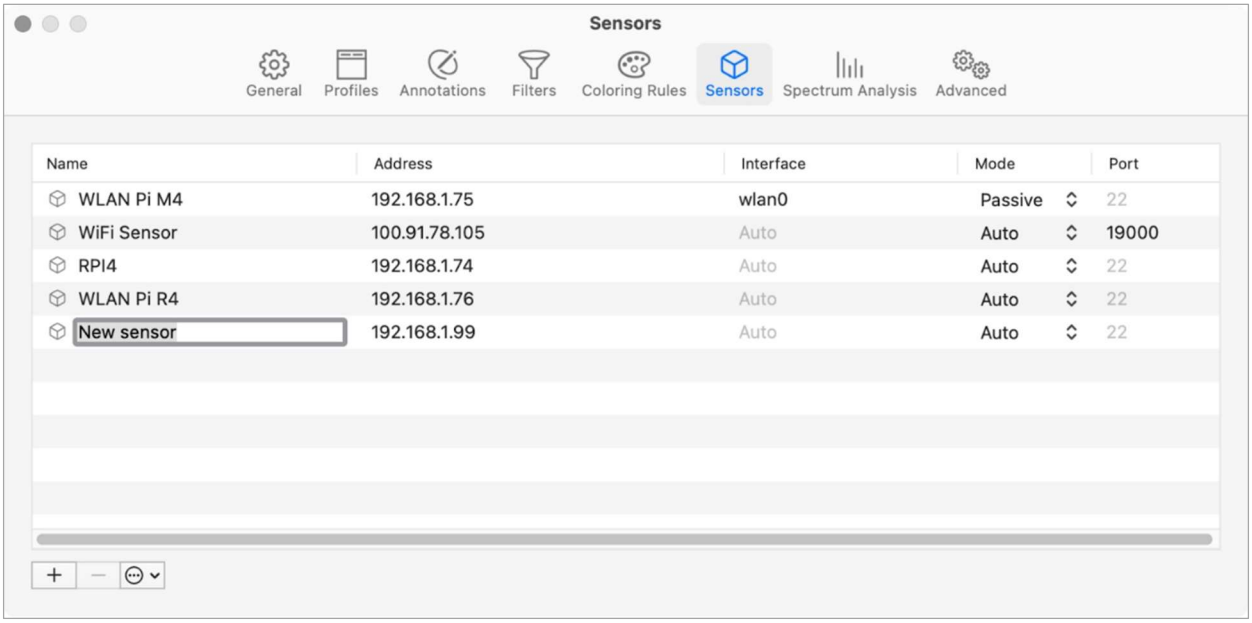

Figure 4-17 - A new sensor with initial attribute values

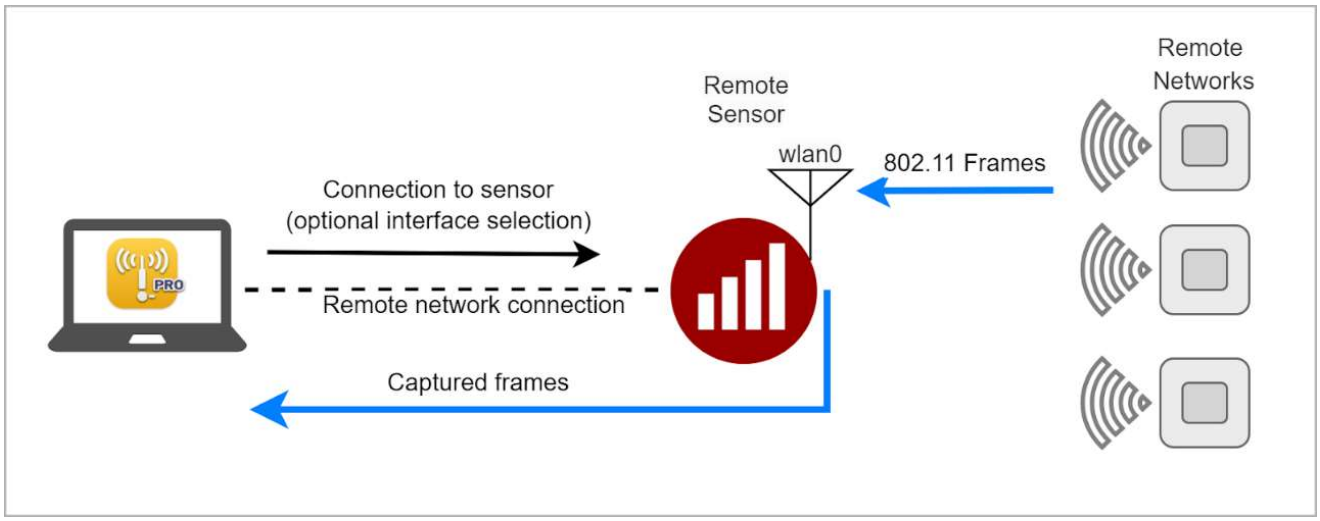

Figure 4-18 - Remote sensor operation

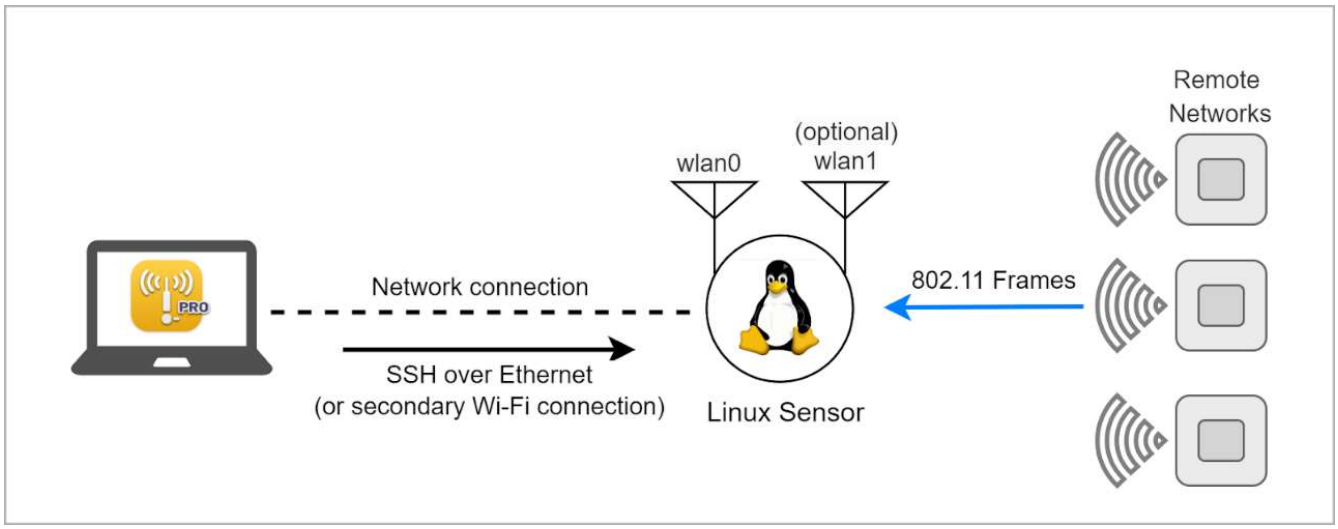

Figure 4-19 - Linux sensor overview

Figure 4-20 - WLAN Pi Pro, M4 and R4

Figure 4-21 - WLAN Pi NEO2

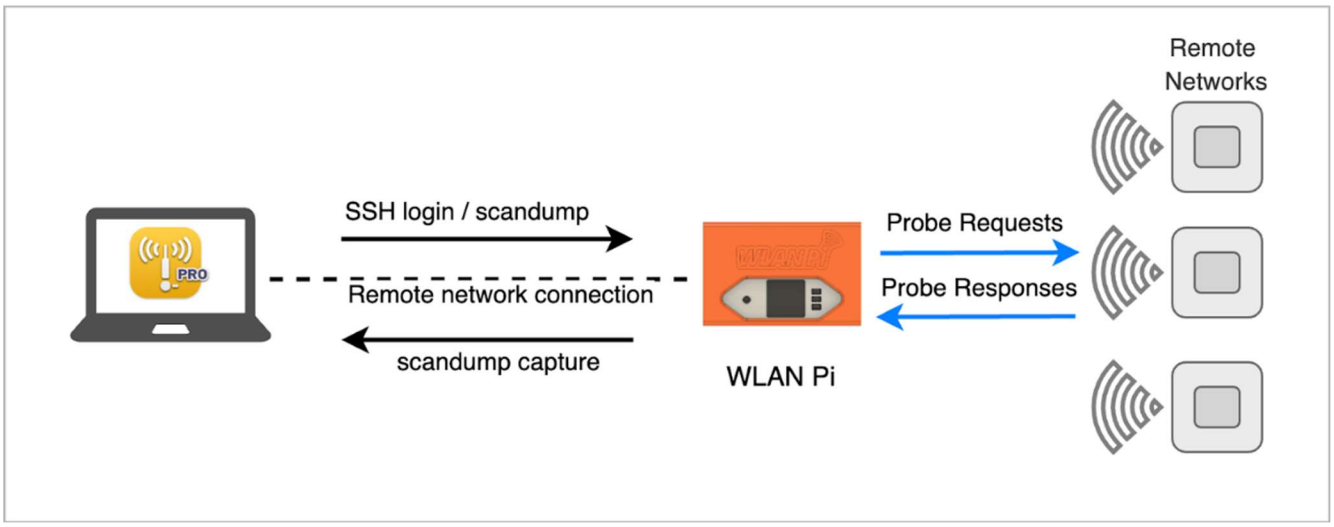

Figure 4-22 - WLAN Pi as a remote sensor using active scanning

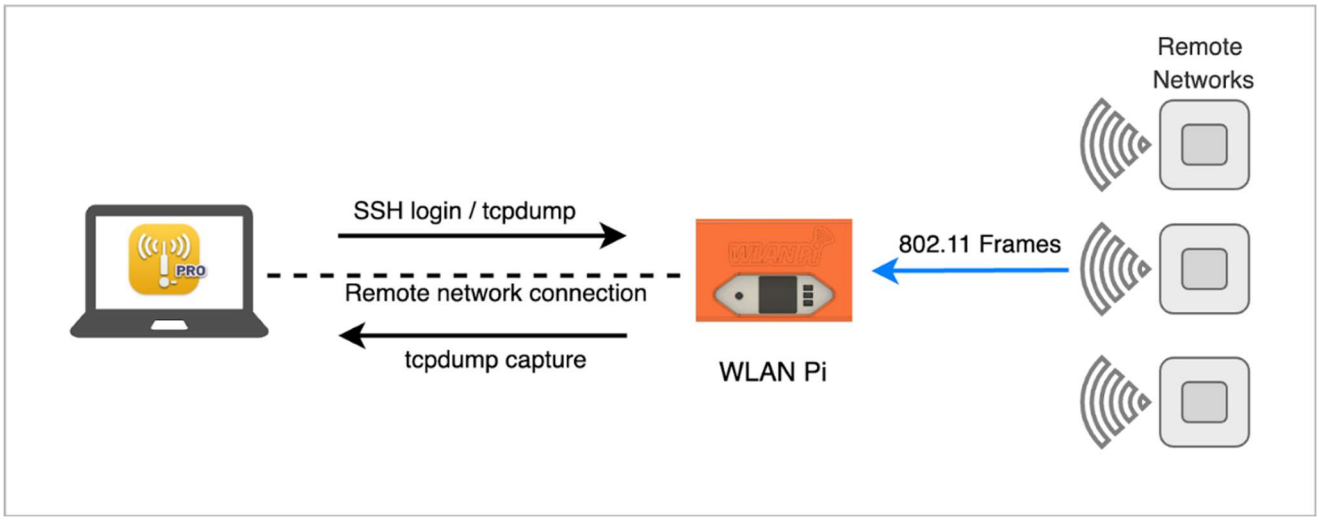

Figure 4-23 - WLAN Pi as a remote sensor using passive scanning

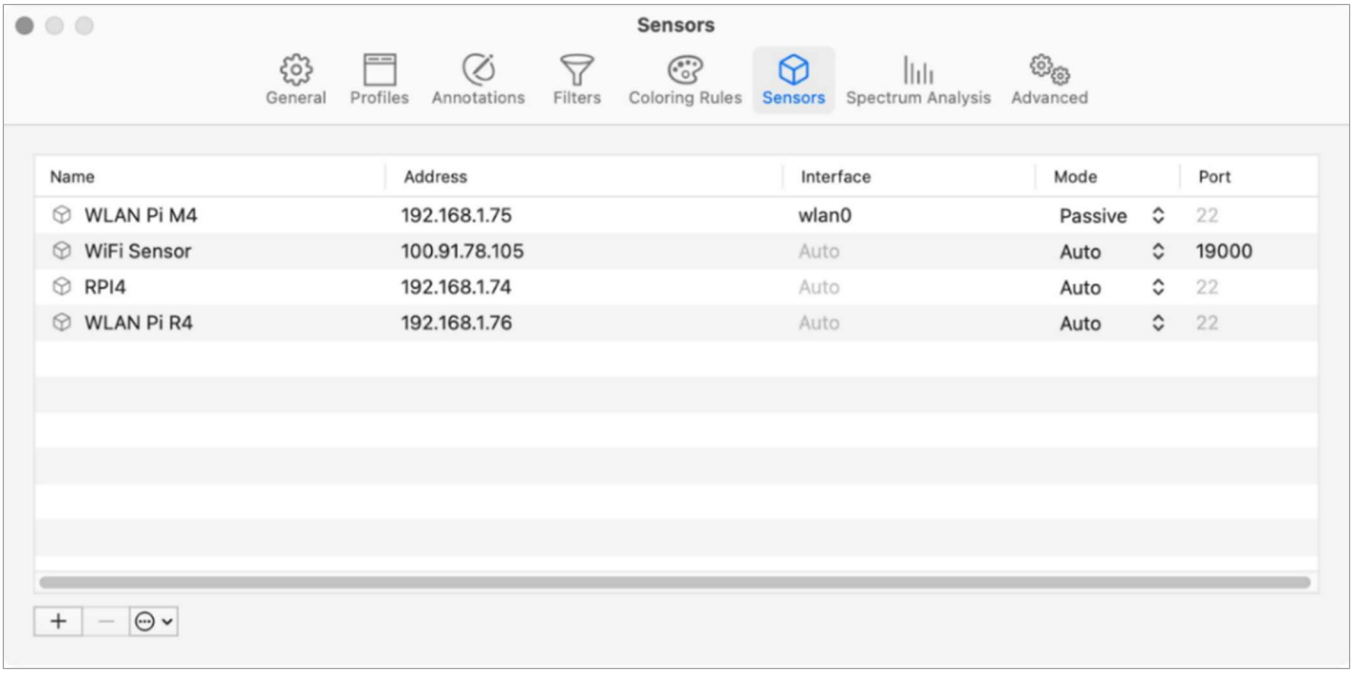

Figure 4-24 - Sensor management panel showing WLAN Pi sensors

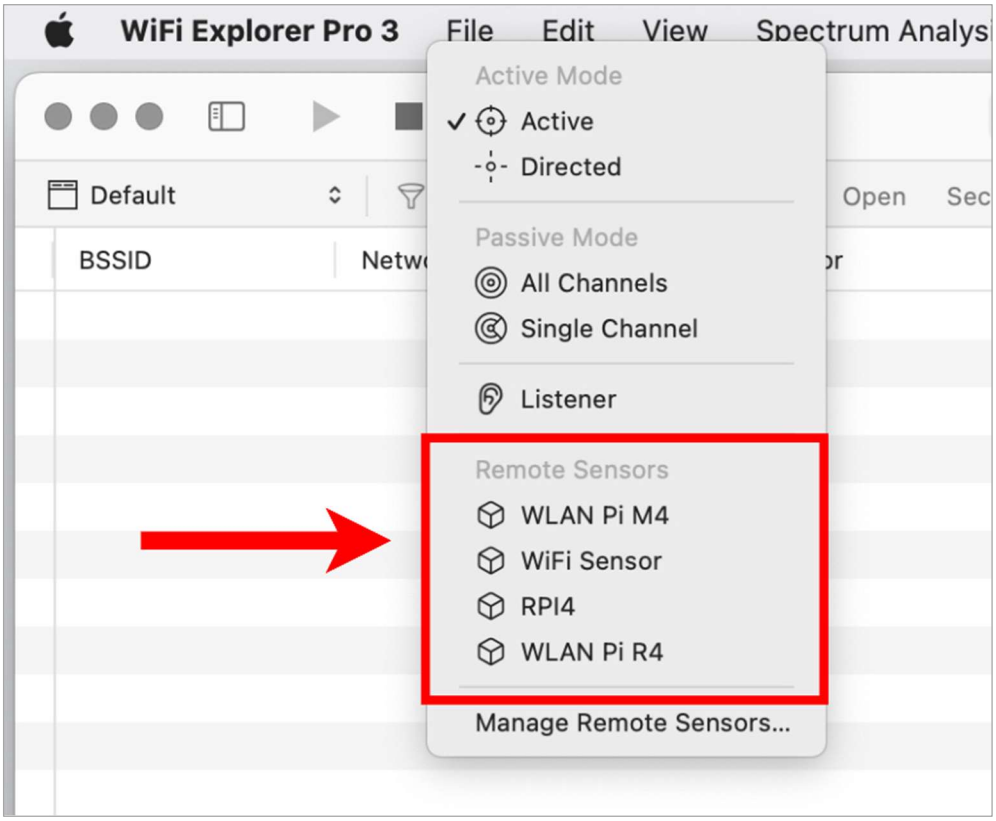

Figure 4-25 - WFE Pro 3 scan mode selector showing WLAN Pi sensors

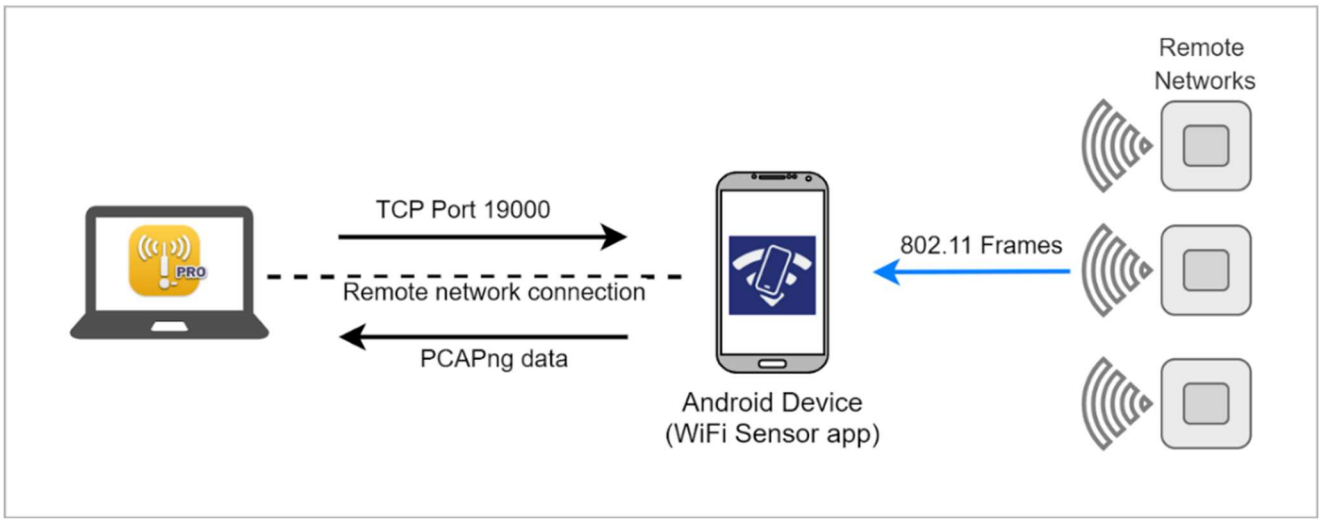

Figure 4-26 - WiFi Sensor app as a remote sensor

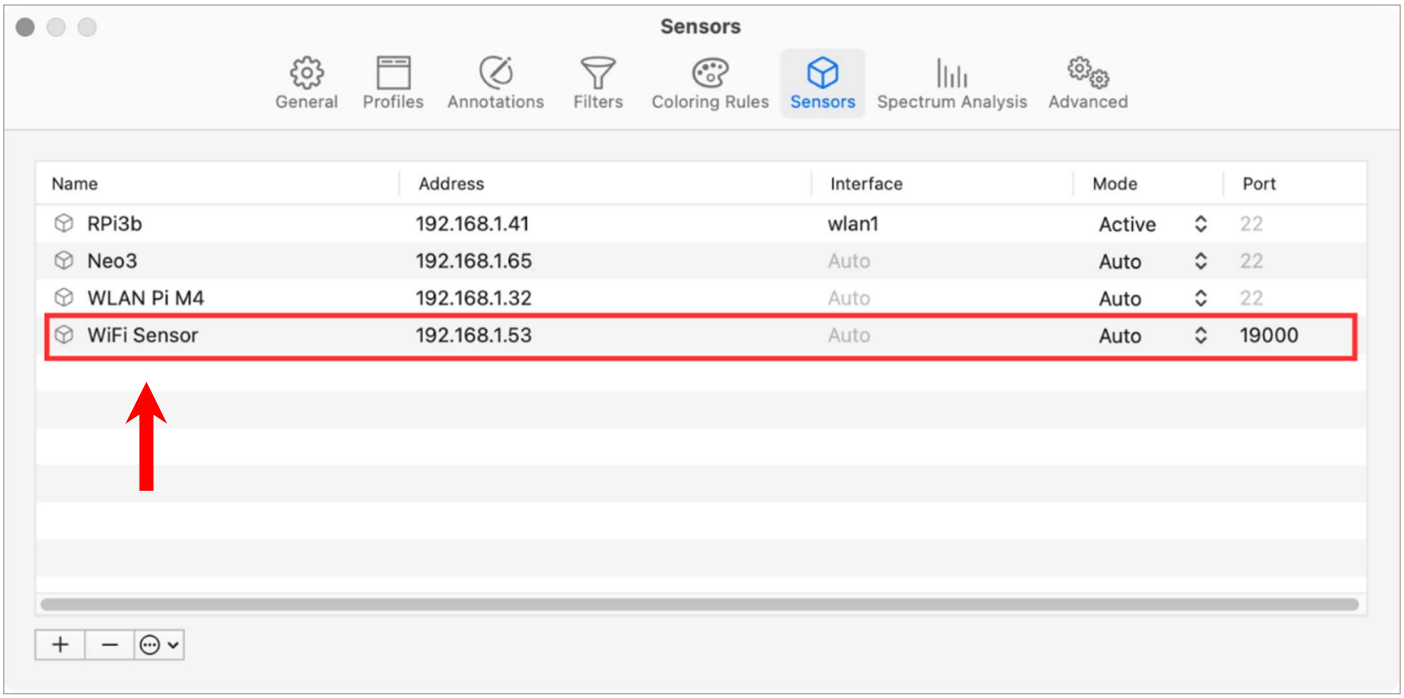

Figure 4-27 - WiFi Sensor Android device added to WFE Pro 3 sensor list

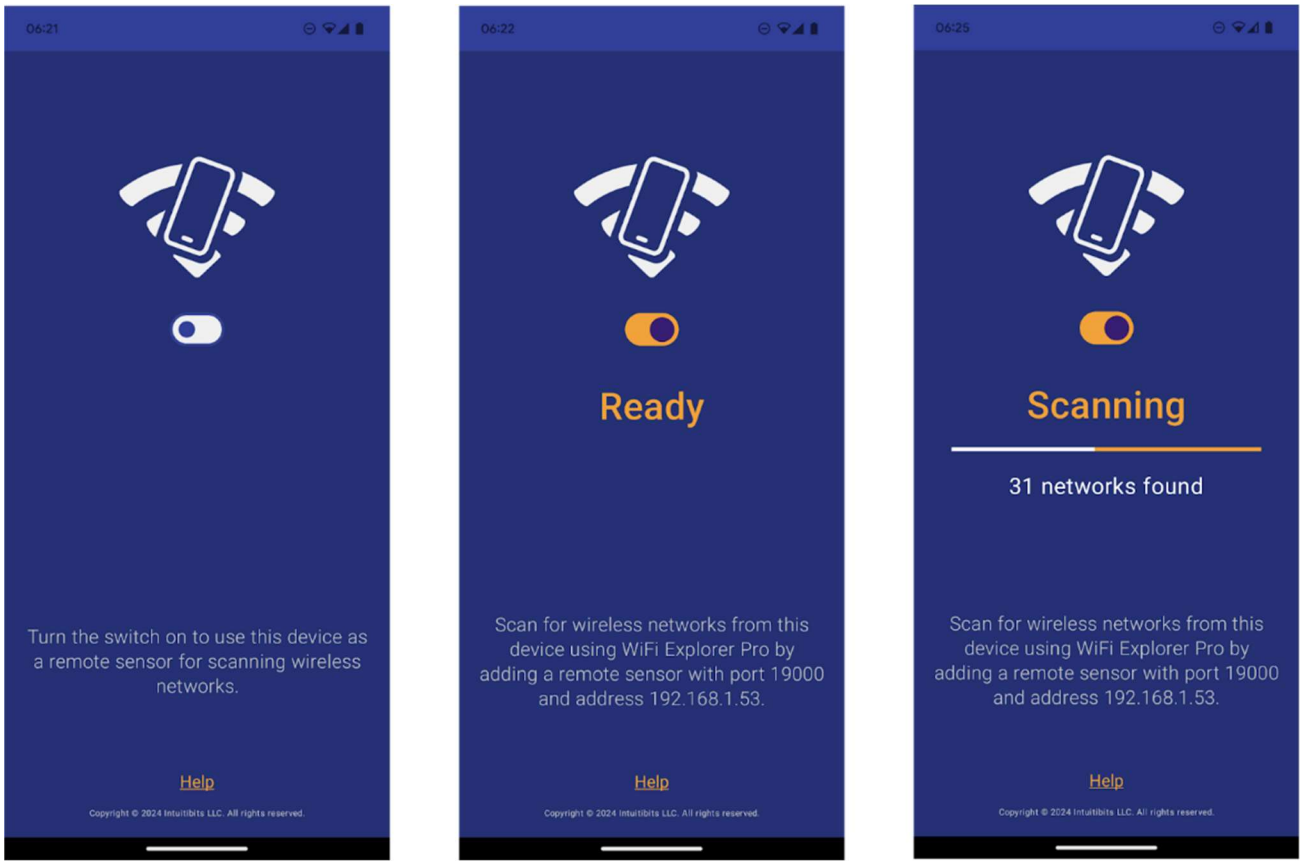

Figure 4-28 - WiFi Sensor app operation

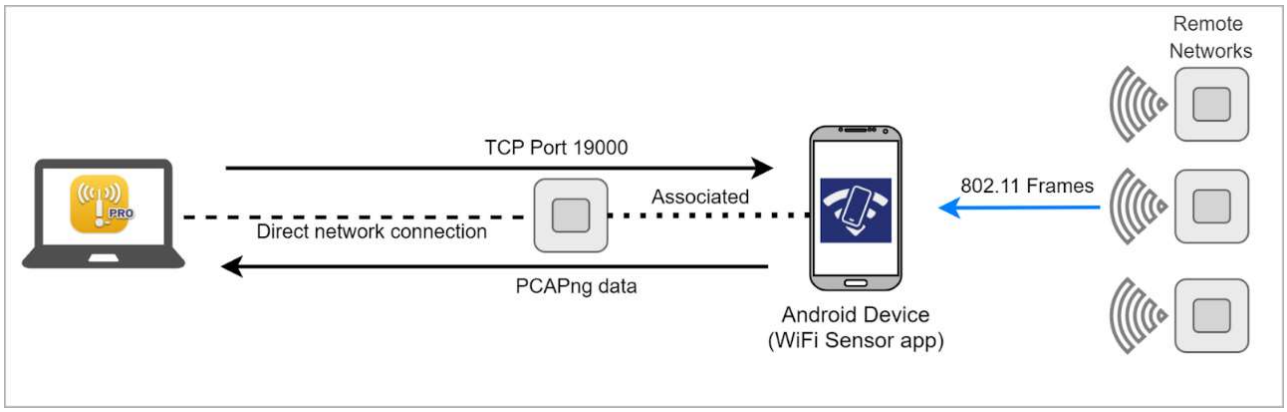

Figure 4-29 - WiFi Sensor direct connectivity

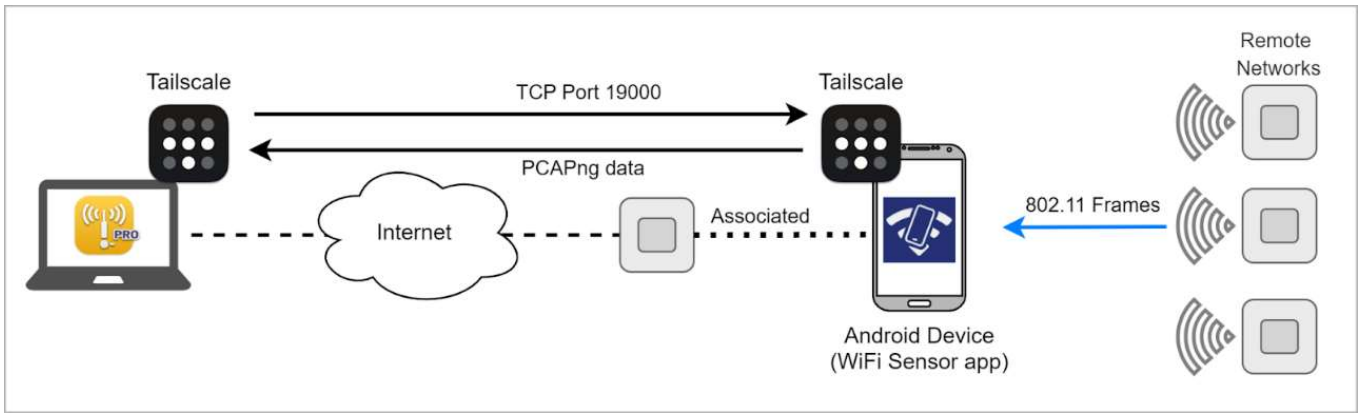

Figure 4-30 - WiFi Sensor VPN connectivity (local Wi-Fi connection)

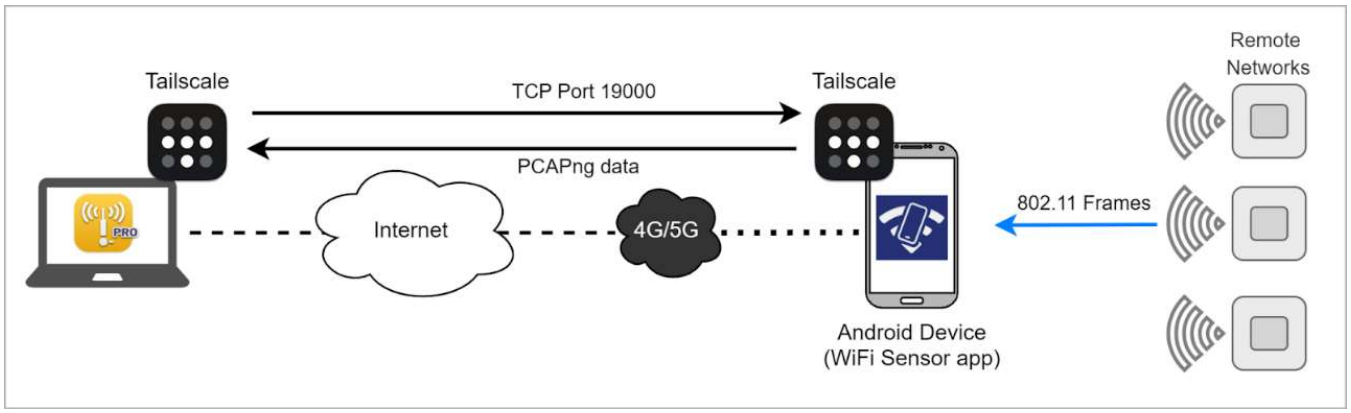

Figure 4-31 - WiFi Sensor VPN connectivity (cellular connection)

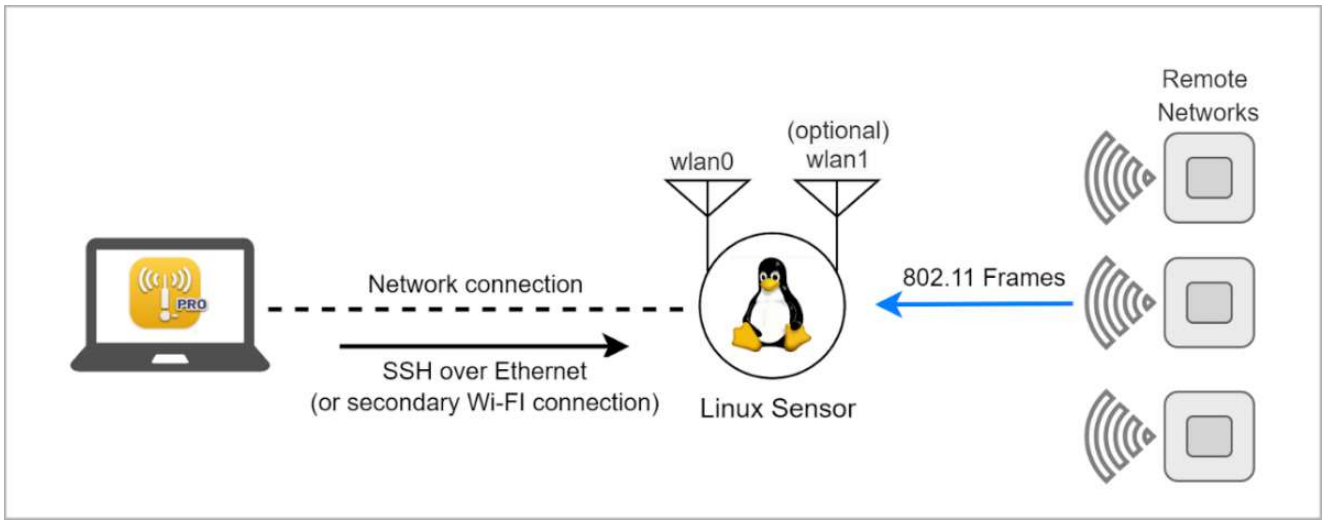

Figure 4-32 - Linux sensor overview

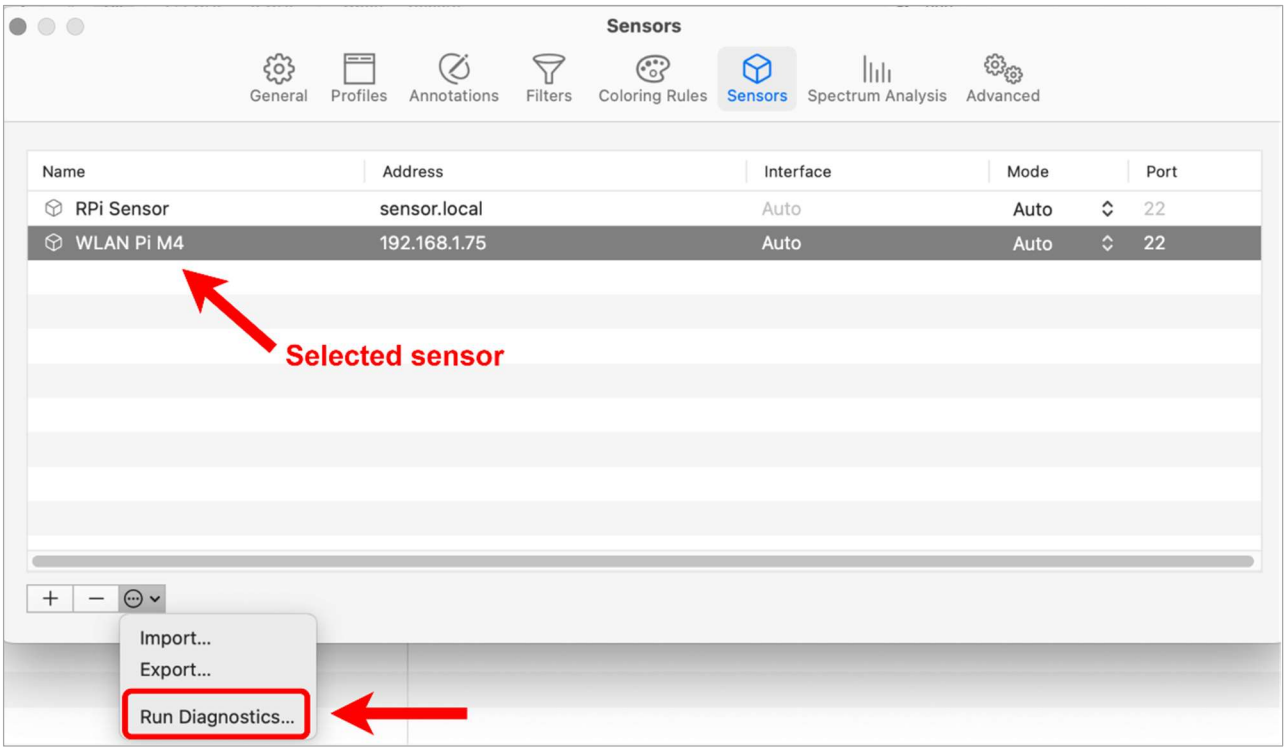

Figure 4-33 - Remote sensor diagnostics

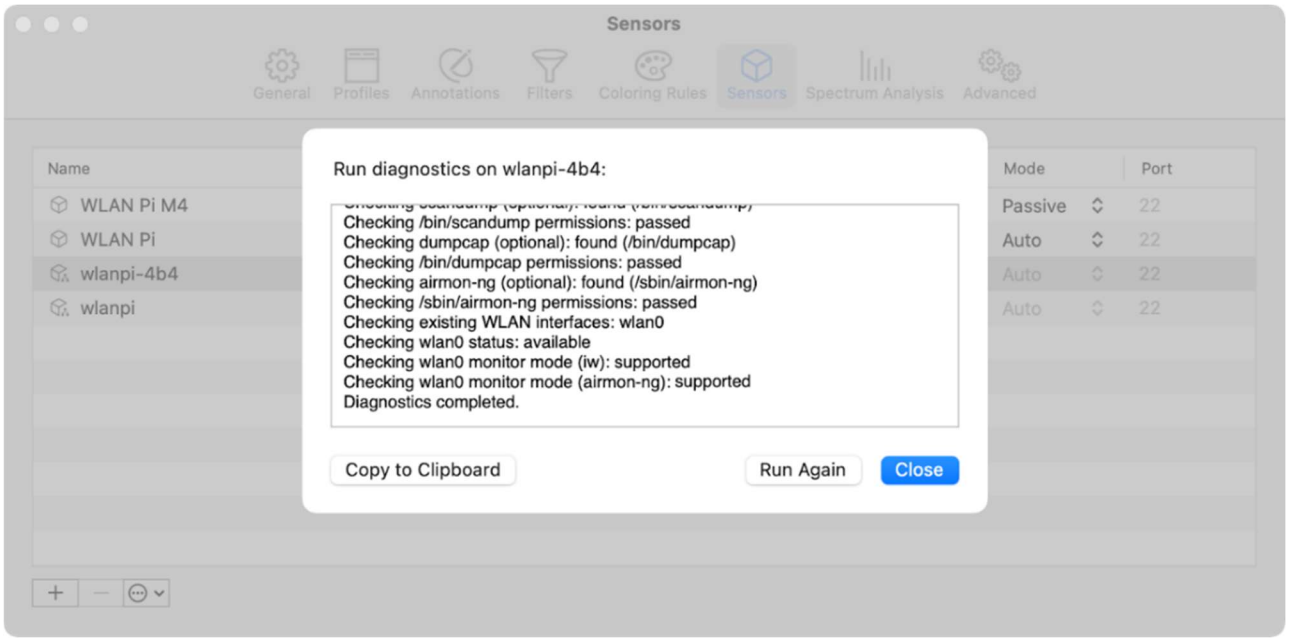

Figure 4-34 - Remote sensor diagnostics results

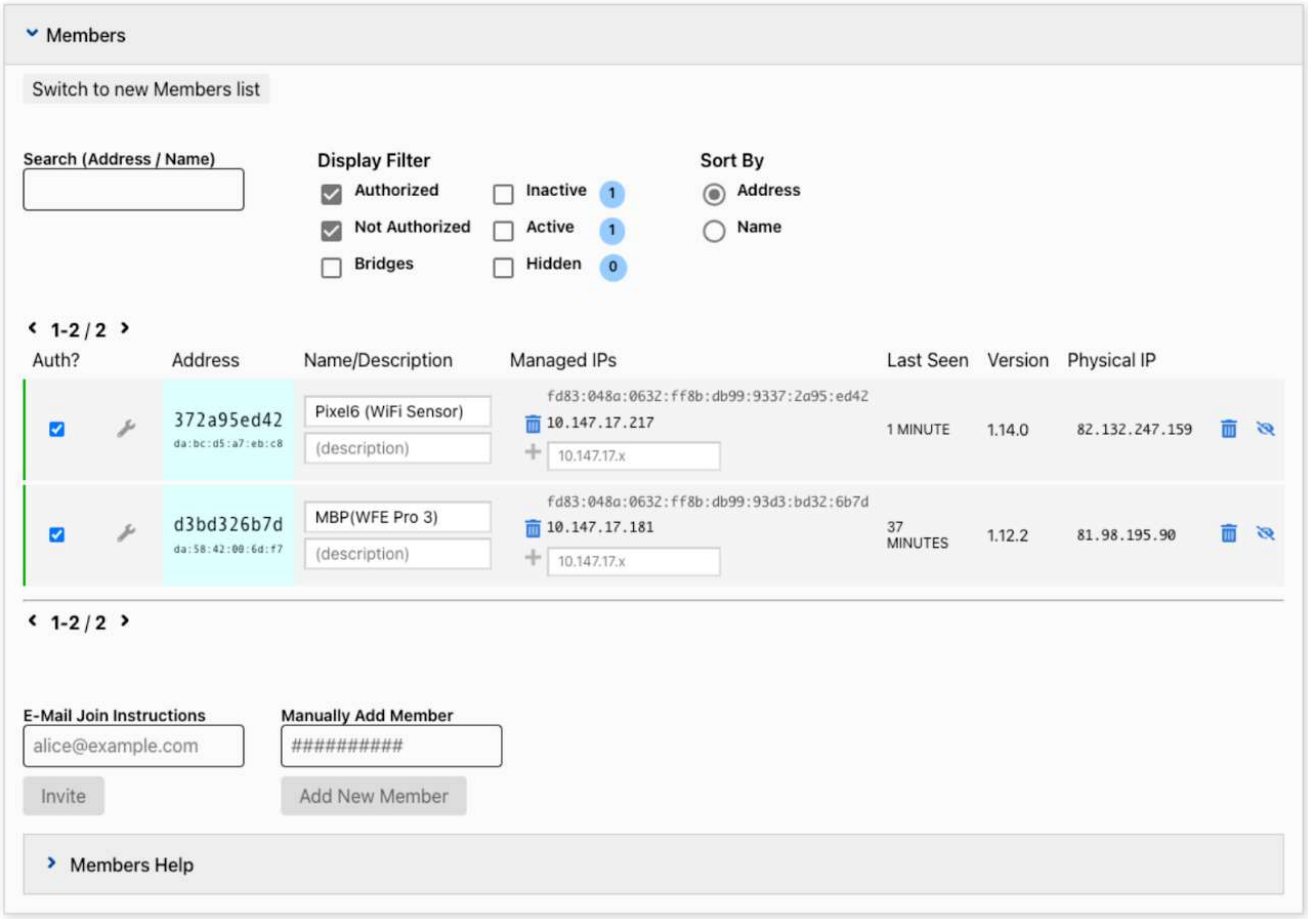

Figure 4-35 - ZeroTier dashboard showing WFE Pro 3 and WiFi Sensor endpoints

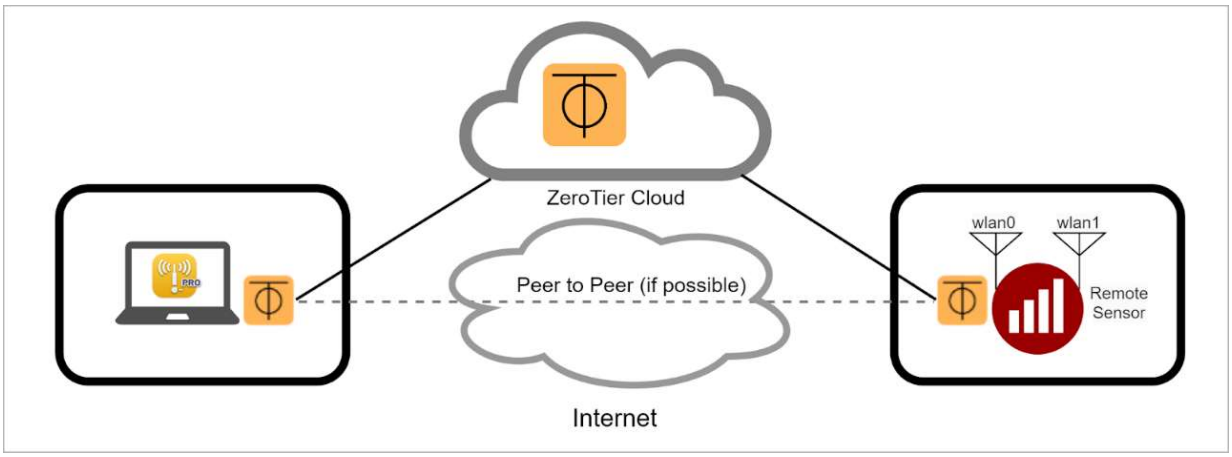

Figure 4-36 - ZeroTier Connectivity

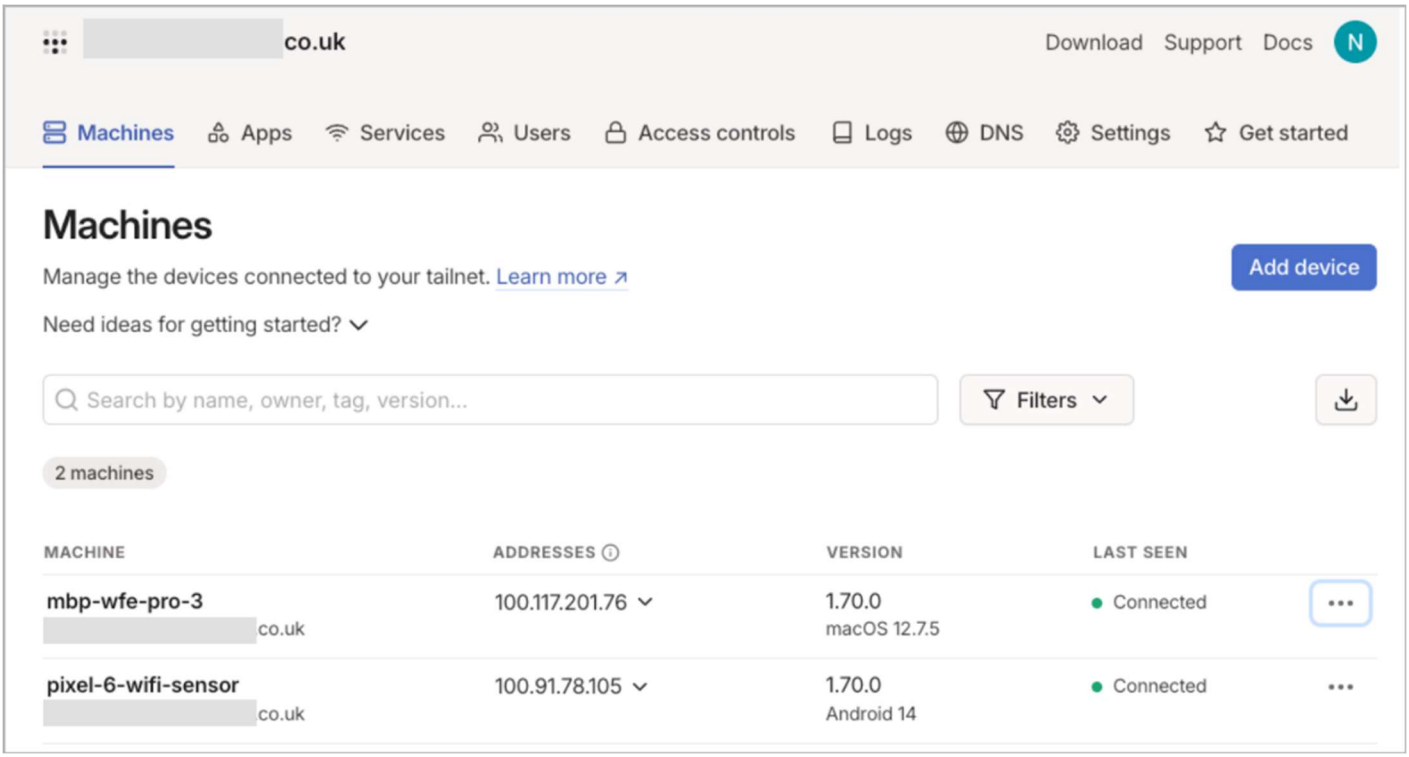

Figure 4-37 - Tailscale dashboard showing WFE Pro 3 and WiFi Sensor endpoints

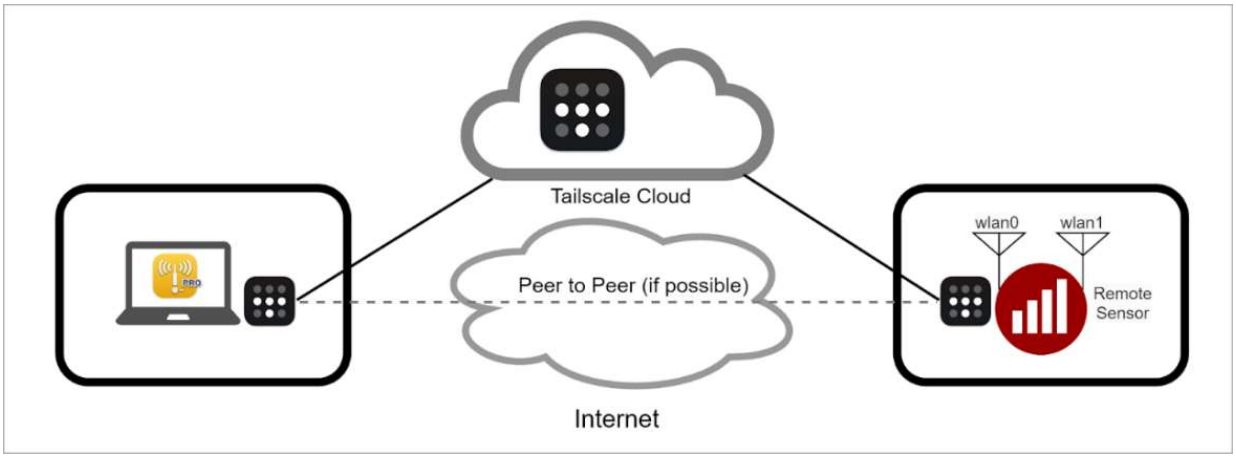

Figure 4-38 - Tailscale Connectivity

Chapter 5 - Data Import From External Systems

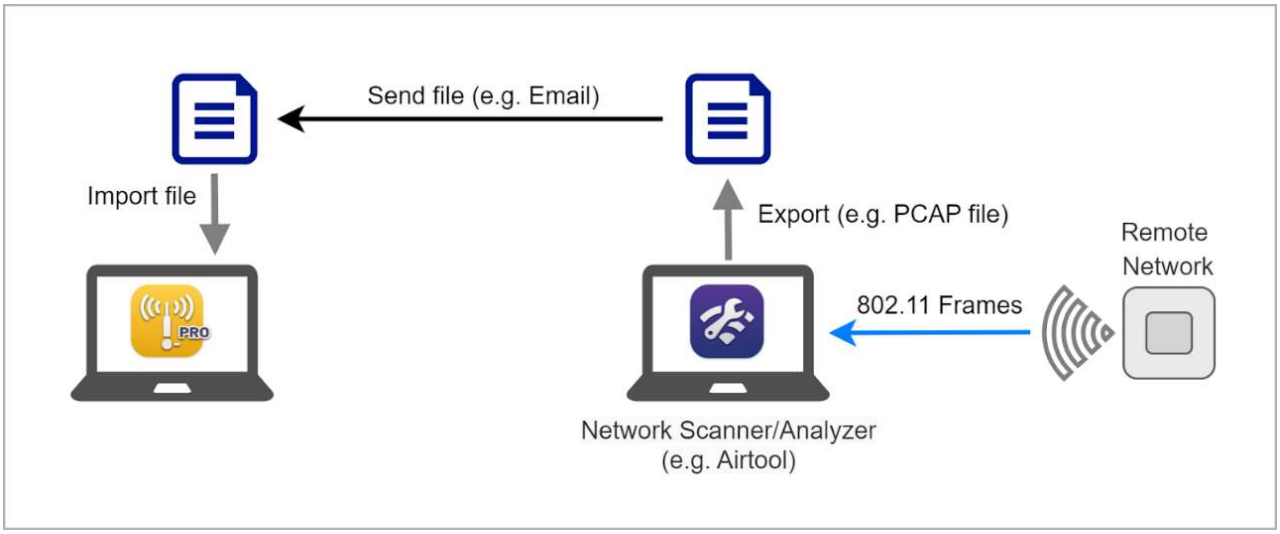

Figure 5-1 - Data import from frame capture application/utility

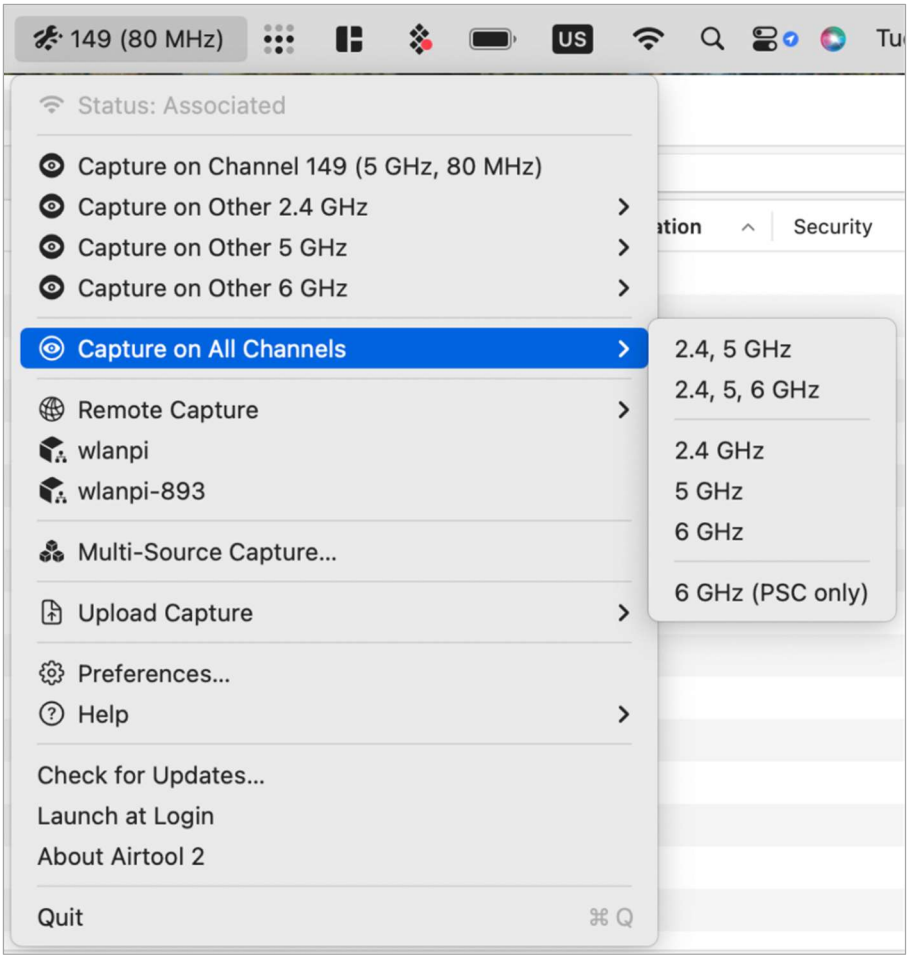

Figure 5-2 - Airtool 2 multi-channel scanning option

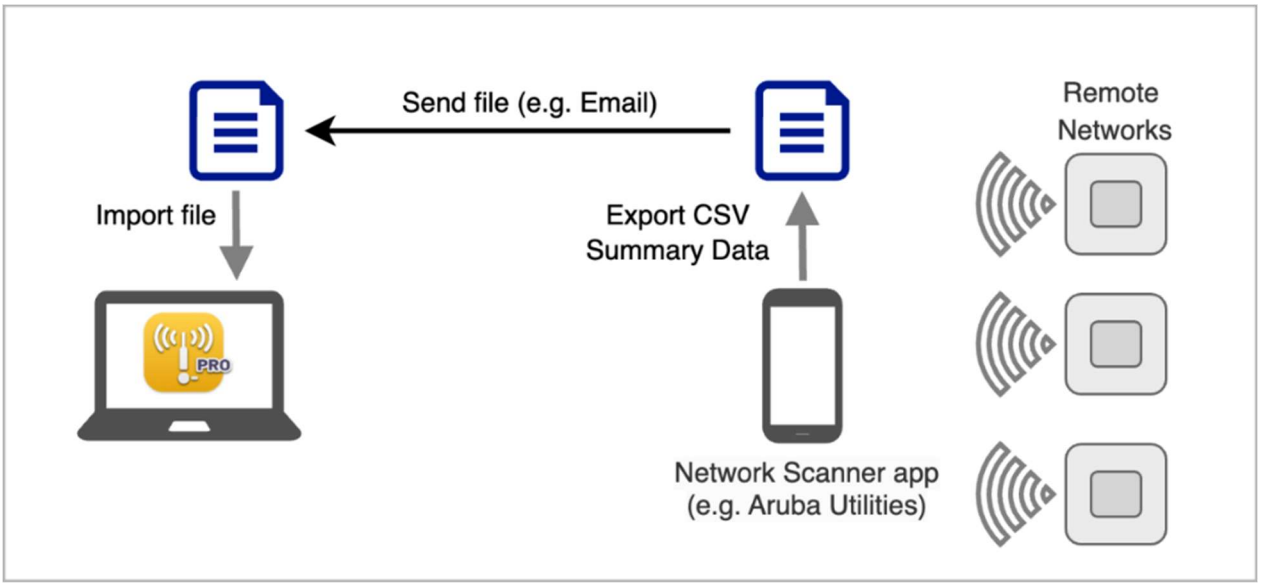

Figure 5-3 - Data import from a network scanner app

text-9810CF953F47-1.txt

```
SSID, BSS, RSSI, Channel, Time
"VM0108420", "C0:06:C3:4F:EA:C2", "-74", "12", "06:16:42"
"VM0108420", "C0:06:C3:4F:EA:C2", "-75", "12", "06:16:45"
"VM0108420", "C0:06:C3:4F:EA:C2", "-77", "12", "06:16:48"
"VM0108420", "C0:06:C3:4F:EA:C2", "-77", "12", "06:16:52"
"VM0108420", "C0:06:C3:4F:EA:C2", "-78", "12", "06:16:55"
"VM0108420", "C0:06:C3:4F:EA:C2", "-79", "12", "06:16:58"
"BT-GMA266", "78:DD:12:B5:0B:37", "-84", "1", "06:16:42"
"BT-GMA266", "78:DD:12:B5:0B:37", "-84", "1", "06:16:45"
"BT-GMA266", "78:DD:12:B5:0B:37", "-90", "1", "06:16:48"
"BT-GMA266", "78:DD:12:B5:0B:37", "-85", "1", "06:16:52"
"BT-GMA266", "78:DD:12:B5:0B:37", "-84", "1", "06:16:55"
"BT-GMA266", "78:DD:12:B5:0B:37", "-84", "1", "06:16:58"
"VM6643873", "18:35:D1:B9:71:DF", "-76", "44", "06:16:42"
"VM6643873", "18:35:D1:B9:71:DF", "-76", "44", "06:16:45"
"VM6643873", "18:35:D1:B9:71:DF", "-79", "44", "06:16:48"
```

Figure 5-4 - Exported CSV data sample

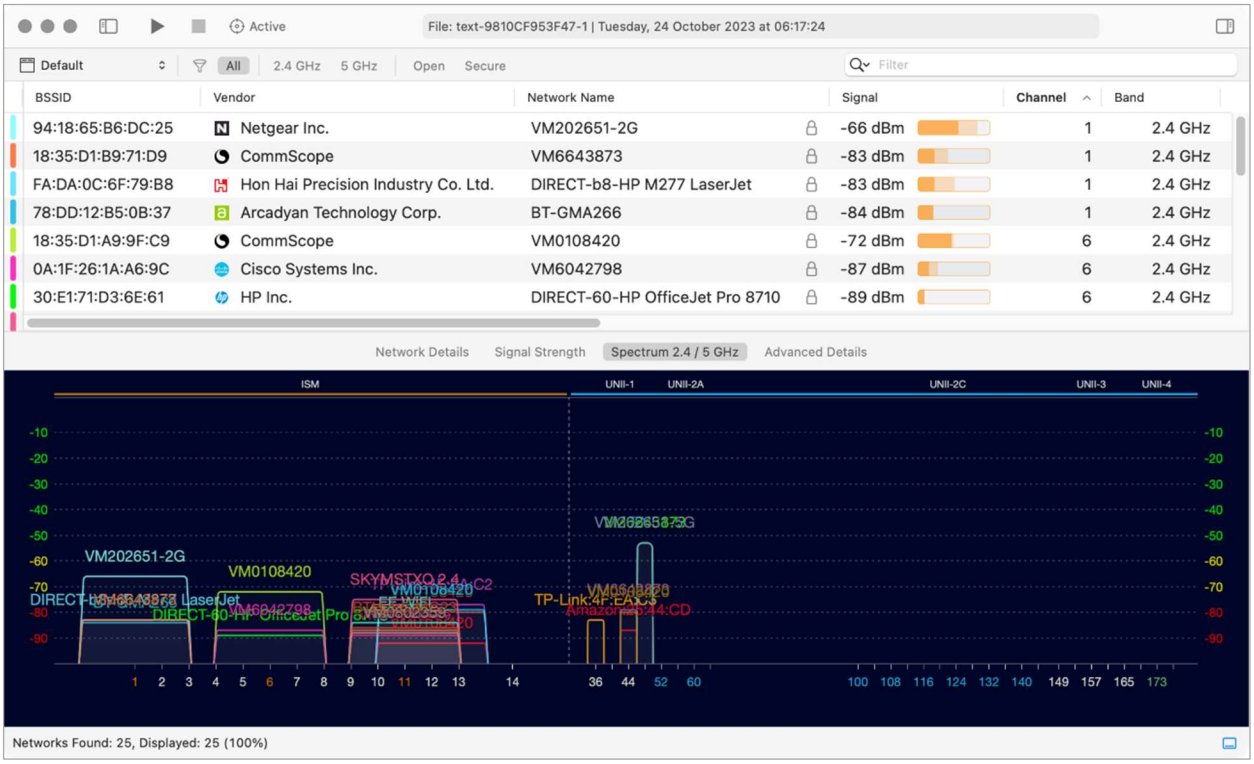

Figure 5-5 - WFE Pro 3 displaying imported CSV data (AirPort Utility)

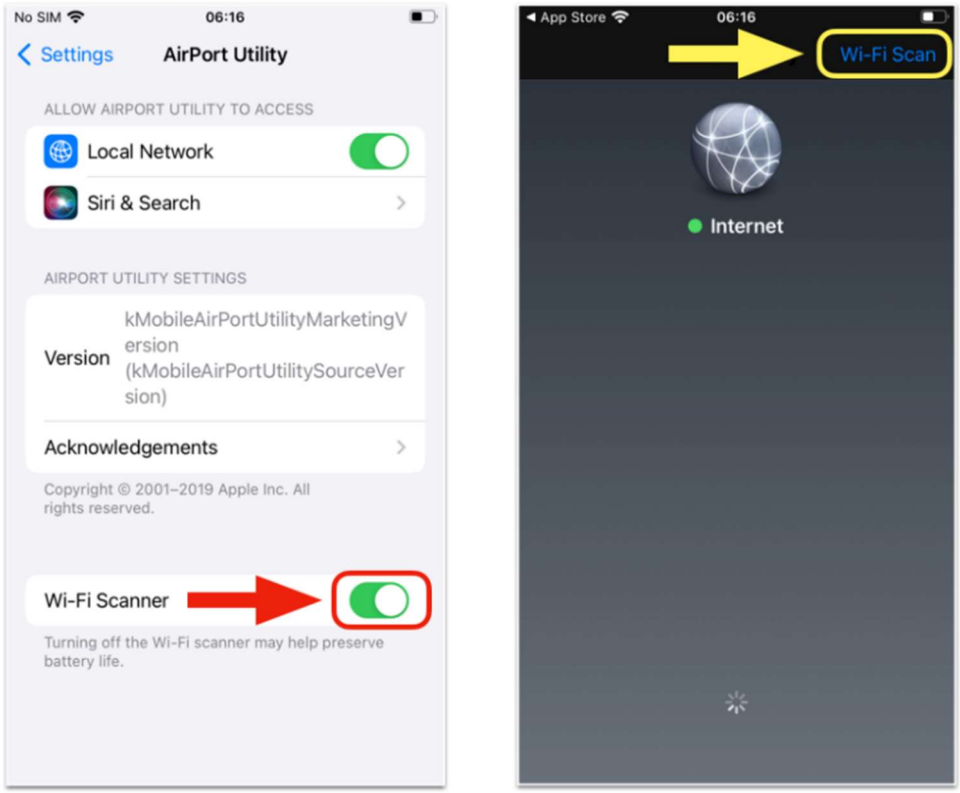

Figure 5-6 - Apple AirPort Utility setup #1

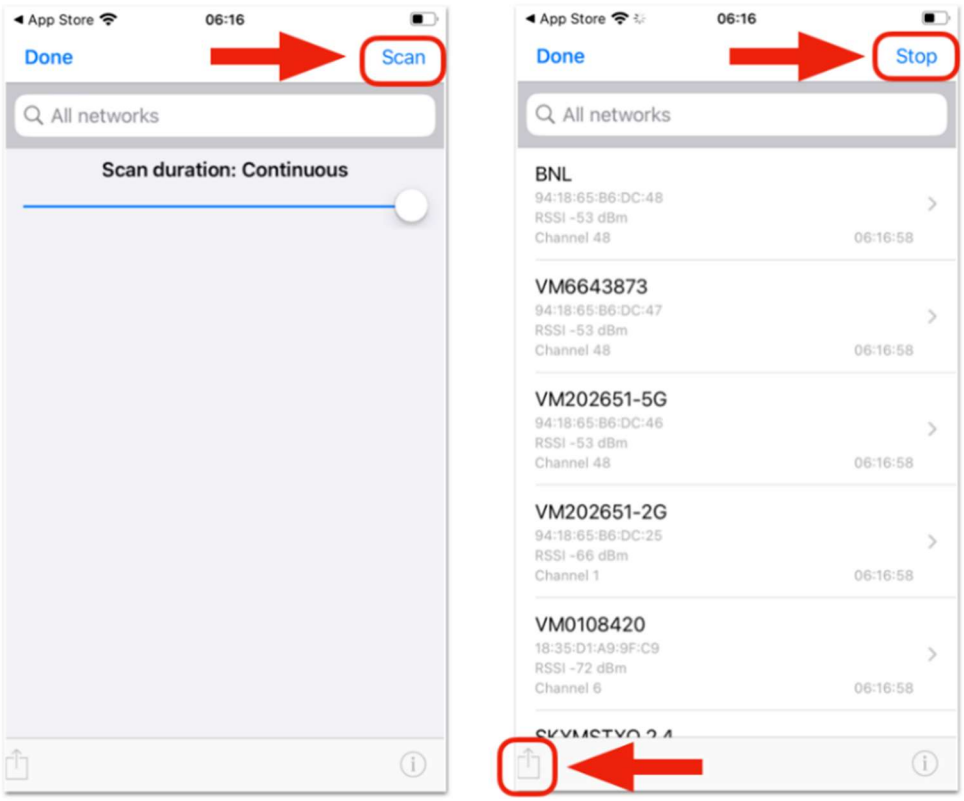

Figure 5-7 - Apple AirPort Utility setup #2

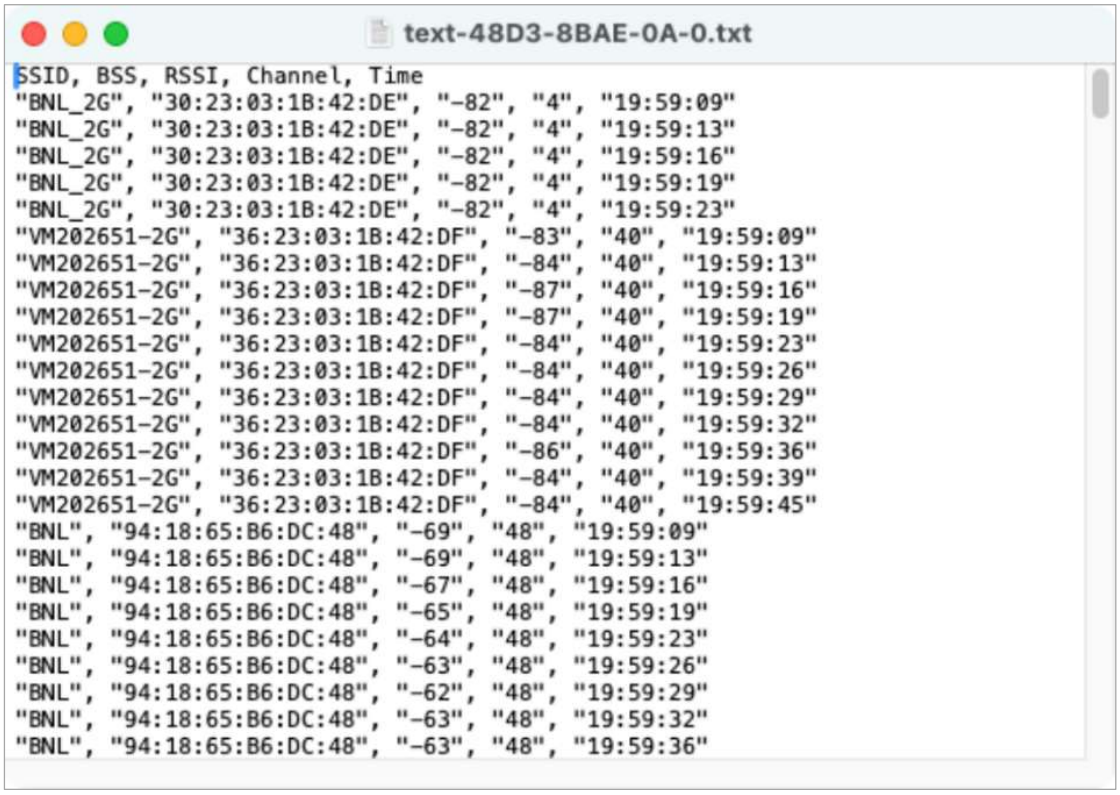

Figure 5-8 - Raw CSV data from AirPort Utility

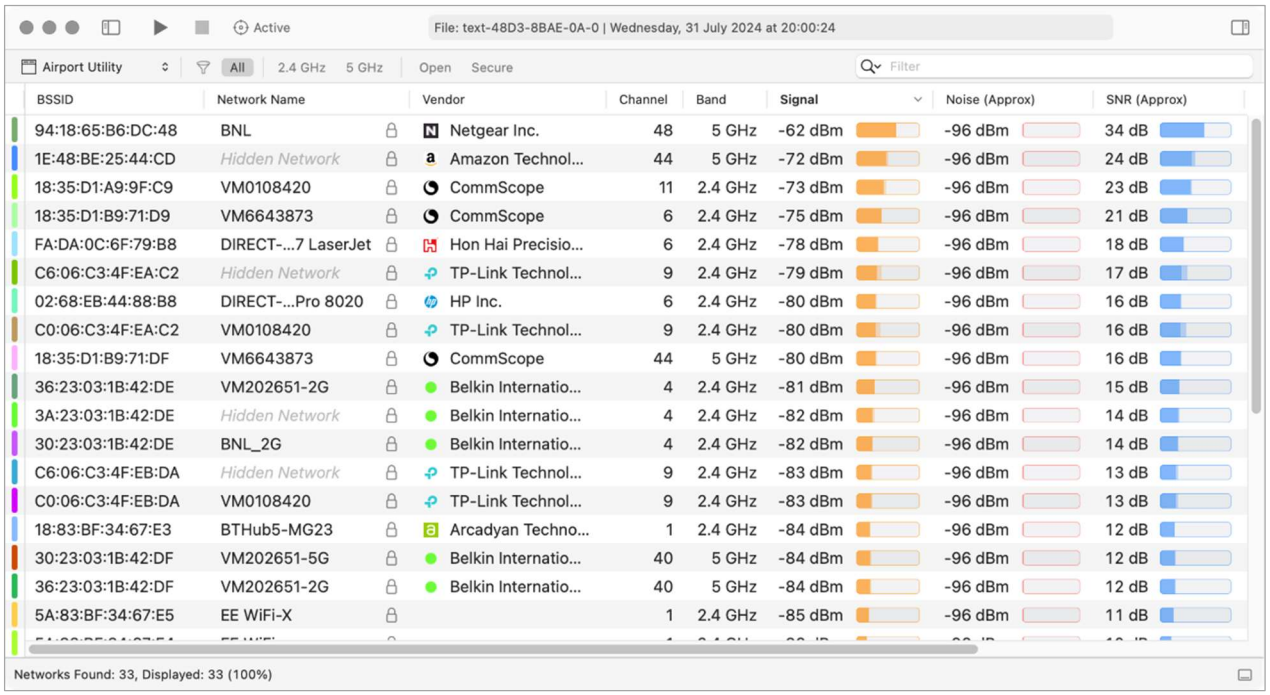

Figure 5-9 - AirPort Utility data displayed in WFE Pro 3

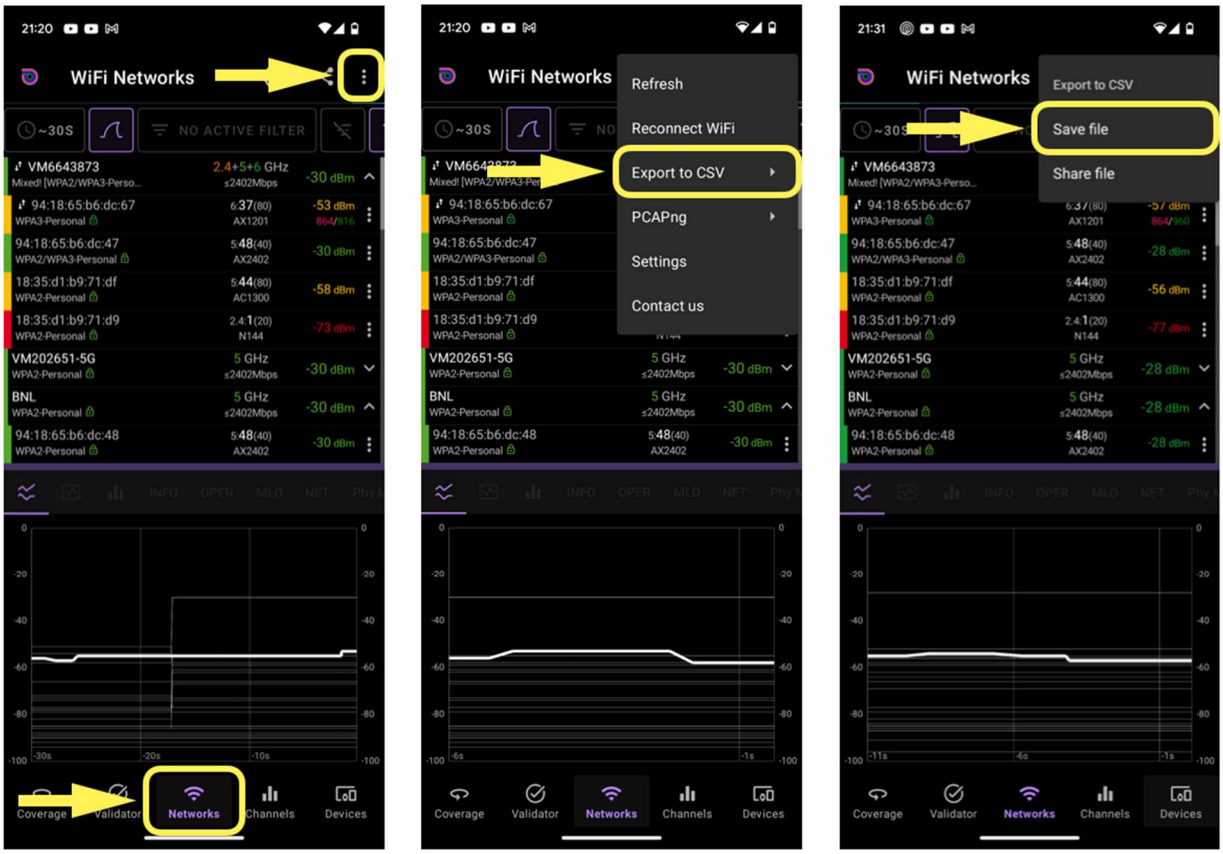

Figure 5-10 - Analiti CSV export process

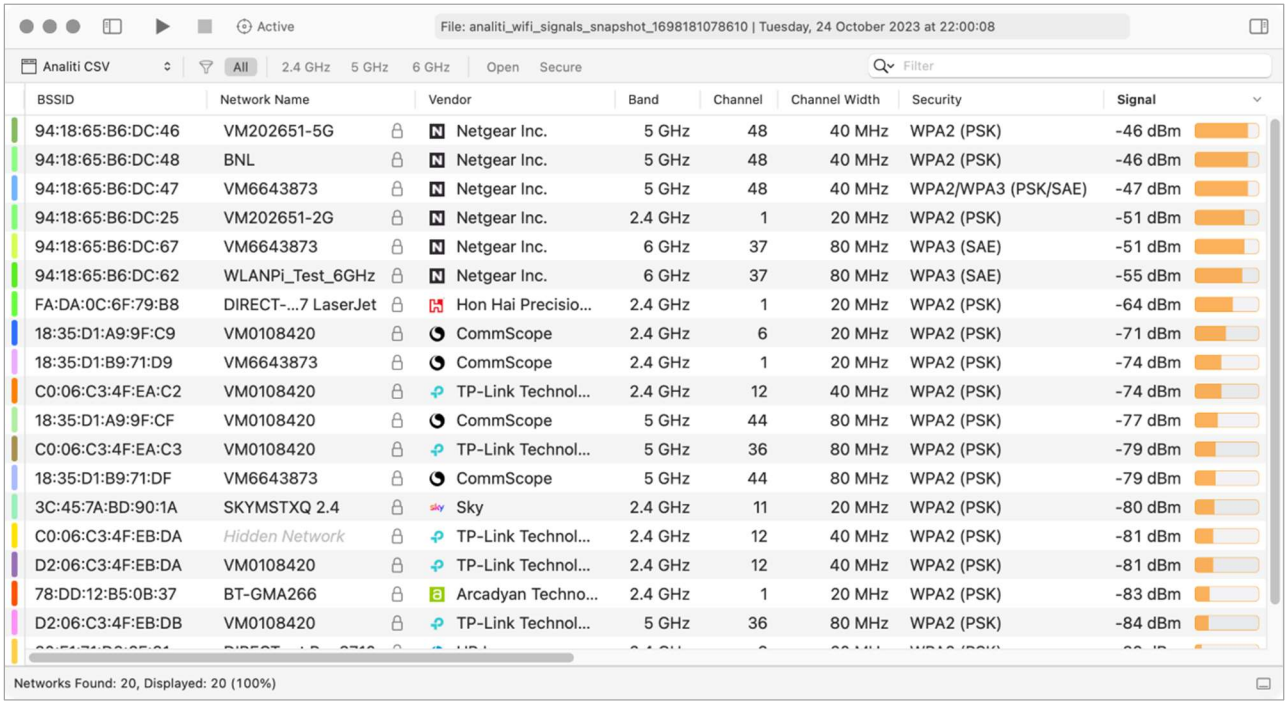

Figure 5-11 - Analiti data displayed in WFE Pro 3

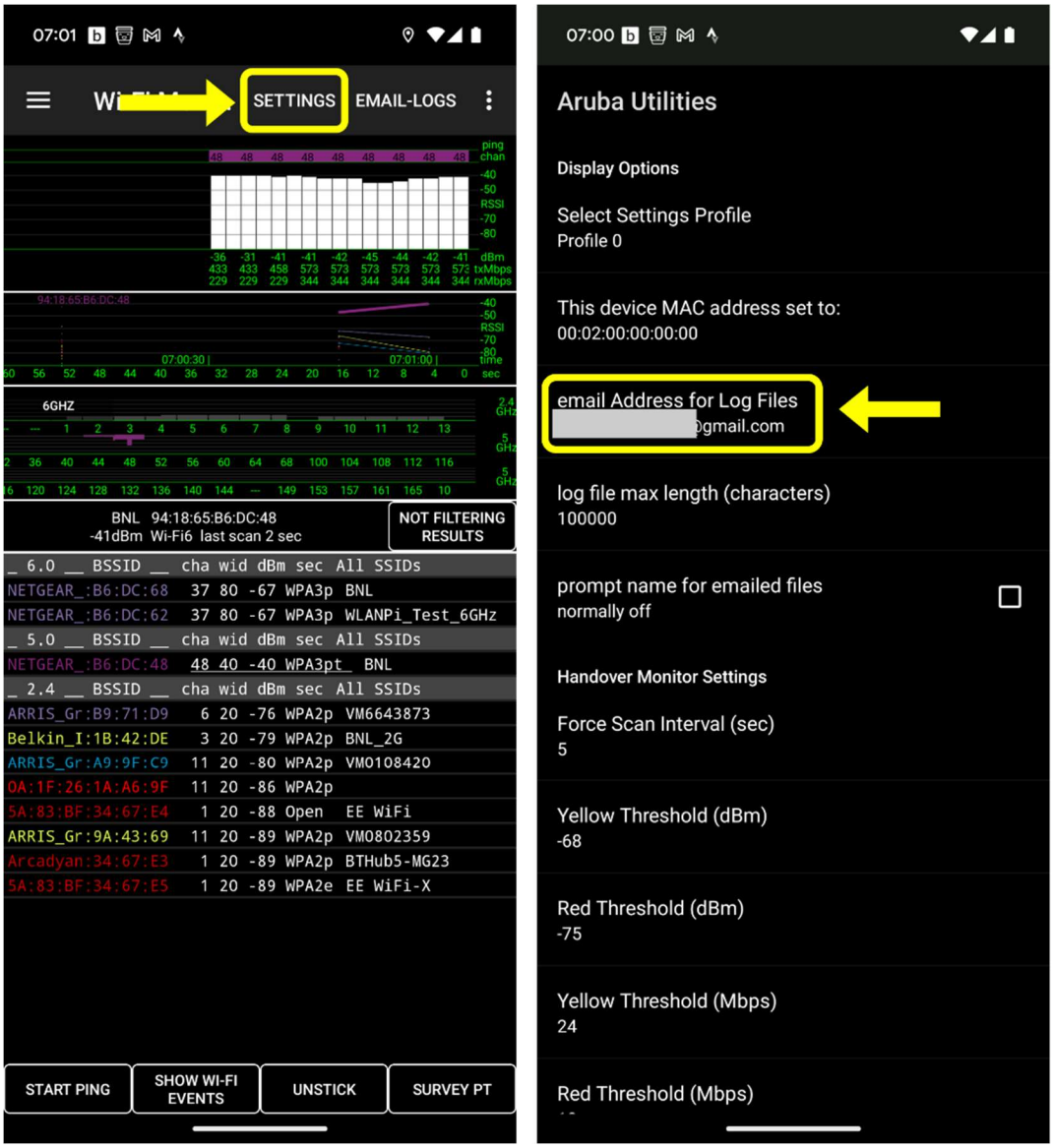

Figure 5-12 - Aruba Utilities network scan and export process #1

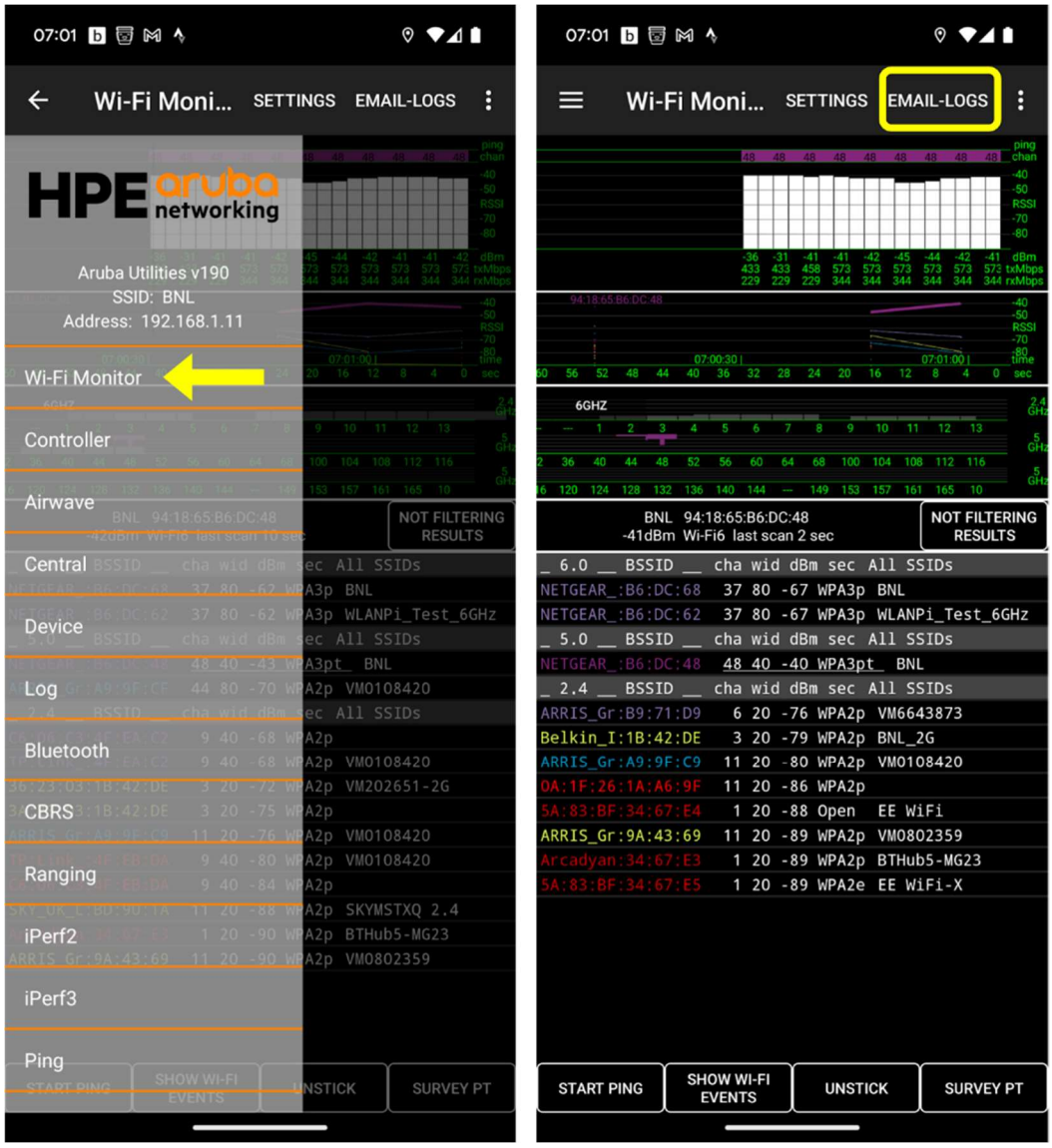

Figure 5-13 - Aruba Utilities network scan and export process #2

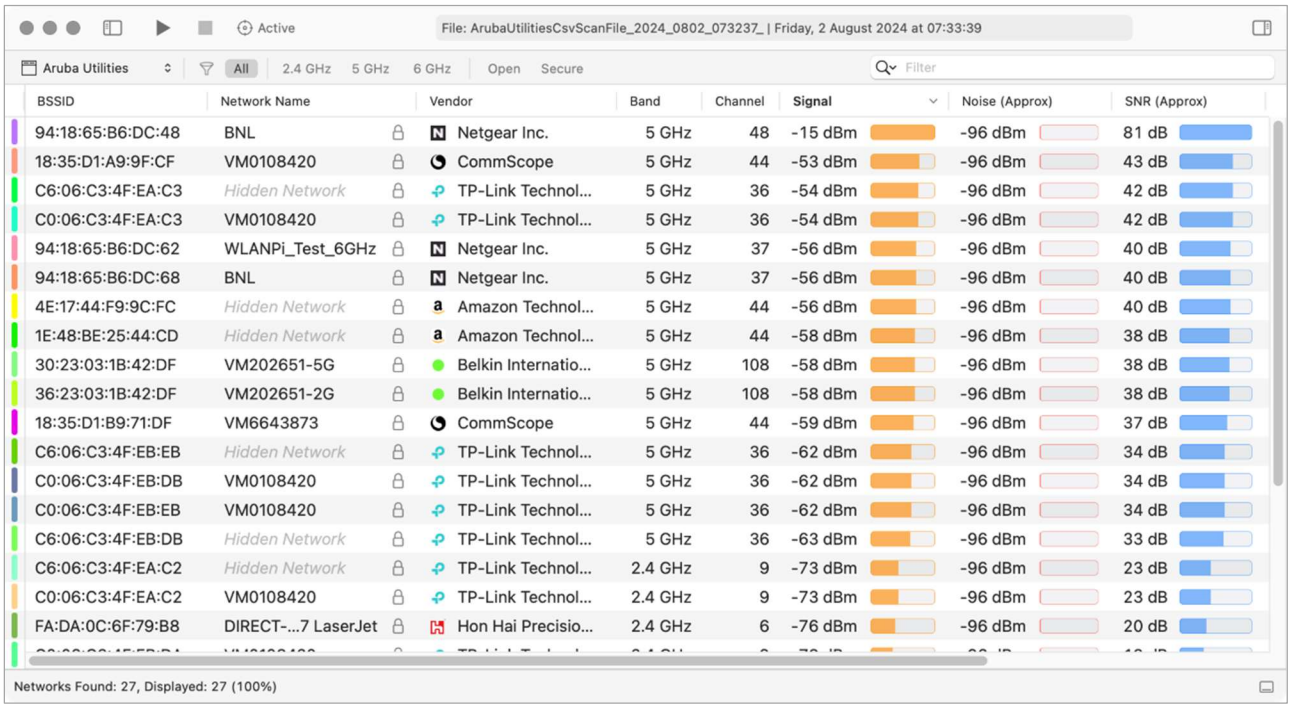

Figure 5-14 - Aruba Utilities data displayed in WFE Pro 3

Chapter 6 - Spectrum Analysis Data

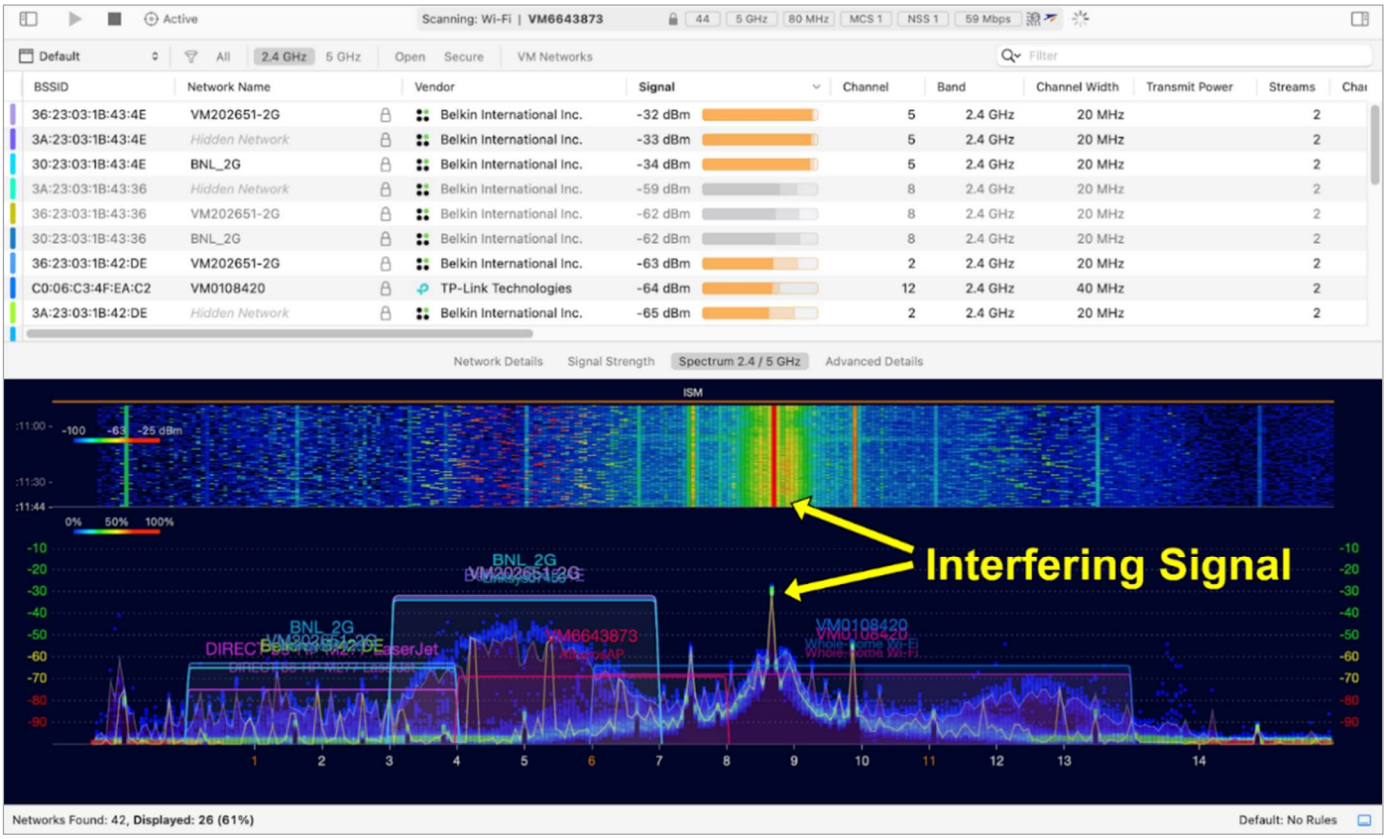

Figure 6-1 - 2.4 GHz Spectrum plot with interferer near channel 9

Figure 6-2 - MetaGeek Wi-Spy DBx & Wi-Spy 2.4x (v2) spectrum analysis dongles

Figure 6-3 - MetaGeek DBx3 spectrum analysis controls

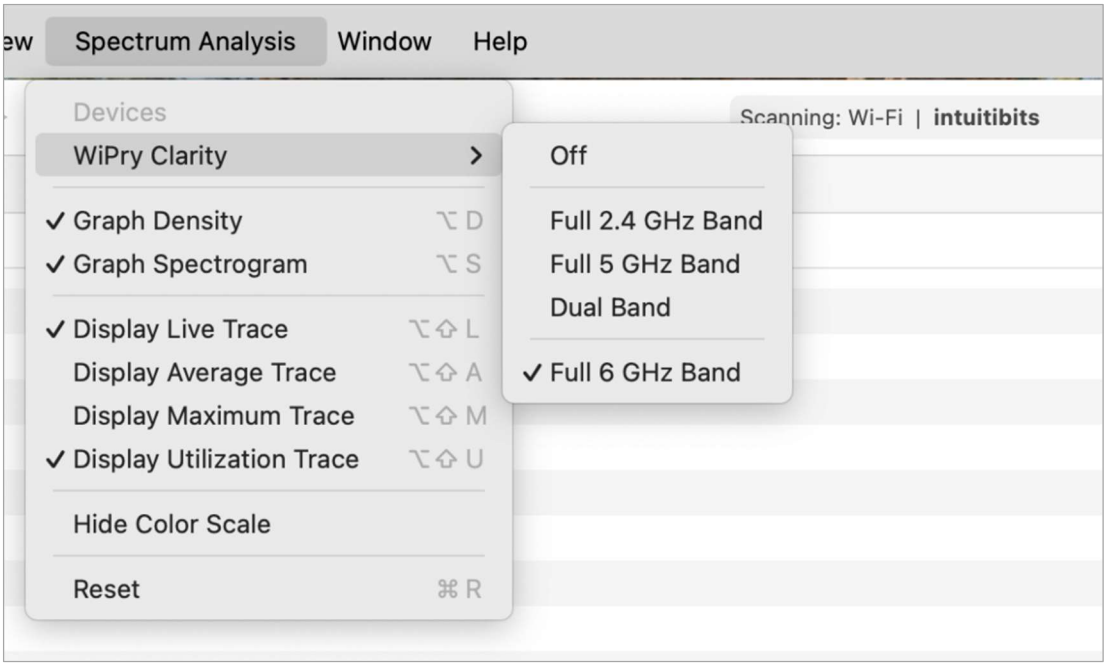

Figure 6-4 - Oscium Clarity spectrum analysis controls

Figure 6-5 - Oscium WiPry 2500x & WiPry Clarity

Figure 6-6 - RF Explorer Wi-Fi Combo

Figure 6-7 - Ubertooth One

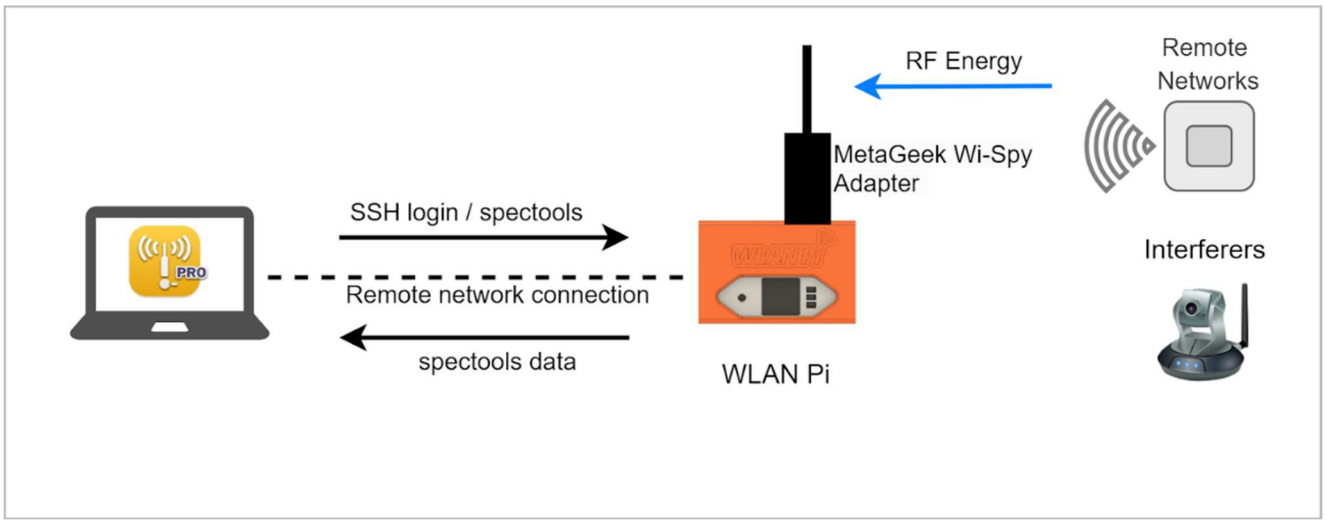

Figure 6-8 - WLAN Pi as a remote Spectrum Analysis probe

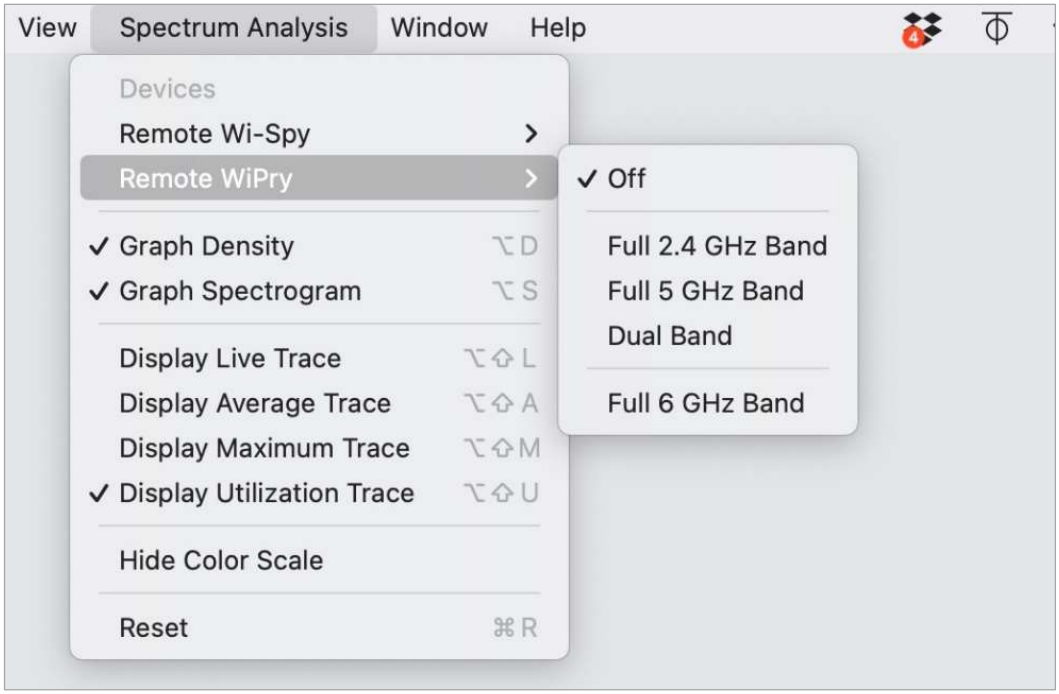

Figure 6-9 - Remote sensor Spectrum Analysis controls

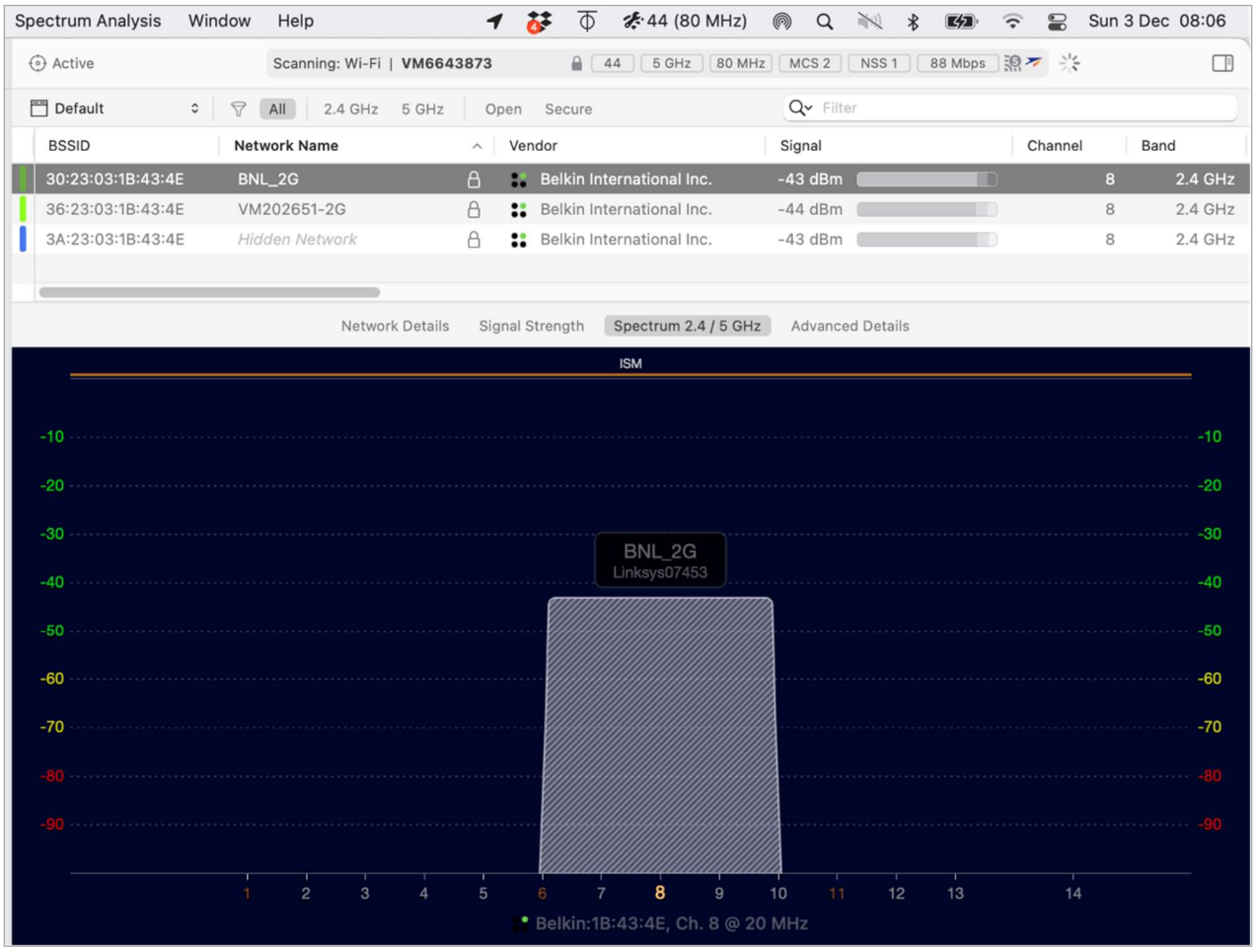

Figure 6-10 - Sample WLAN

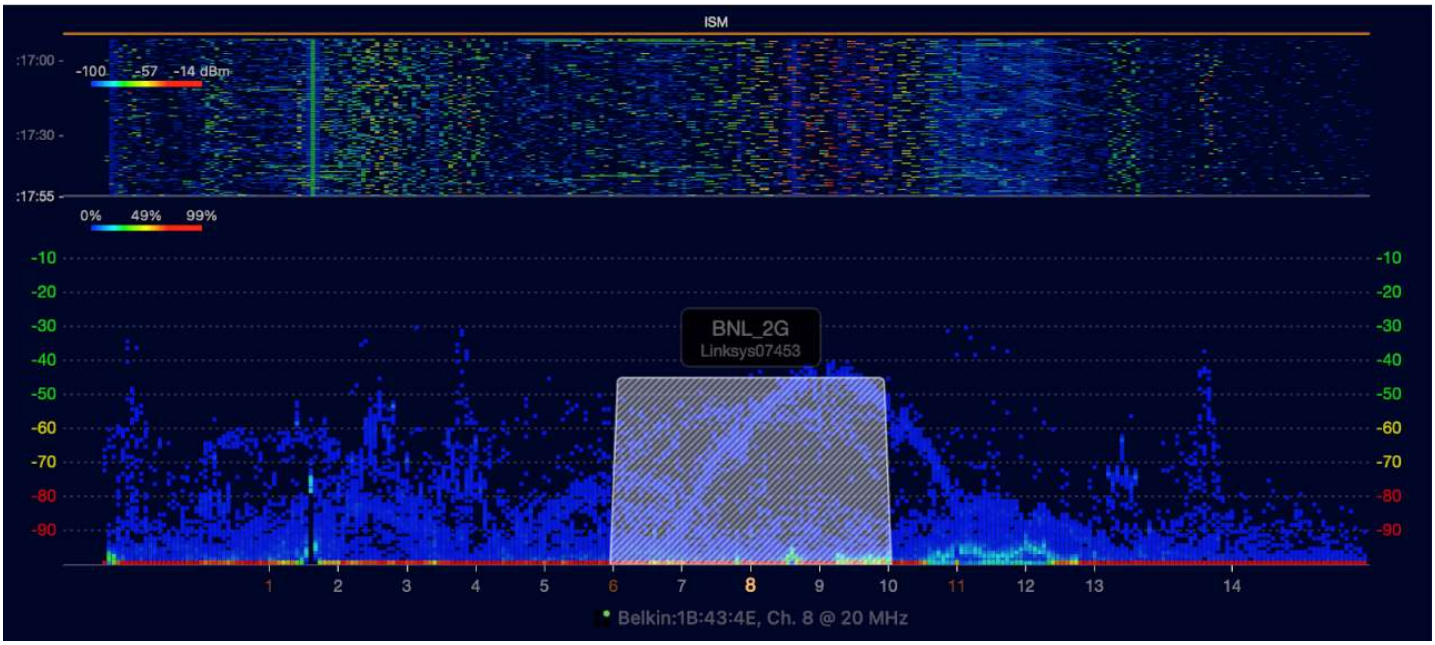

Figure 6-11 - Sample WLAN with Graph Density & Graph Spectrogram views enabled

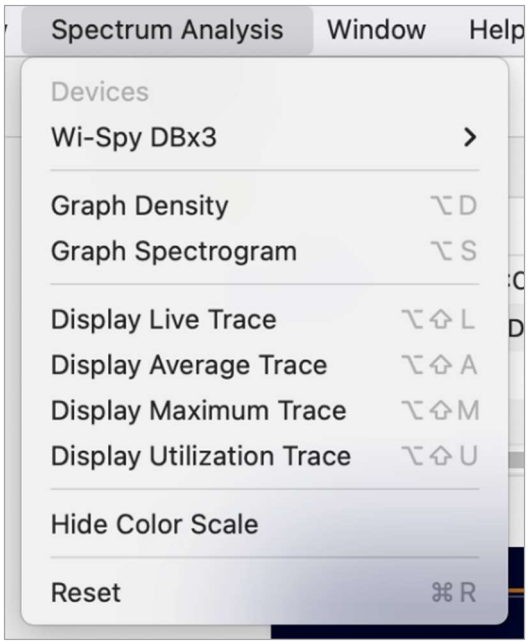

Figure 6-12 - WFE Pro 3 Spectrum Analysis options

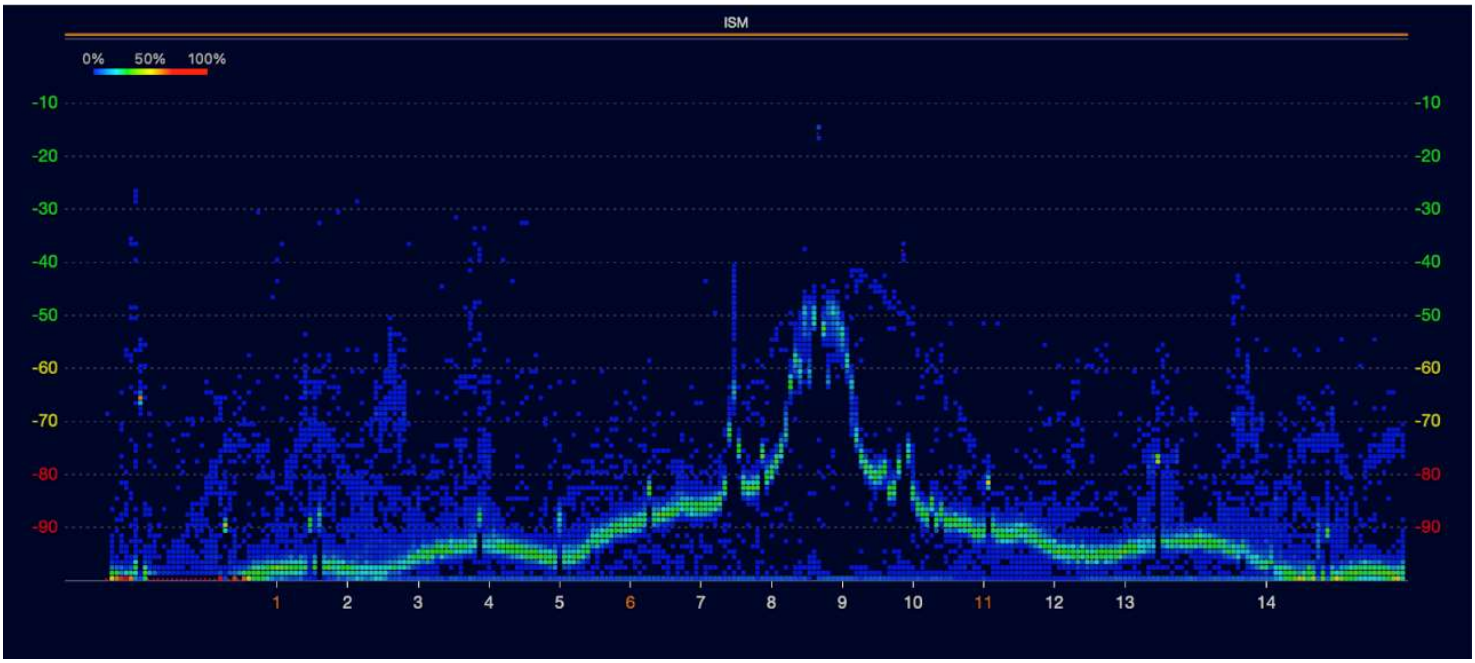

Figure 6-13 - Graph Density view detail with an interferer

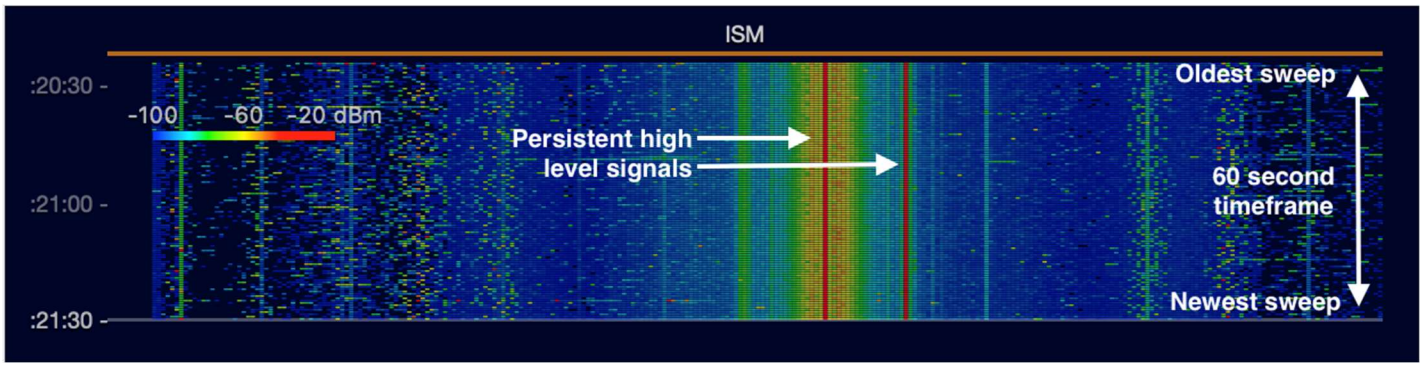

Figure 6-14 - Spectrogram view detail with an interferer

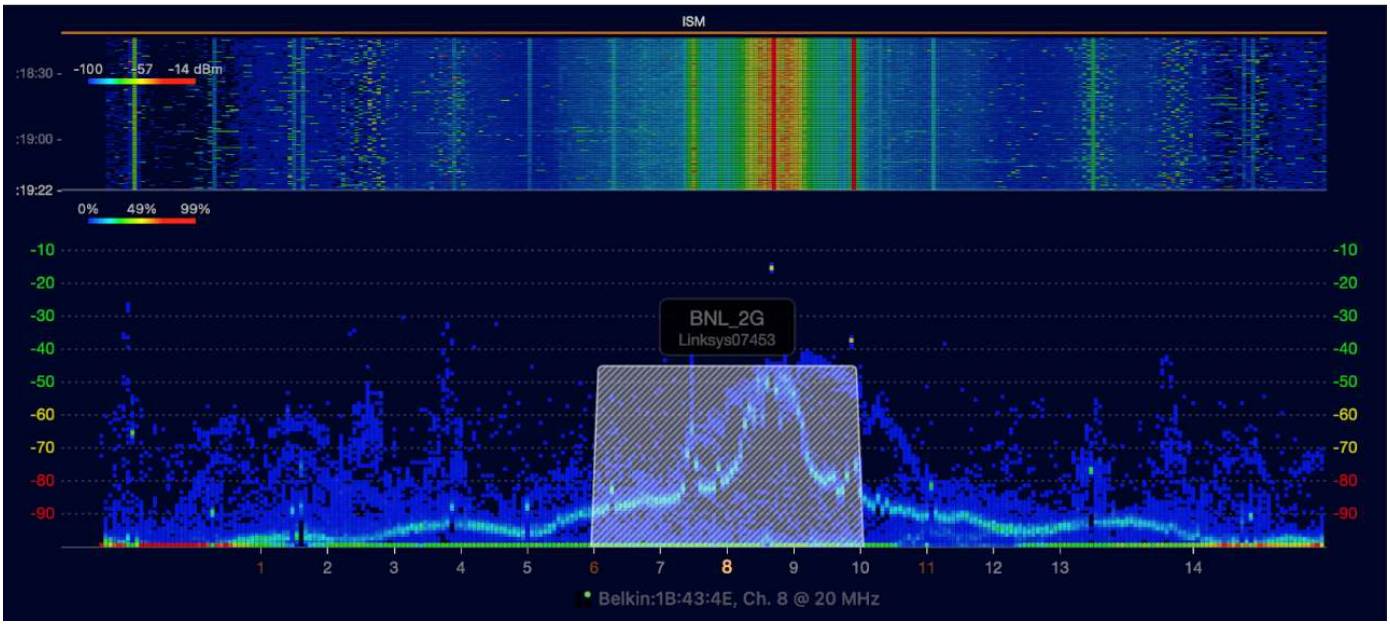

Figure 6-15 - Spectrogram (top) and density view (bottom) with an interferer

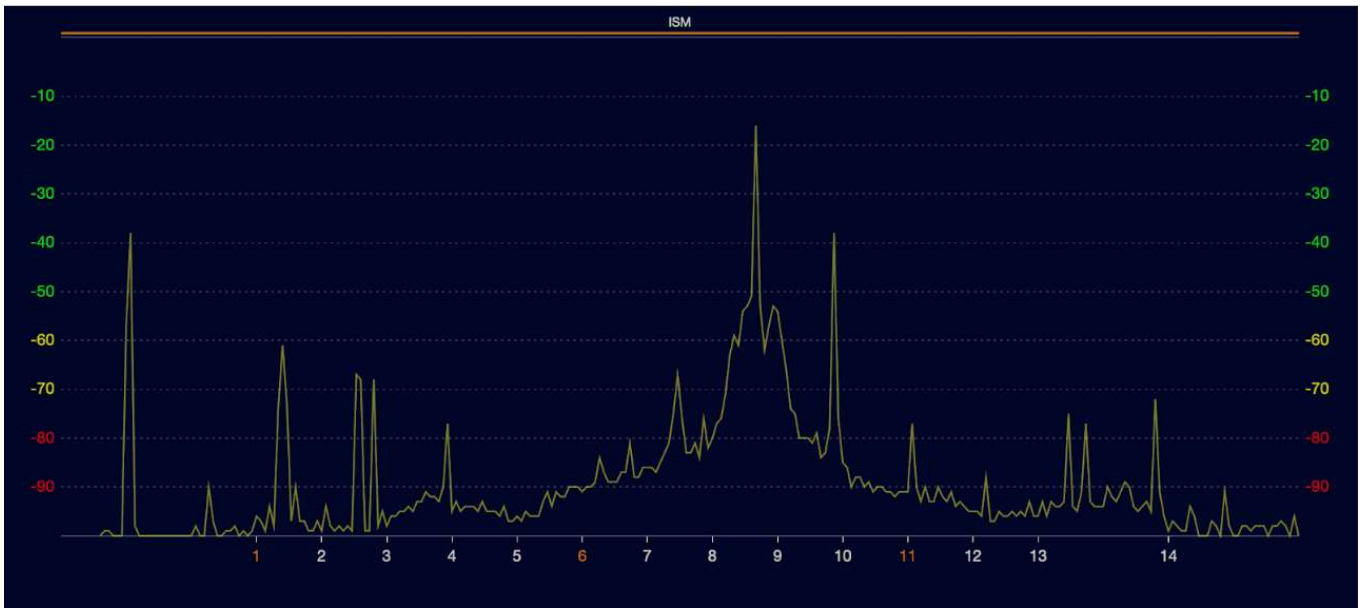

Figure 6-16 - Live trace

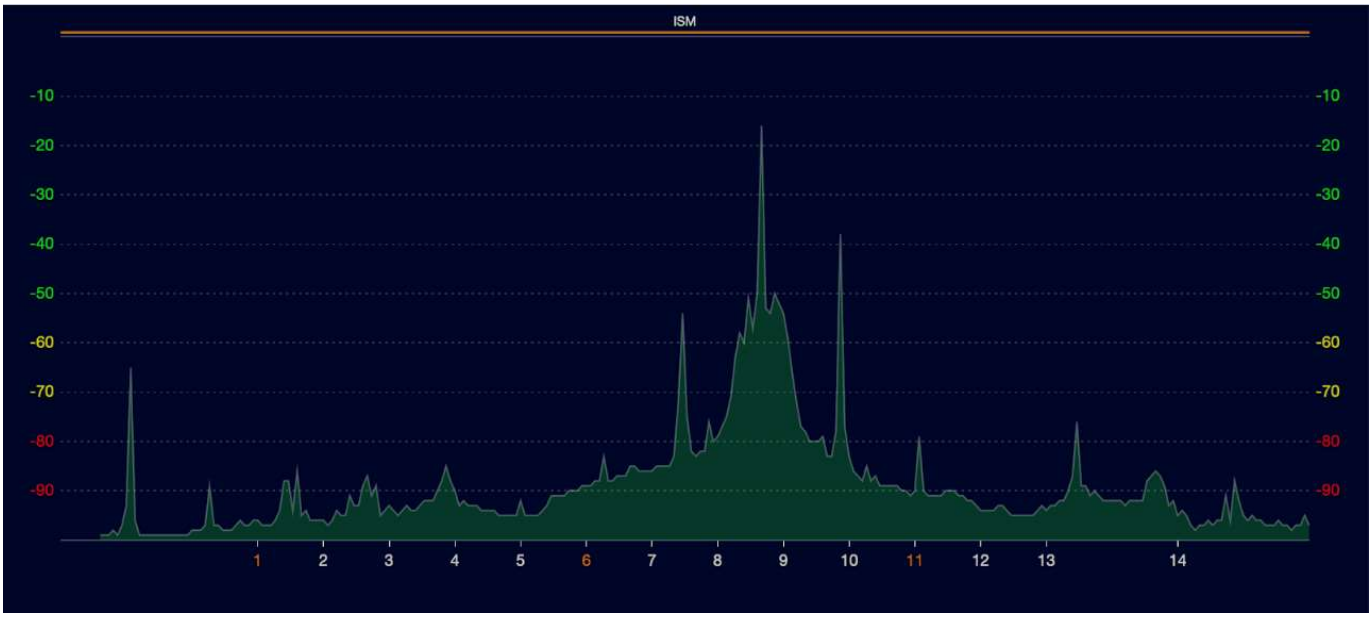

Figure 6-17 - Average trace

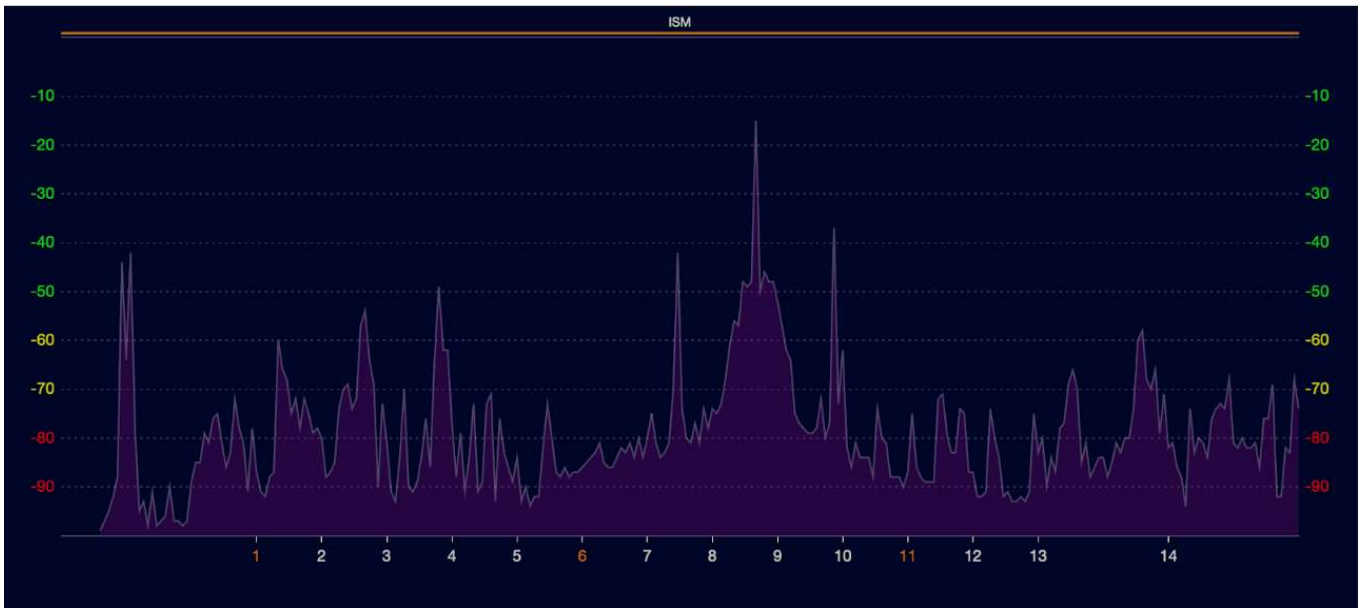

Figure 6-18 - Maximum trace

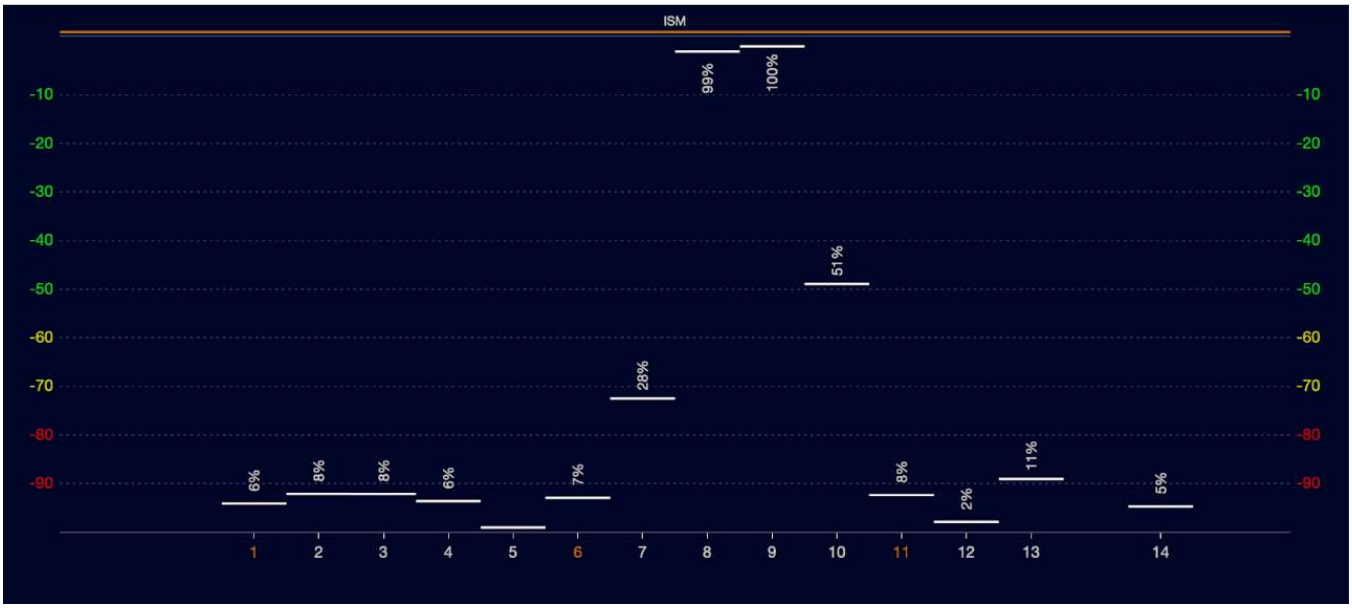

Figure 6-19 - Utilization trace

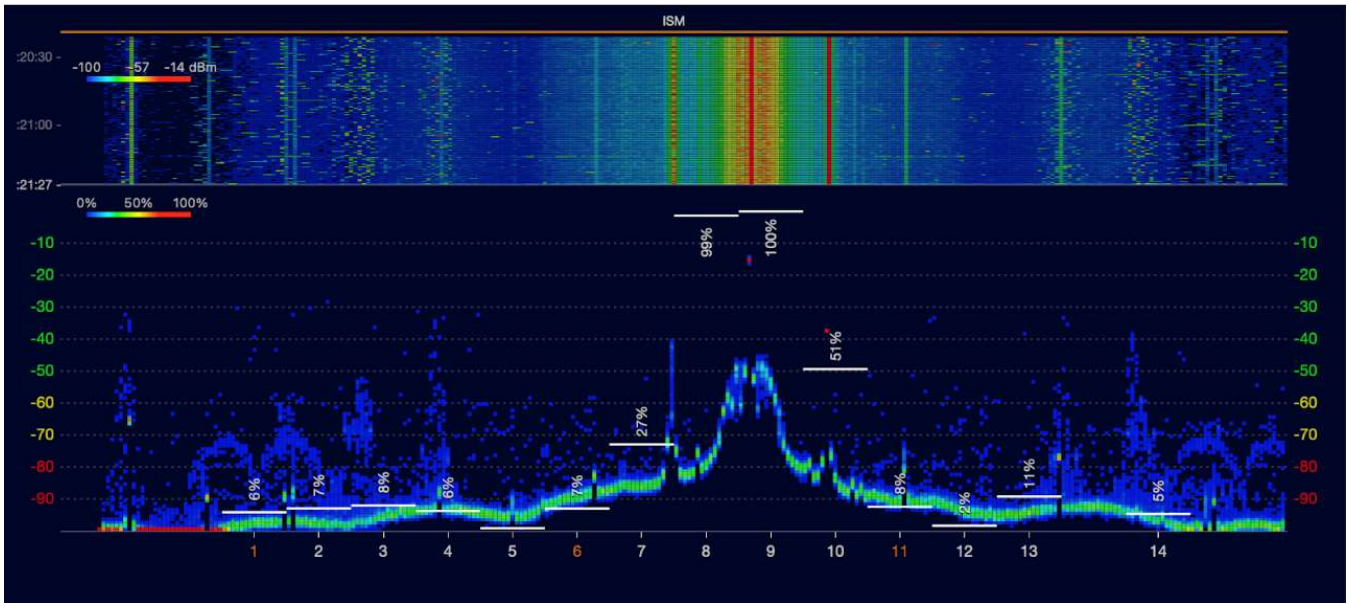

Figure 6-20 - Combined traces showing a wireless camera interferer

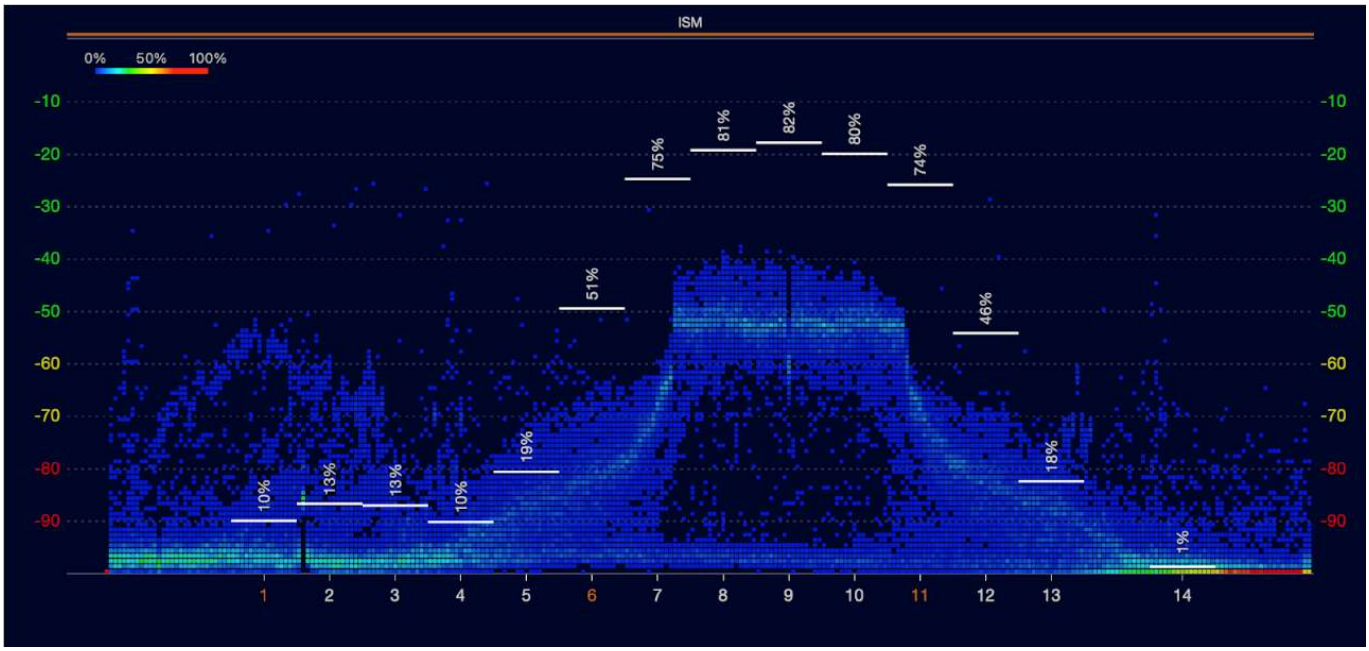

Figure 6-21 - 2.4 GHz WLAN density graph & utilization trace

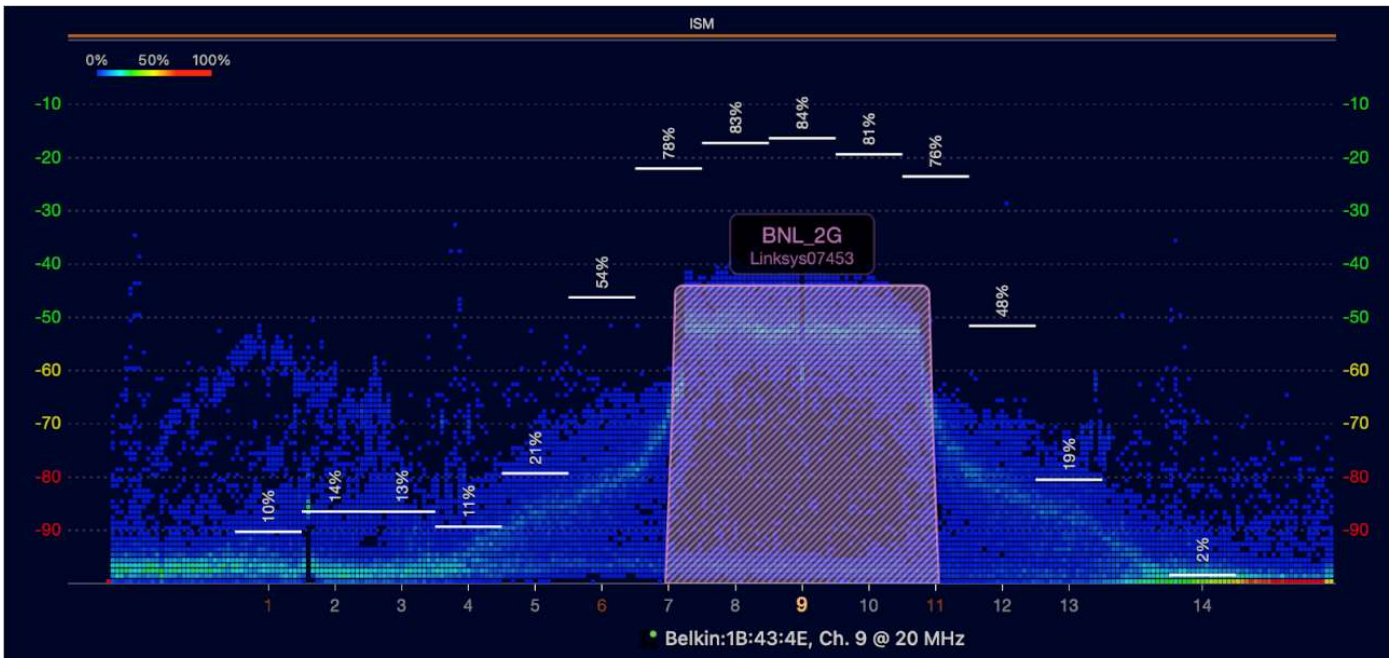

Figure 6-22 - 2.4 GHz WLAN density graph & utilization trace with network overlay

Chapter 7 - Bluetooth & Zigbee Data

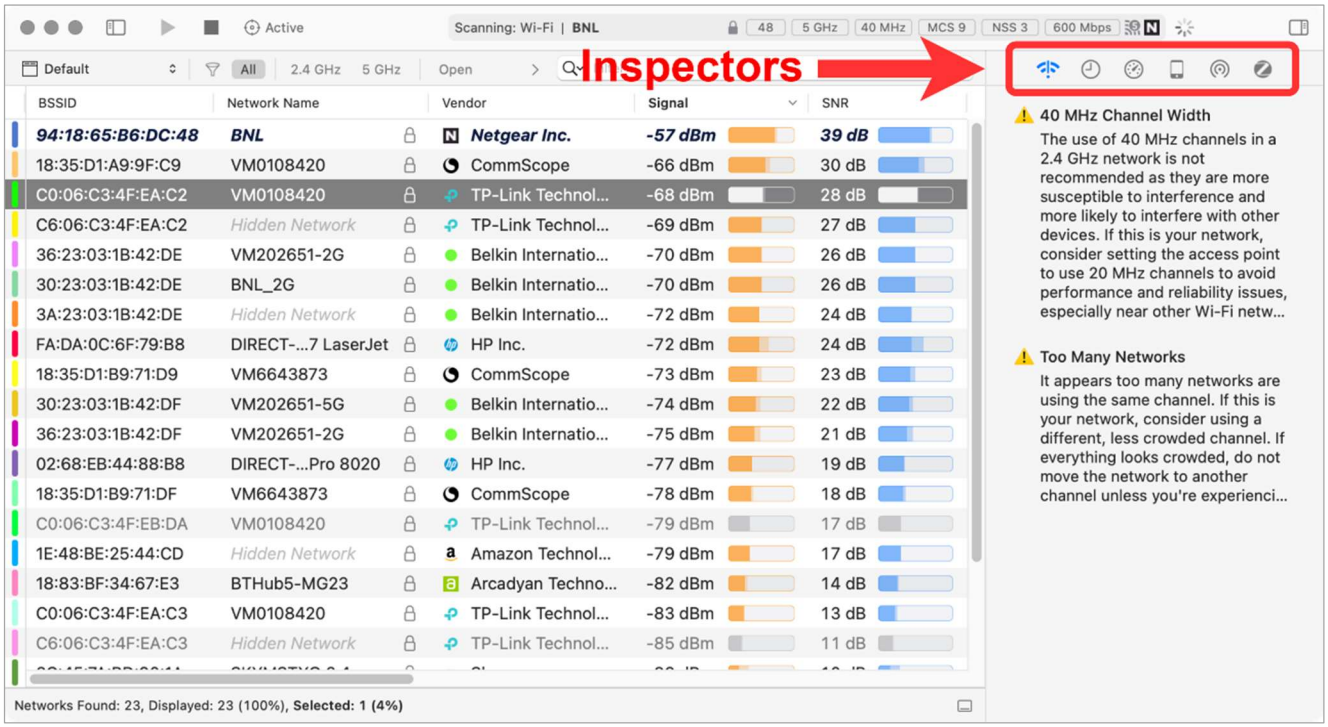

Figure 7-1 - WFE Pro 3 *Inspectors* panel

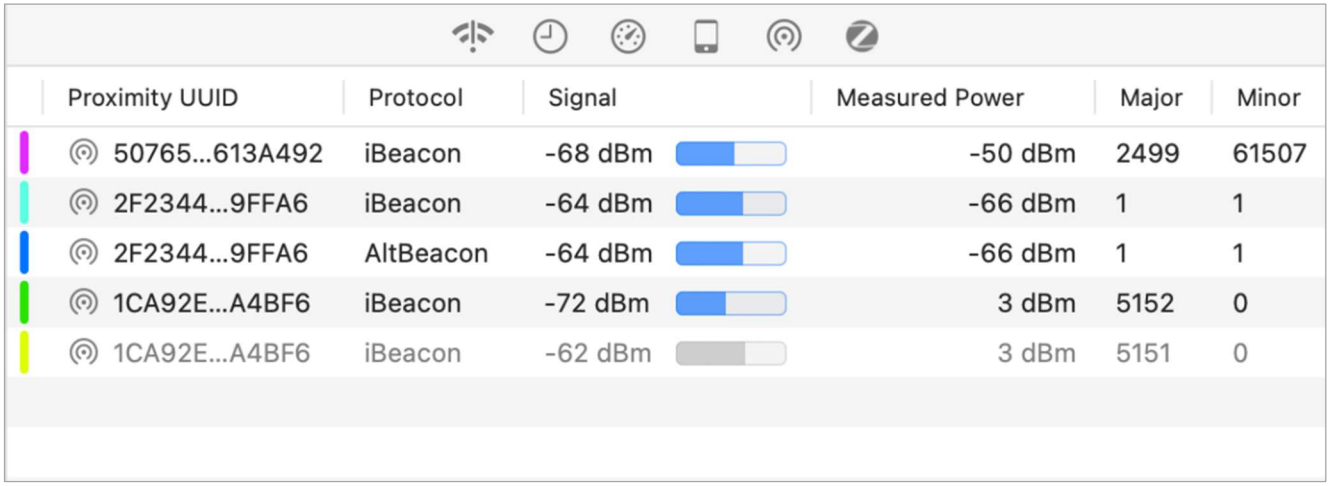

Figure 7-2 - Proximity beacon inspector

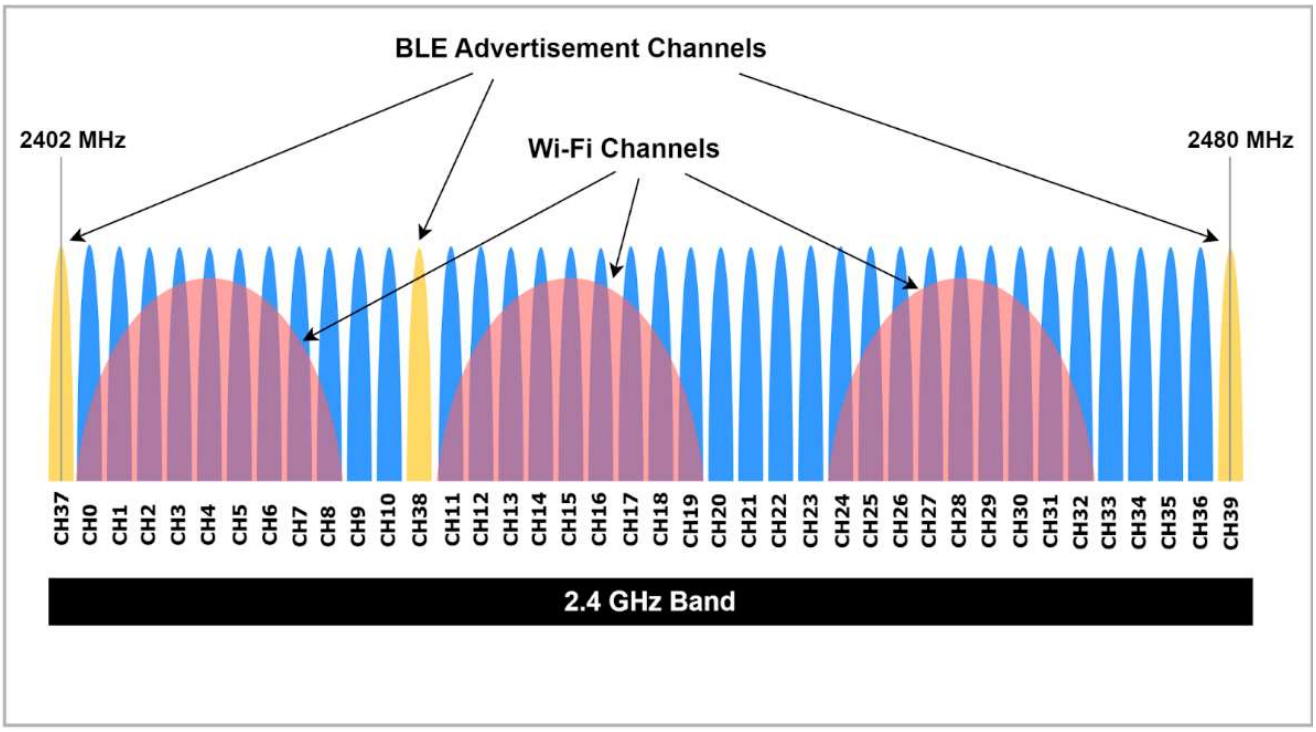

Figure 7-3 - 2.4 GHz band showing BLE channels with Wi-Fi band overlaid

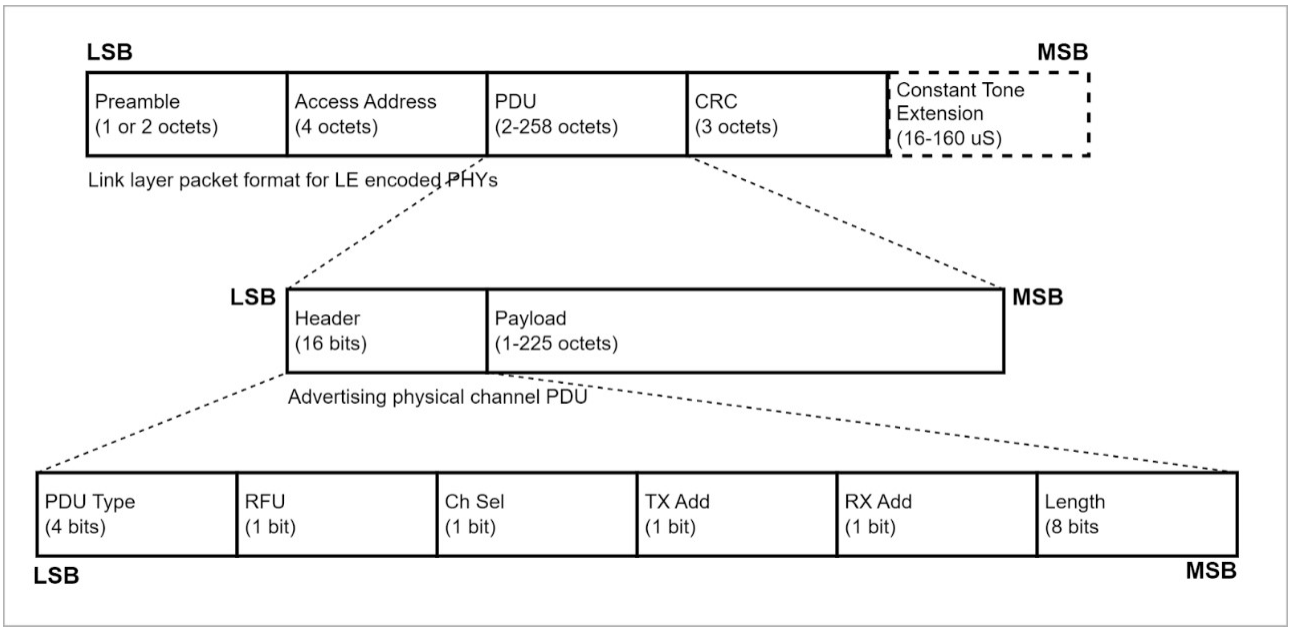

Figure 7-4 - BLE PDU details

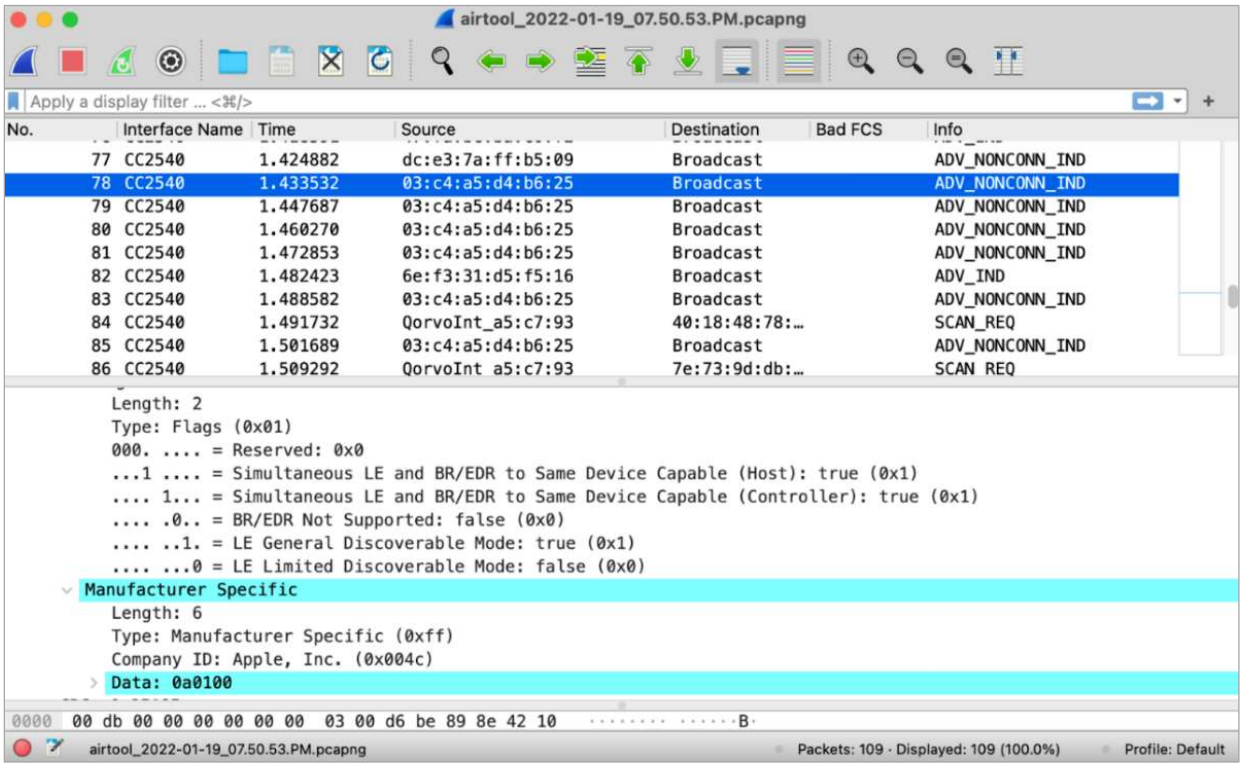

Figure 7-5 - A capture showing BLE advertisements

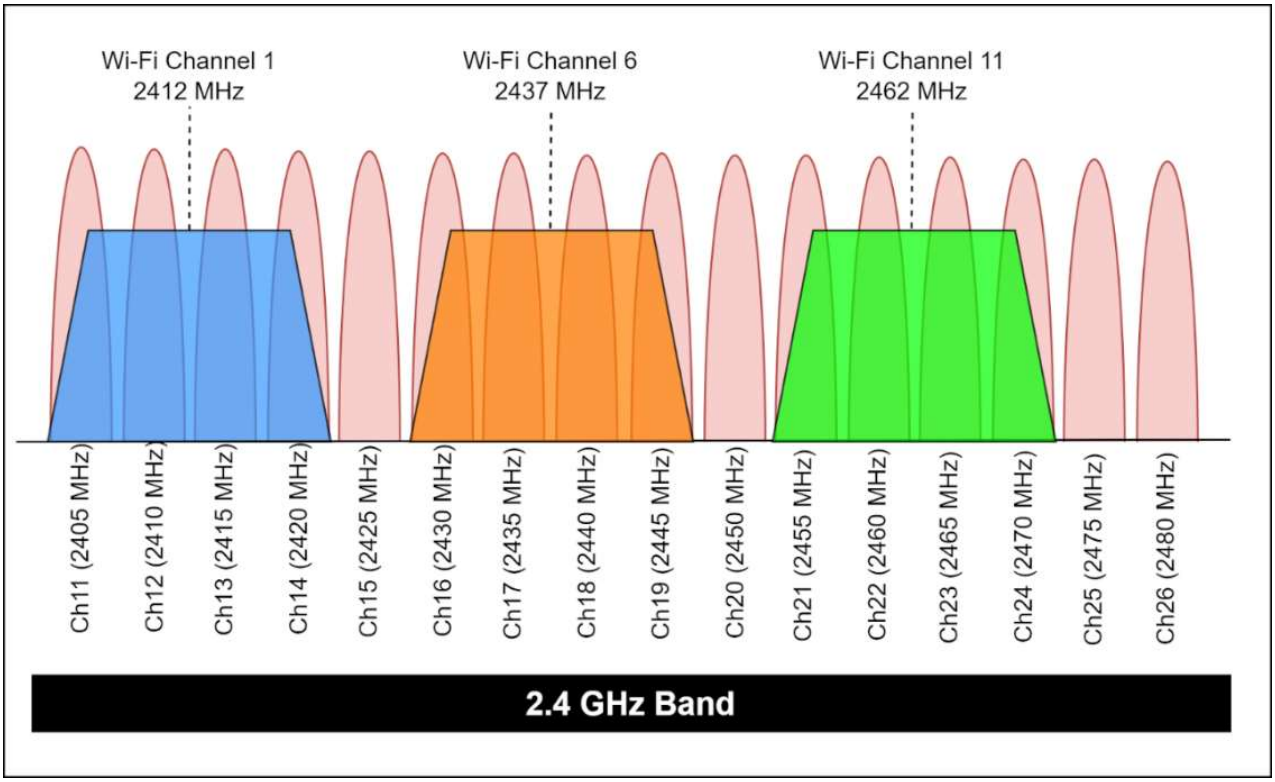

Figure 7-6 - Zigbee channel plan

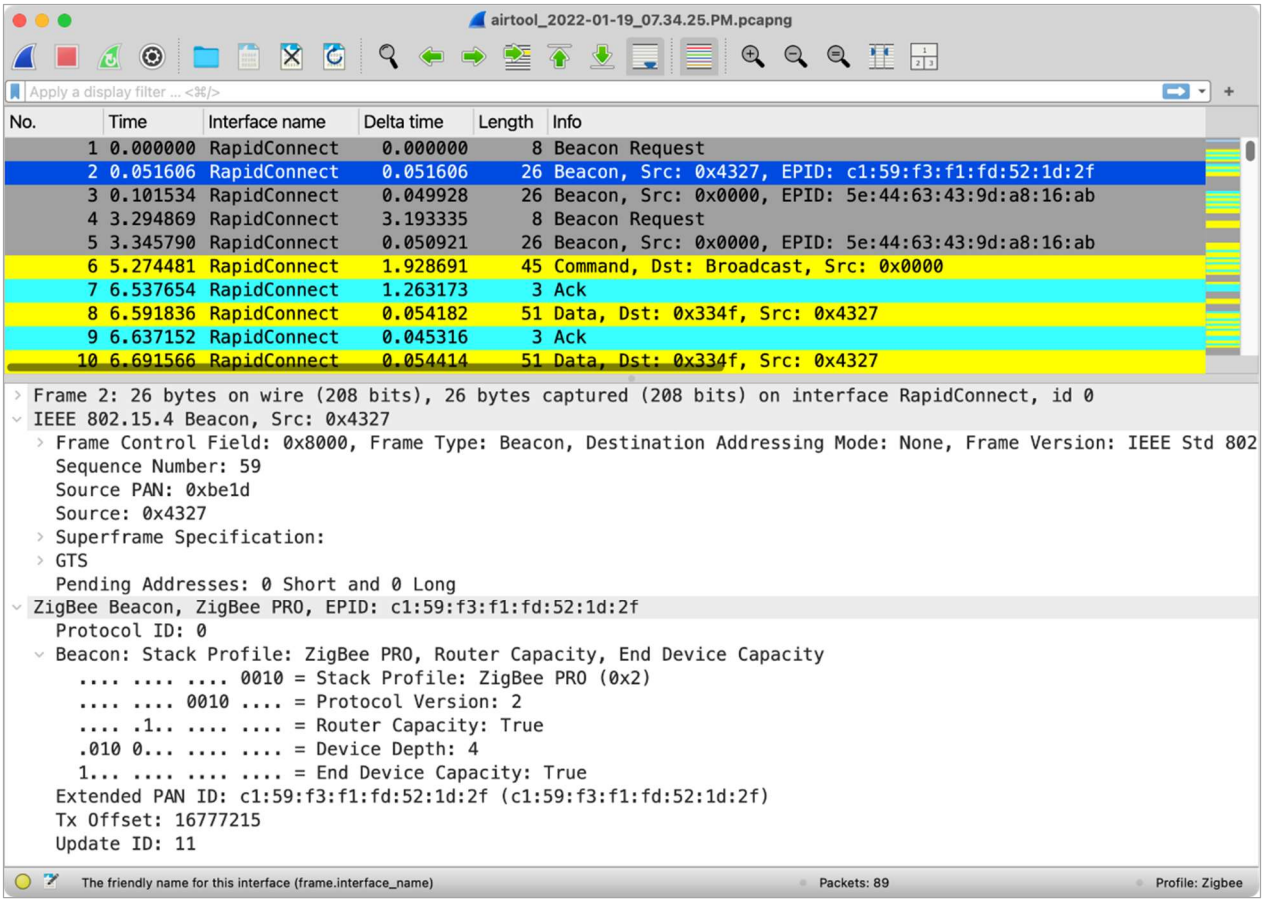

Figure 7-7 - A capture showing Zigbee beacons

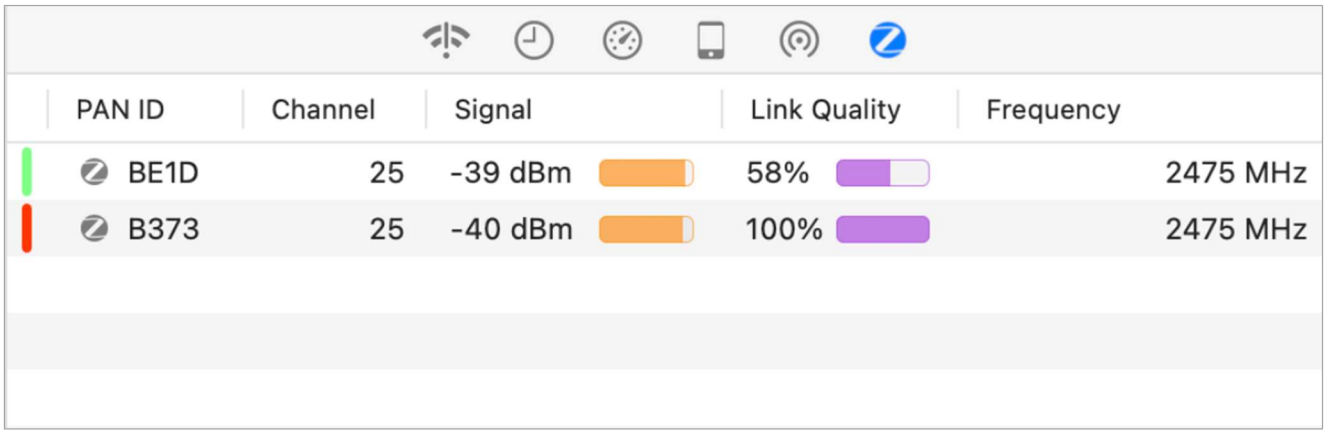

Figure 7-8 - Zigbee network discovery

Figure 7-9 - Zigbee network overlaid on Wi-Fi networks

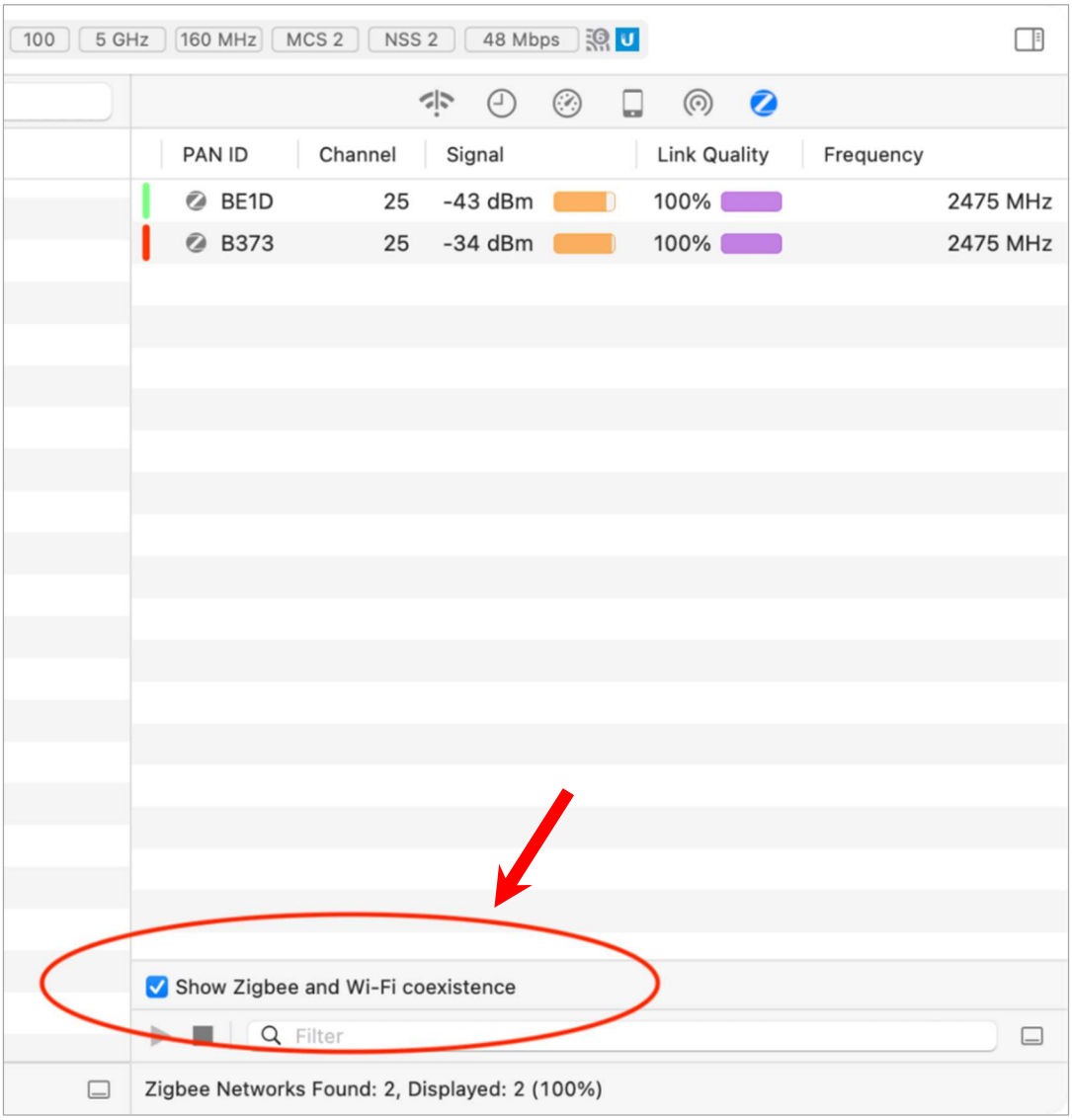

Figure 7-10 - Control to enable/disable Zigbee overlay on Wi-Fi networks

Figure 7-11 - The RapidConnect Zigbee Smart Energy USE Stick

Chapter 8 - WiFi Explorer Pro 3 UI Tour

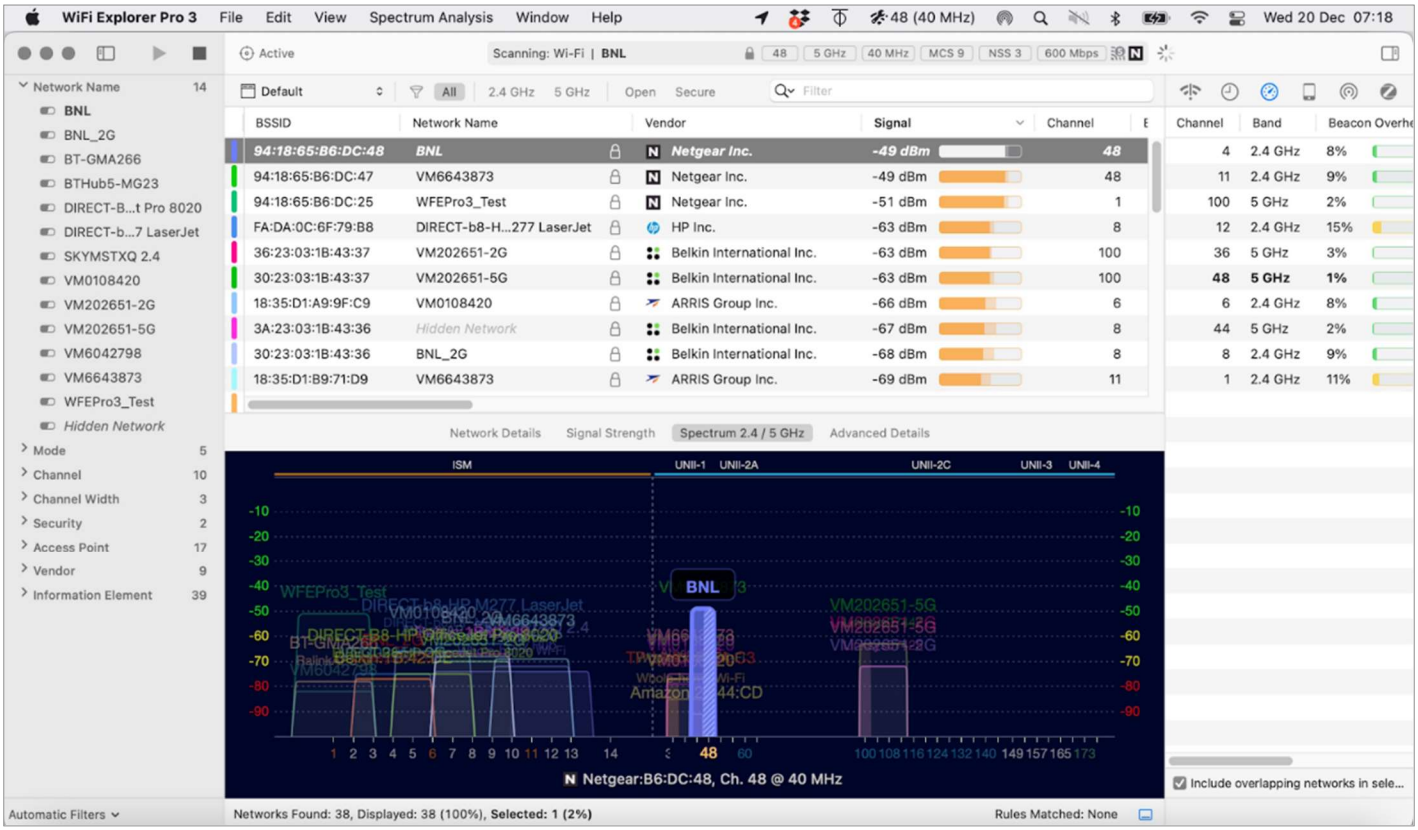

Figure 8-1 - WFE Pro 3's user interface

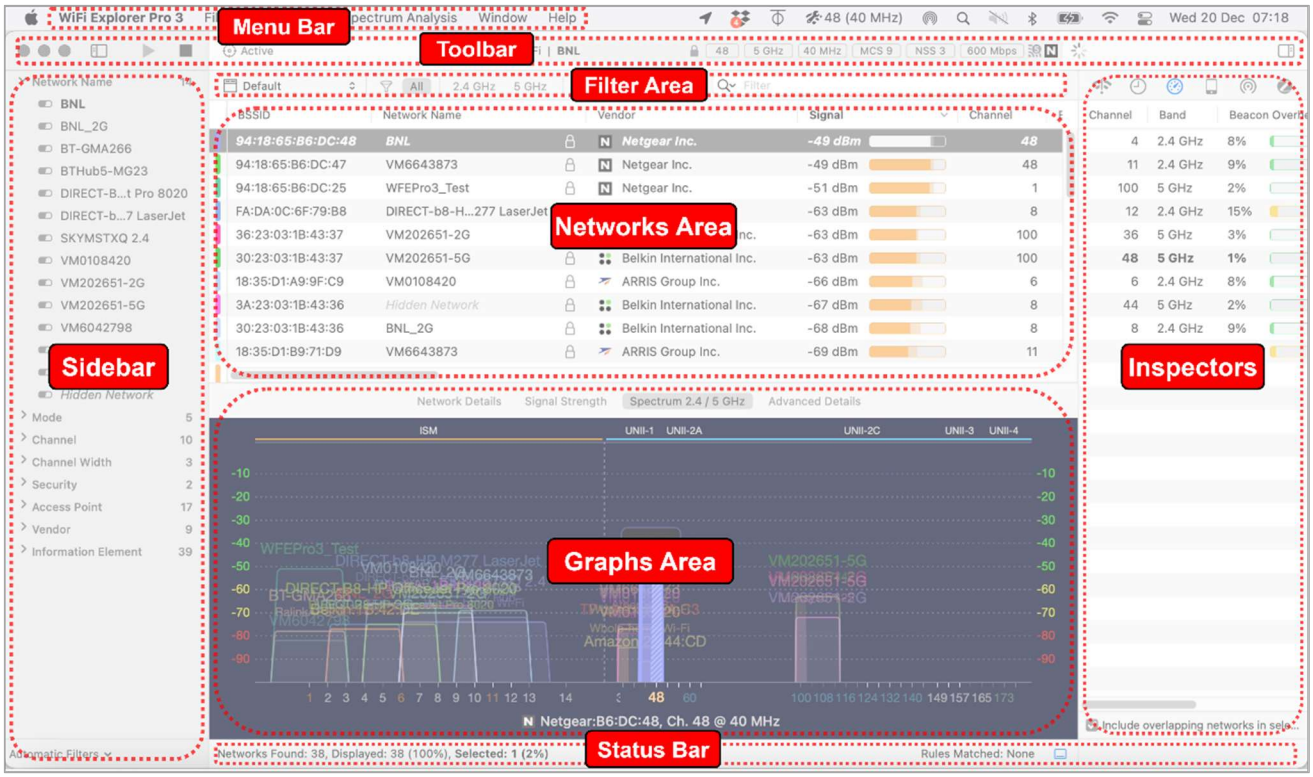

Figure 8-2 - WFE Pro 3's user interface areas

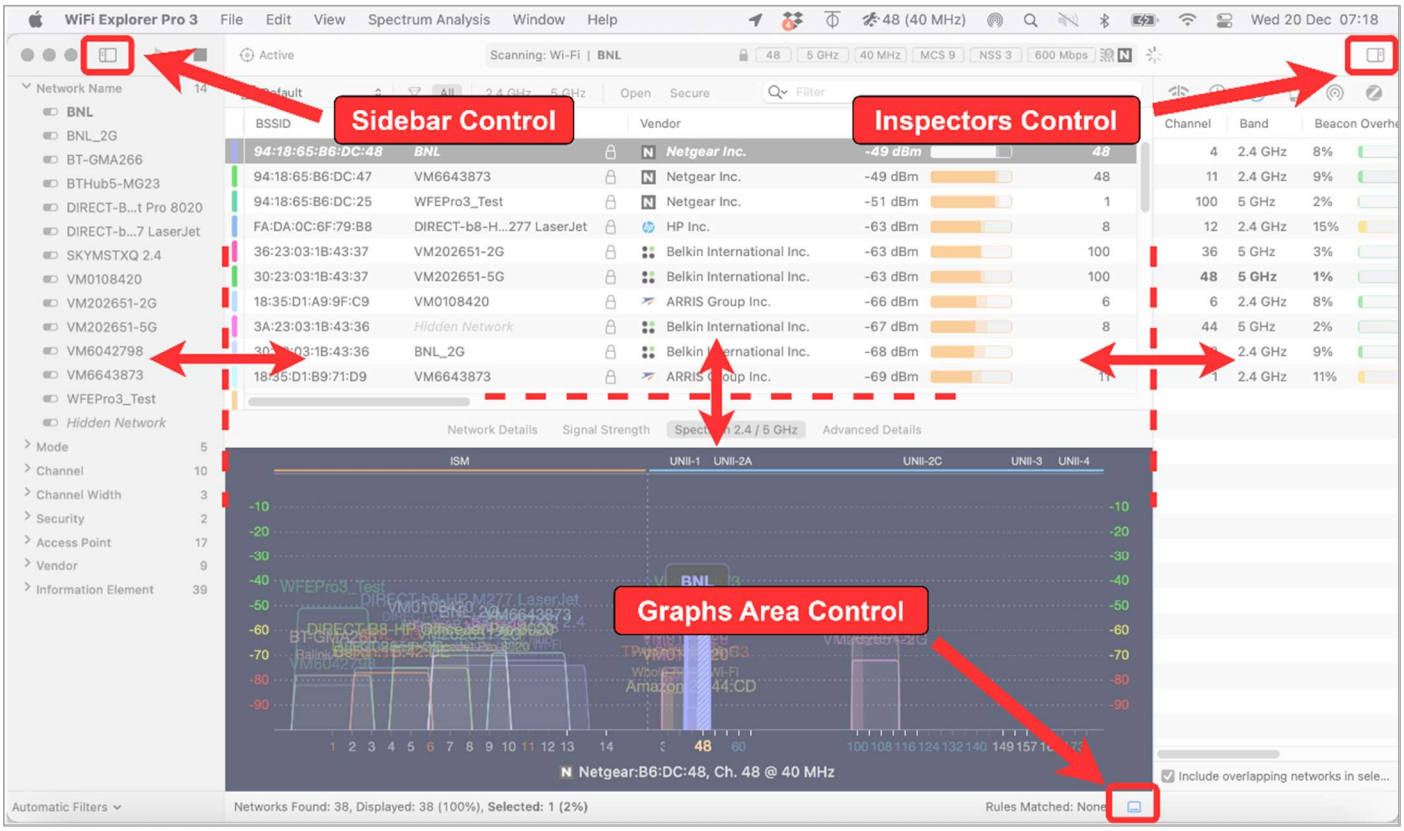

Figure 8-3 - WFE Pro 3's UI area reveal/hide controls

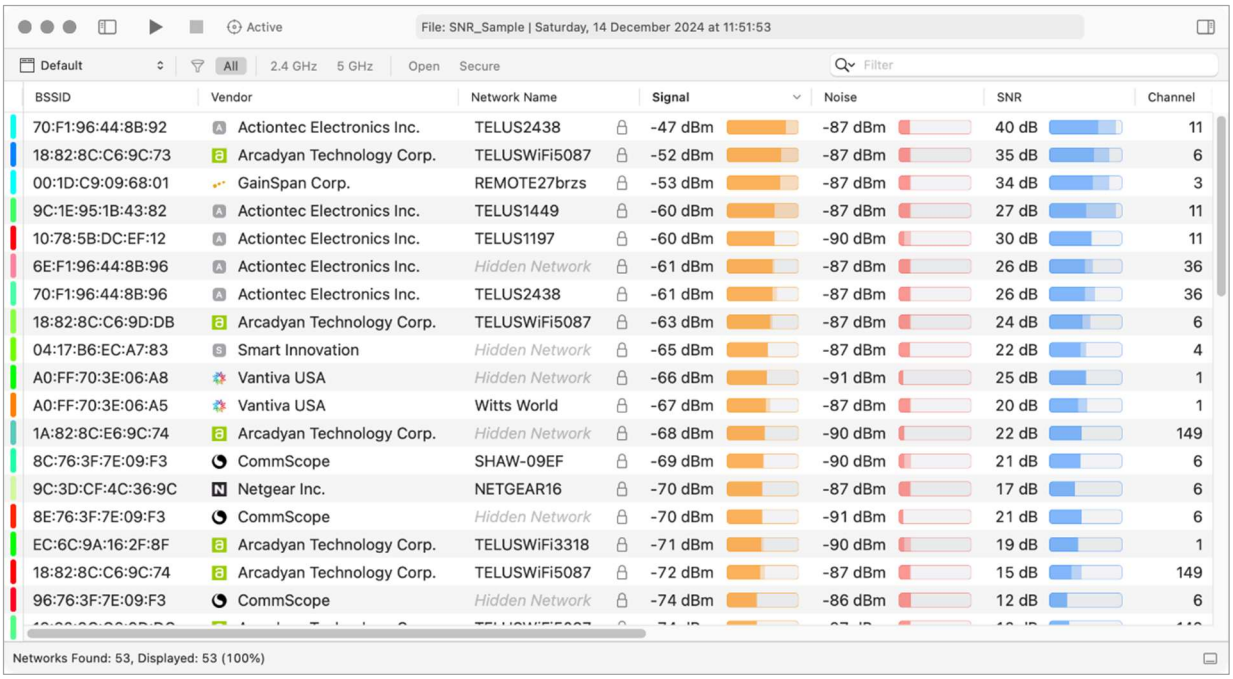

Figure 8-4 - WFE Pro 3's UI with sidebar, inspectors, and graphs areas hidden

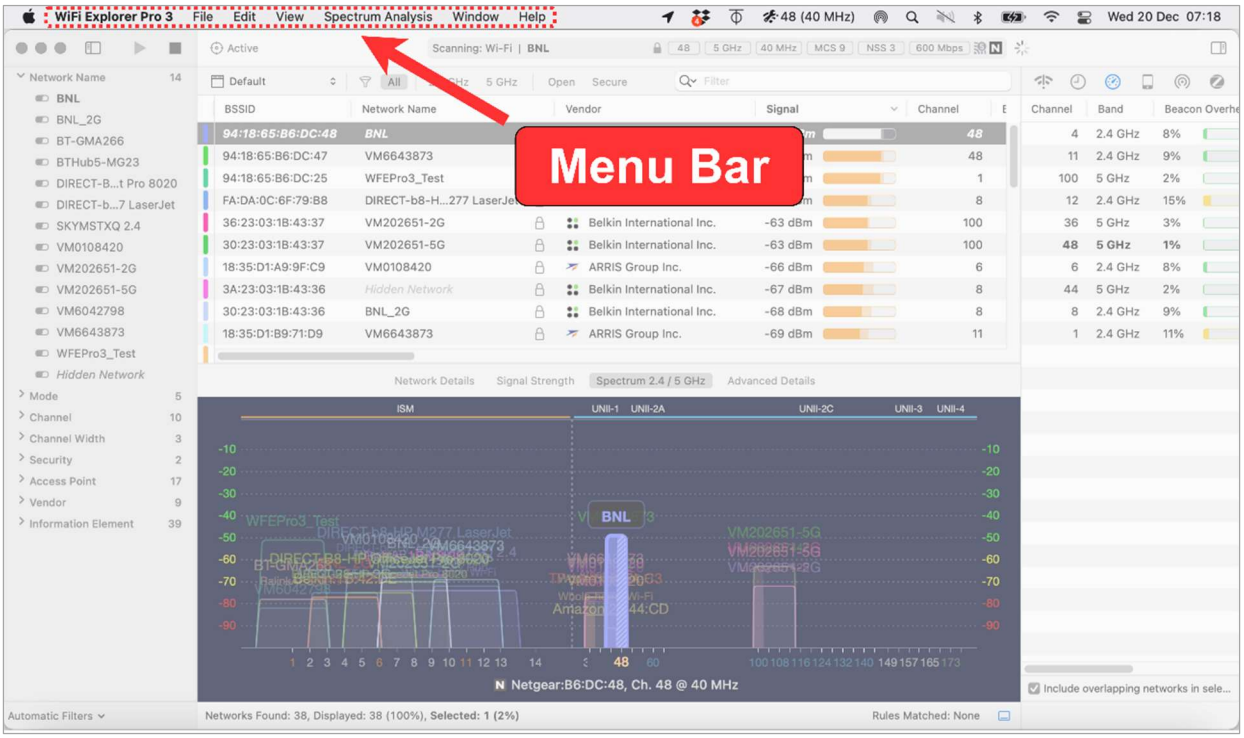

Figure 8-5 - *Menu Bar* UI location

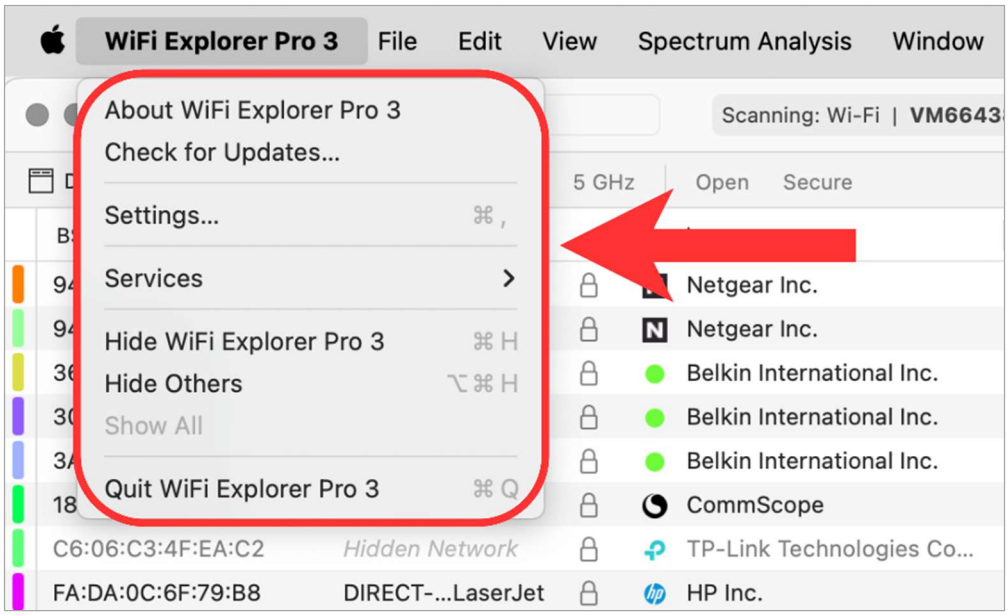

Figure 8-6 – *WiFi Explorer Pro 3* menu items

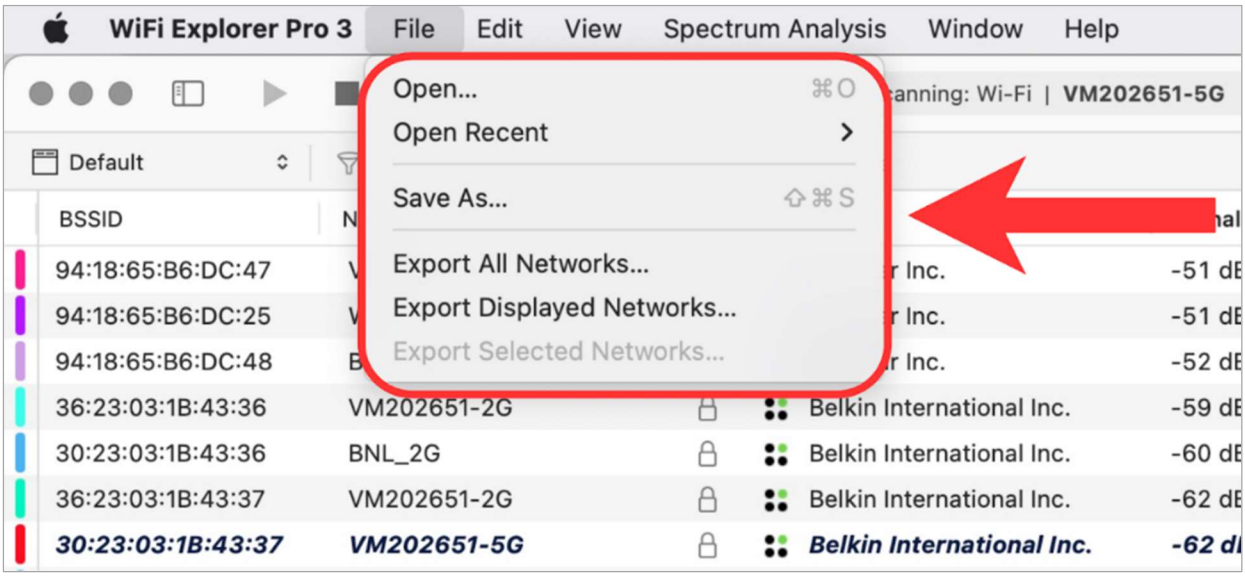

Figure 8-7 - *File* menu items

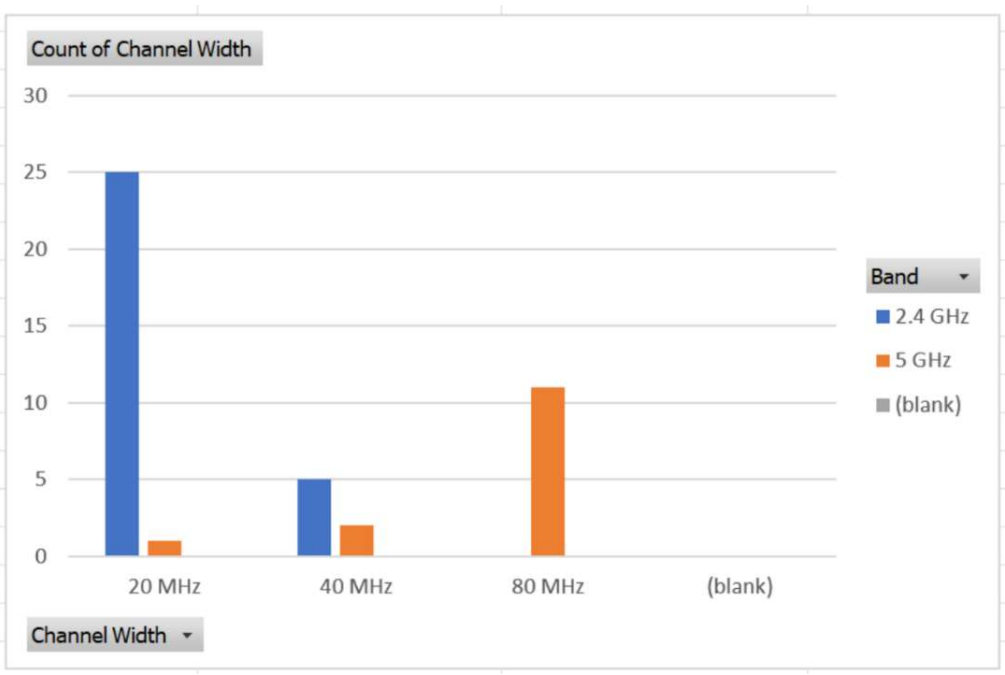

Figure 8-8 - Sample report created from exported CSV data using Excel

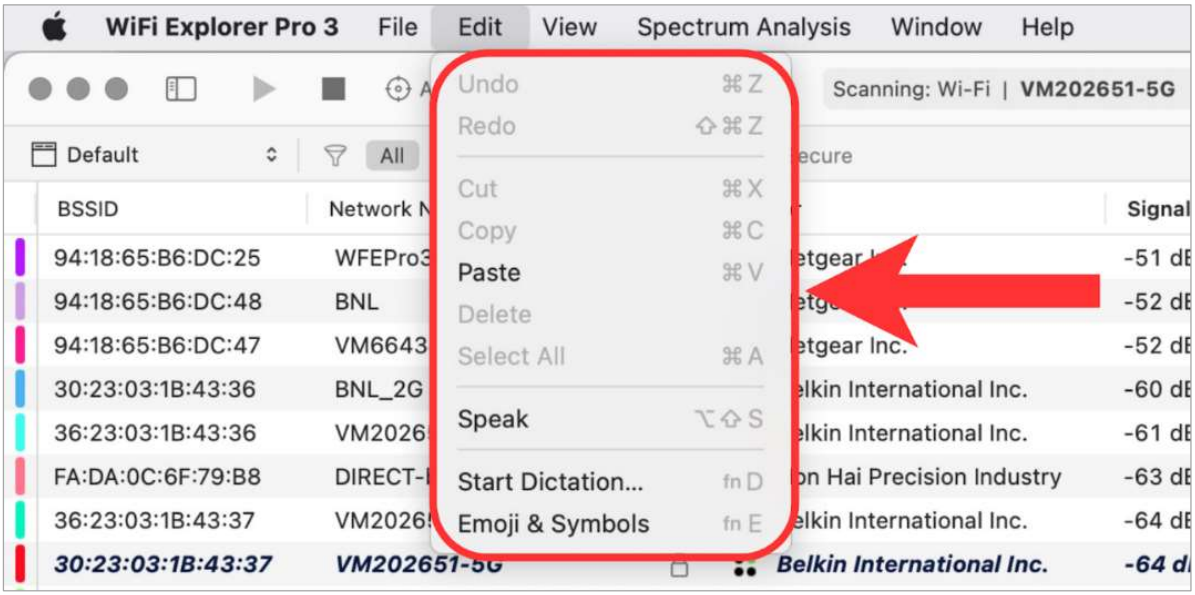

Figure 8-9 - *Edit* menu items

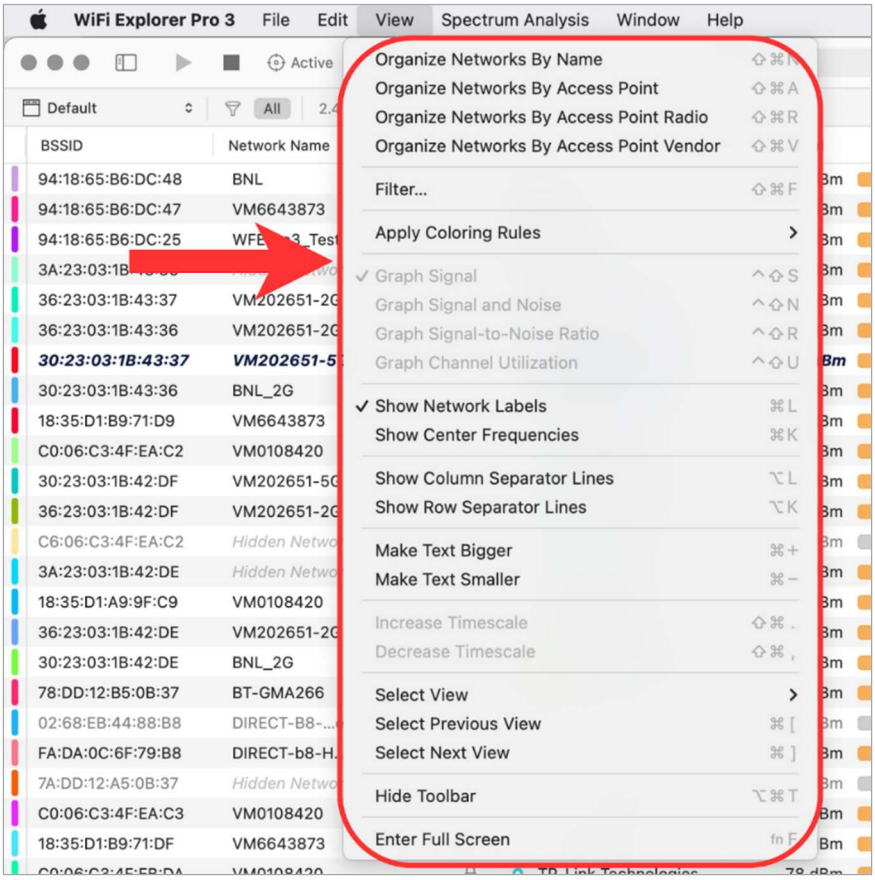

Figure 8-10 - *View* menu items

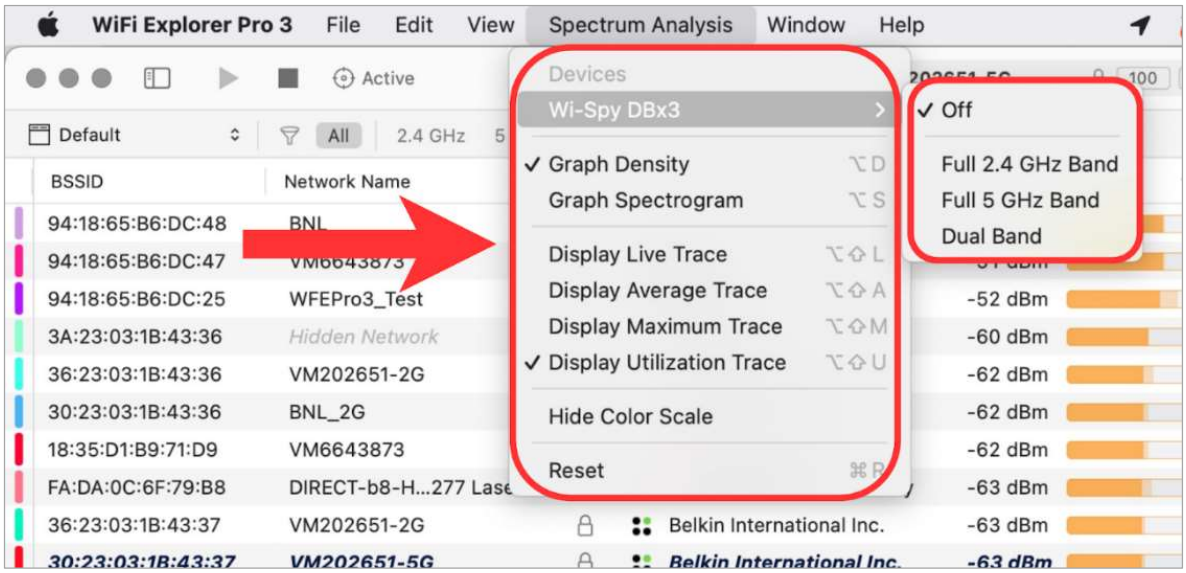

Figure 8-11 – *Spectrum Analysis* menu items

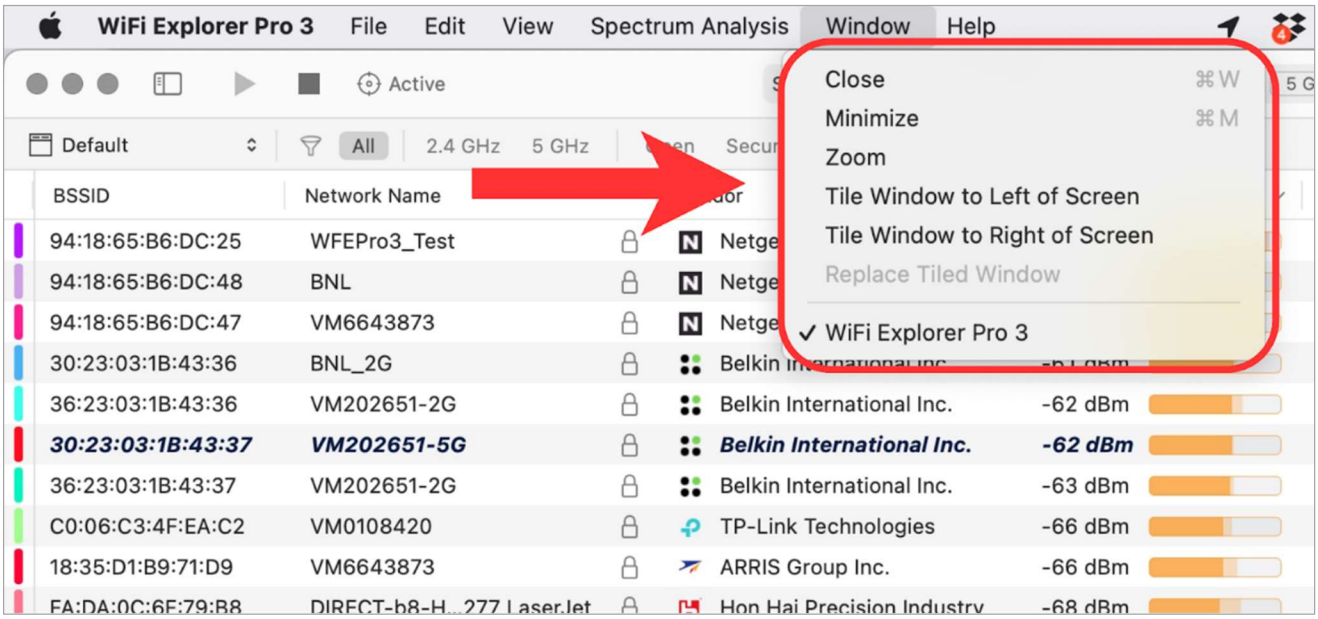

Figure 8-12 - *Window* menu item

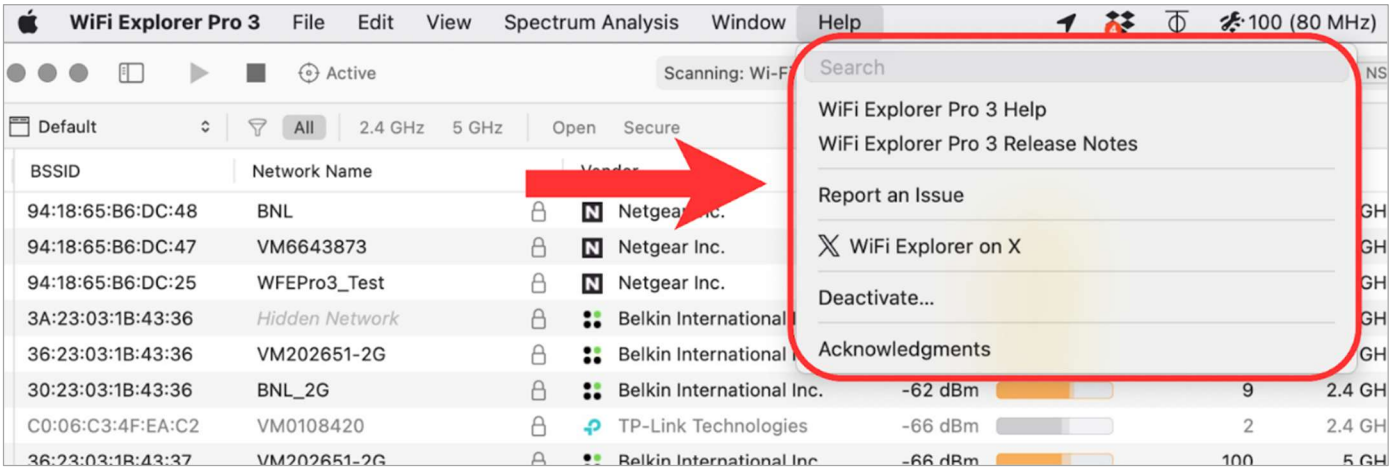

Figure 8-13 - *Help* menu items

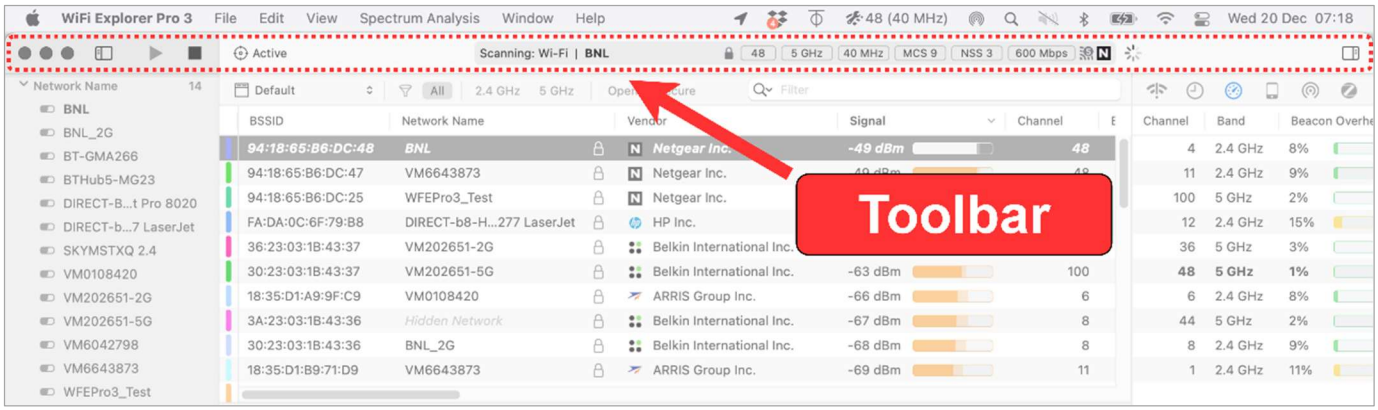

Figure 8-14 - *Toolbar* UI location

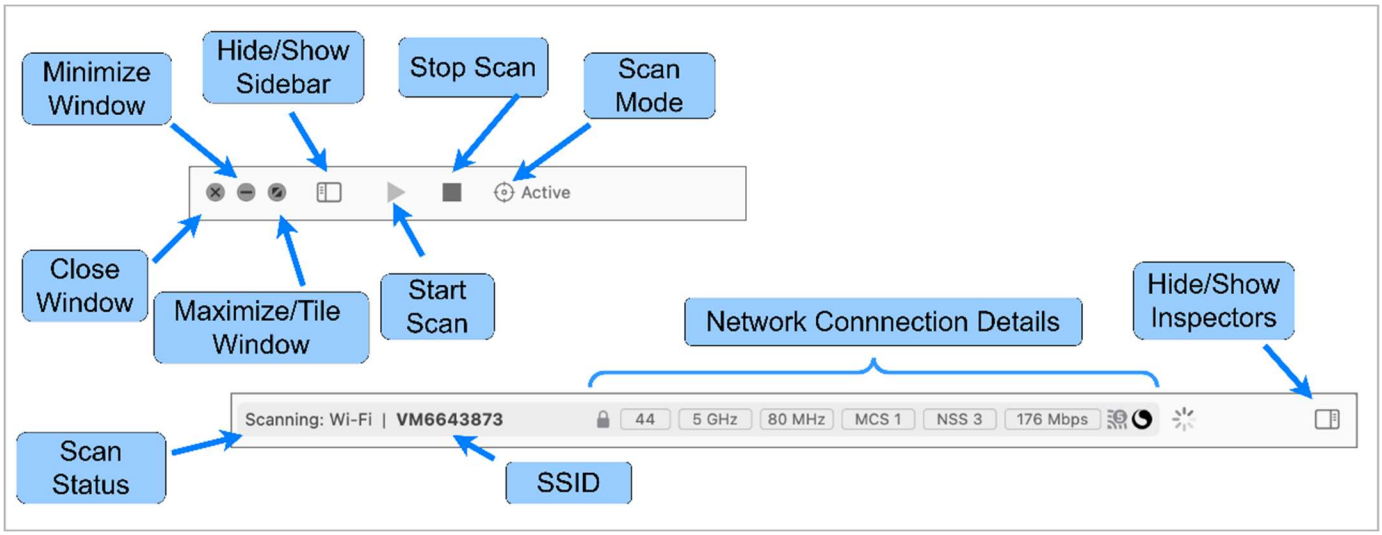

Figure 8-15 - Toolbar details (toolbar split to show details)

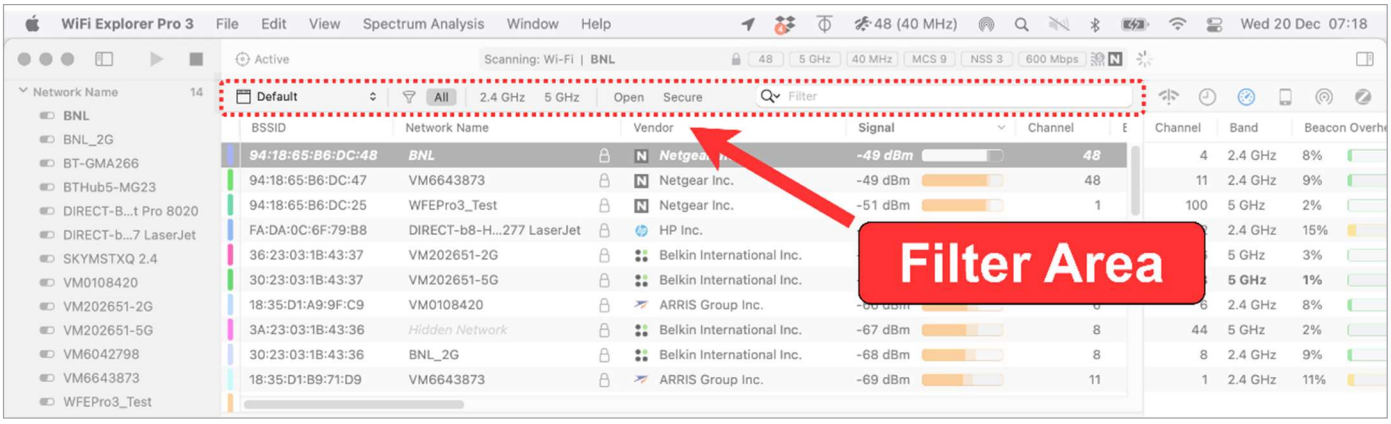

Figure 8-16 - *Filter Area* UI location

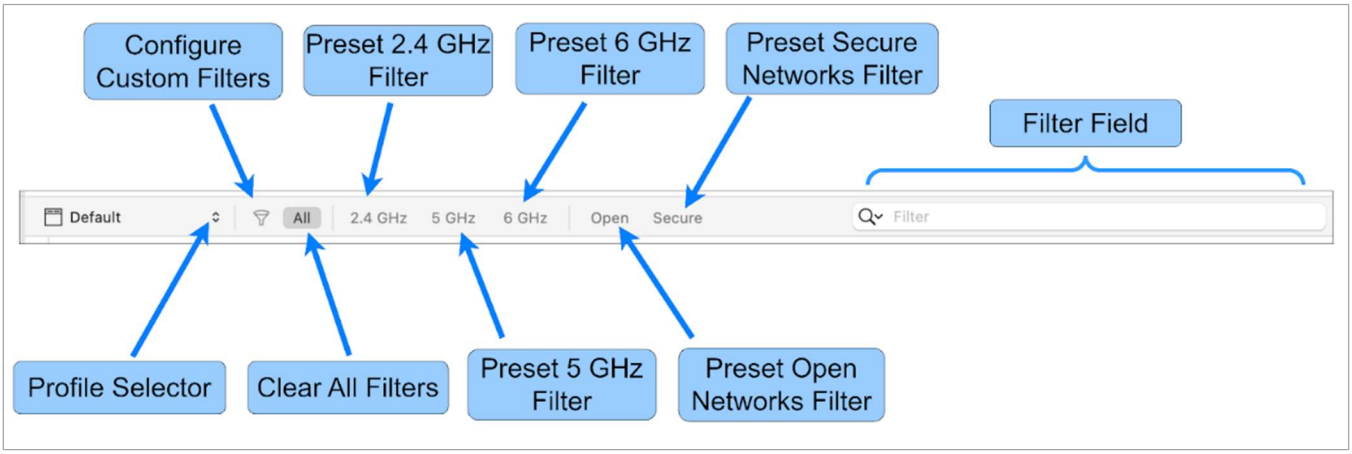

Figure 8-17 - *Filter Area* details

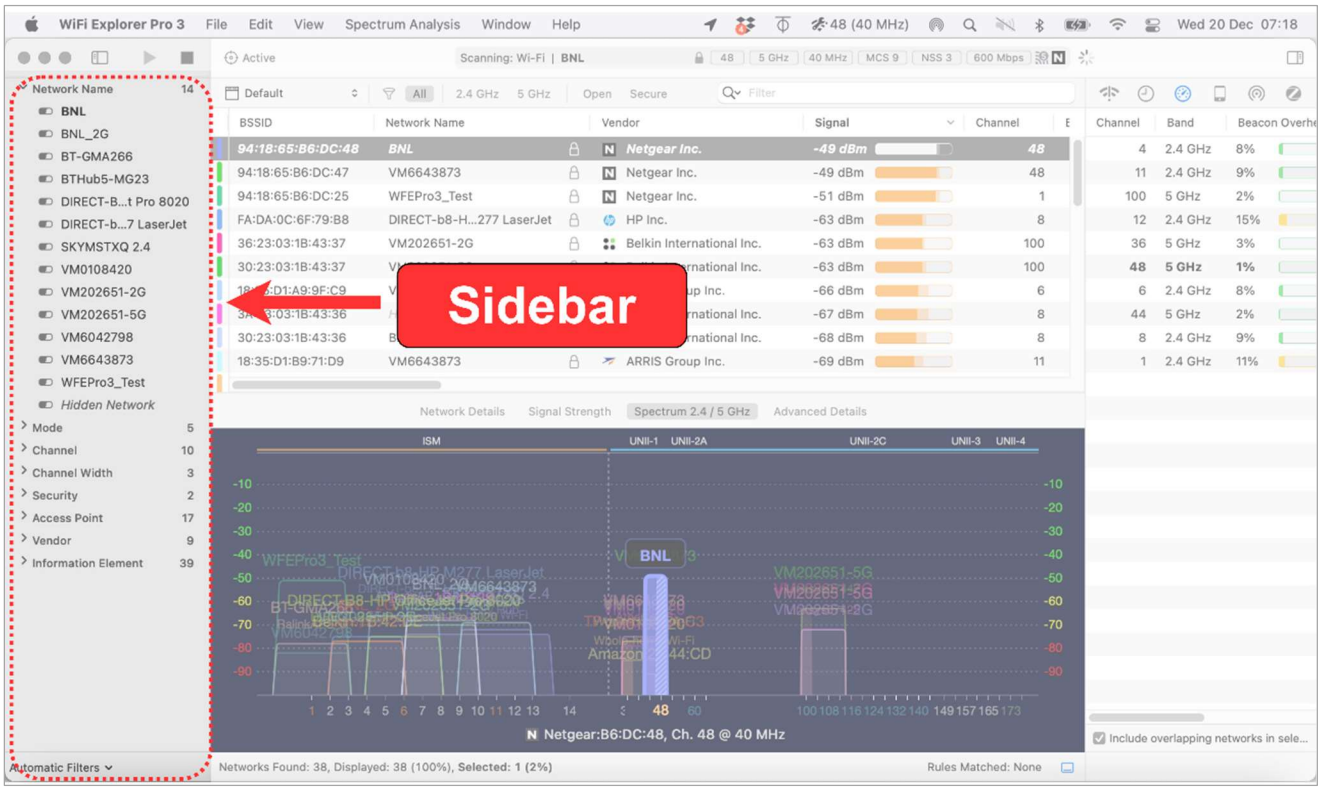

Figure 8-18 - *Sidebar* UI location

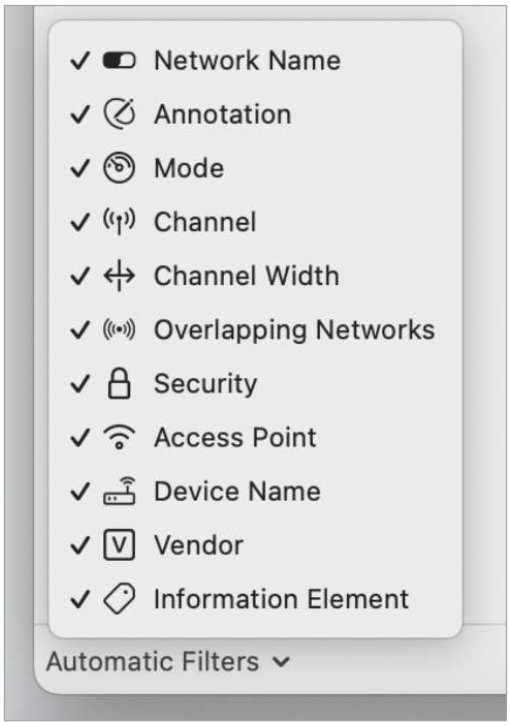

Figure 8-19 - Sidebar *Automatic Filter* Options

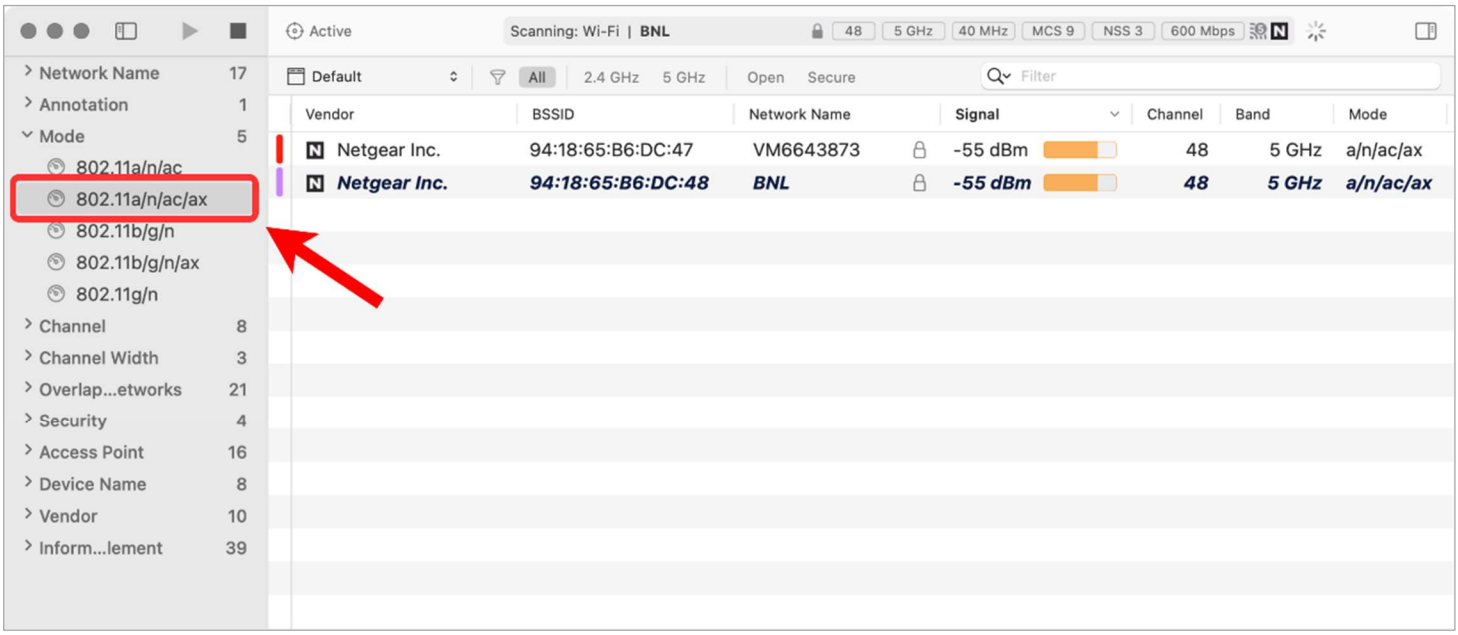

Figure 8-20 - *Sidebar* filter example using a *Mode* filter

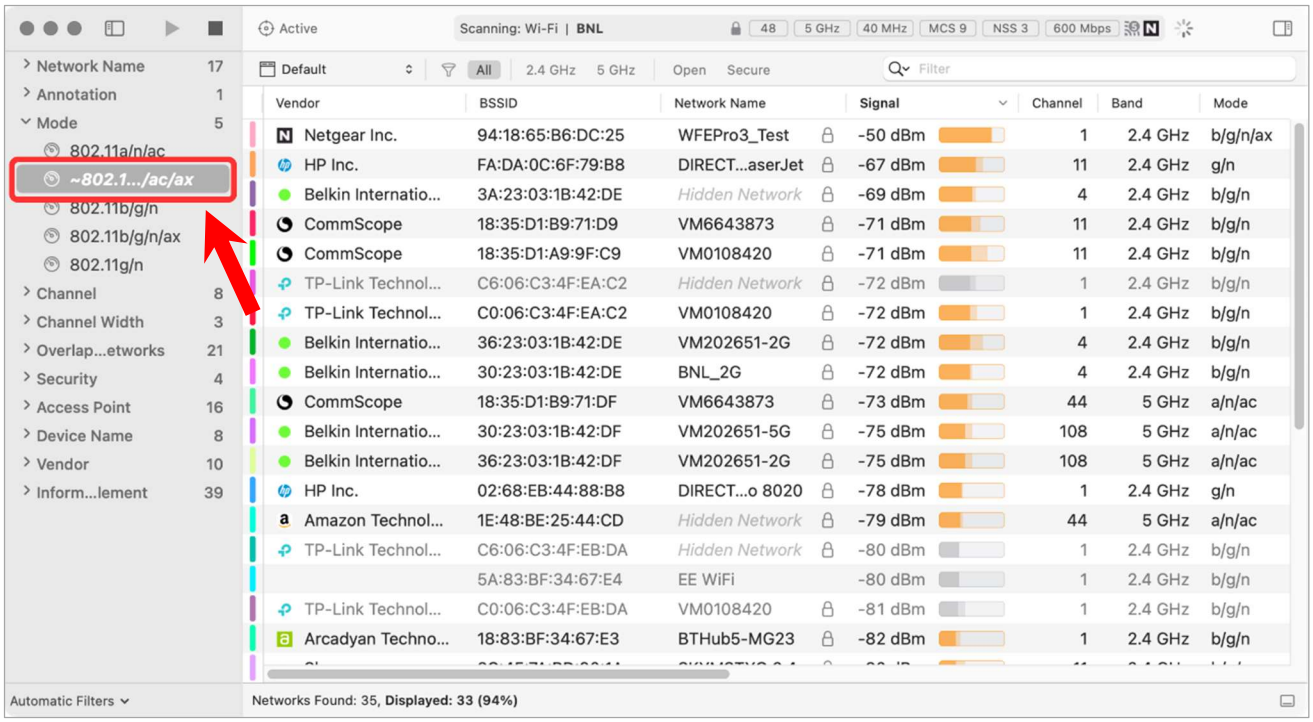

Figure 8-21 - *Sidebar* filter example using a negated *Mode* filter

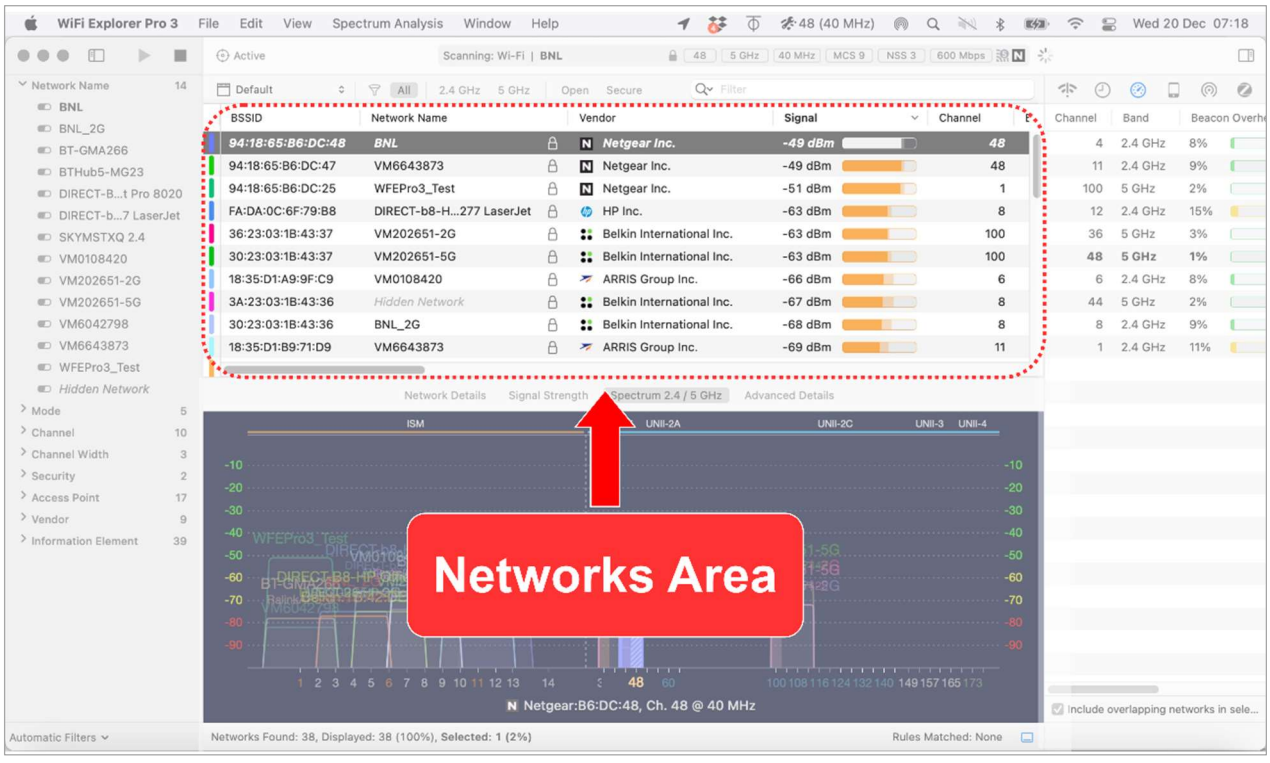

Figure 8-22 - *Networks Area* UI location (also referred to as the "networks table")

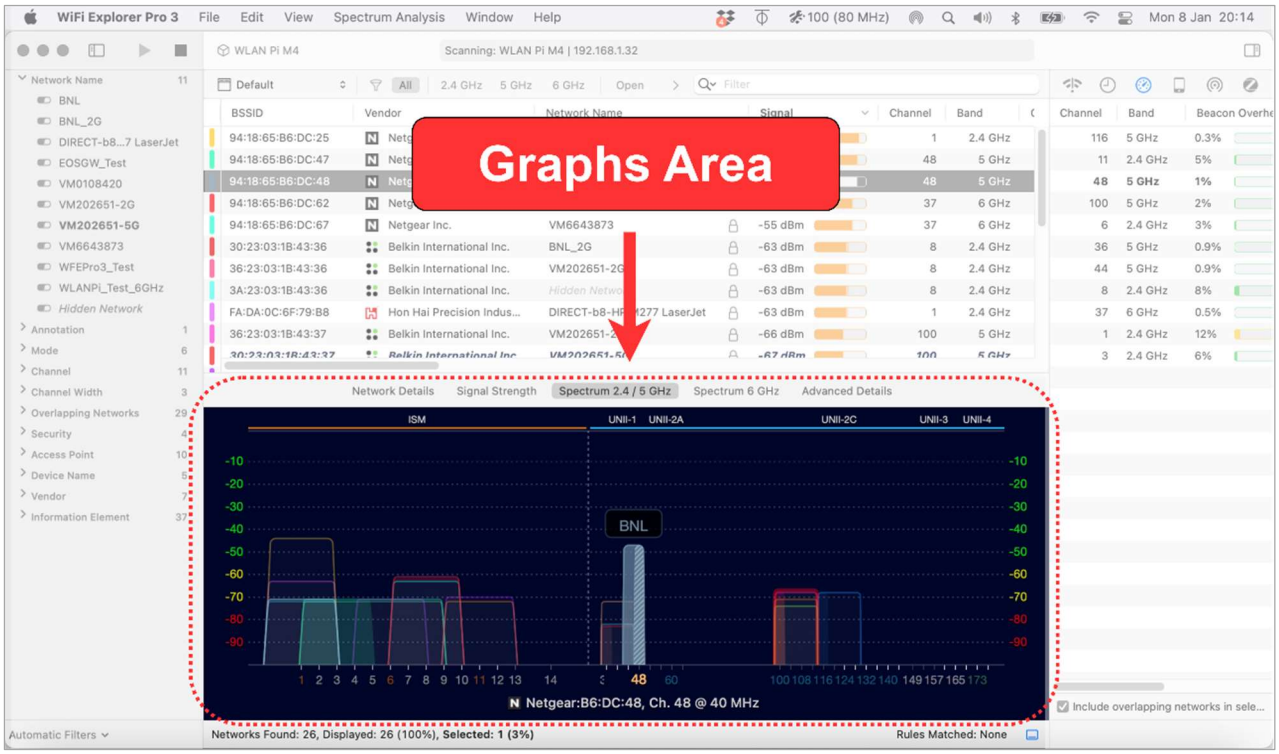

Figure 8-23 - *Graphs Area* UI location

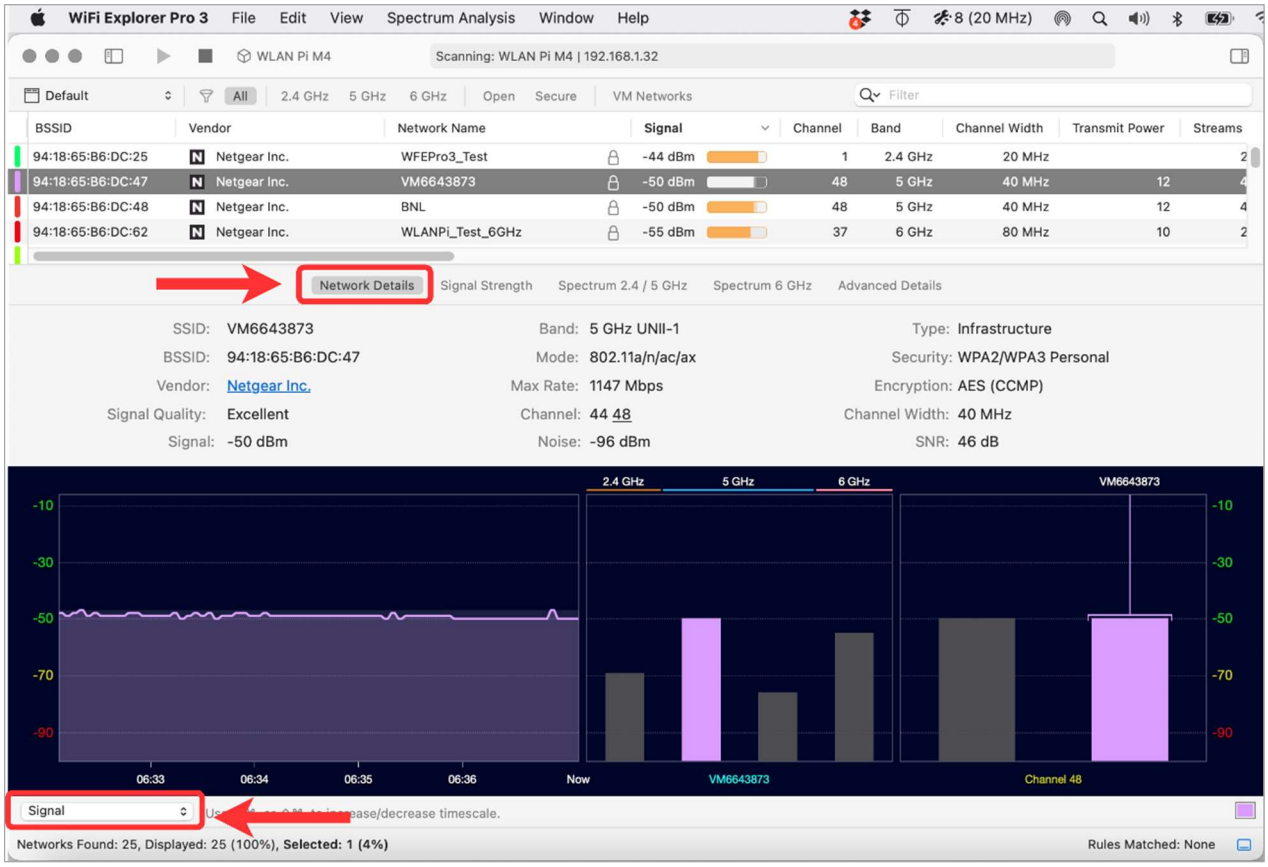

Figure 8-24- *Graphs Area*: Network Details panel

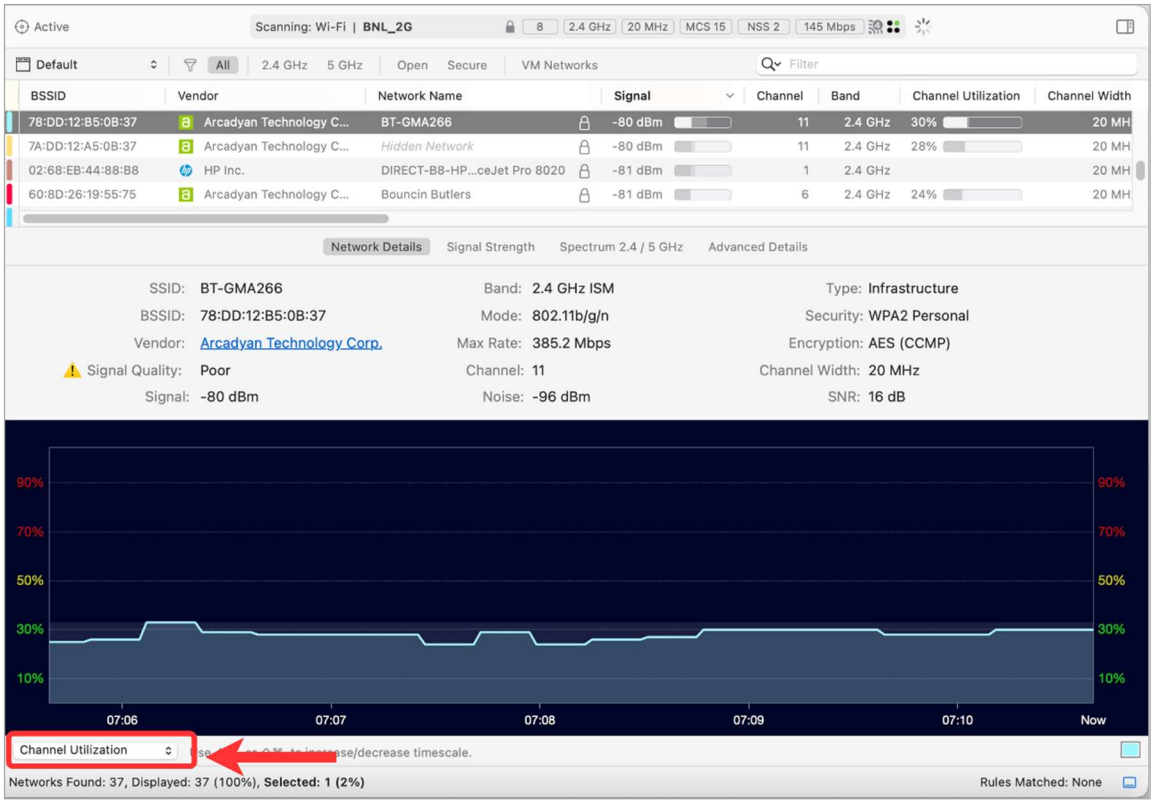

Figure 8-25 - *Graphs Area*: Network Details panel showing channel utilization graph

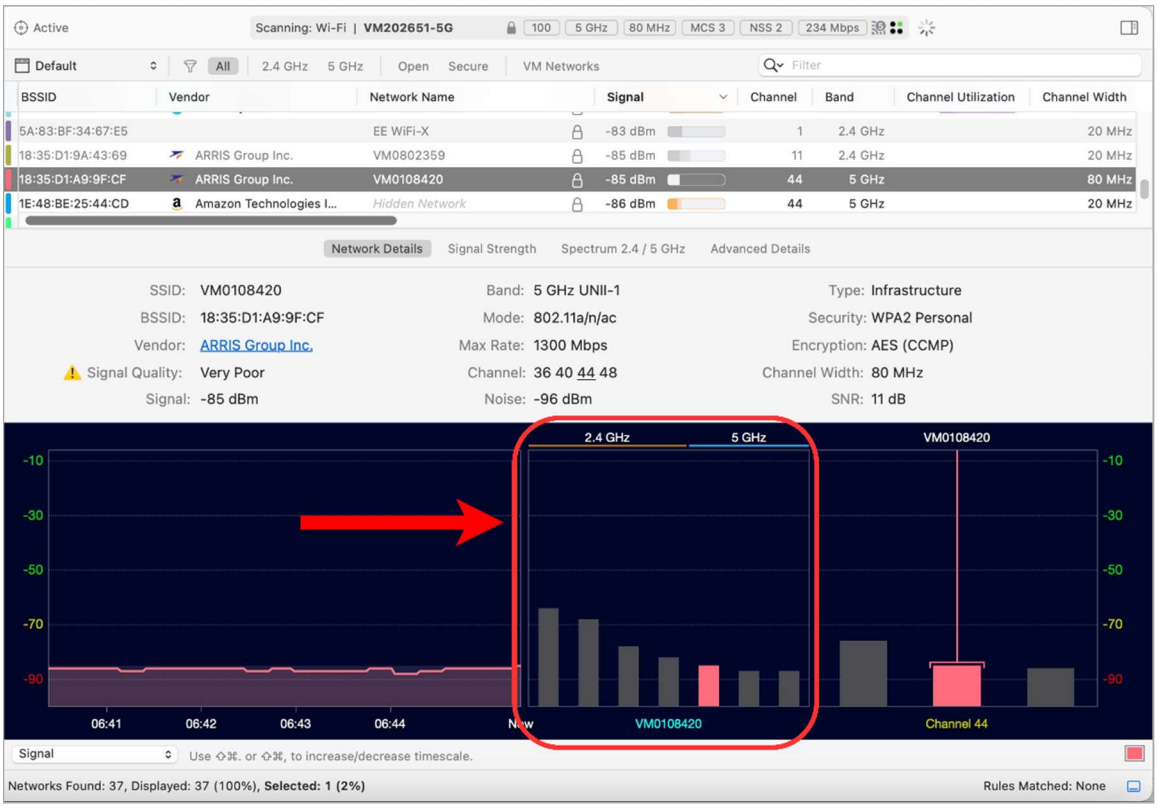

Figure 8-26 - *Graphs Area*: Network Details panel with SSID Band Peers Graph highlighted

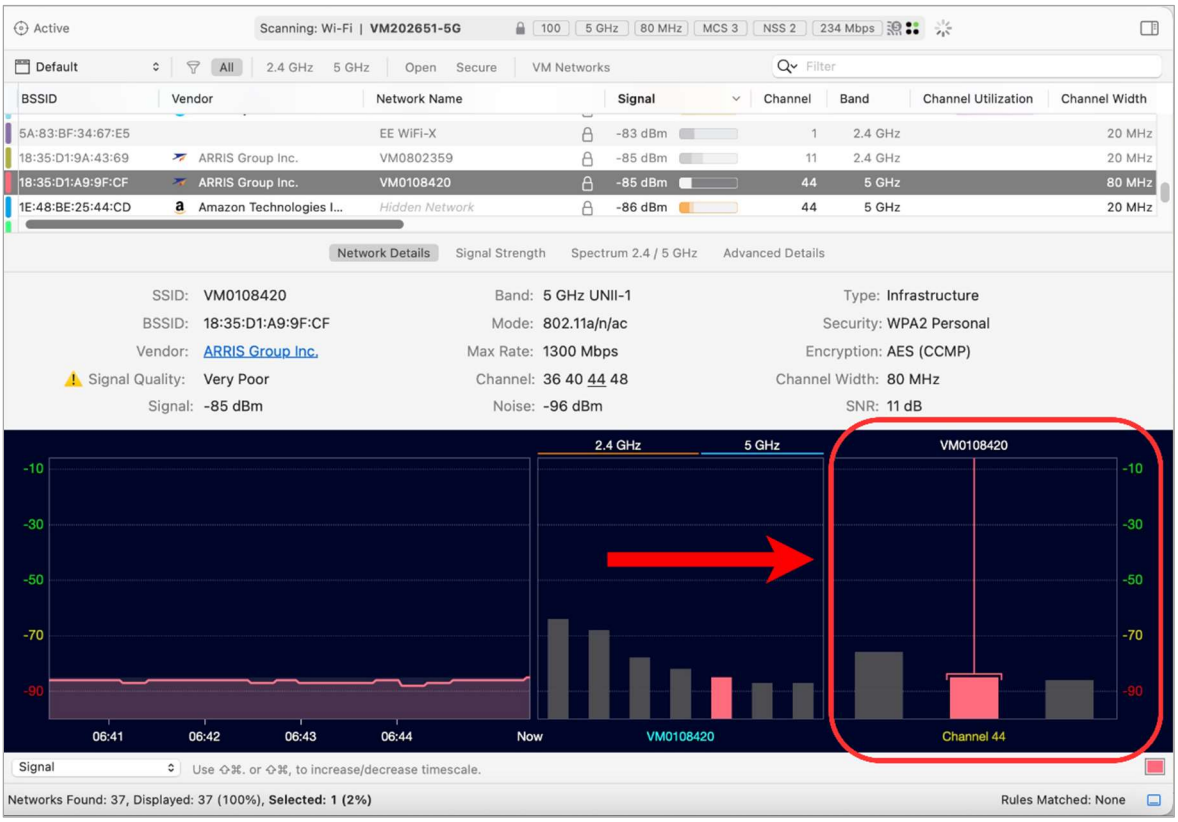

Figure 8-27 - *Graphs Area*: Network Details panel with the Channel Peers Graph highlighted

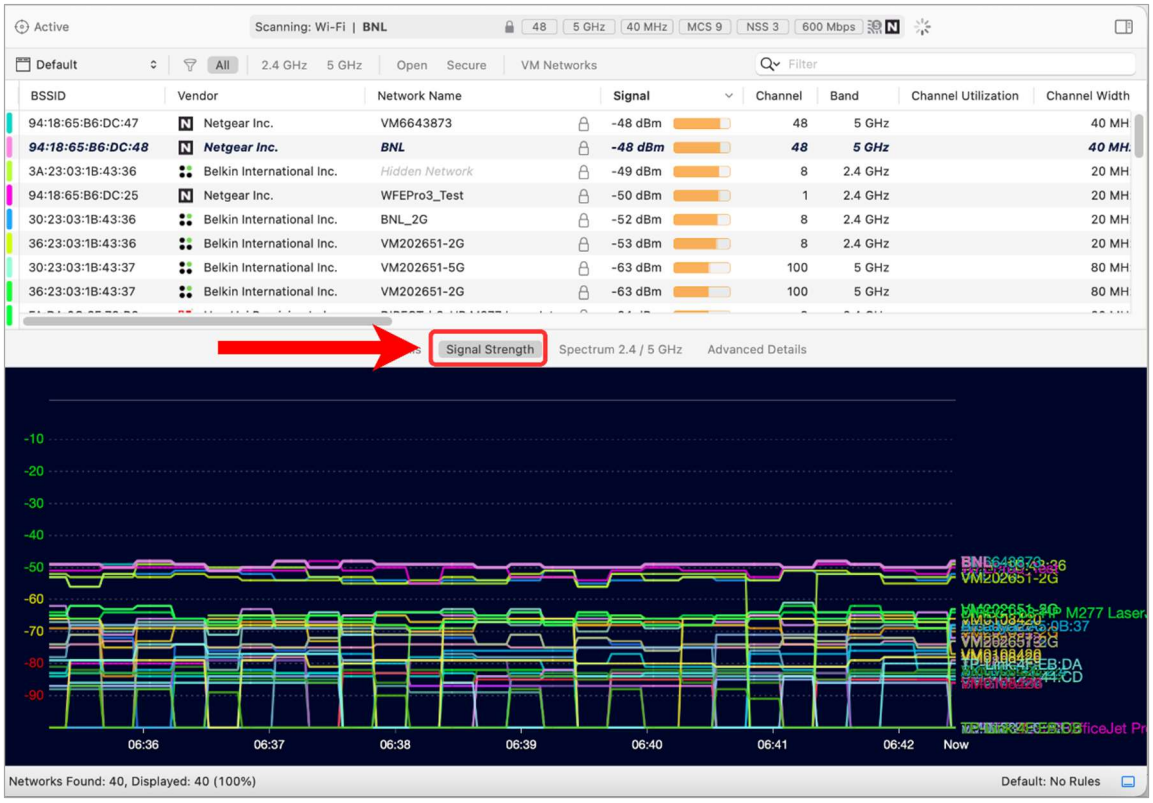

Figure 8-28 - *Graphs Area*: Signal Strength panel, all networks

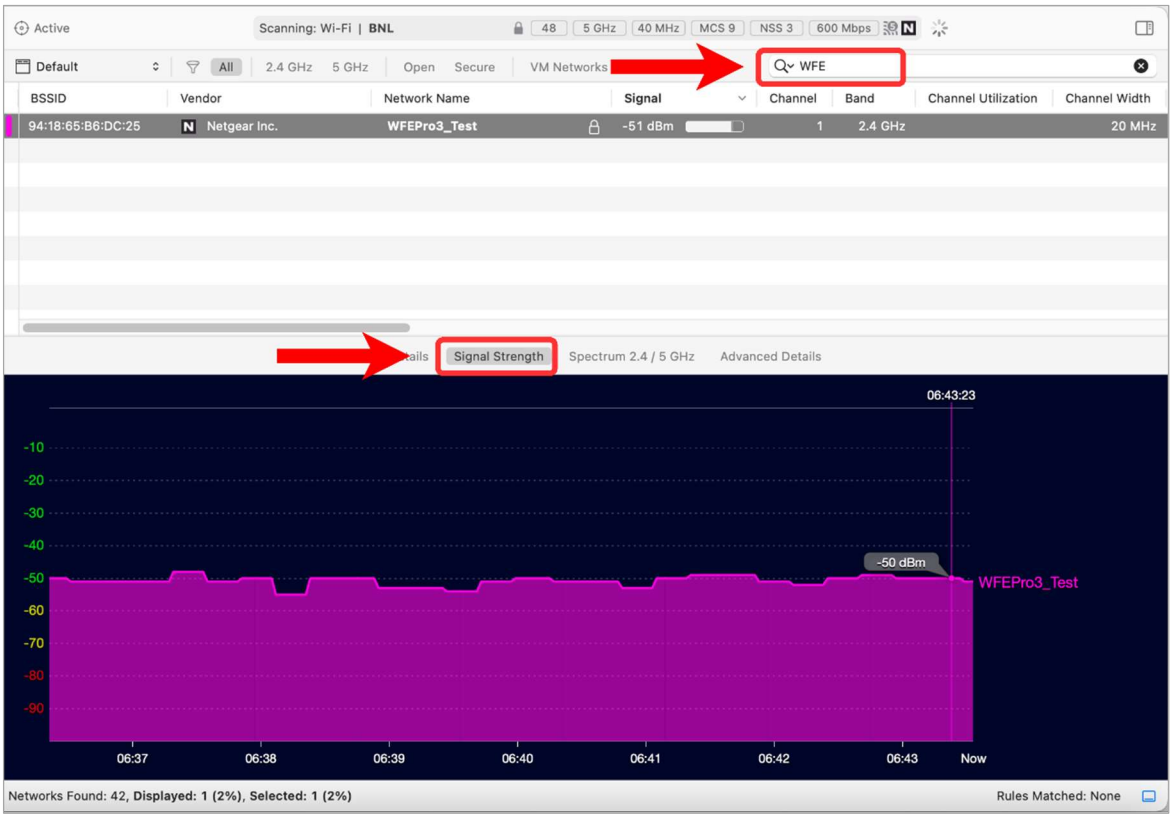

Figure 8-29 - *Graphs Area*: Signal Strength panel showing a single filtered BSSID

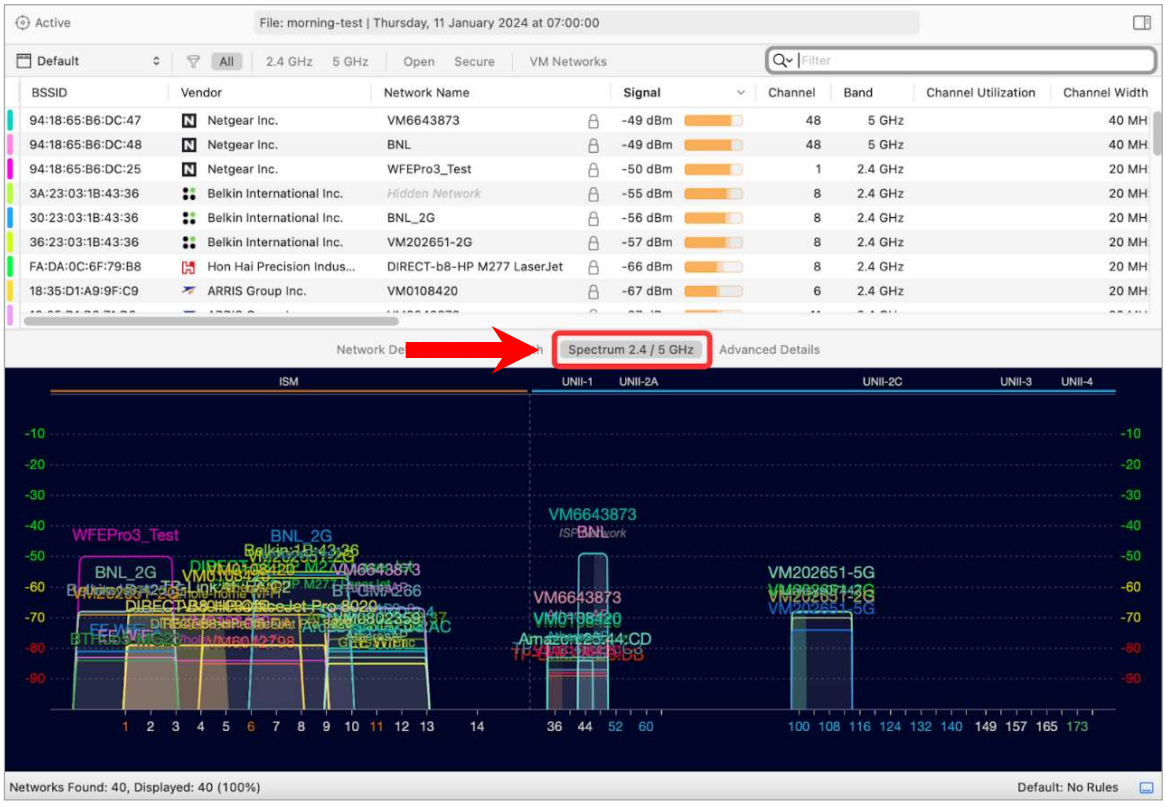

Figure 8-30 - *Graphs Area*: Spectrum 2.4/5 GHz panel showing all networks

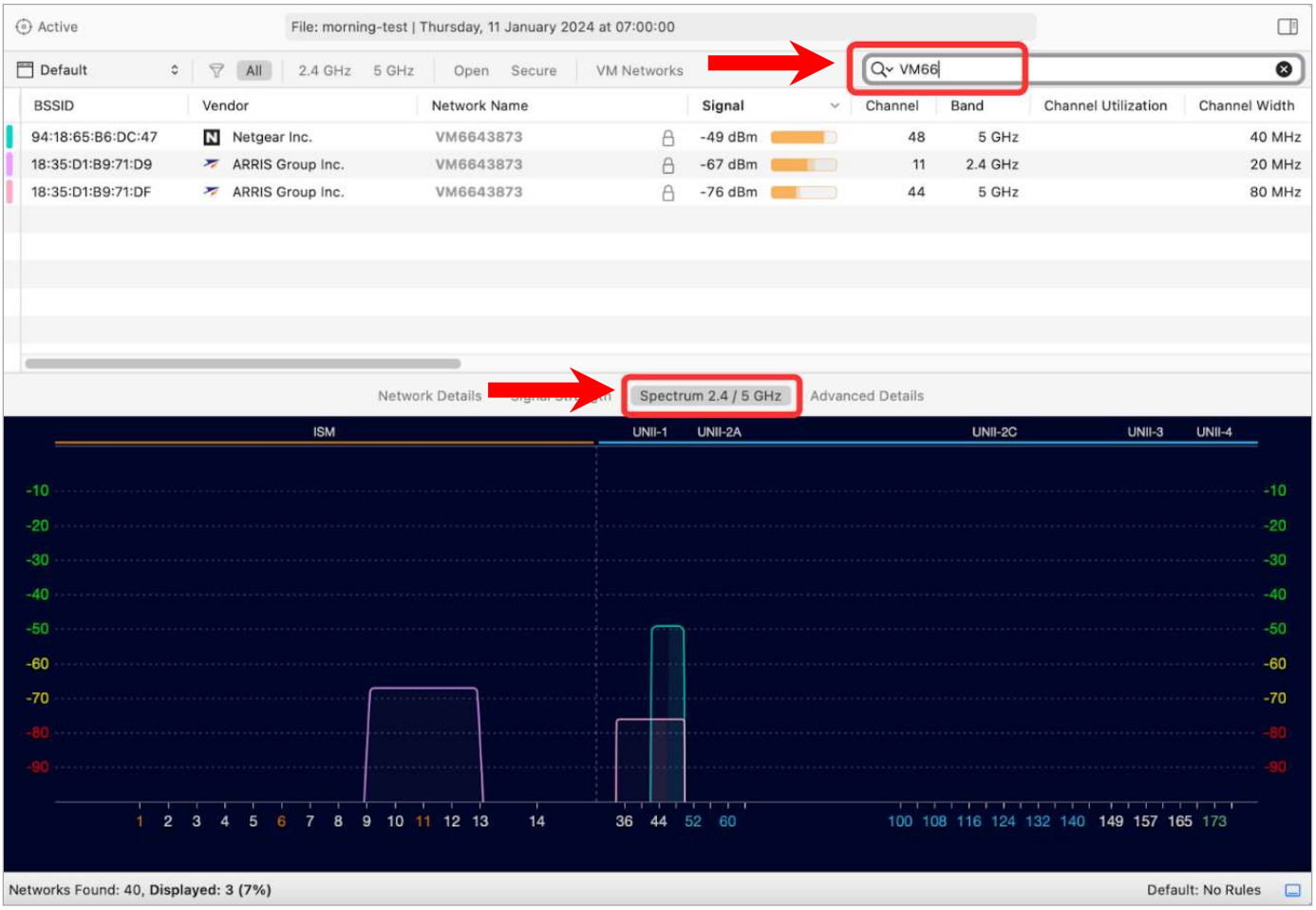

Figure 8-31 - *Graphs Area*: Spectrum 2.4/5 GHz panel showing a filtered network

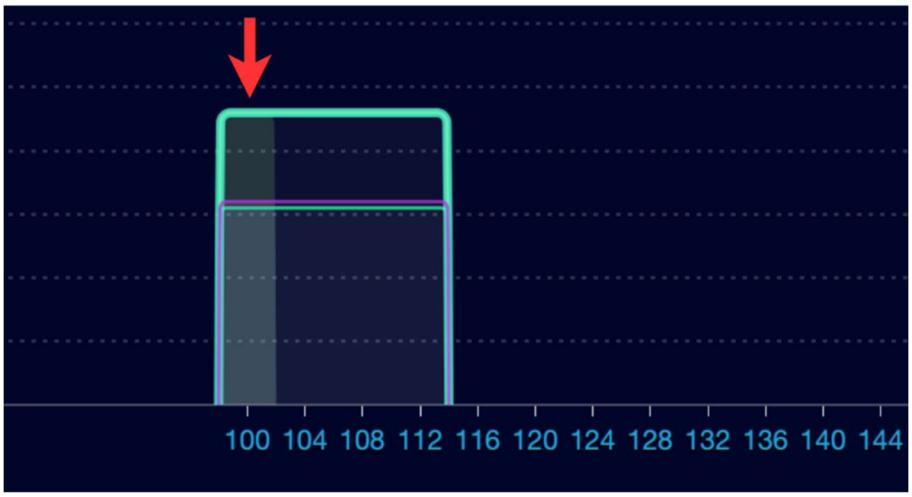

Figure 8-32 - *Graphs Area*: Spectrum 2.4/5 GHz panel indicating a primary channel (ch. 100)

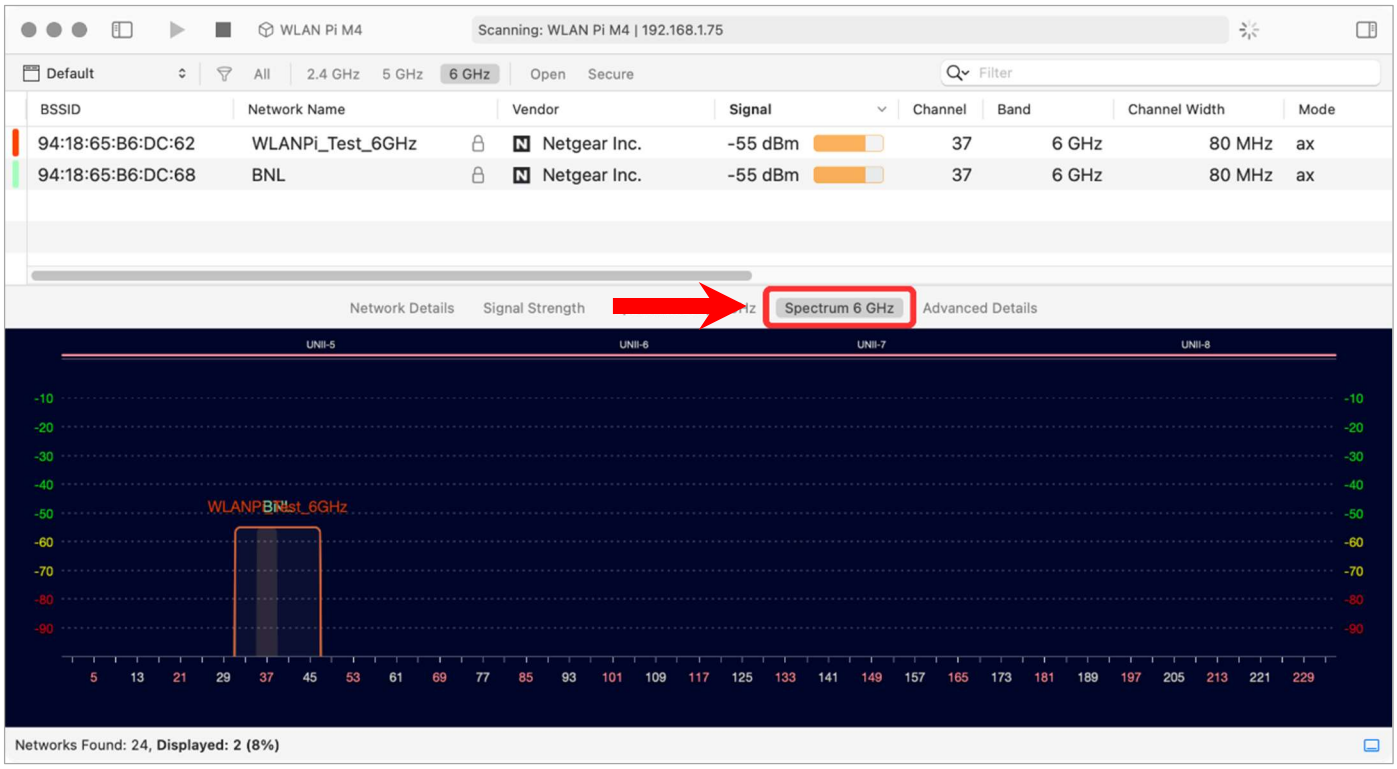

Figure 8-33 - *Graphs Area*: Spectrum 6 GHz panel showing two networks

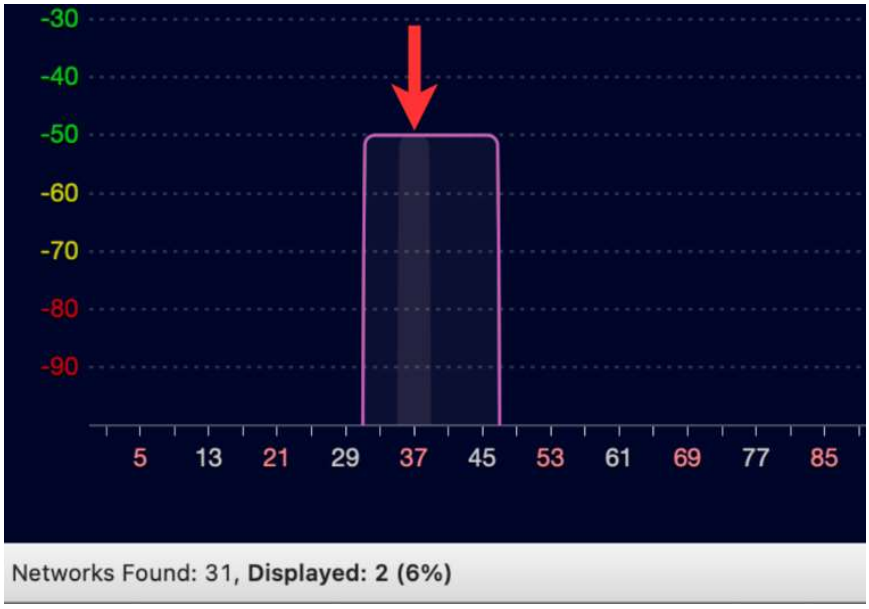

Figure 8-34 - *Graphs Area*: Spectrum 6 GHz panel showing a primary channel (Ch. 37)

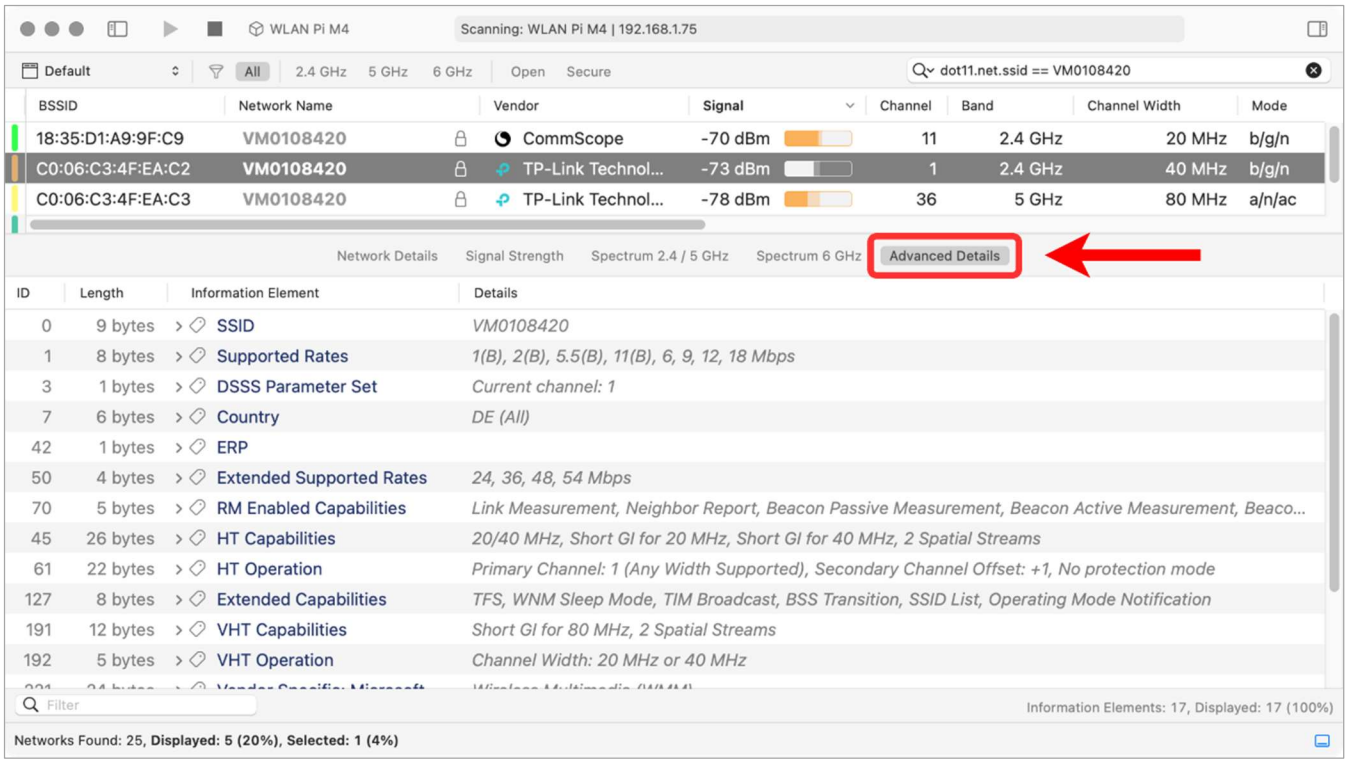

Figure 8-35 - *Graphs Area*: Advanced Details panel showing IEs for a selected network

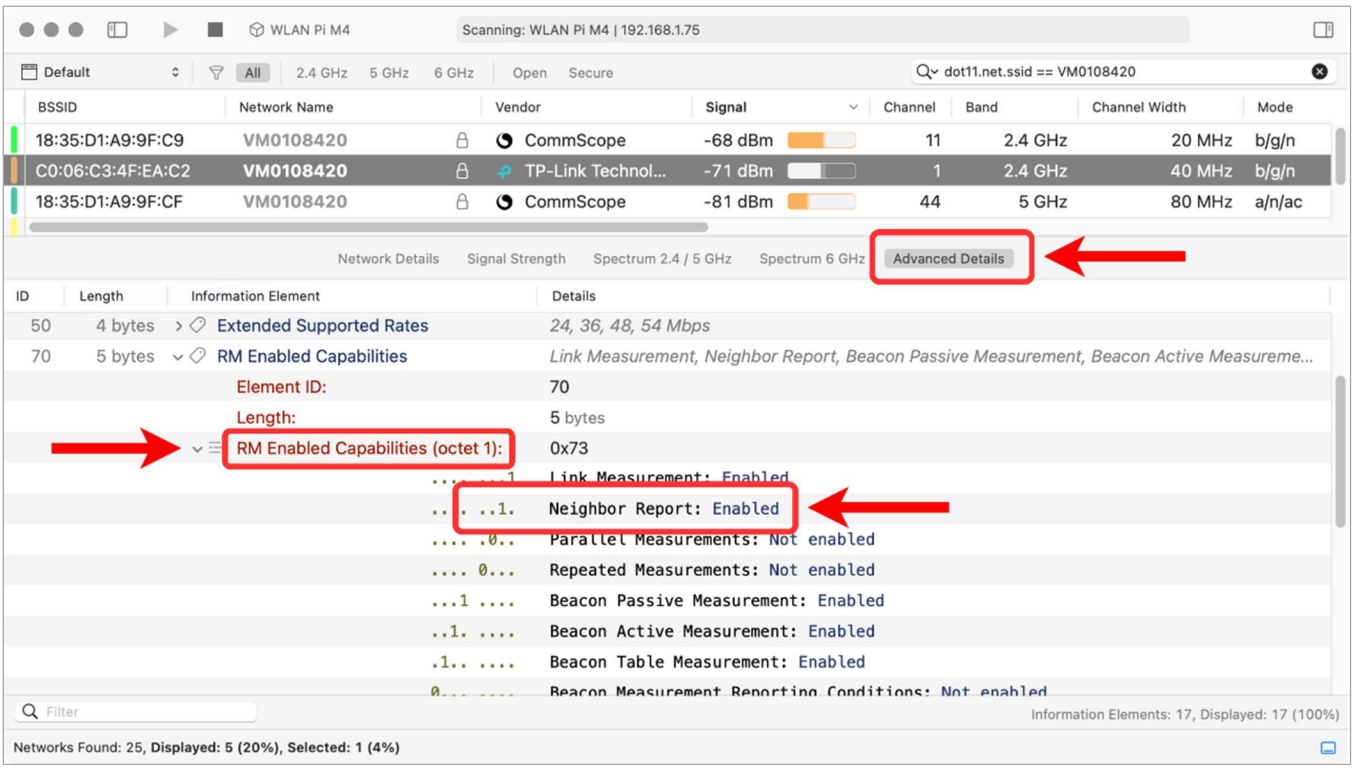

Figure 8-36 - *Graphs Area*: Advanced Details showing the Neighbor Report field for a selected BSSID

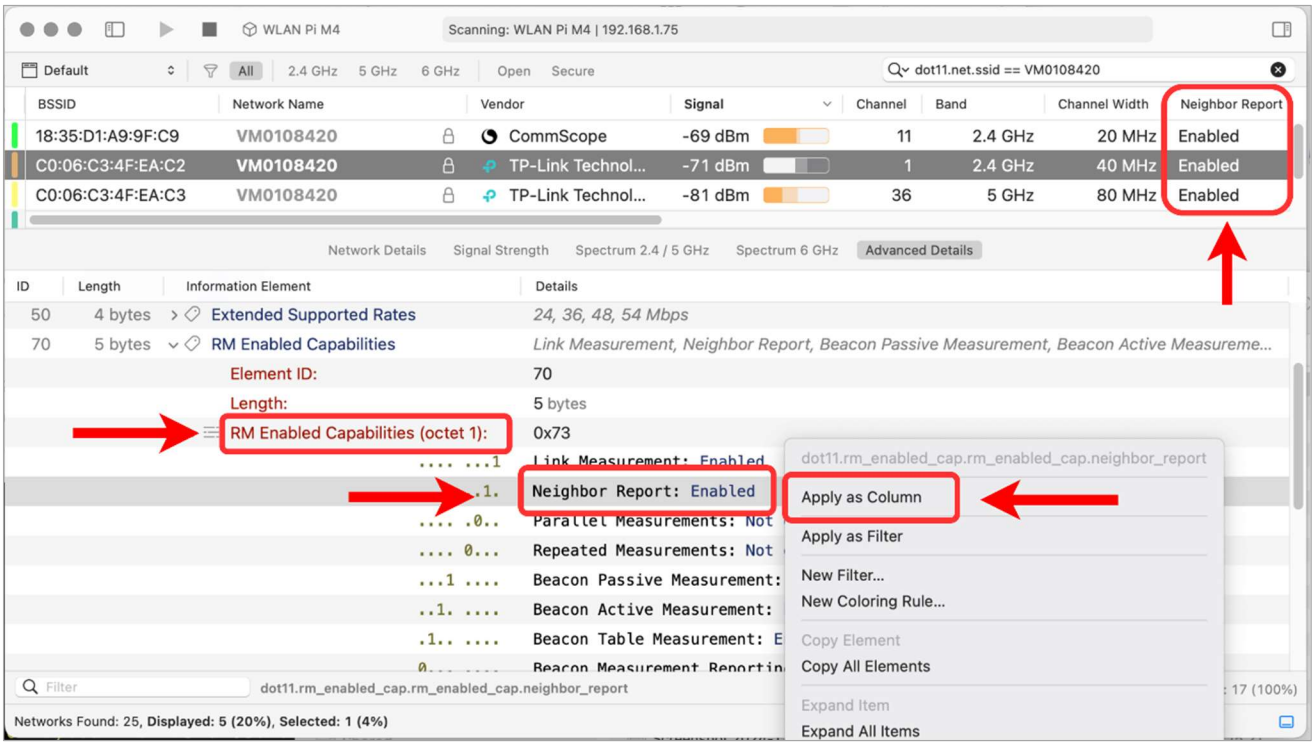

Figure 8-37 - *Graphs Area*: Advanced Details panel showing how to add Neighbor Report as a column

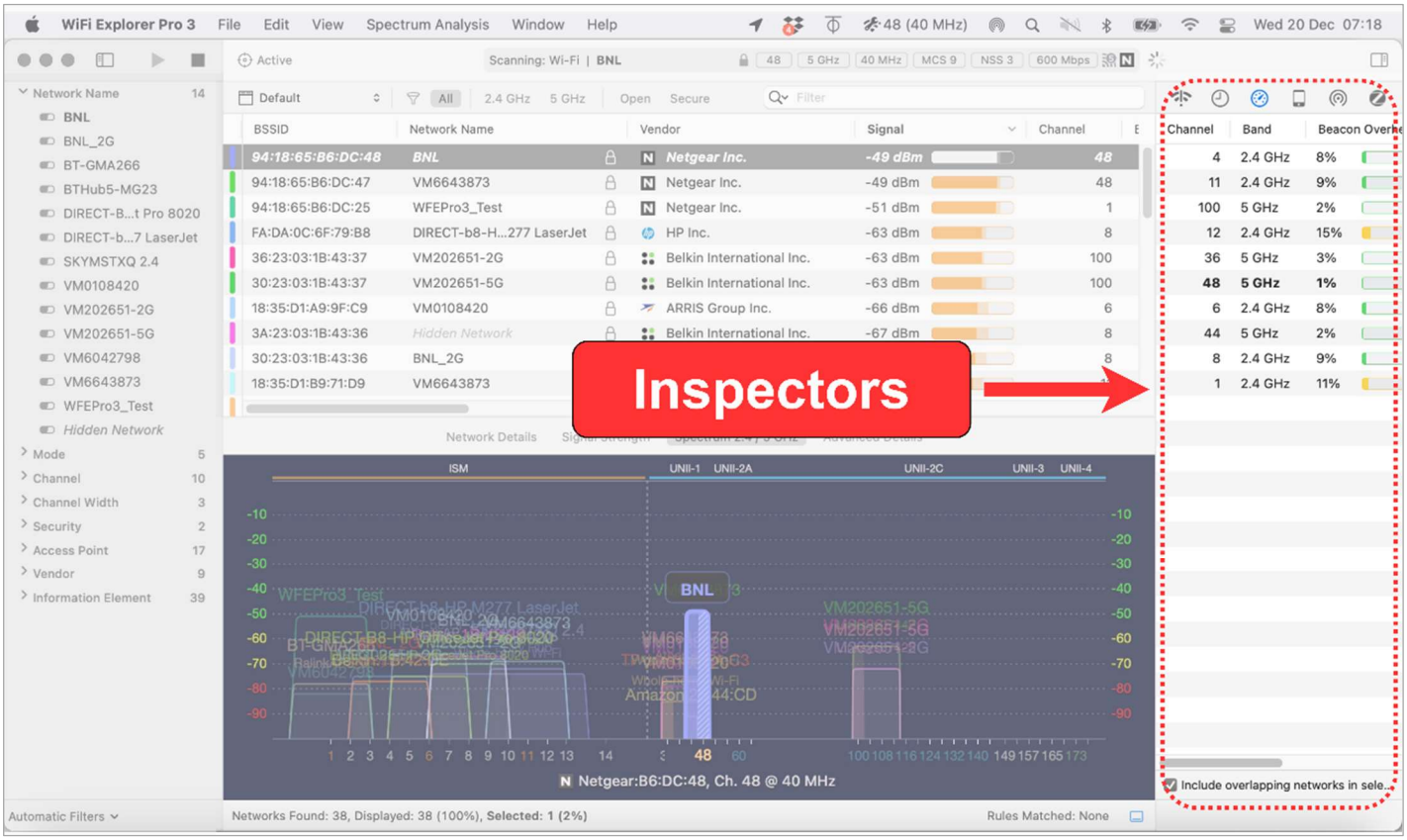

Figure 8-38 - *Inspectors* UI location

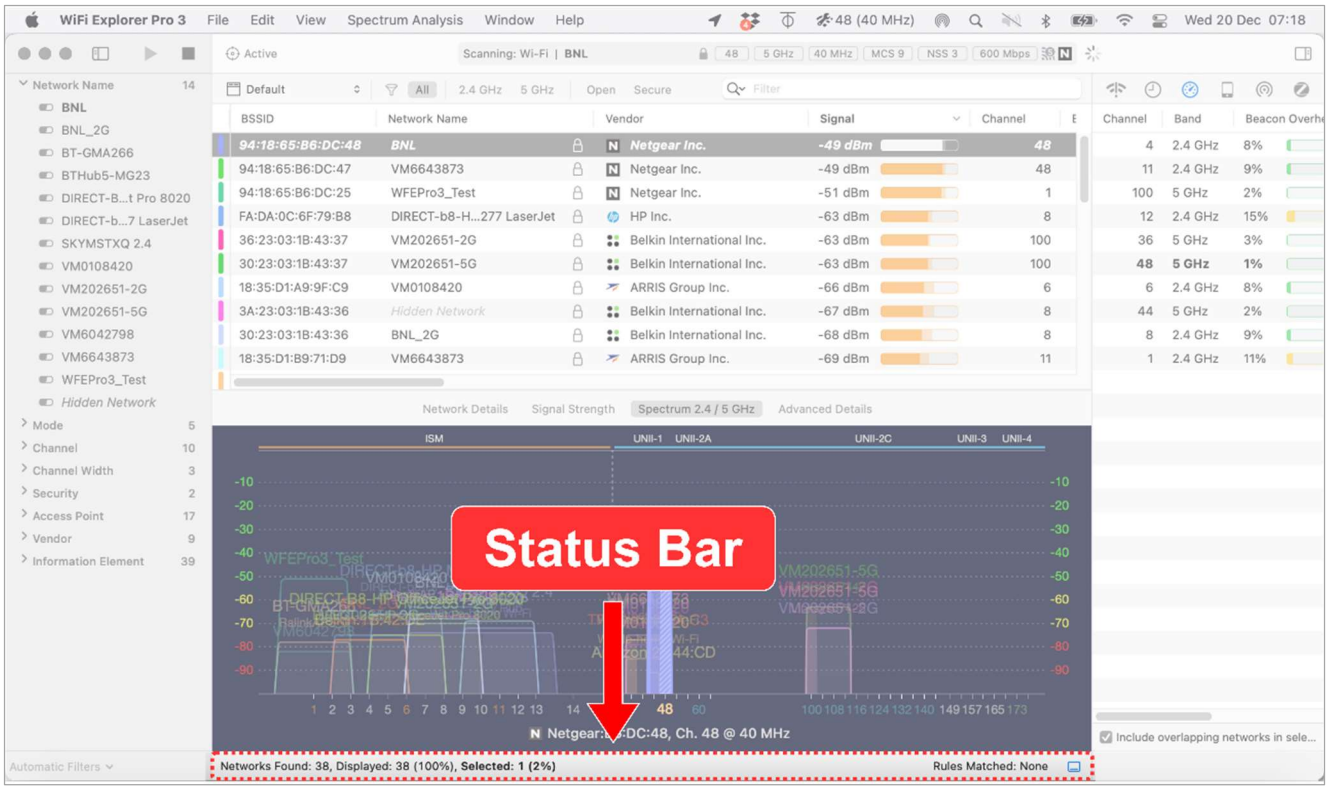

Figure 8-39 - *Status Bar* UI location

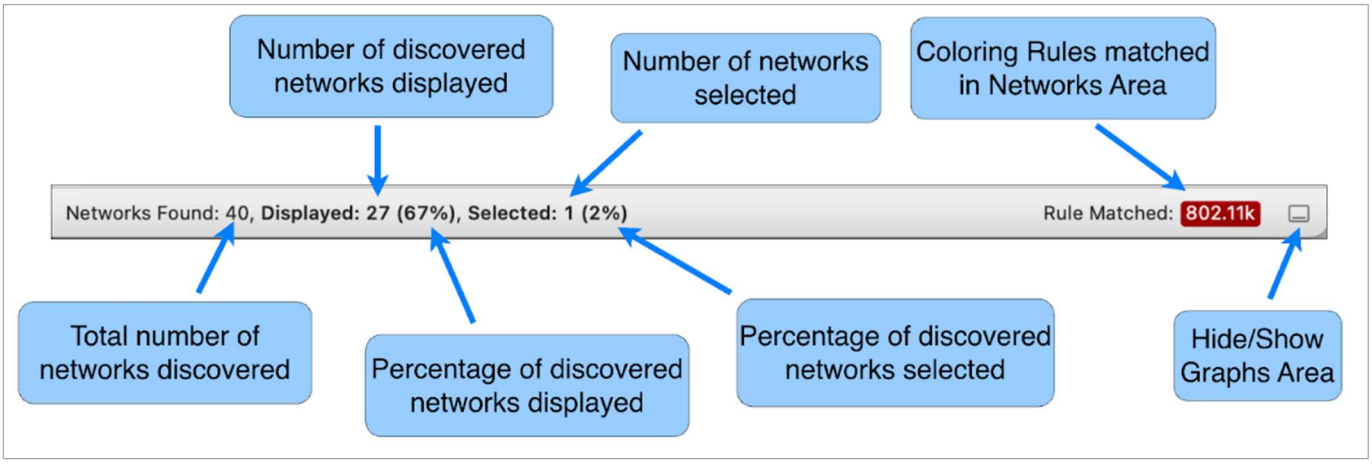

Figure 8-40 - *Status Bar* Details

Chapter 9 - WiFi Explorer Pro 3 Settings

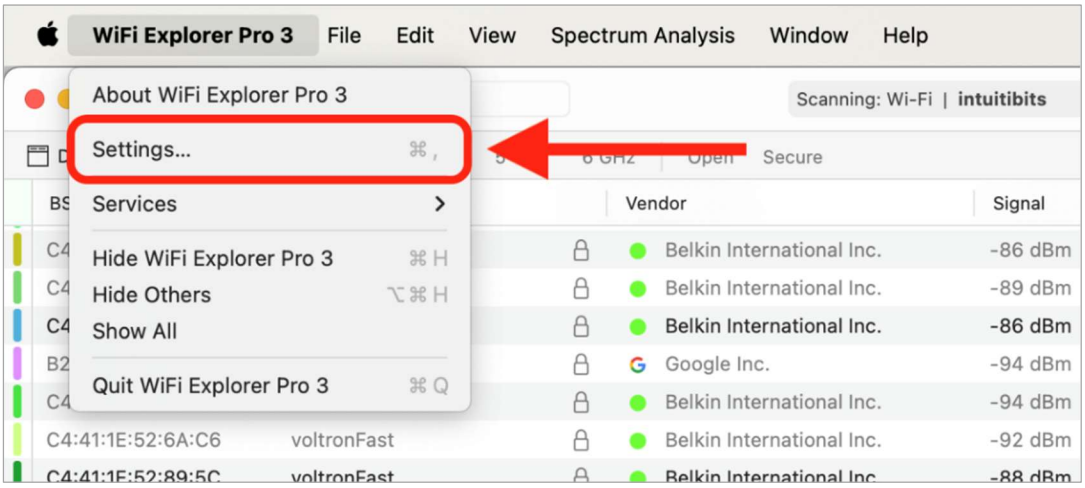

Figure 9-1 - Accessing the *Settings* window

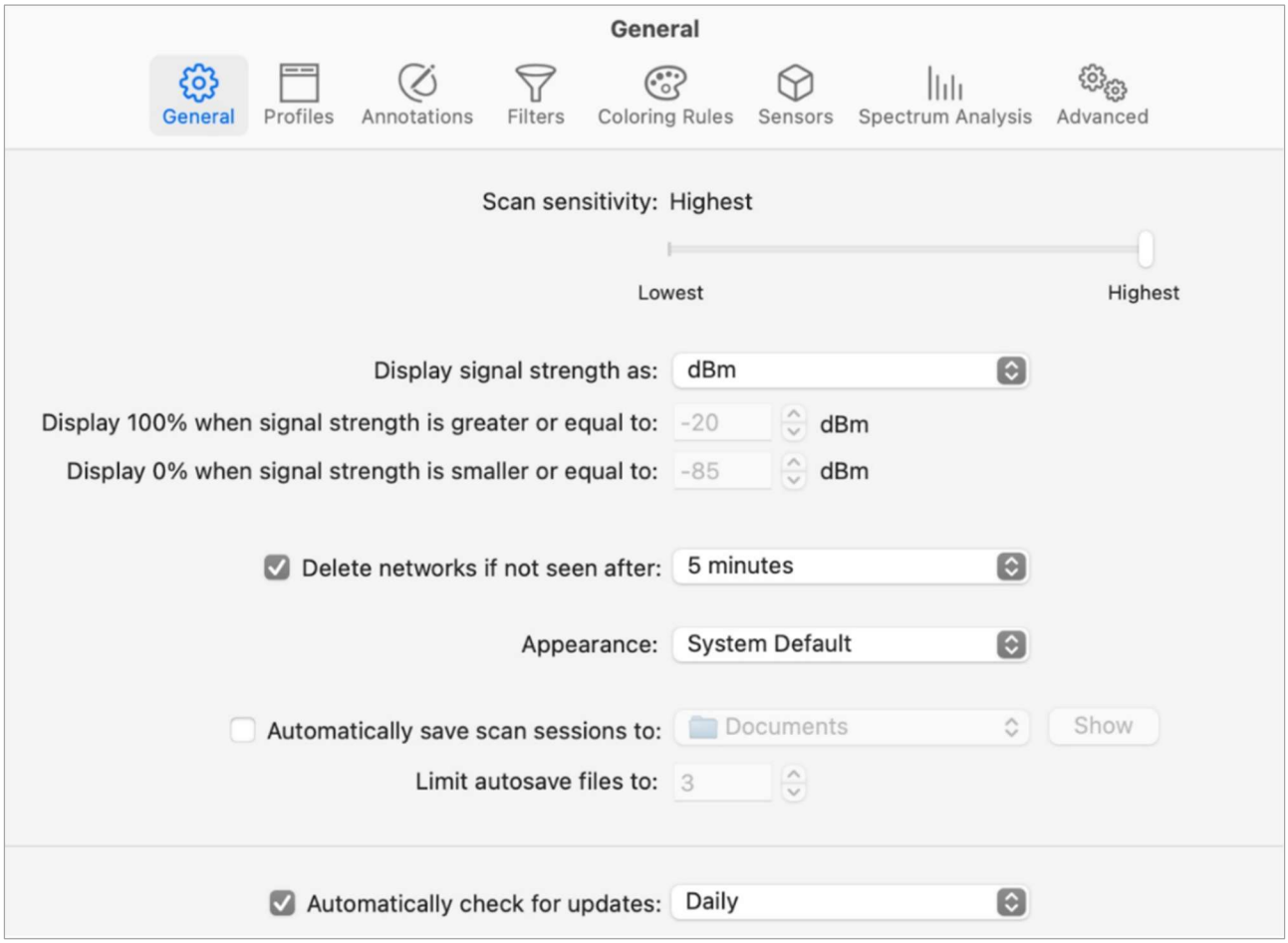

Figure 9-2 - The *General* settings tab

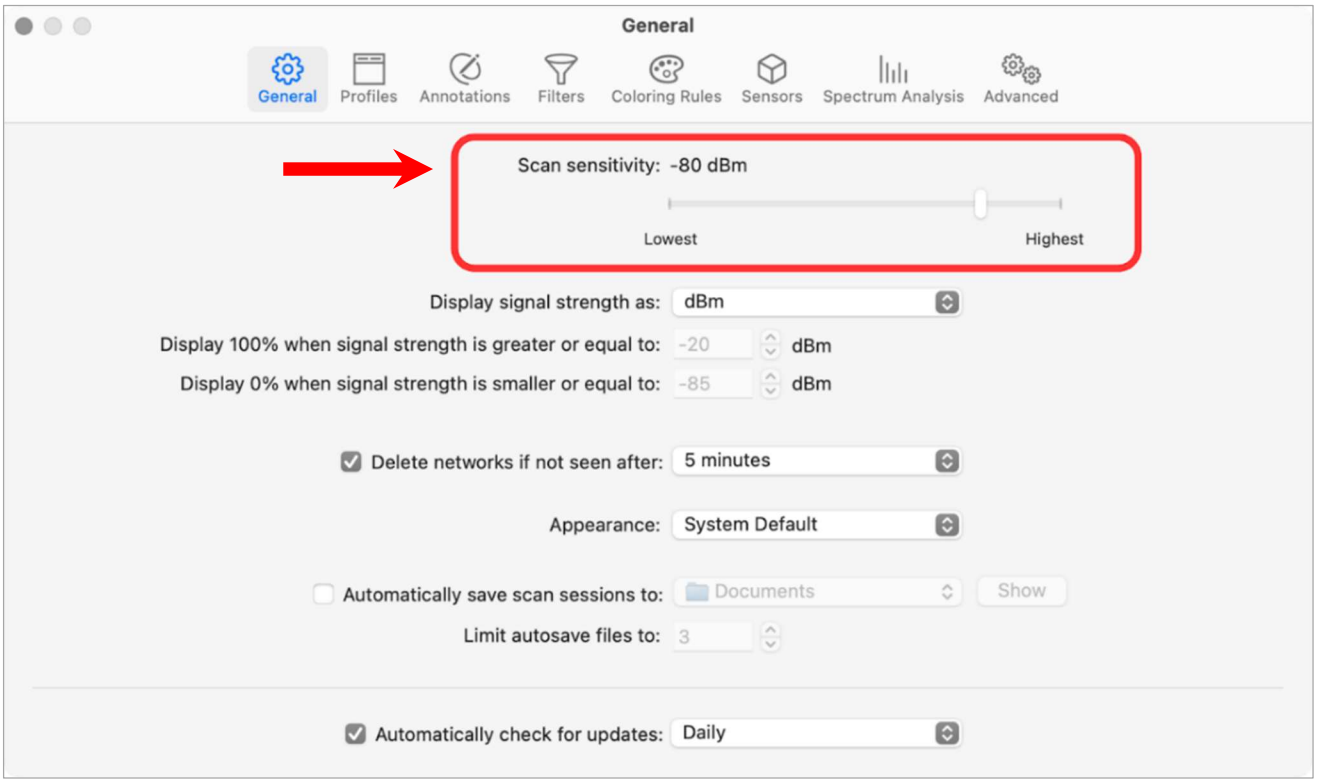

Figure 9-3 - Scan sensitivity adjustment under the *General* settings tab

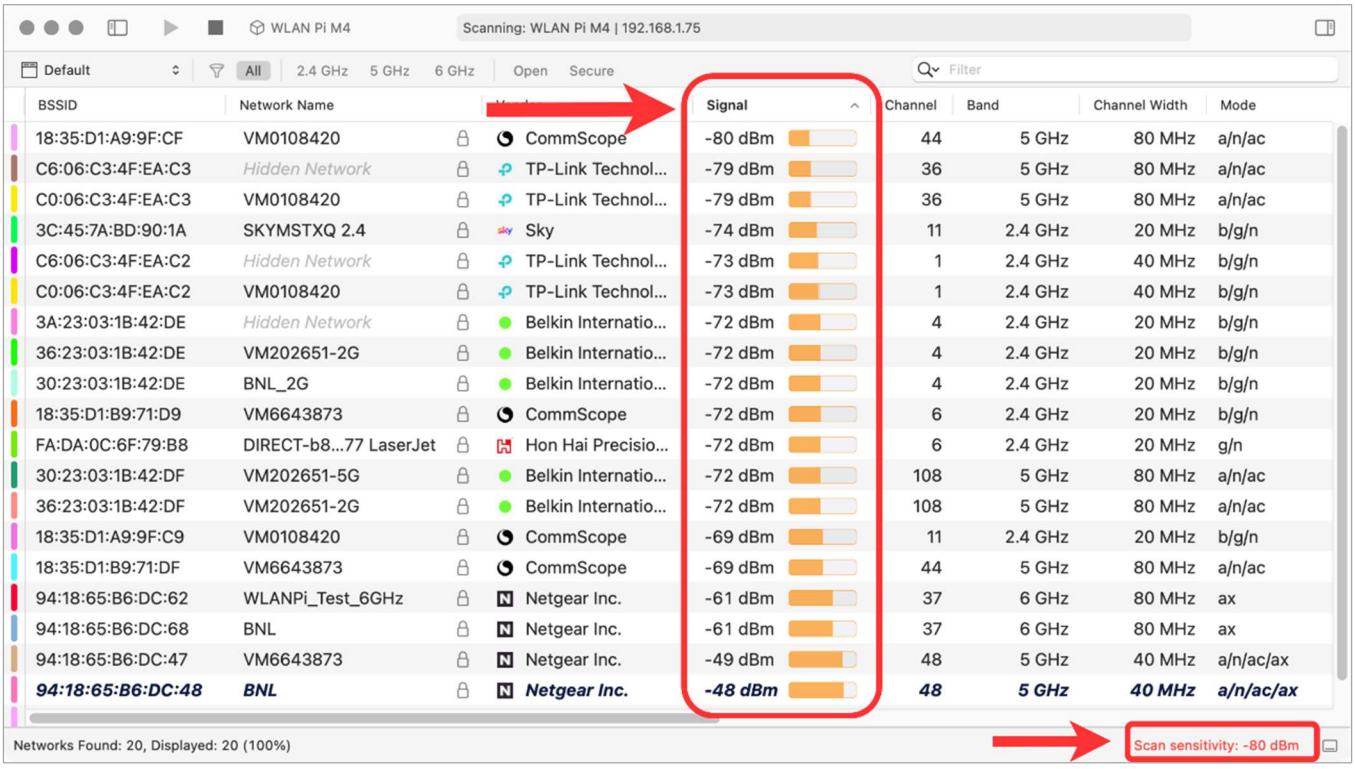

Figure 9-4 - The effect of adjusting scan sensitivity

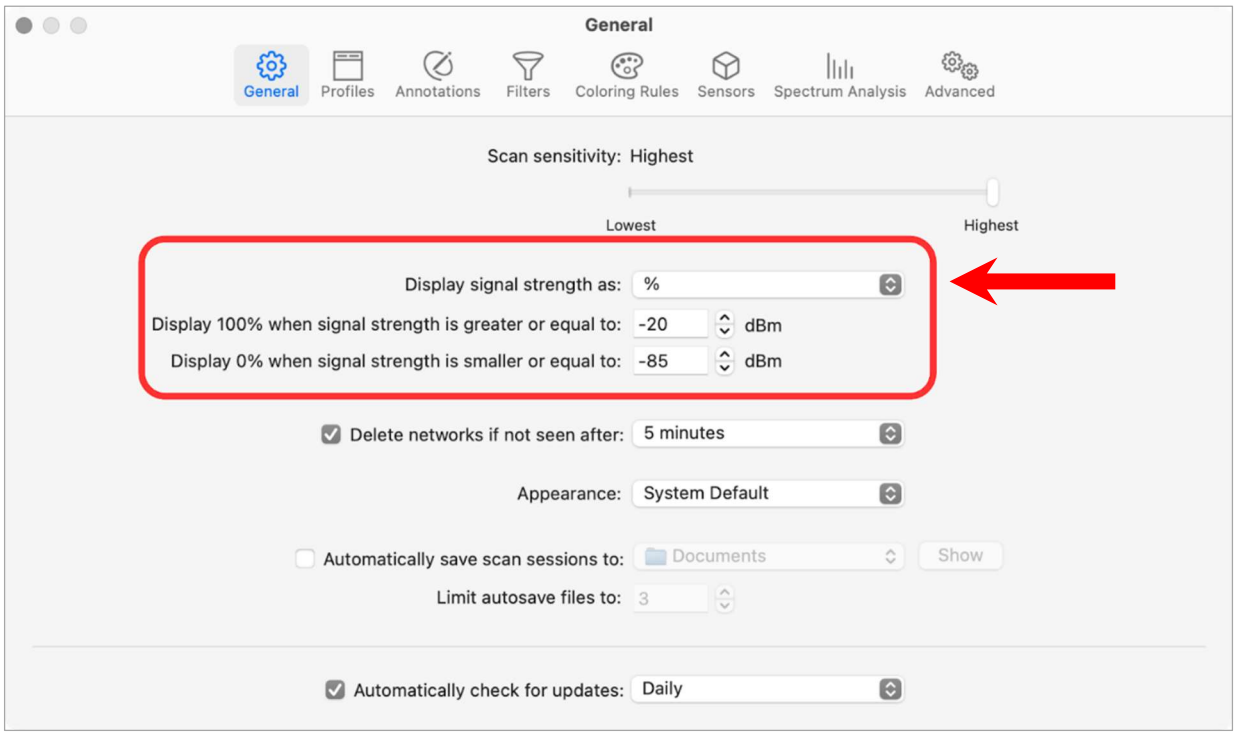

Figure 9-5 - Signal strength units under the *General* settings tab

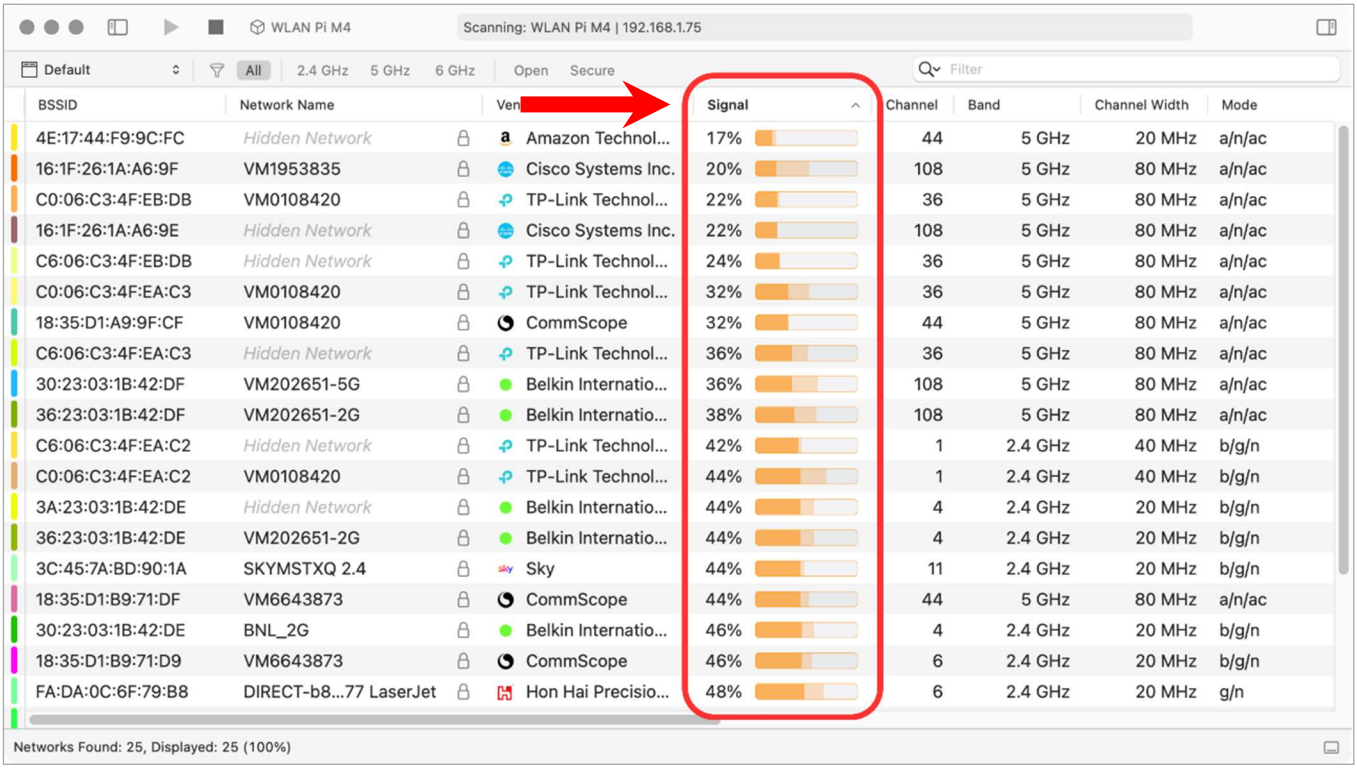

Figure 9-6 - The effect of setting signal level units to percentage values

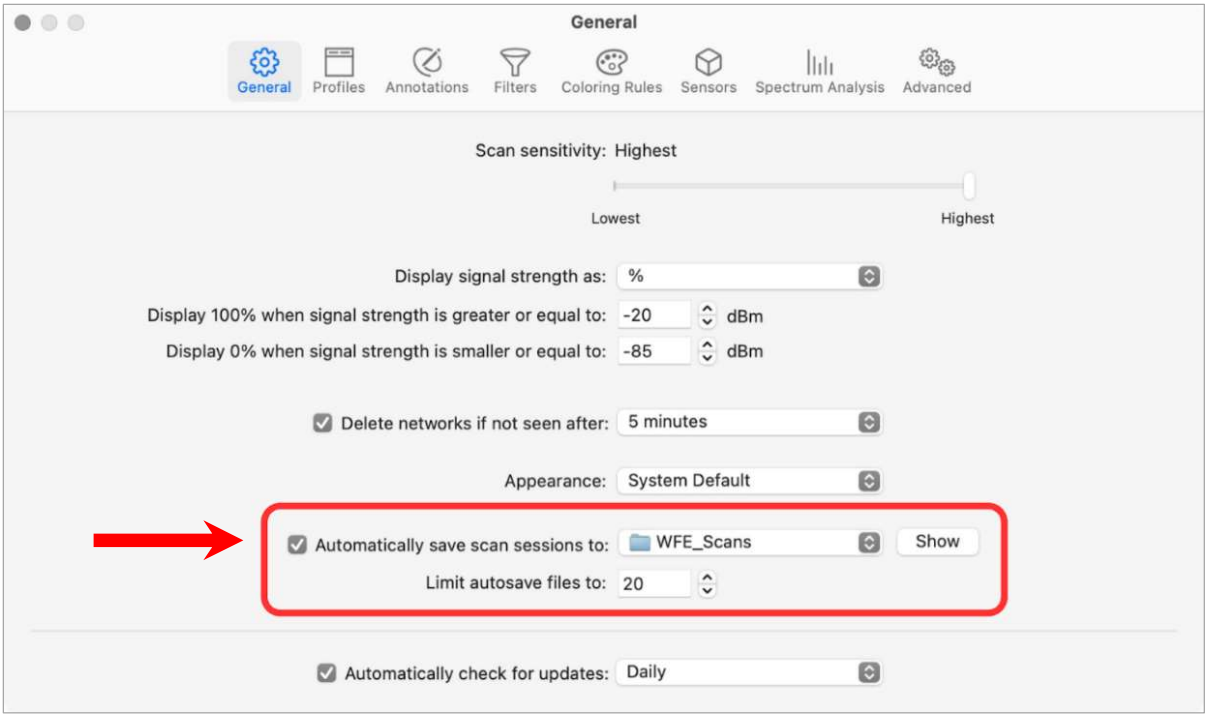

Figure 9-7 - Setting WFE Pro 3 to auto-save scan data to files

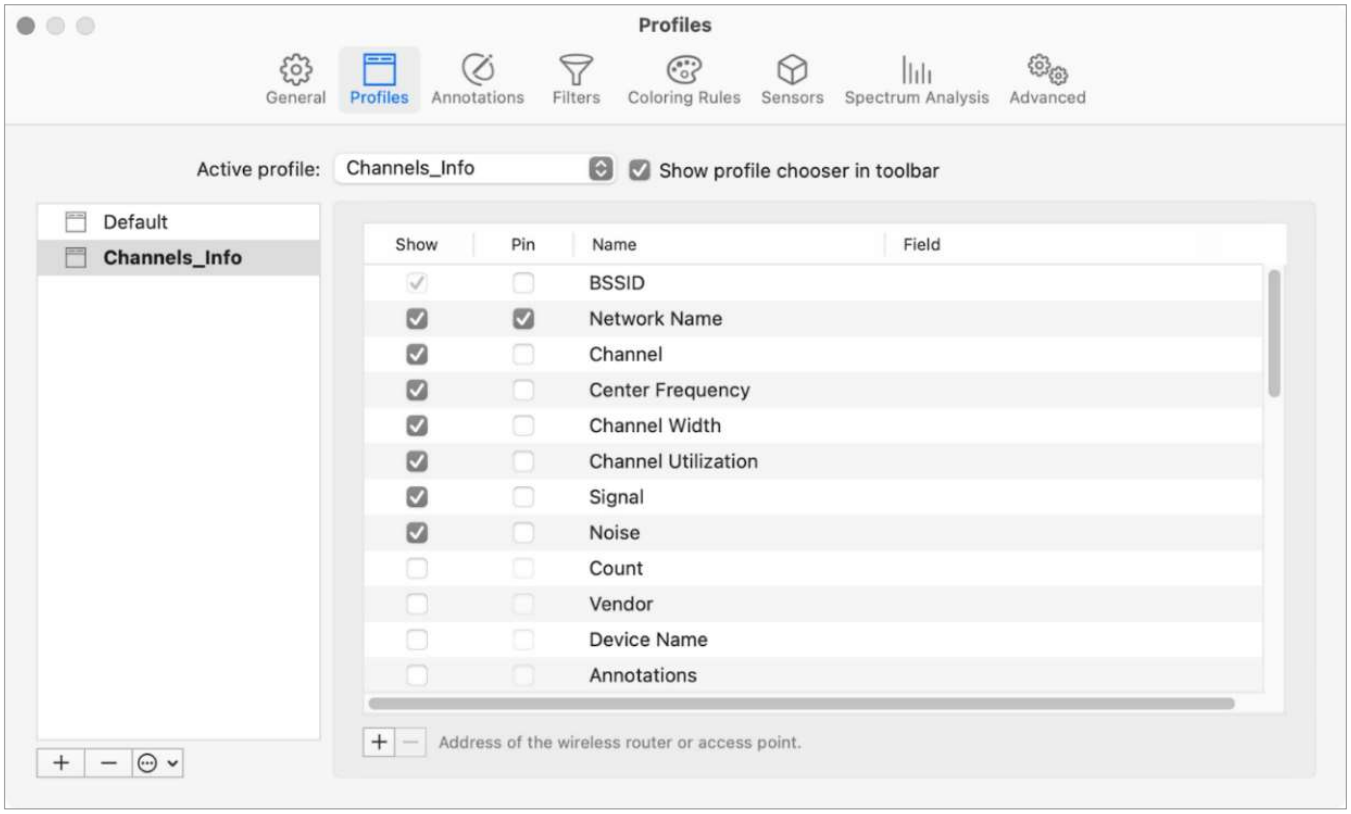

Figure 9-8 - The *Profiles* settings tab

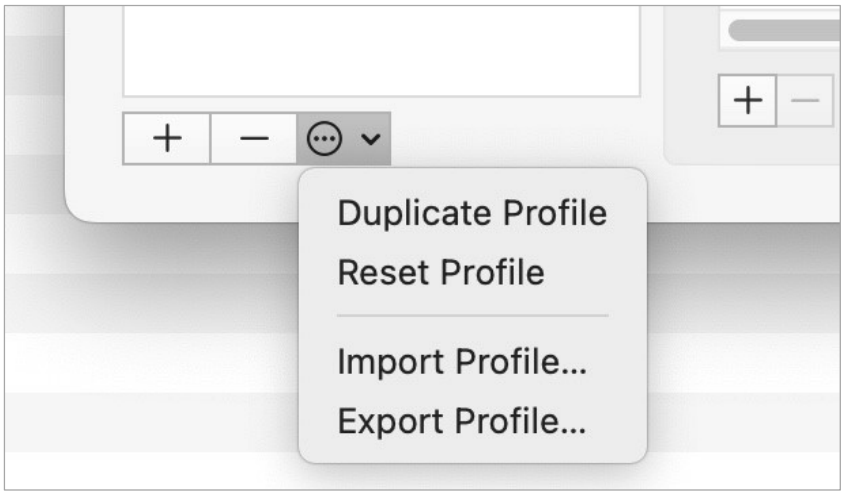

Figure 9-9 - The profiles list *More* button options

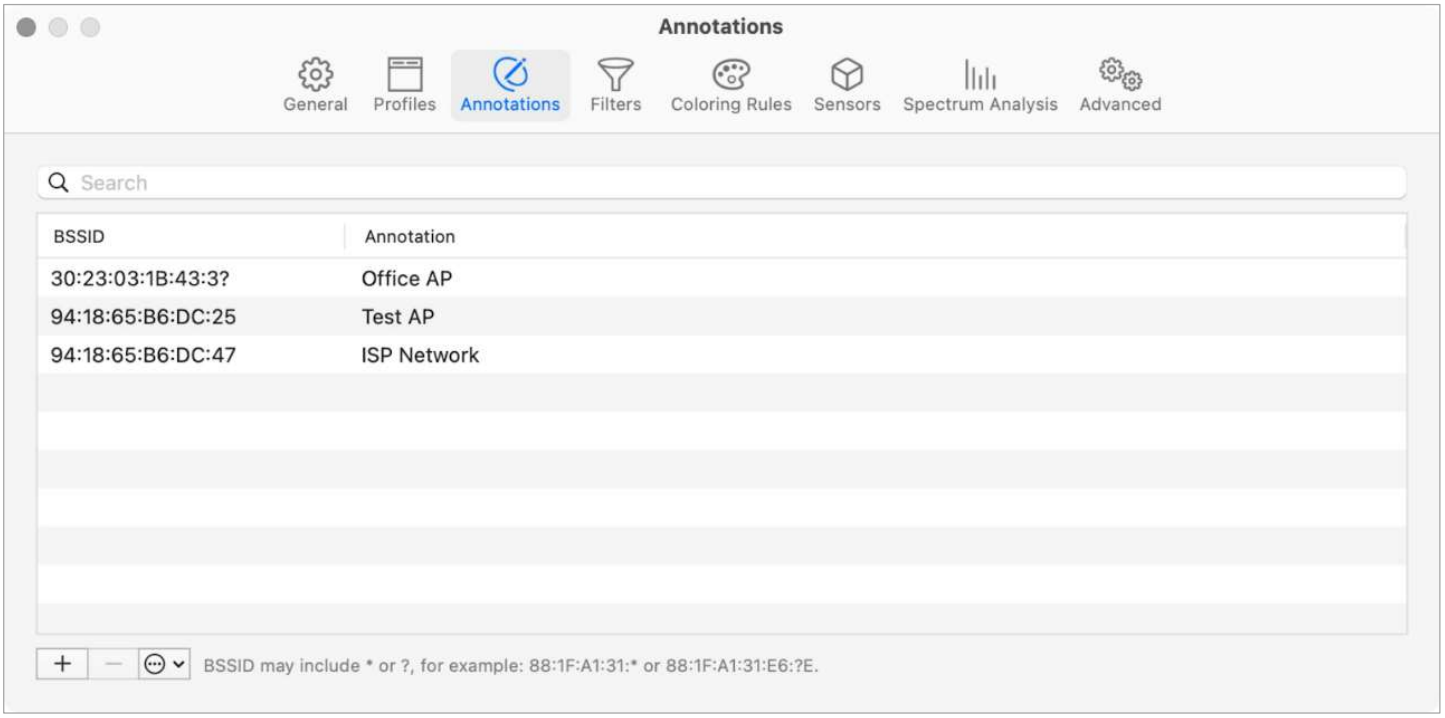

Figure 9-10 - The *Annotations* settings tab

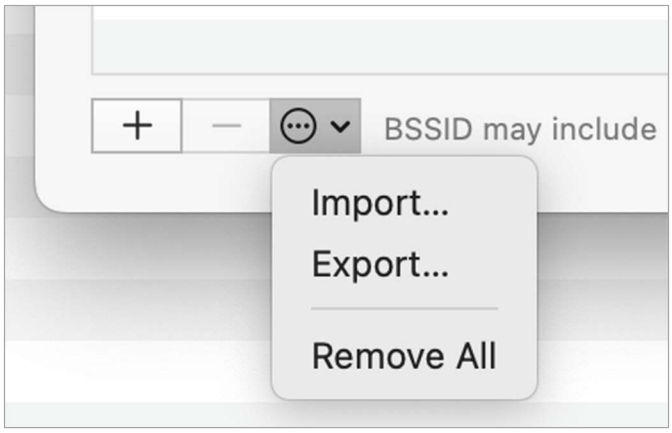

Figure 9-11 - The annotations list *More* button options

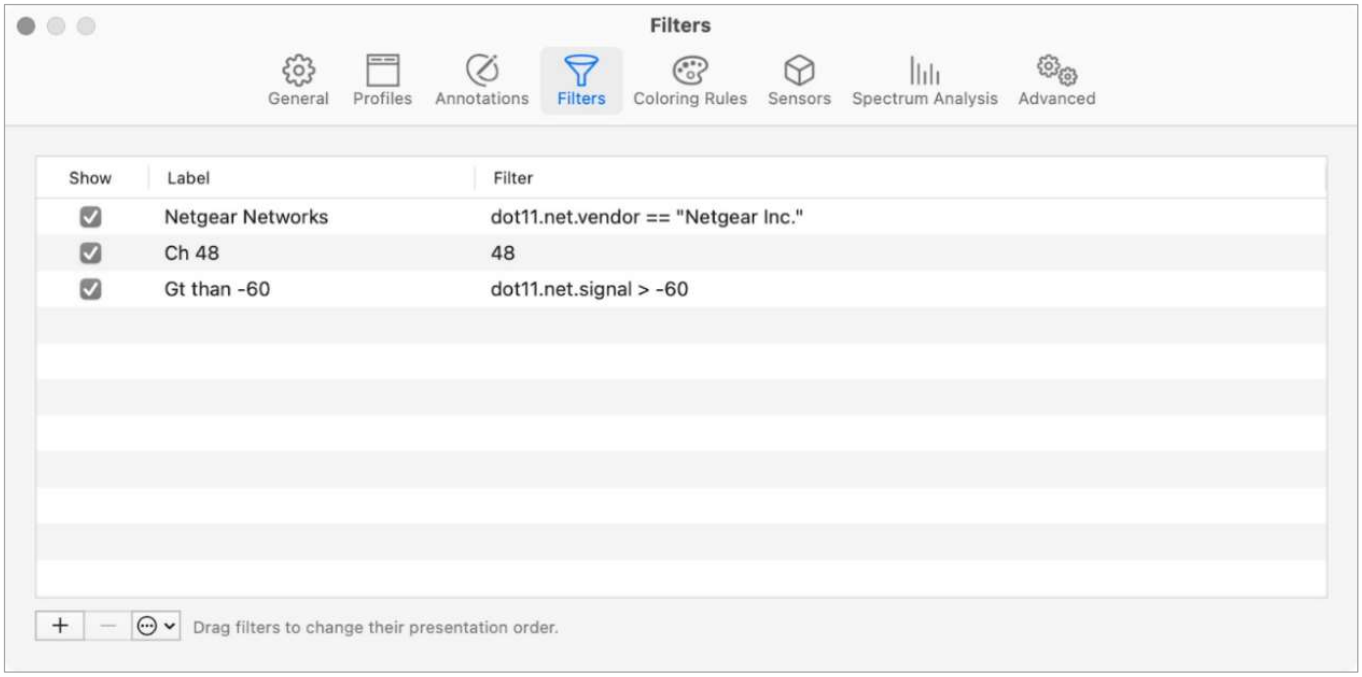

Figure 9-12 – The *Filters* settings tab

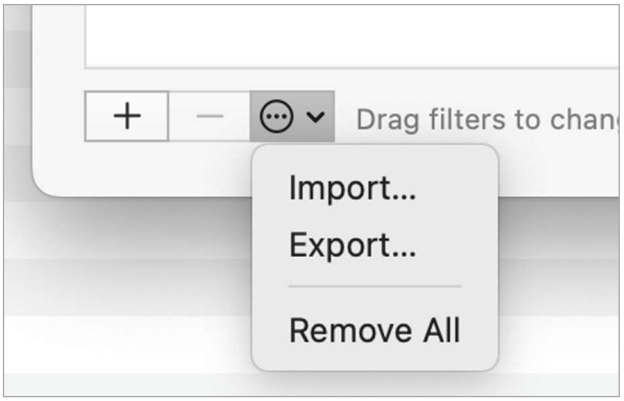

Figure 9-13 - The filters list *More* button options

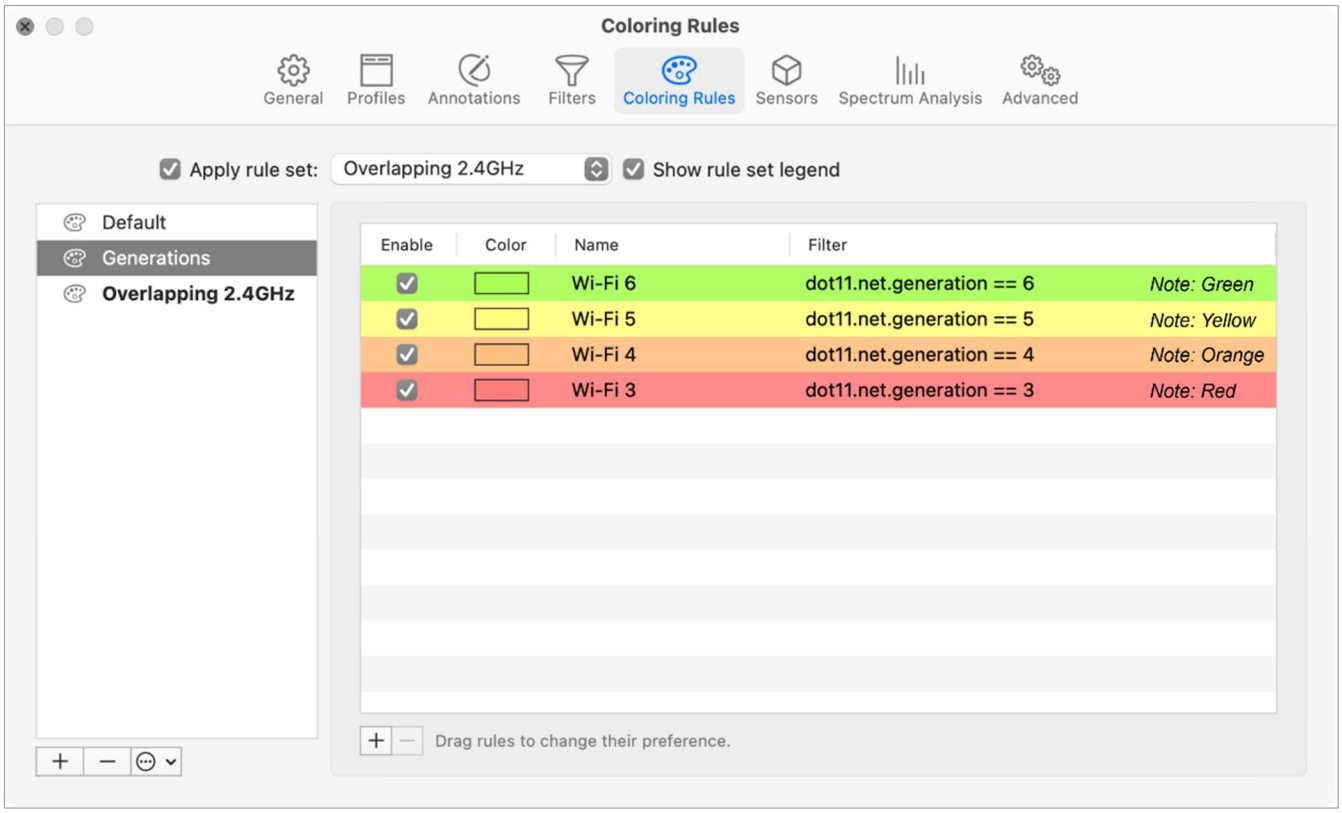

Figure 9-14 - The *Coloring Rules* settings tab

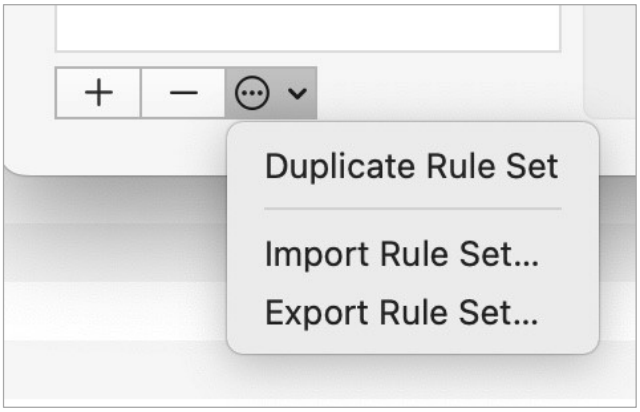

Figure 9-15 - The coloring rule sets list *More* button options

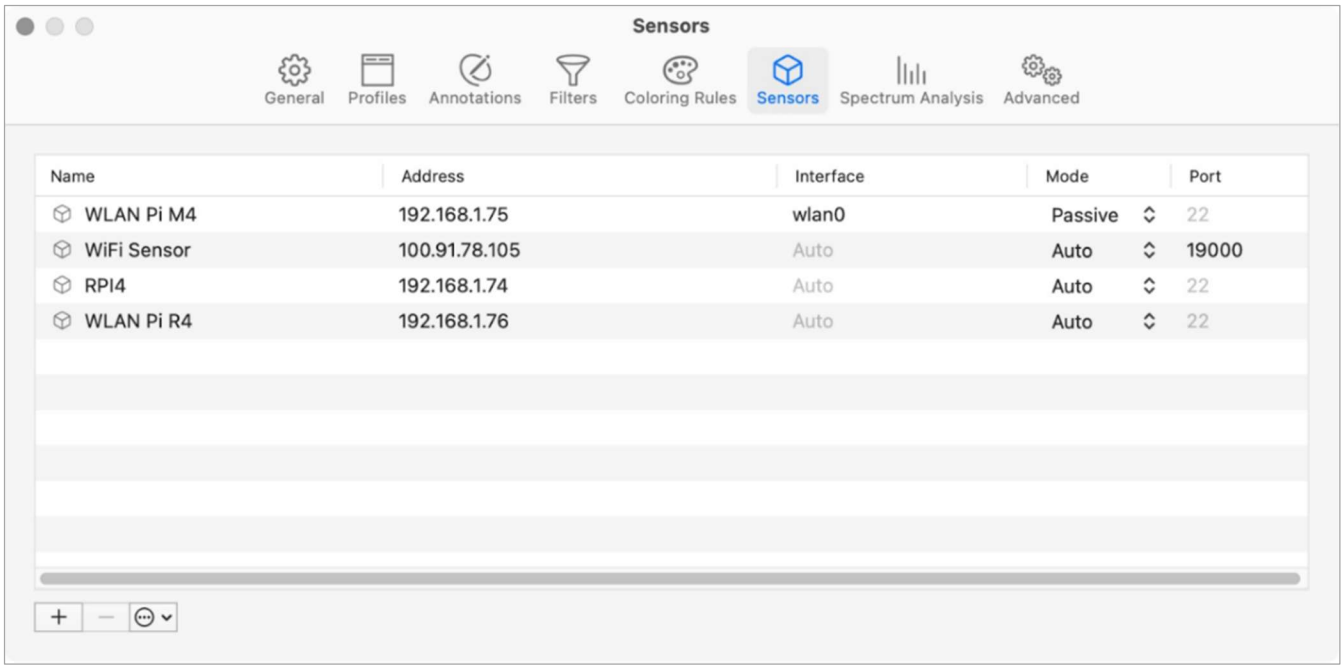

Figure 9-16 - The *Sensors* settings tab

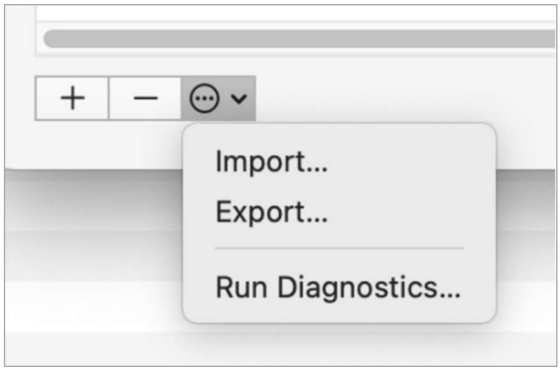

Figure 9-17 - The sensors list *More* button options

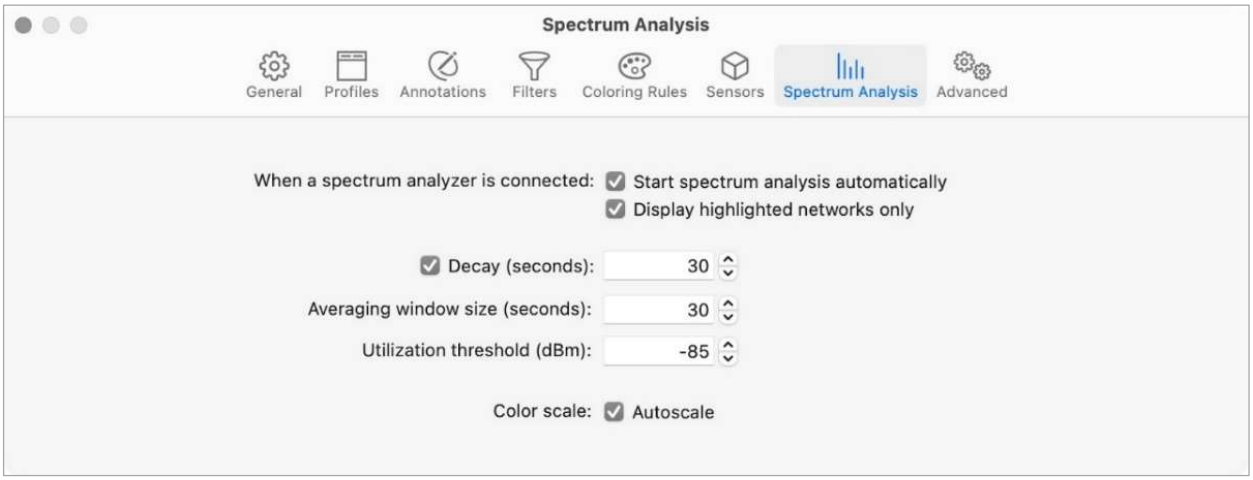

Figure 9-18 – The *Spectrum Analysis* settings tab

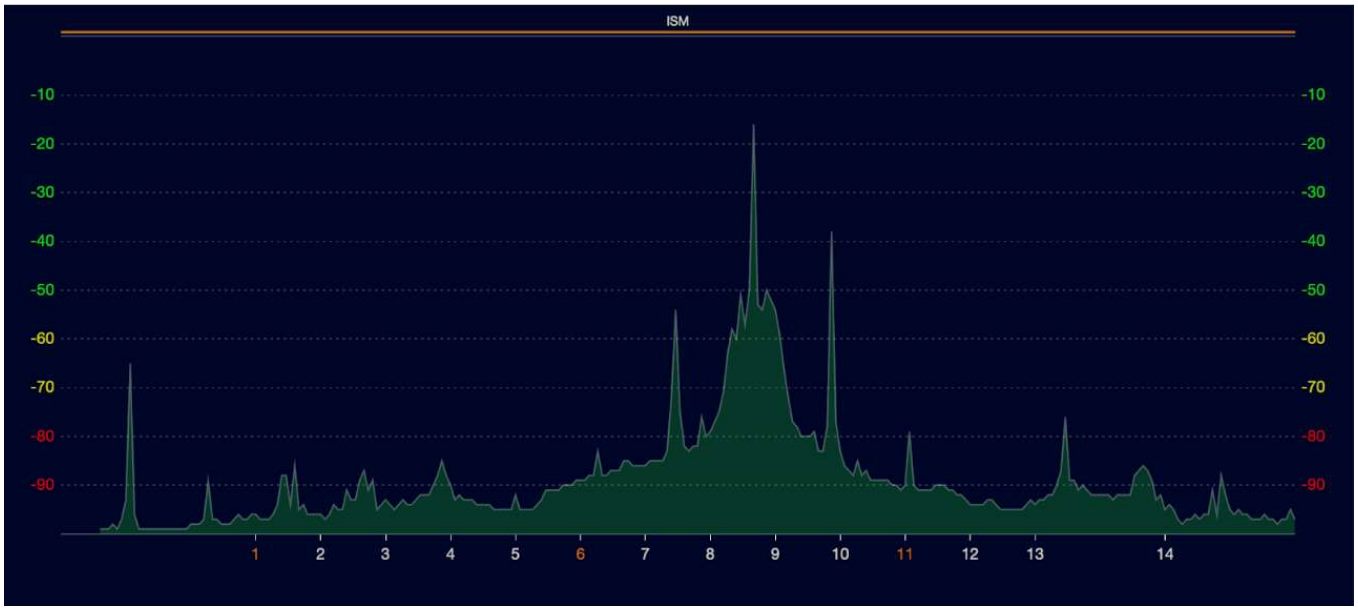

Figure 9-19 – Spectrum analysis Average Trace

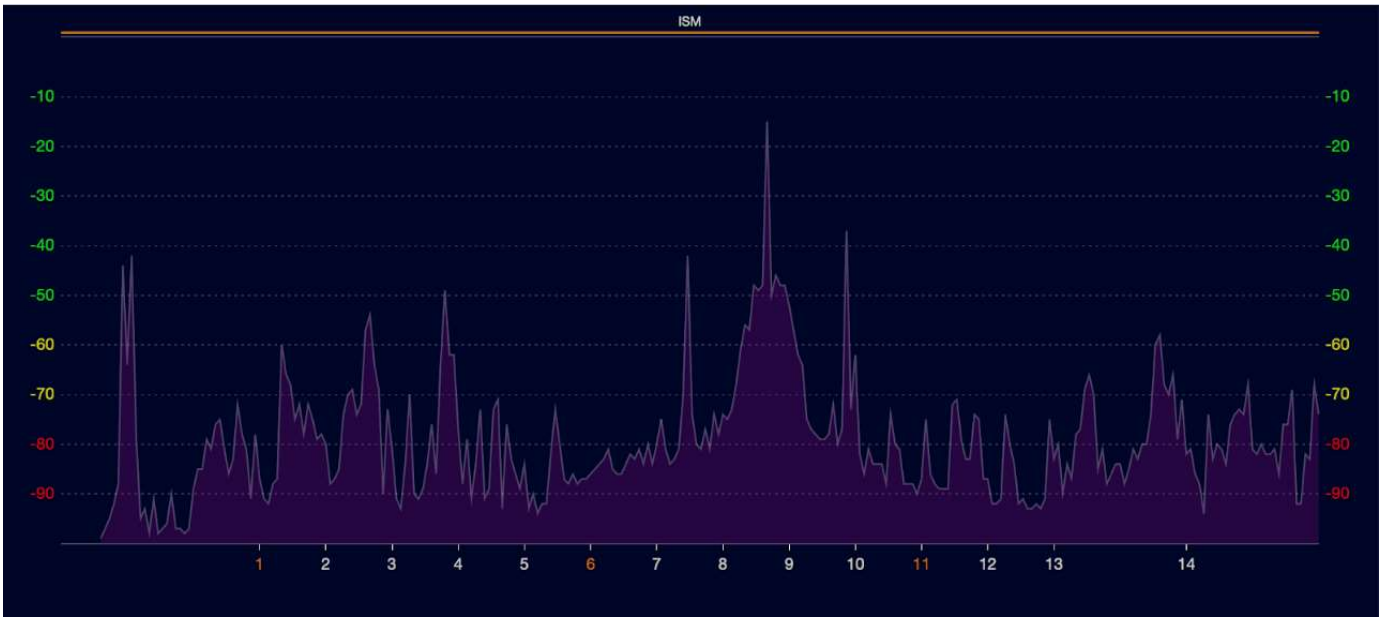

Figure 9-20 – Spectrum analysis Maximum Trace

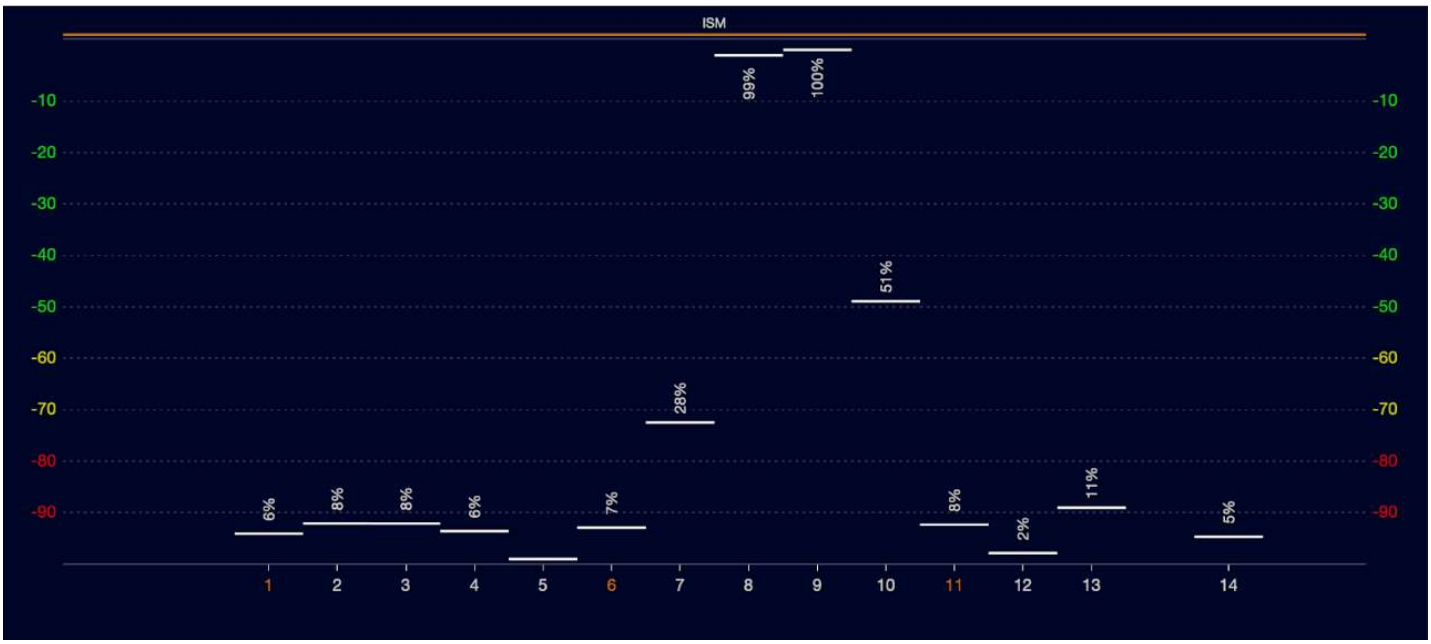

Figure 9-21 – Spectrum analysis Utilization Trace

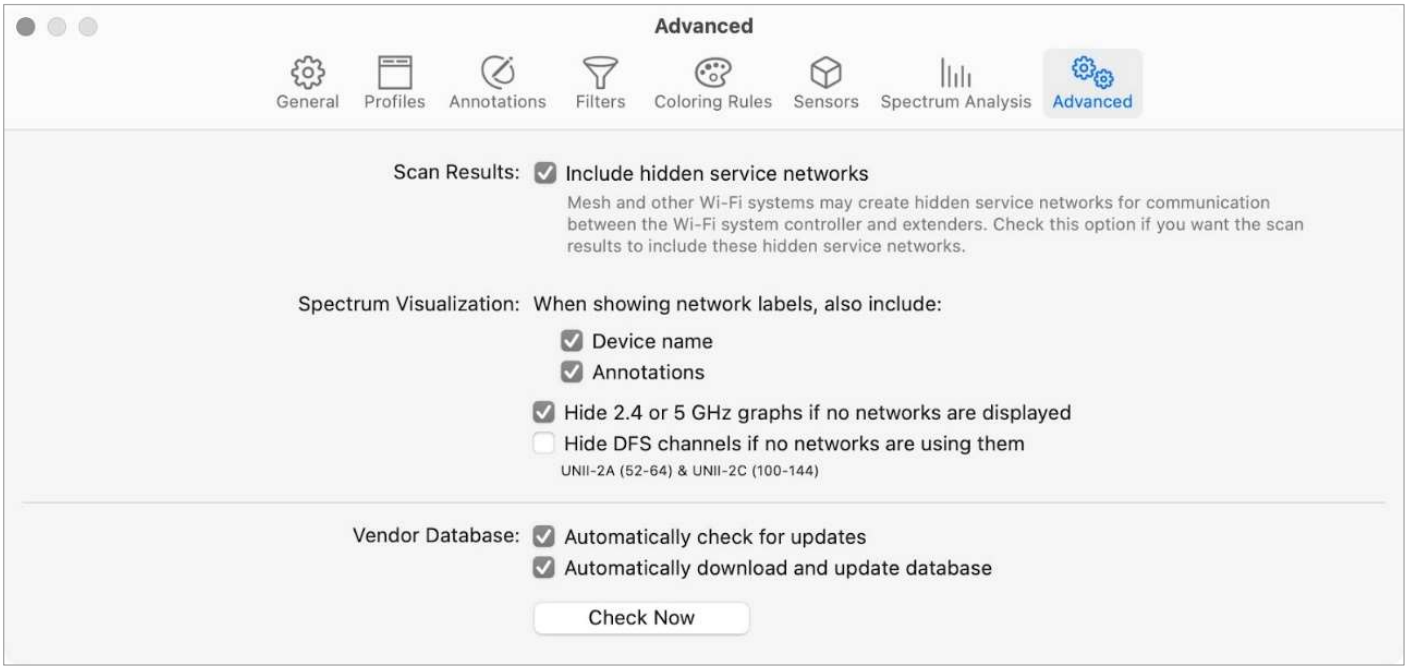

Figure 9-22 – The *Advanced* settings tab

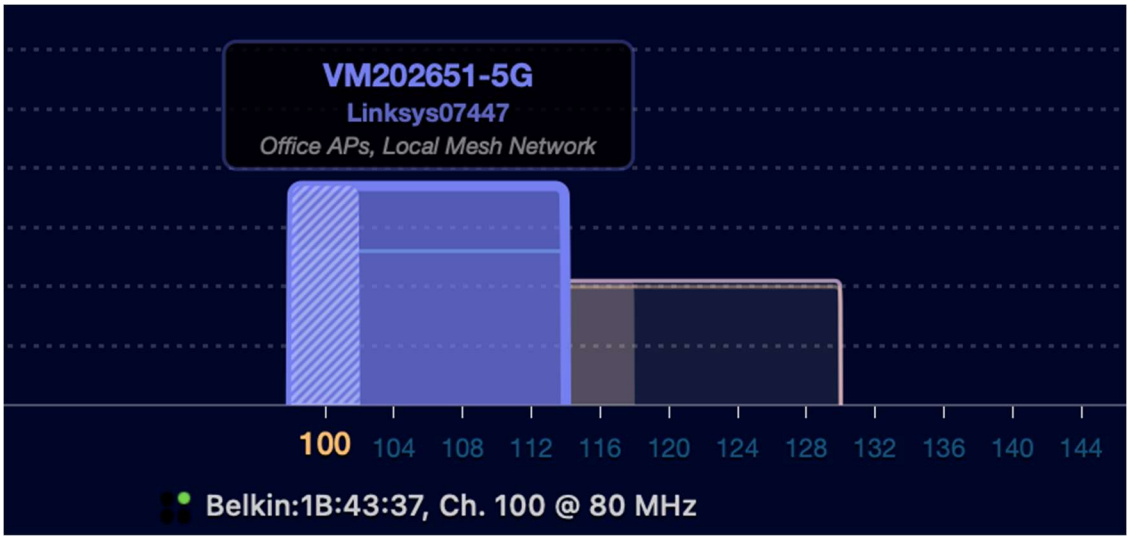

Figure 9-23 – Spectrum Visualization with device names & annotations enabled

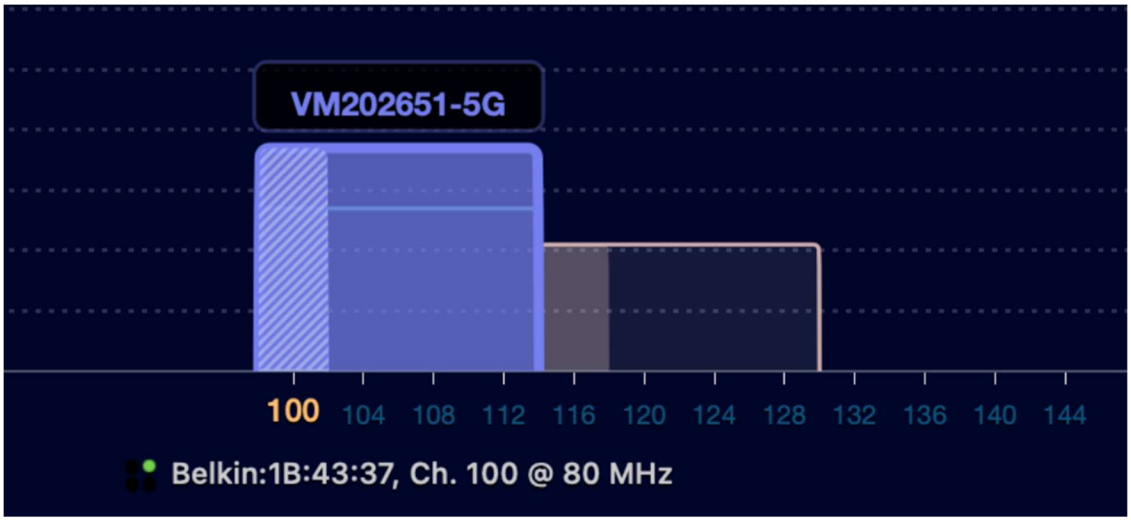

Figure 9-24 – Spectrum Visualization with device names & annotations disabled

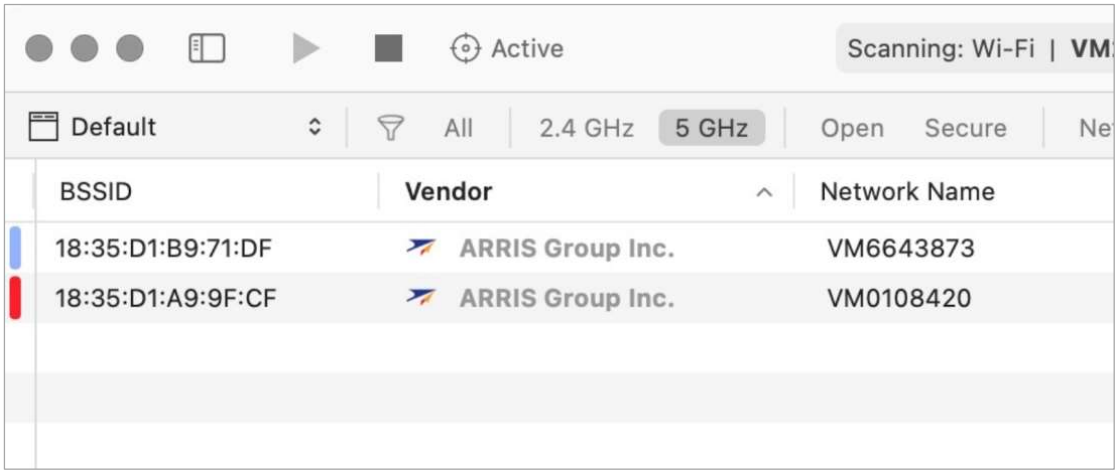

Figure 9-25 – Networks table showing Arris Group Inc. devices

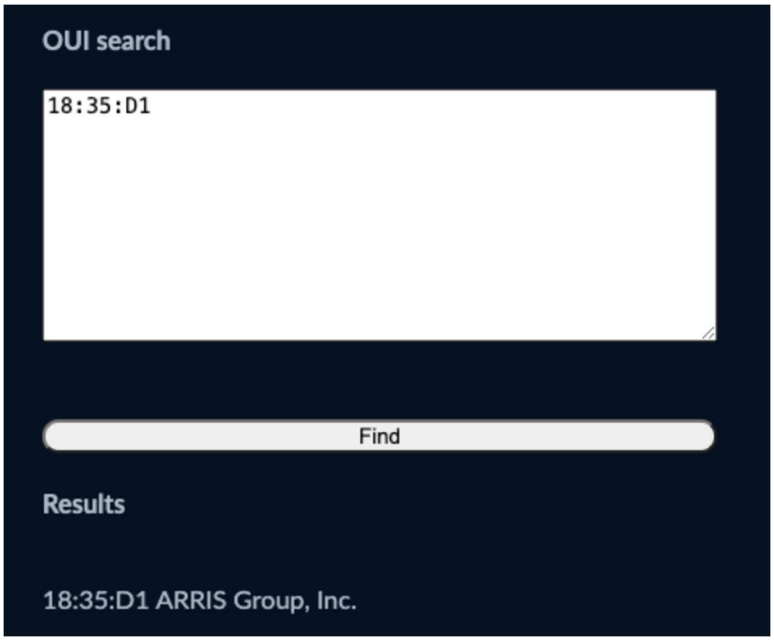

Figure 9-26 – Online lookup of the 18:35:D1 OUI details

Chapter 10 – Data Visualization: Filter Expressions & Display Filters

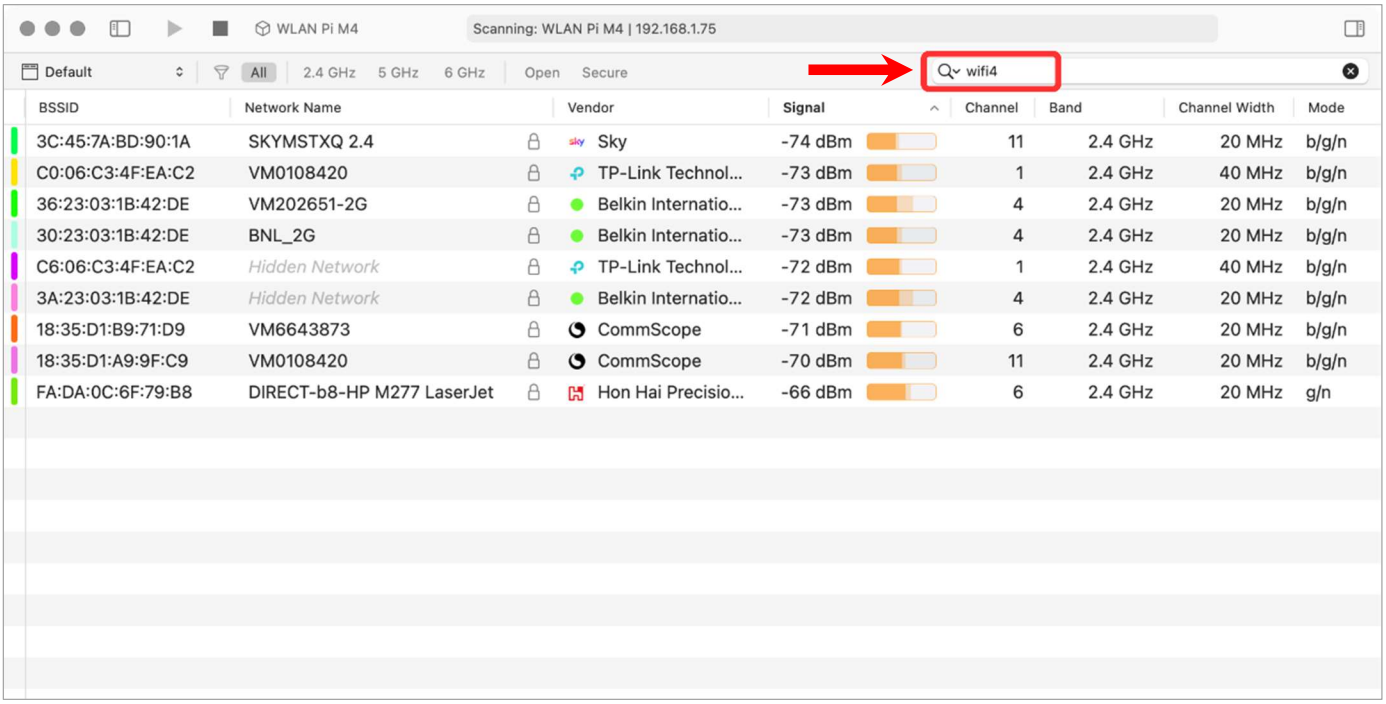

Figure 10-1 – Filtering with keywords

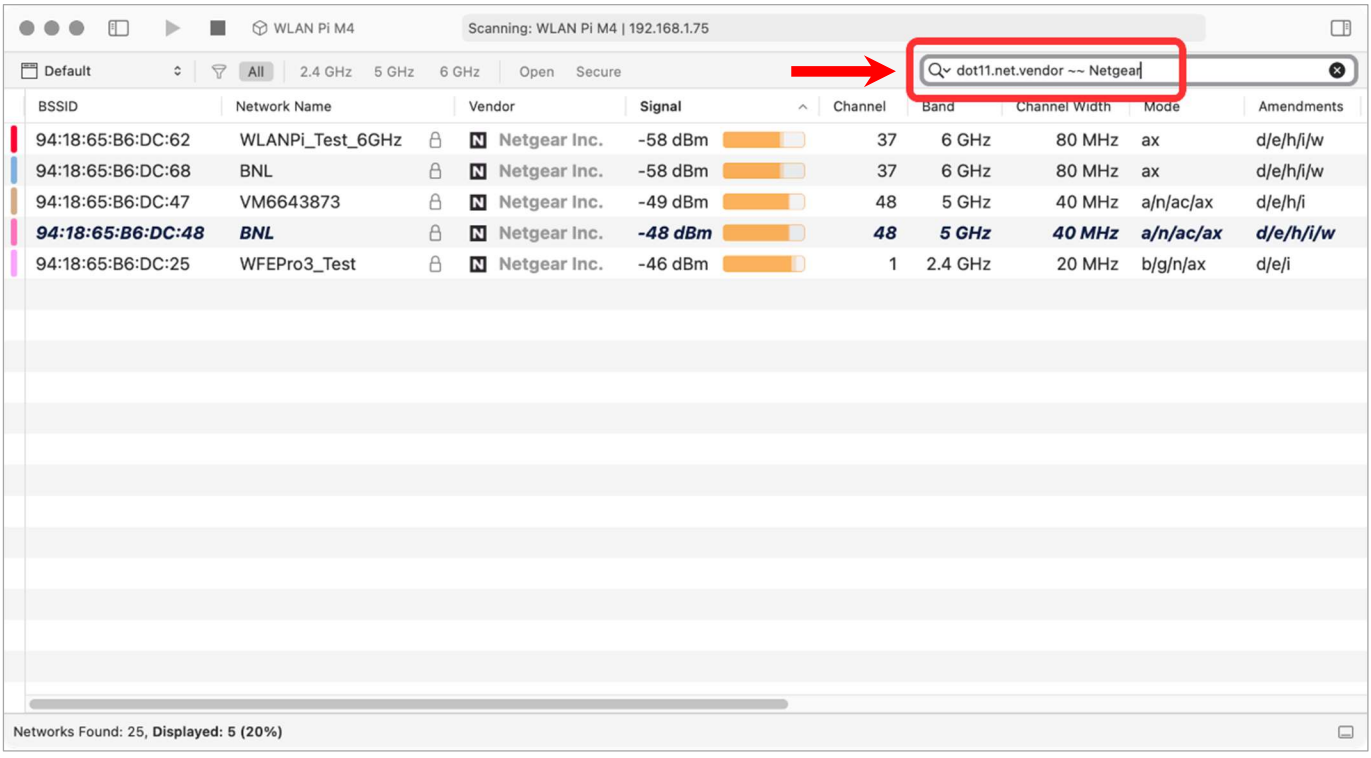

Figure 10-2 – Network attribute filter applied to the networks table

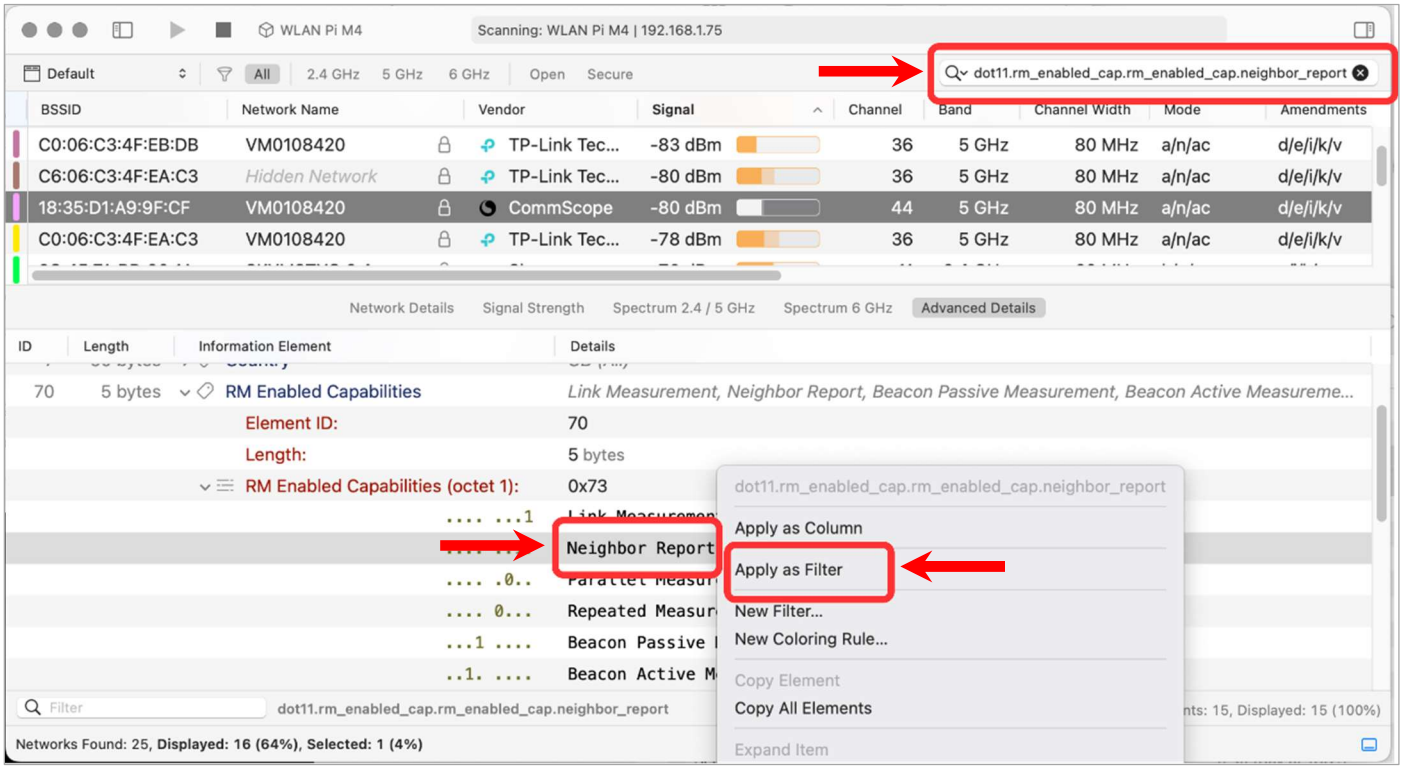

Figure 10-3 – Information element field filter applied to the networks table

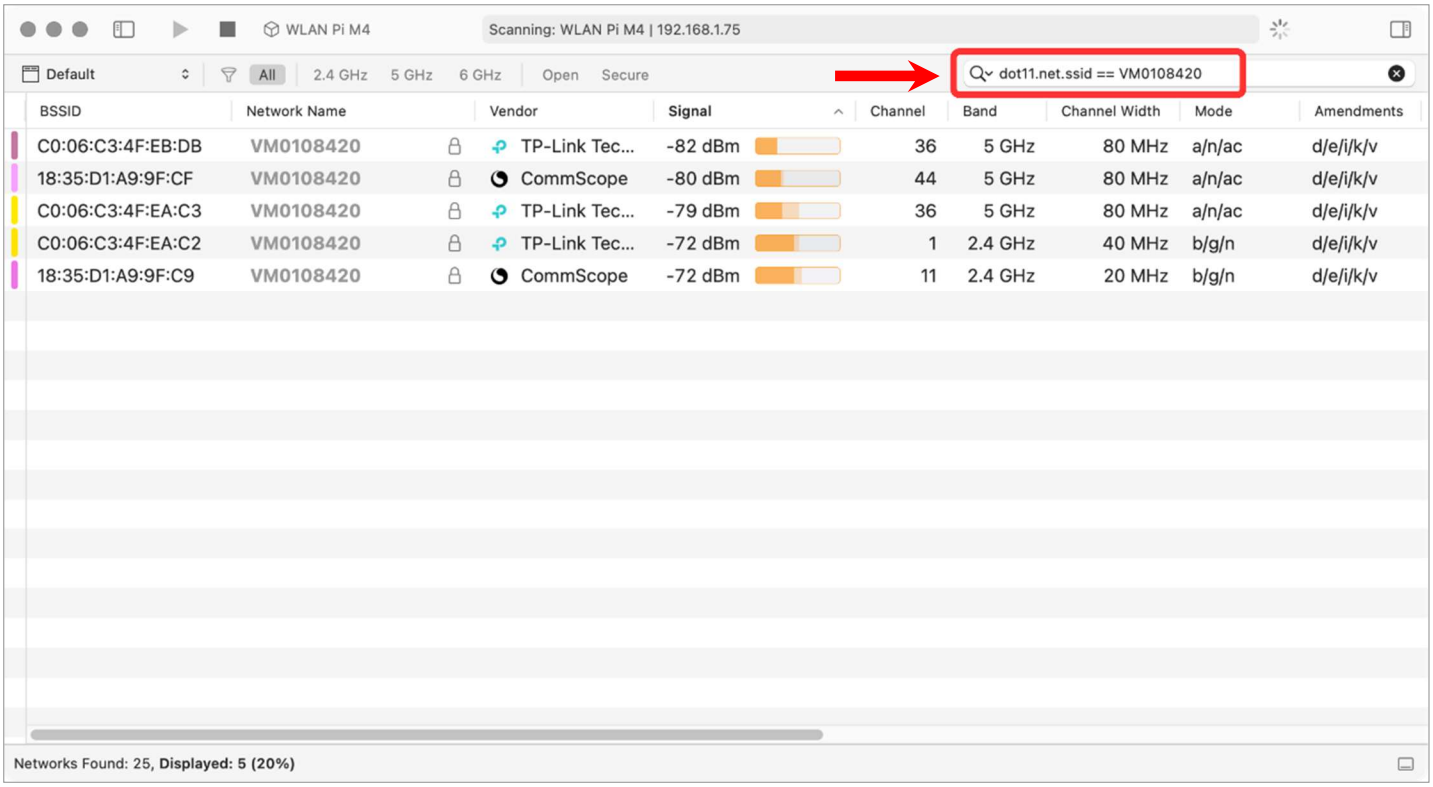

Figure 10-4 – Filtering using a comparison operator

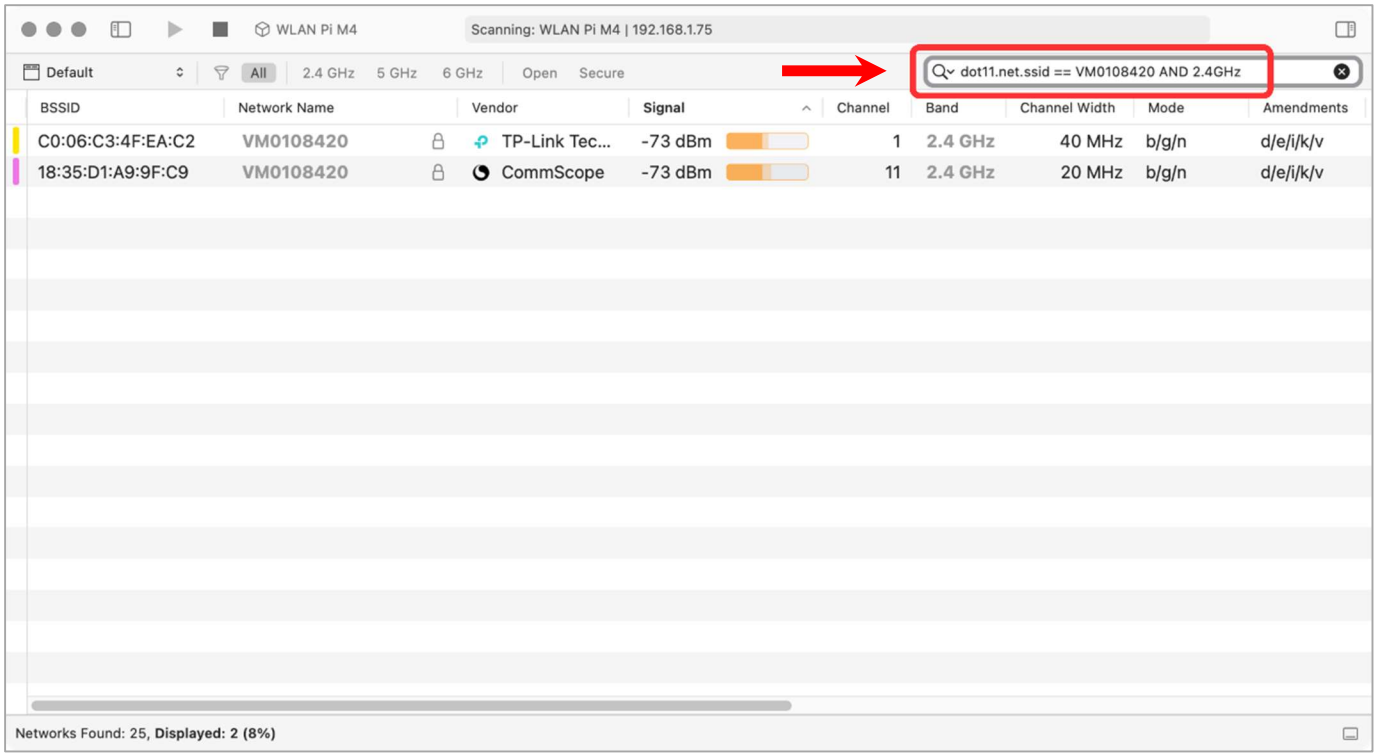

Figure 10-5 – Filtering example using multiple expressions

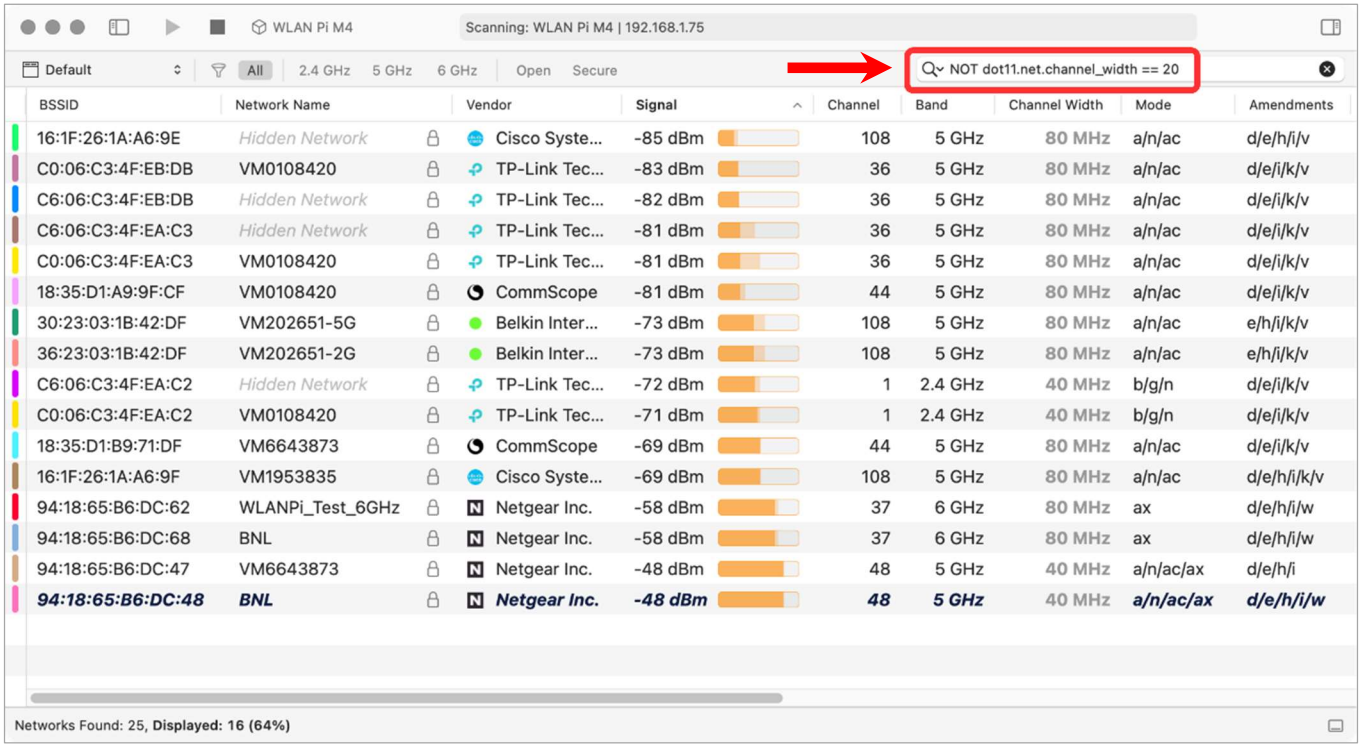

Figure 10-6 – Filtering using the negation operator

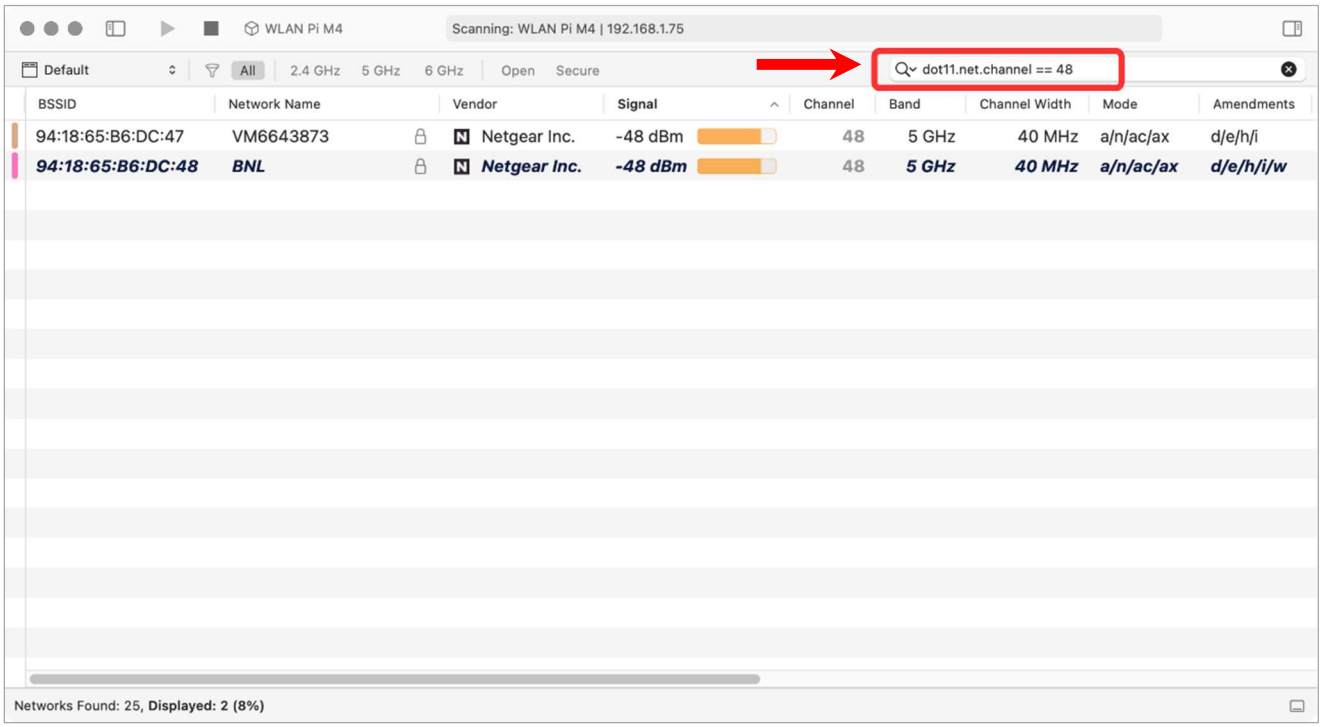

Figure 10-7 – Filter field location

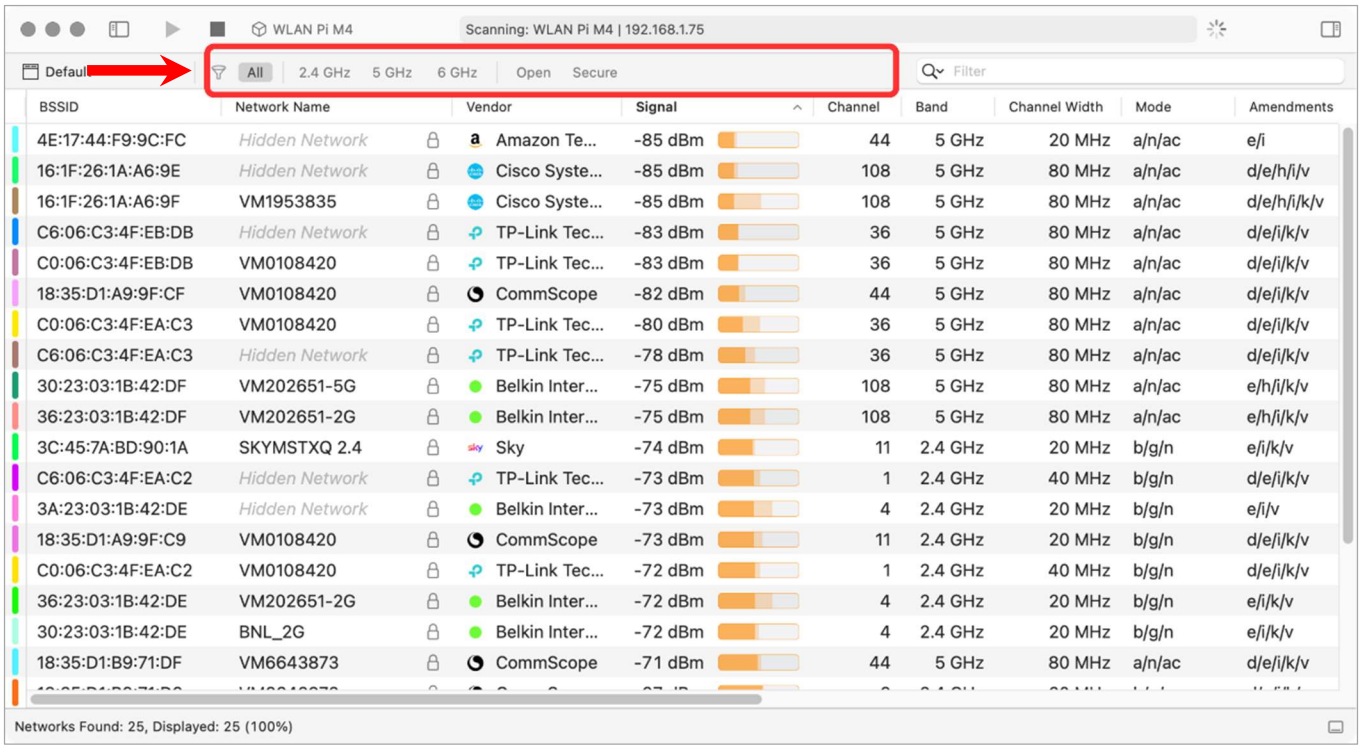

Figure 10-8 – Quick filter bar location

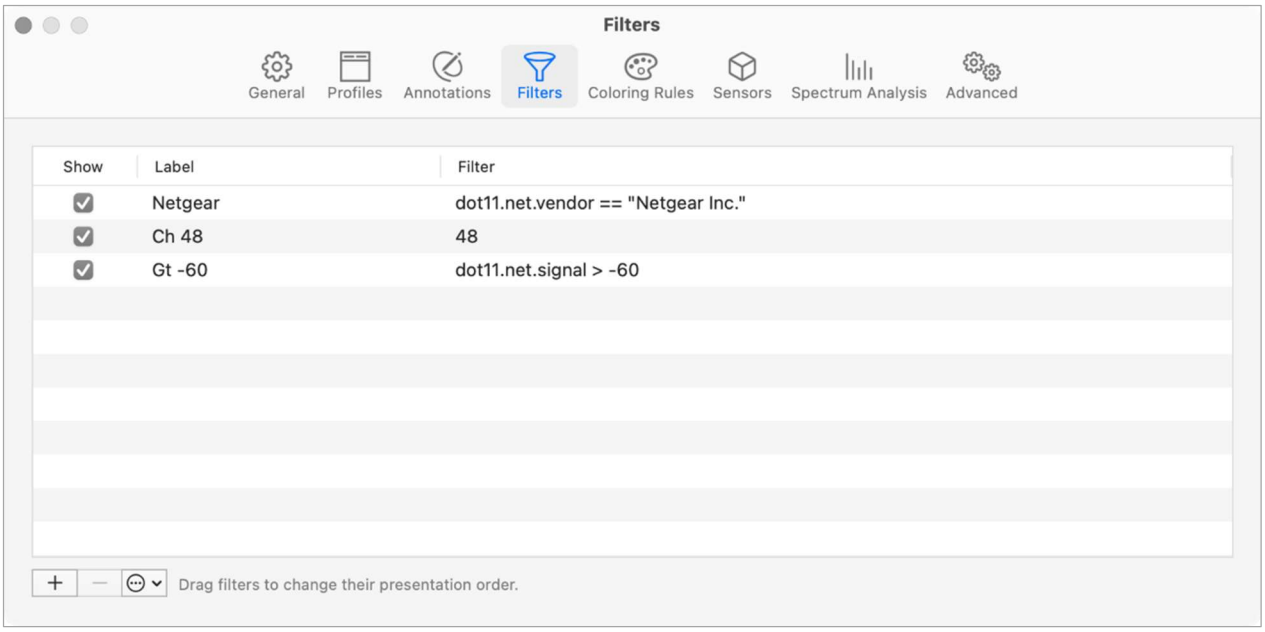

Figure 10-9 – The *Filters* settings tab

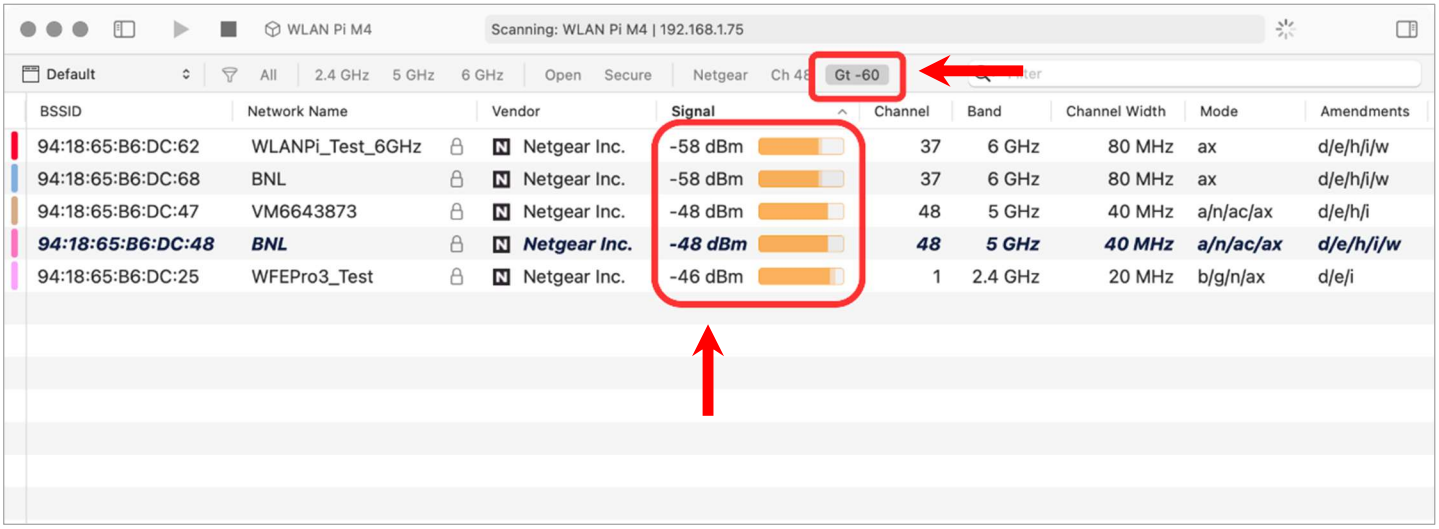

Figure 10-10 – Custom filters on the quick filter bar

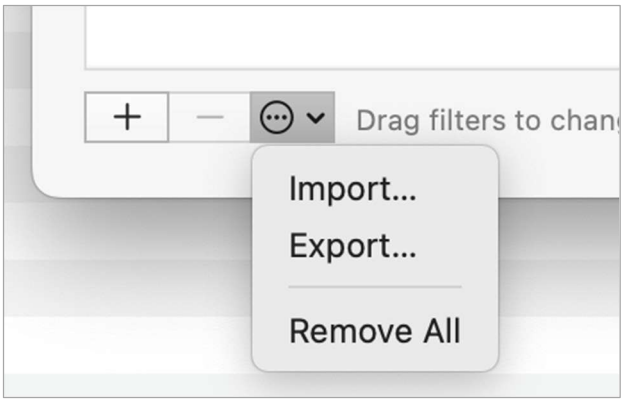

Figure 10-11 - The filters list *More* button options

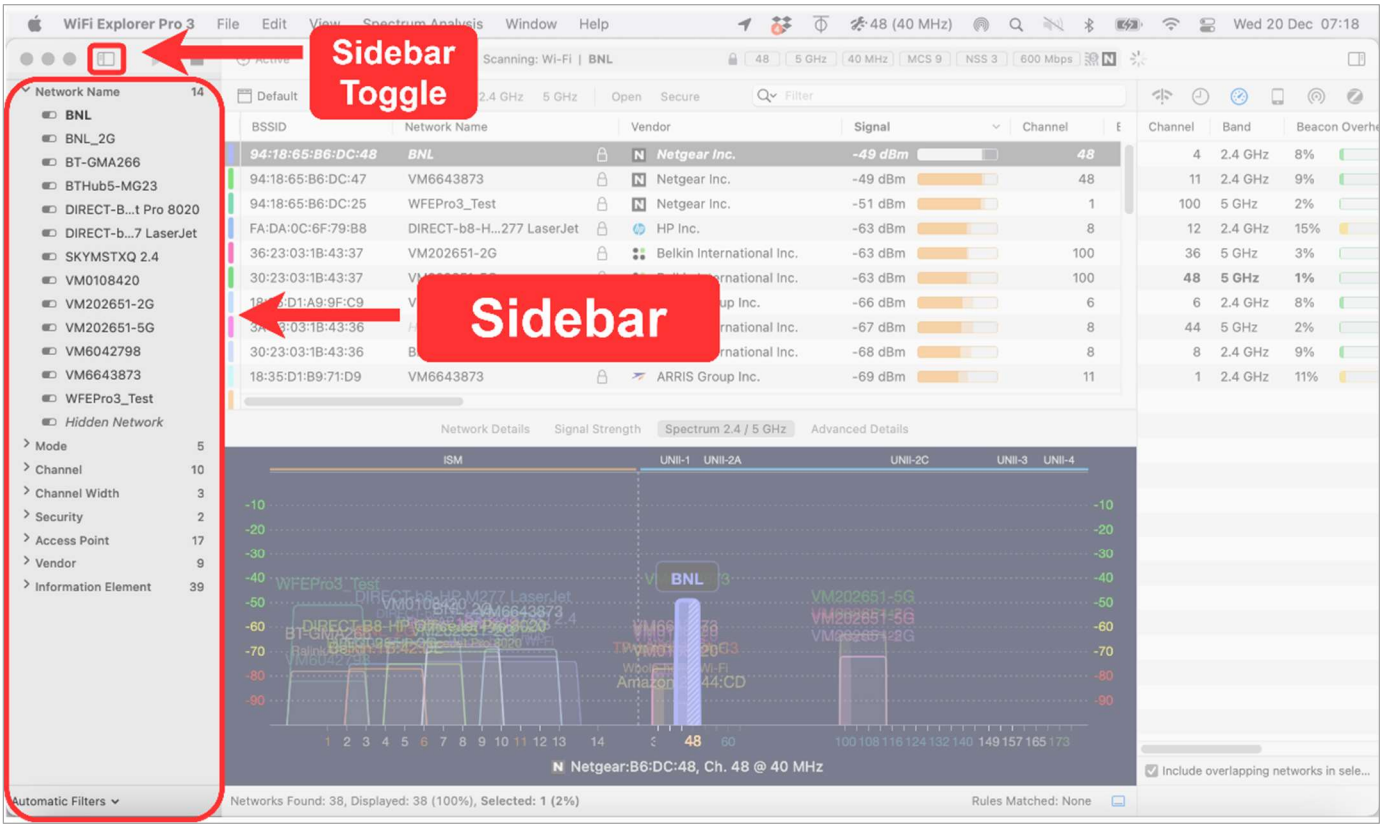

Figure 10-12 - *Sidebar* UI location

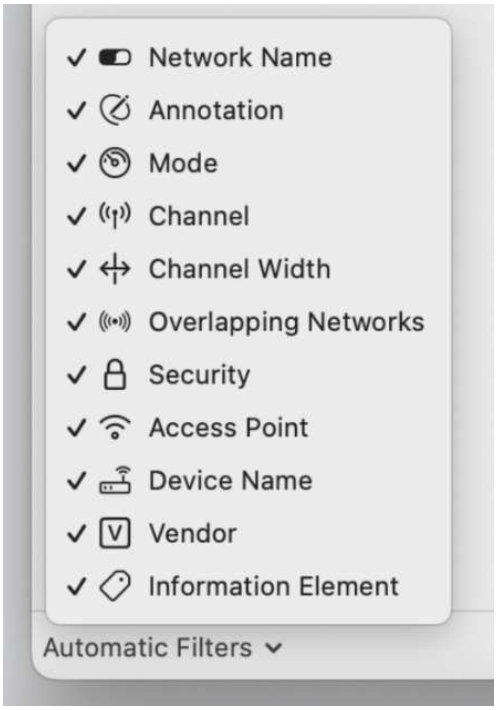

Figure 10-13 - Sidebar *Automatic Filter* options

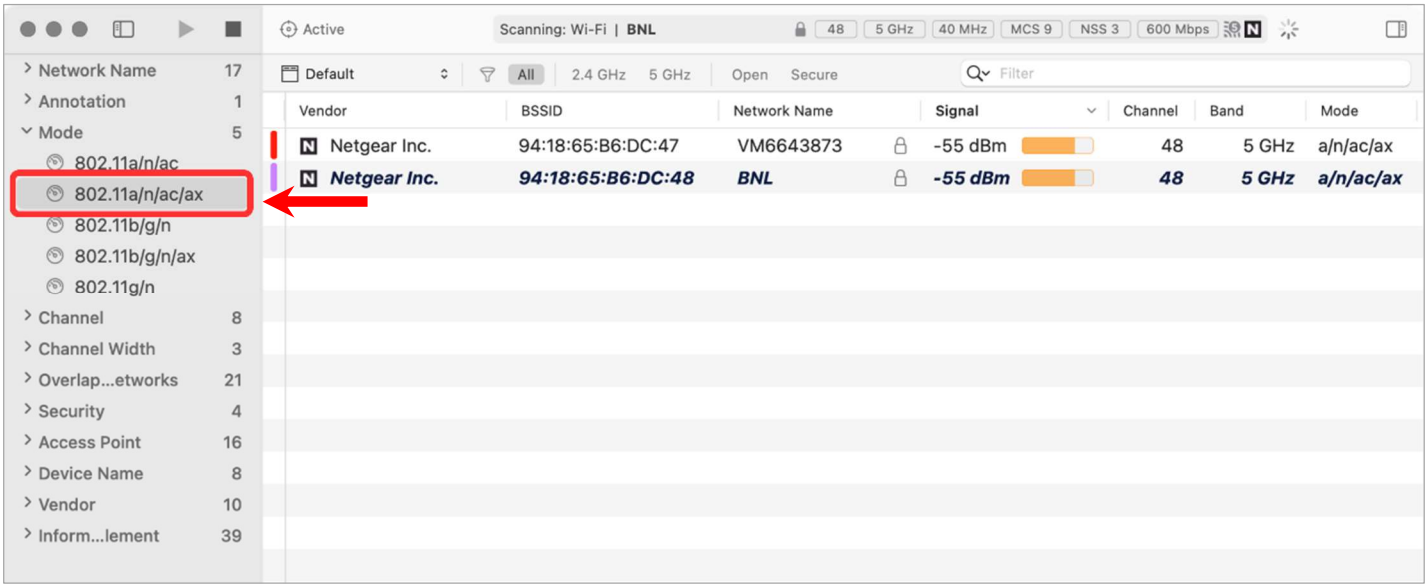

Figure 10-14 - *Sidebar* filter example using a *Mode* filter

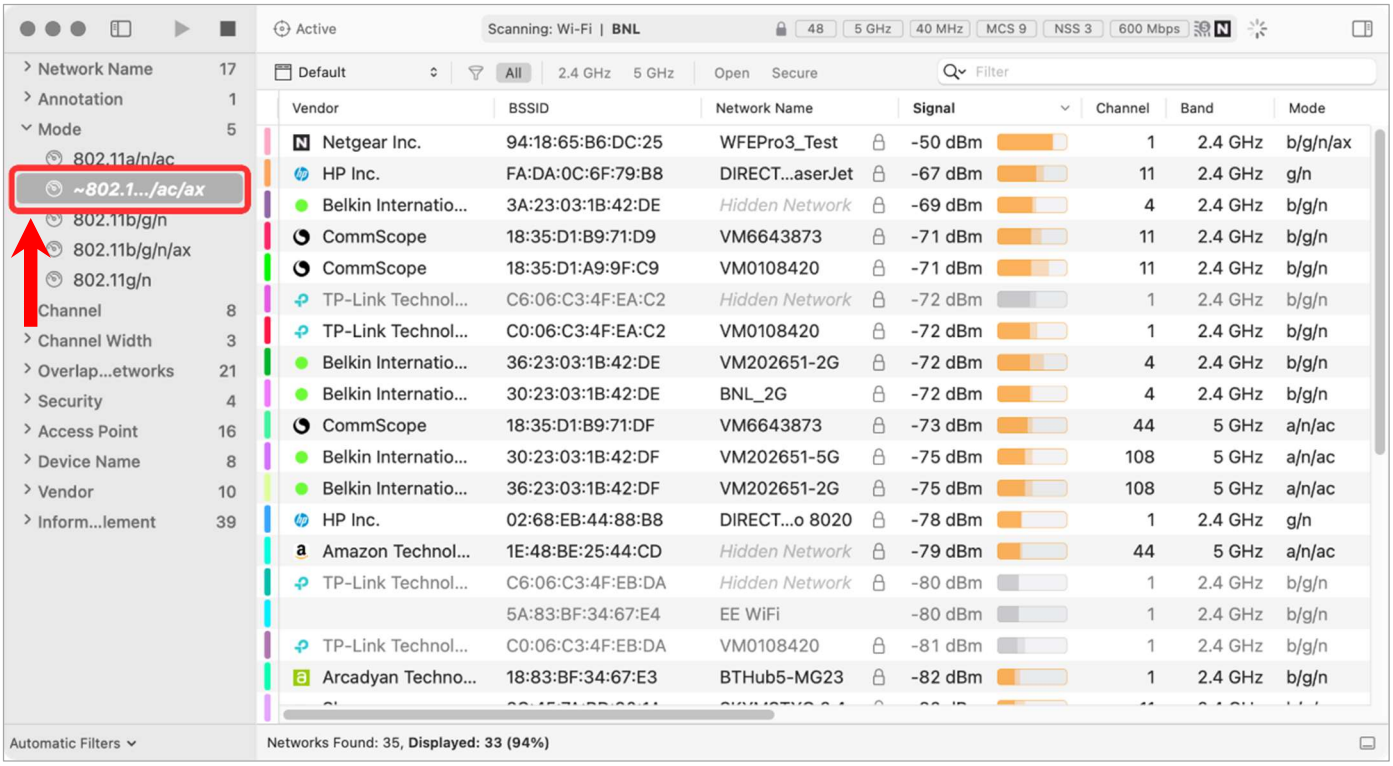

Figure 10-15 - *Sidebar* filter example using a negated *Mode* filter

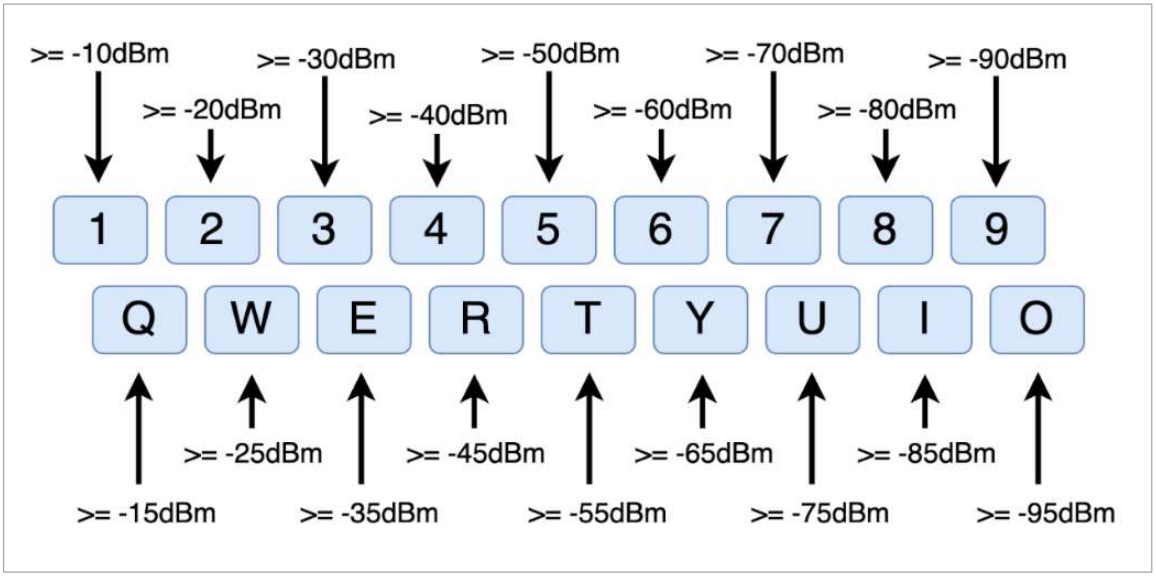

Figure 10-16 - Keyboard shortcut filters

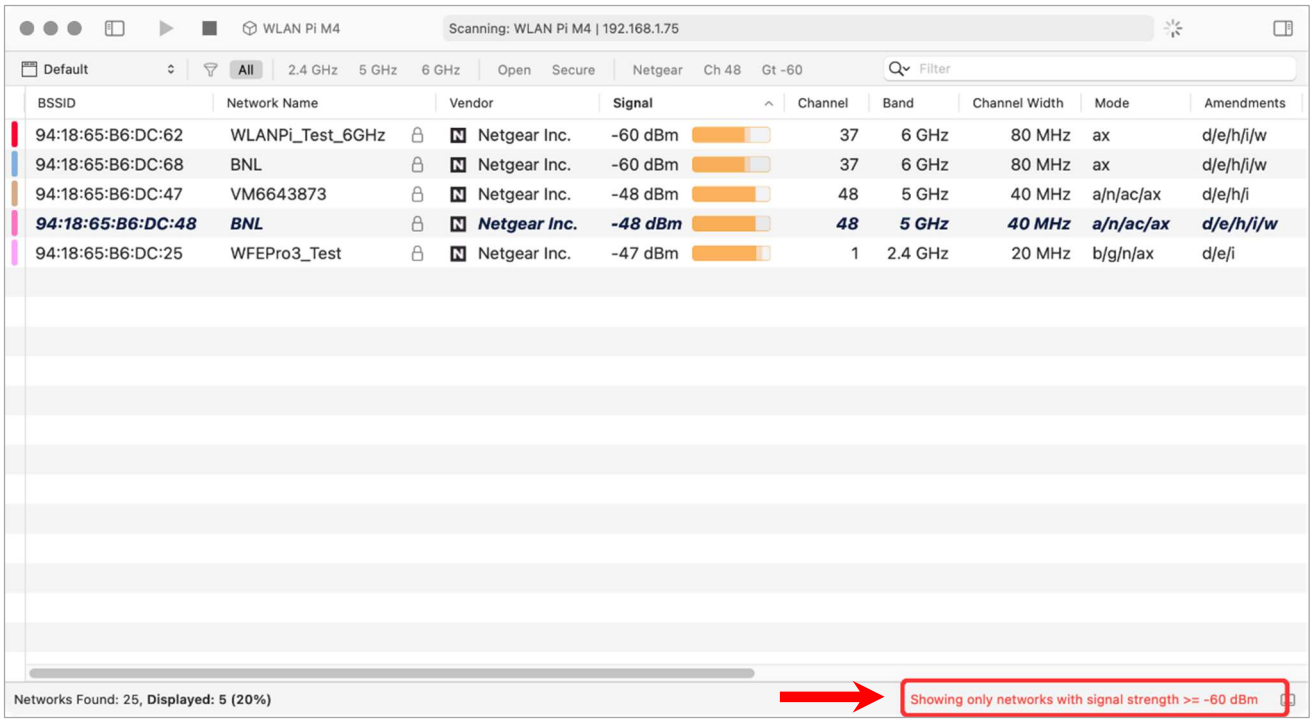

Figure 10-17 - Keyboard shortcut filter applied for -60 dBm (Ctrl-6)

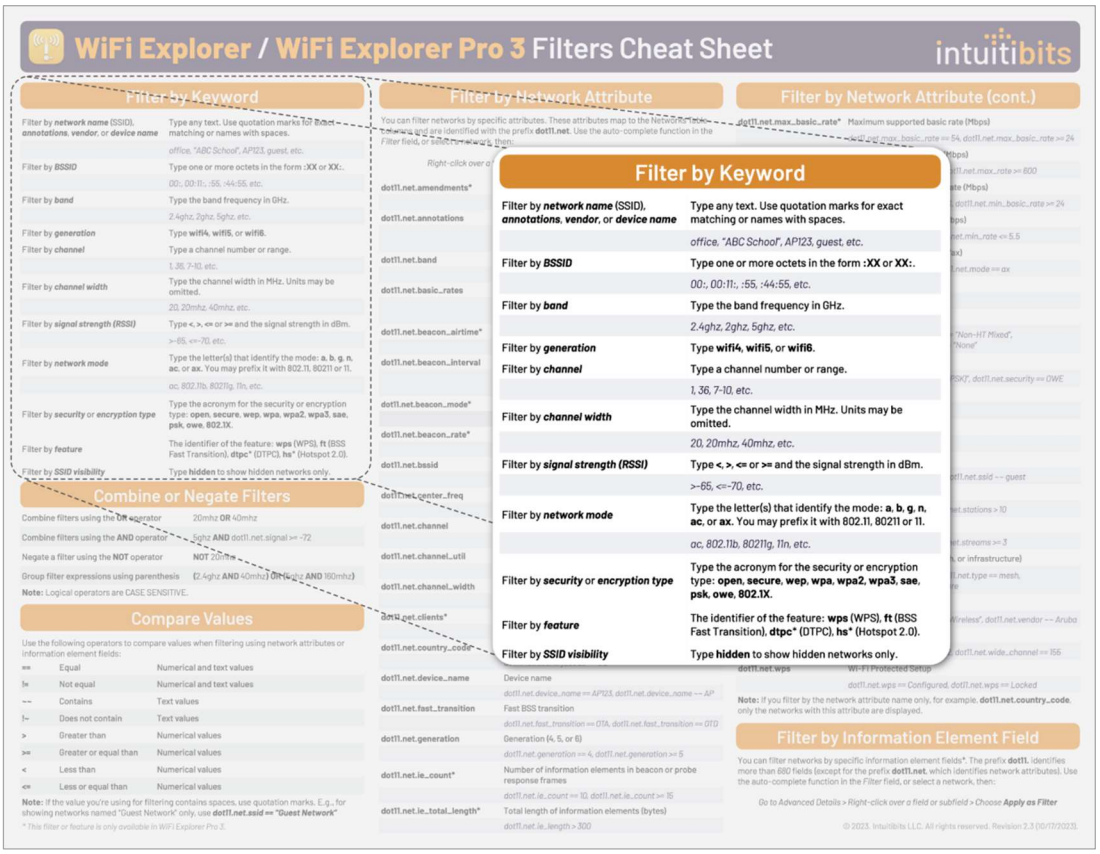

Figure 10-18 – Filters cheat sheet available from www.intuitibits.com

Chapter 11 - Data Visualization: Columns & Profiles

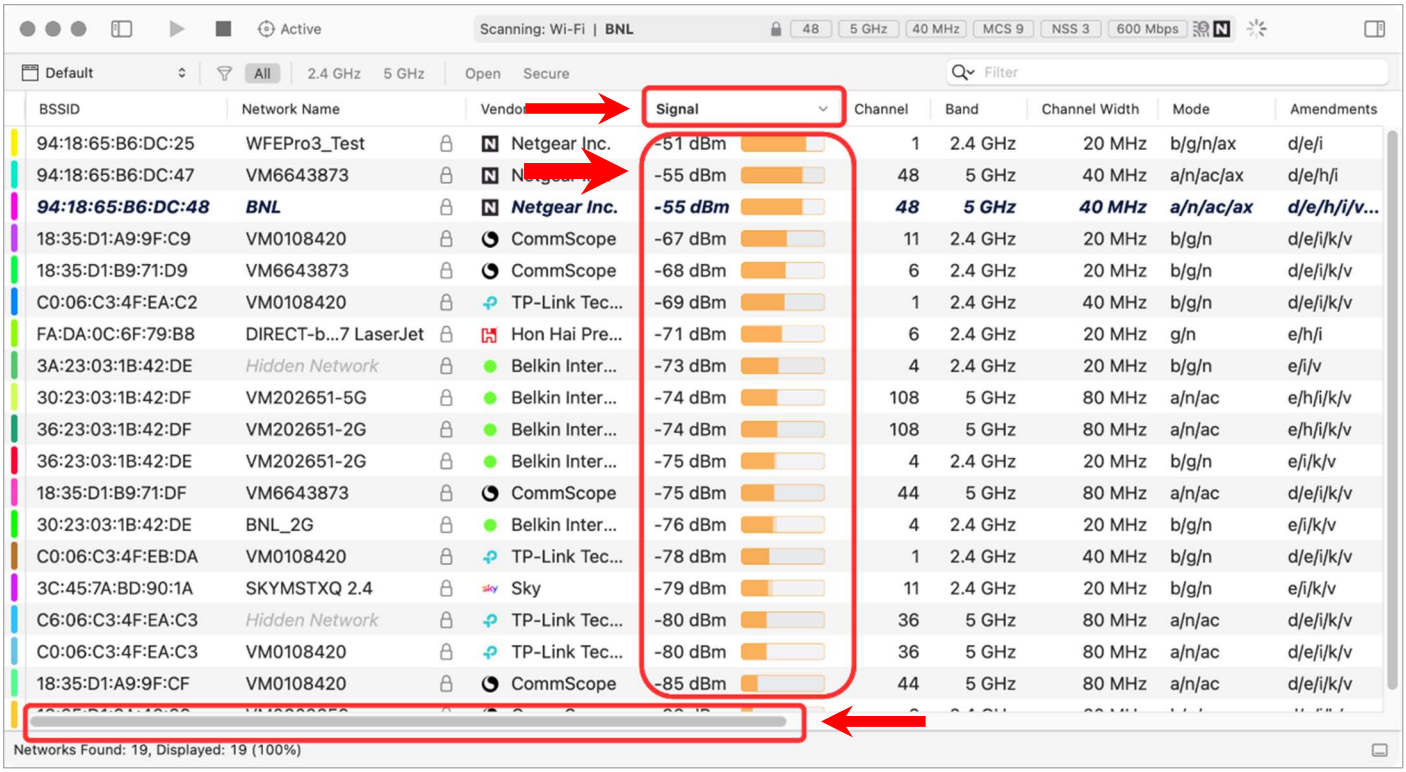

Figure 11-1 - Typical WLAN scan data listing

Figure 11-2 - Columns menu (accessed by Control-clicking any column header)

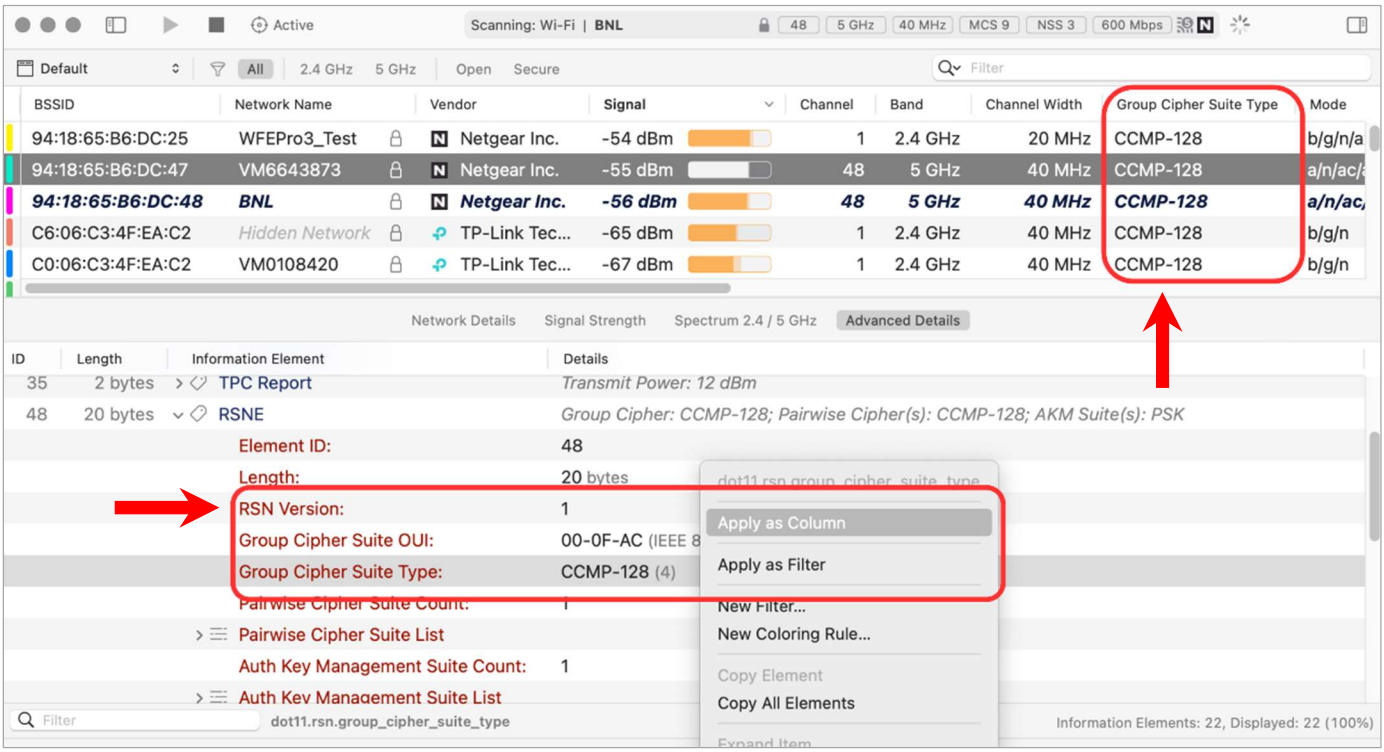

Figure 11-3 - Custom column addition

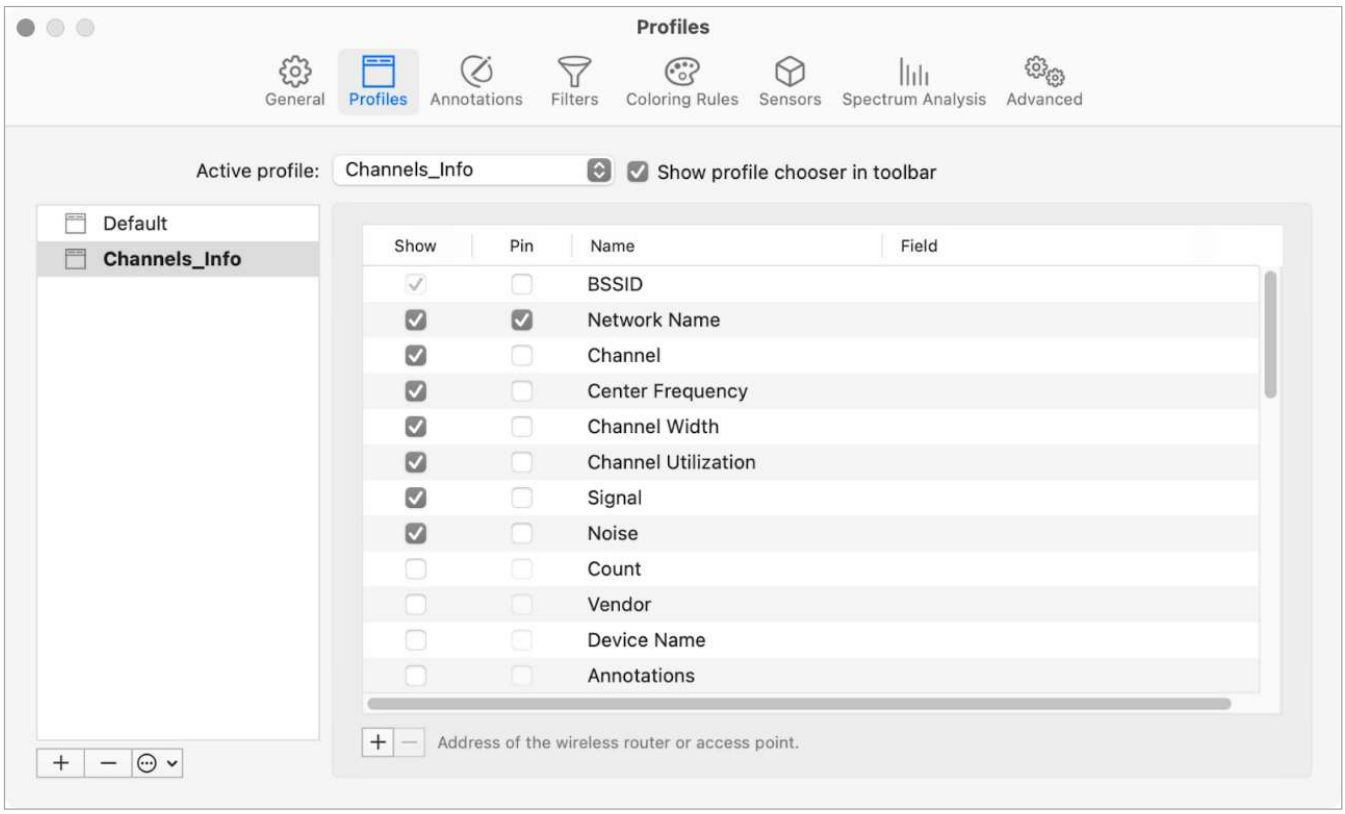

Figure 11-4 – The *Profiles* settings tab showing a custom profile

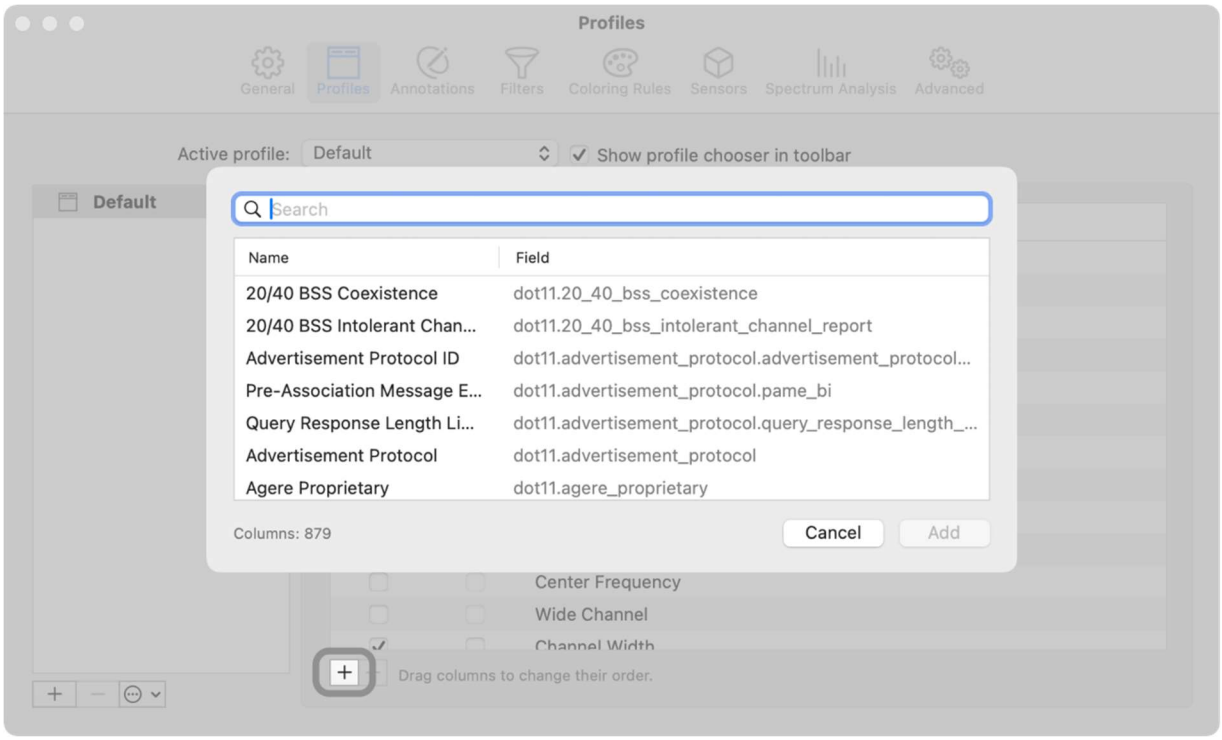

Figure 11-5 - Adding new columns to a profile

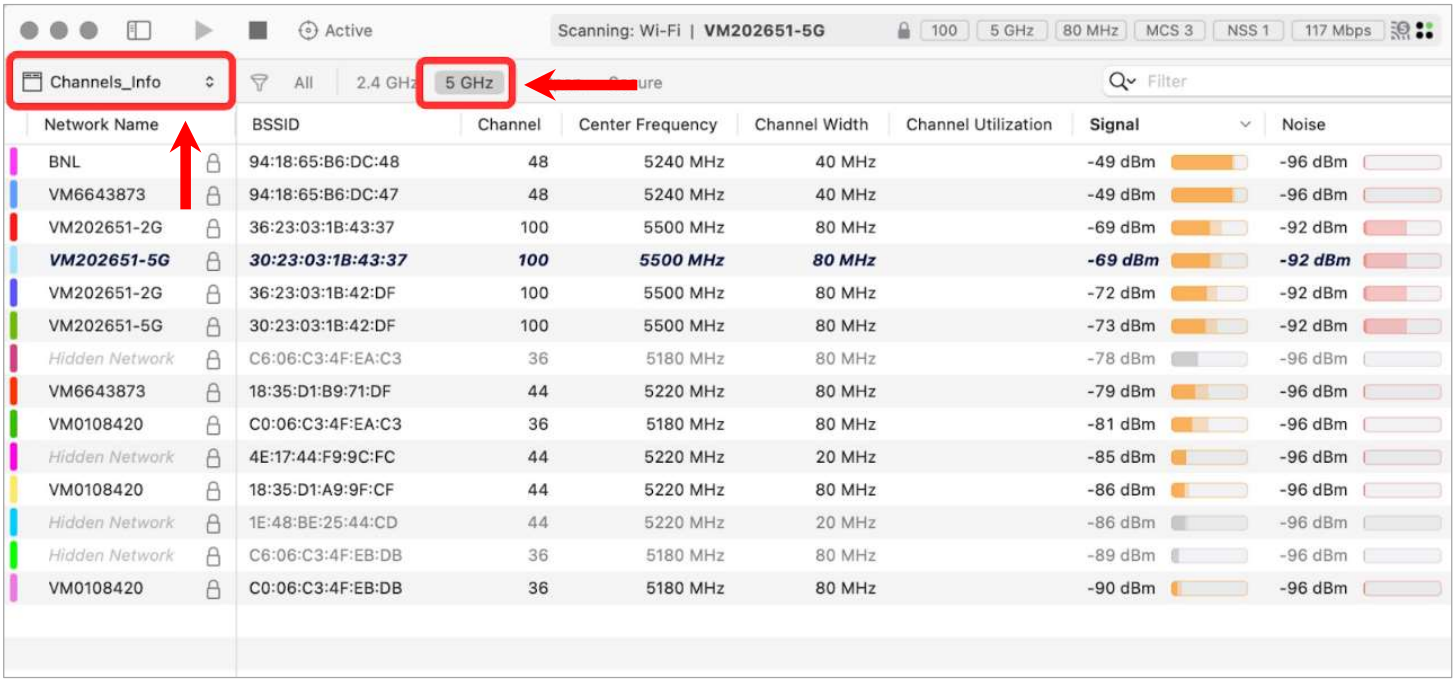

Figure 11-6 - *Networks Area* with "Channels_Info" profile applied

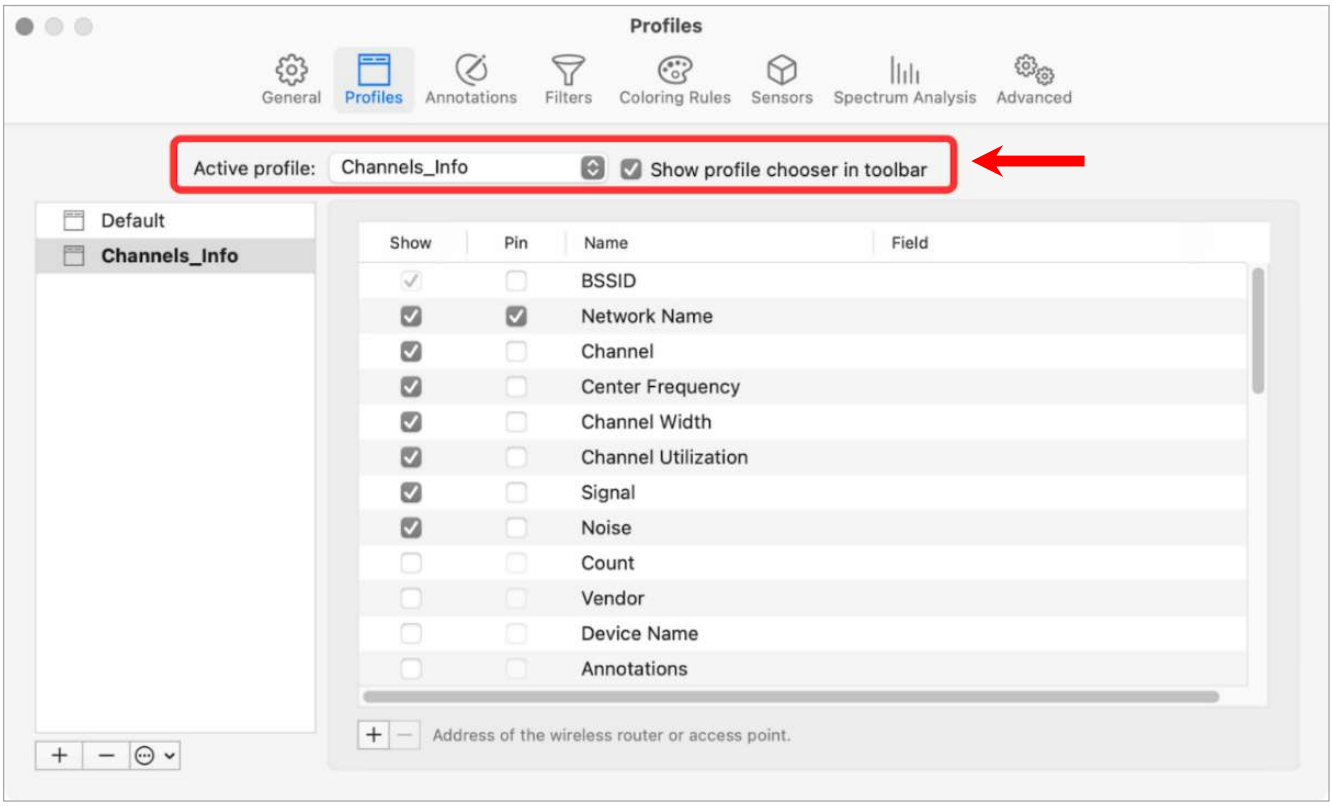

Figure 11-7 - Active profile selector in *Settings*

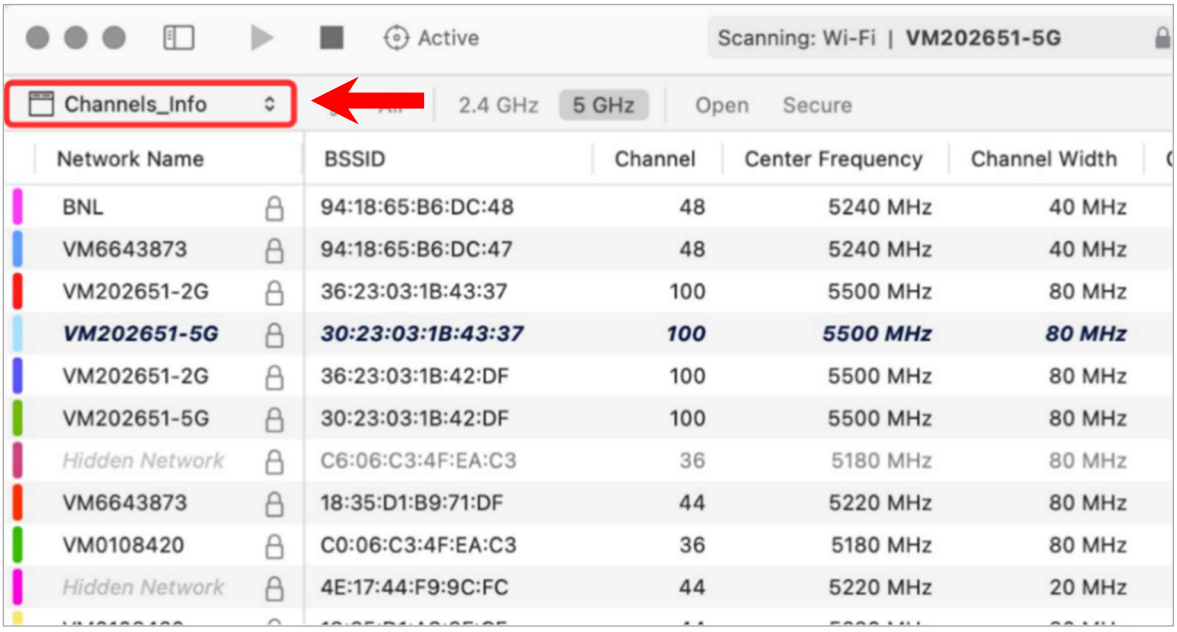

Figure 11-8 - Profile chooser location

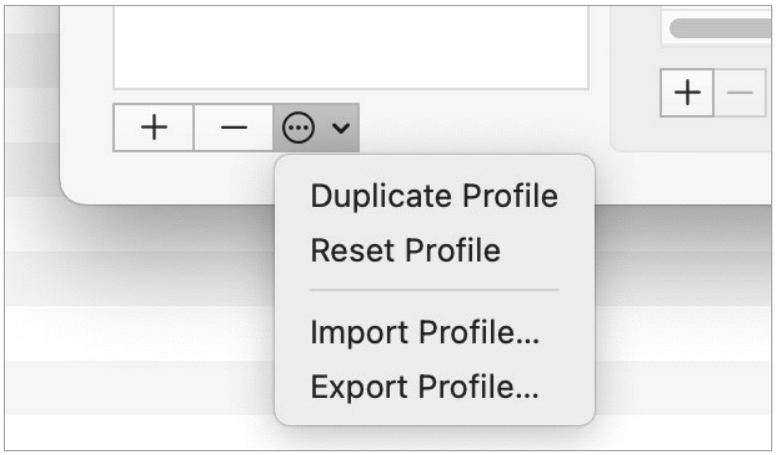

Figure 11-9 - The profiles list *More* button options

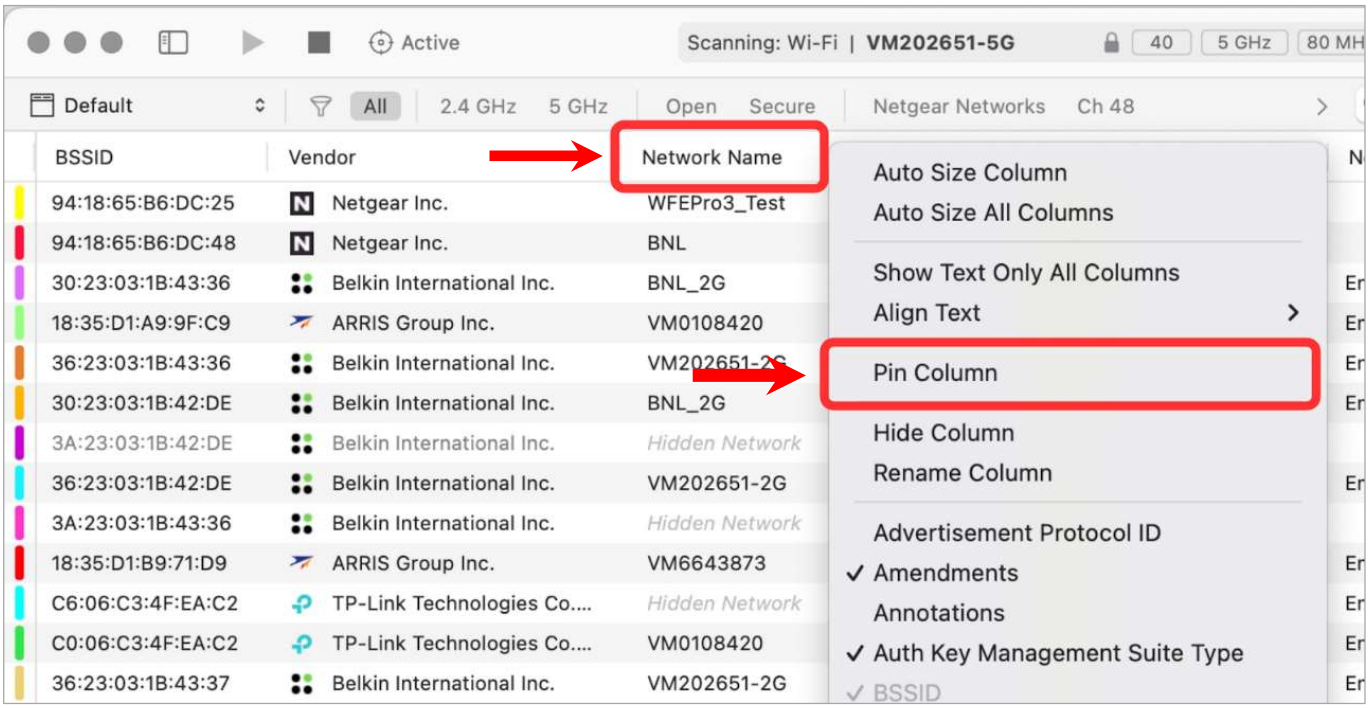

Figure 11-10 - Pinning a column using a column header

Chapter 12 - Data Visualization: Scan Results Organization, Coloring Rules, Data Enhancements & Hidden Gems

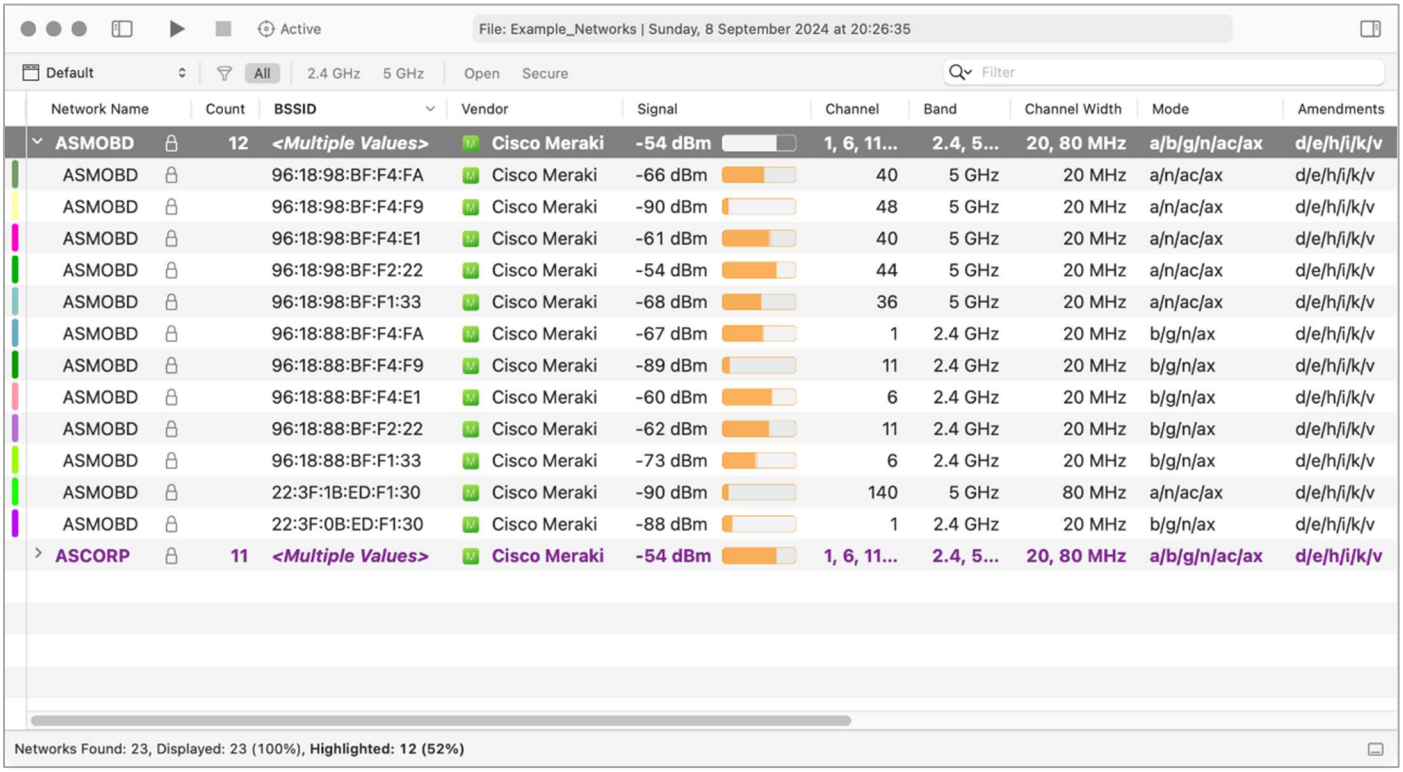

Figure 12-1 - Networks organized by name

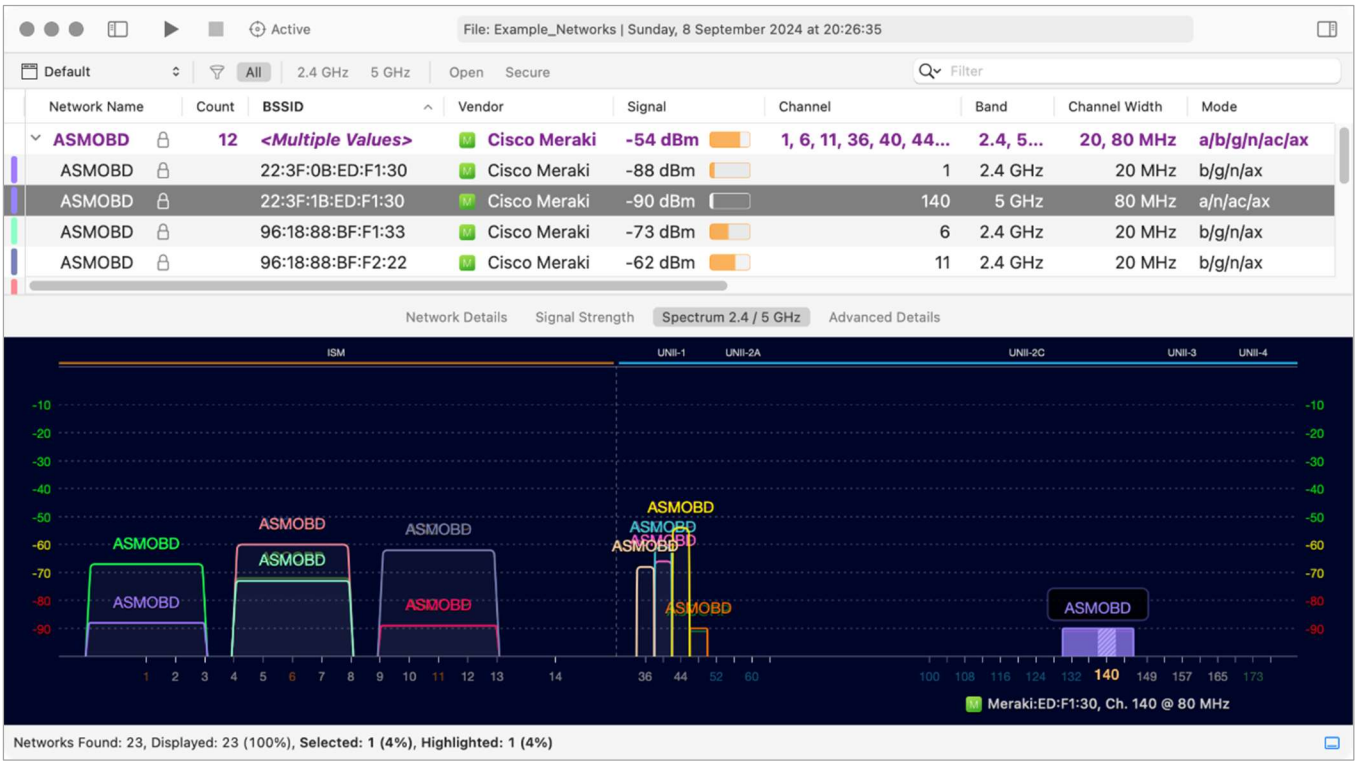

Figure 12-2 - Networks organized by name spectrum view

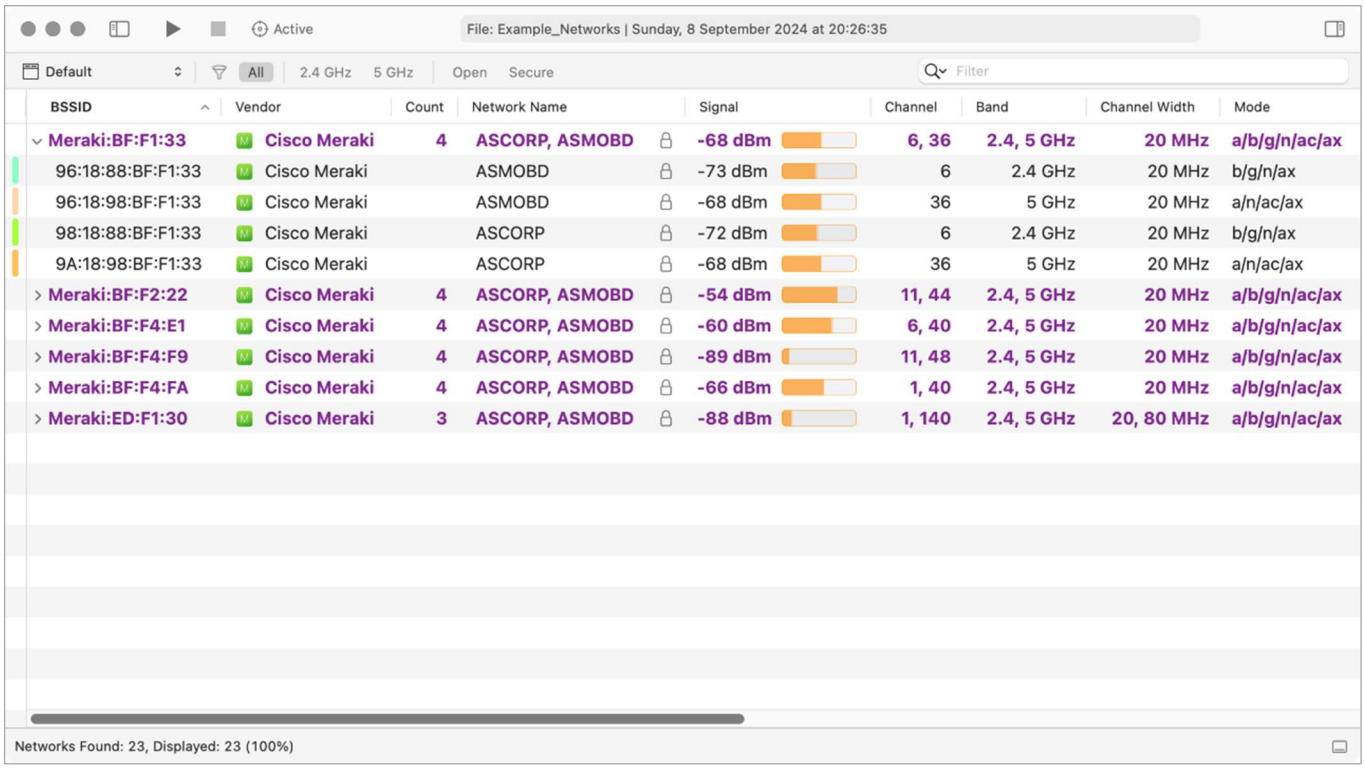

Figure 12-3 - Networks organized by access point

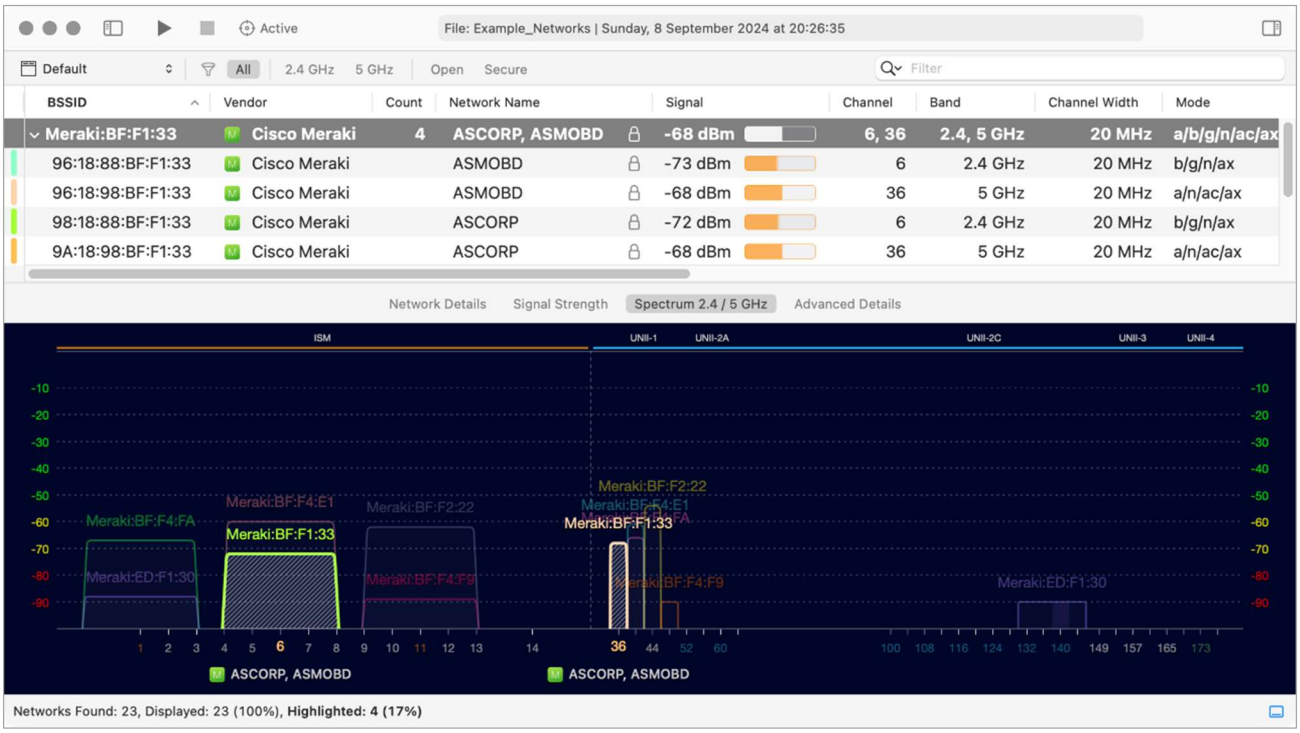

Figure 12-4 - Networks organized by access point spectrum view with a group selected

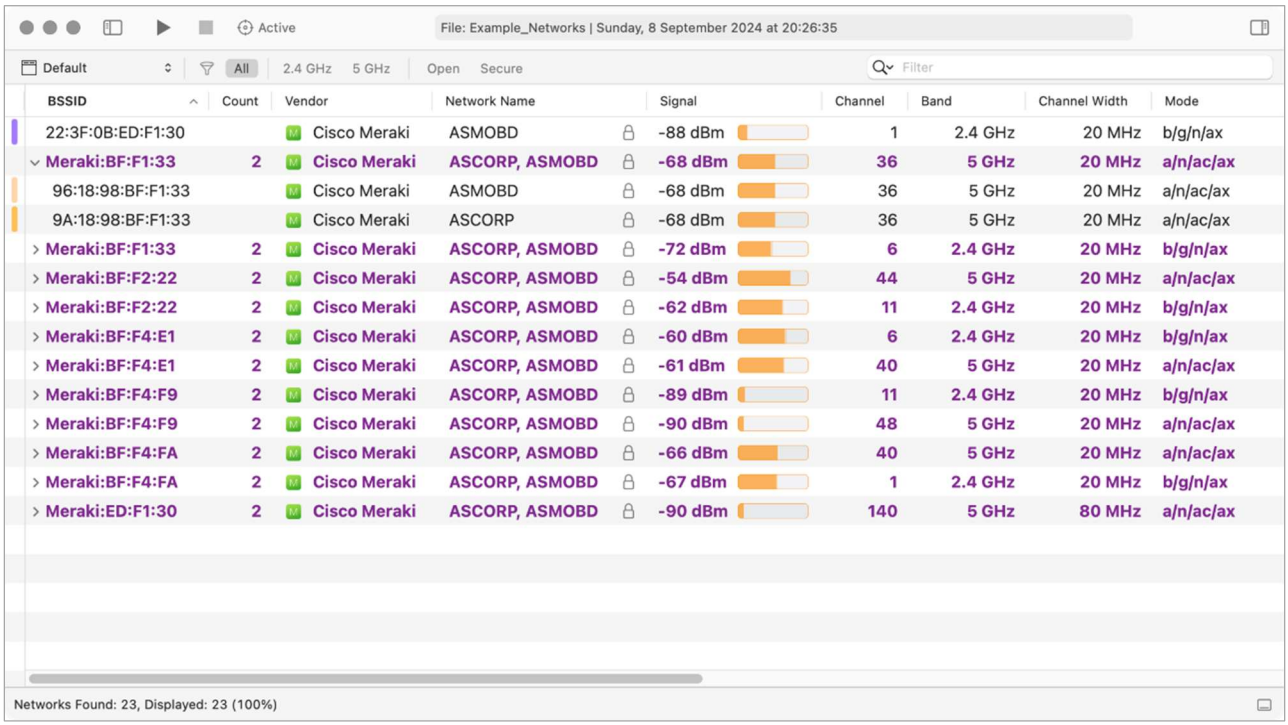

Figure 12-5 - Networks organized by access point radio

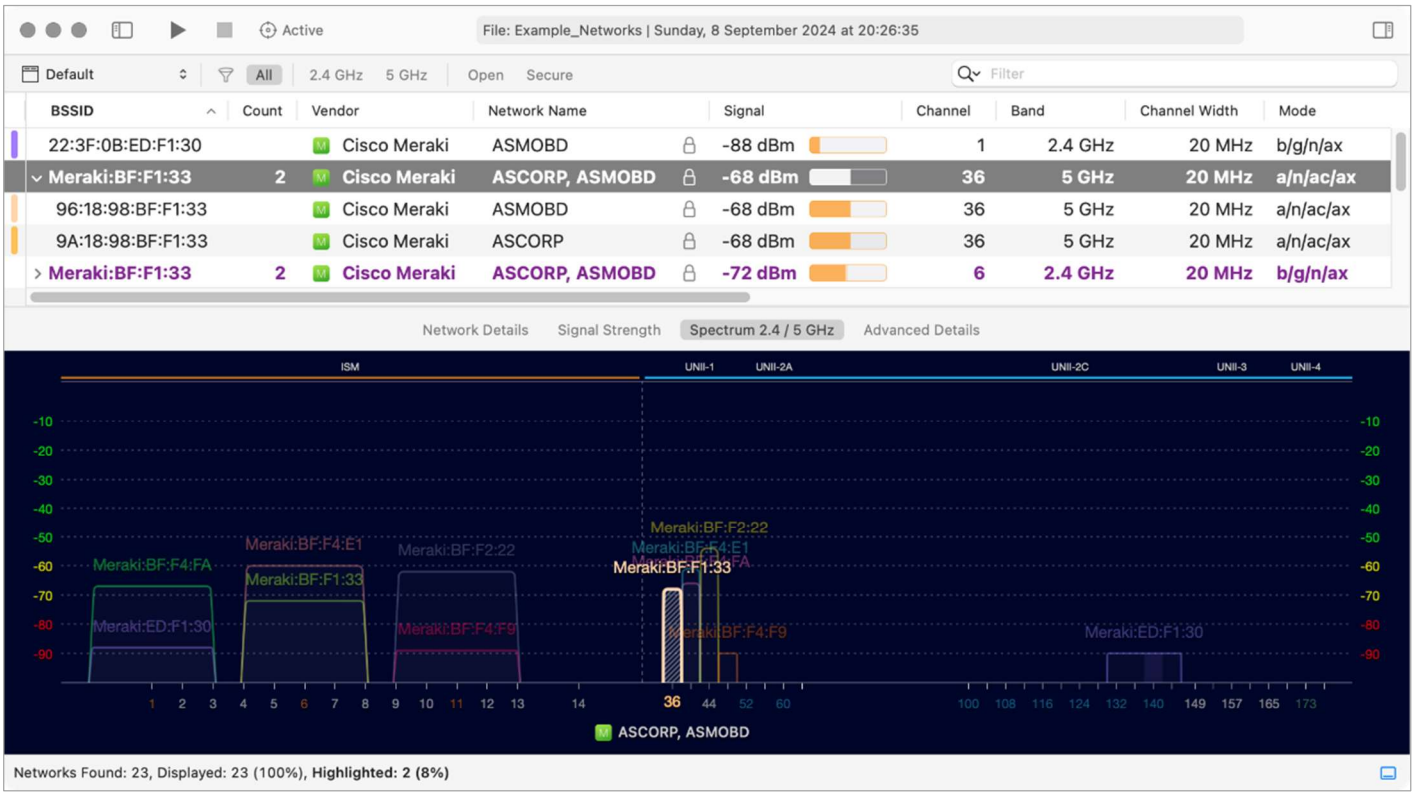

Figure 12-6 - Networks organized by access point radio in the spectrum view

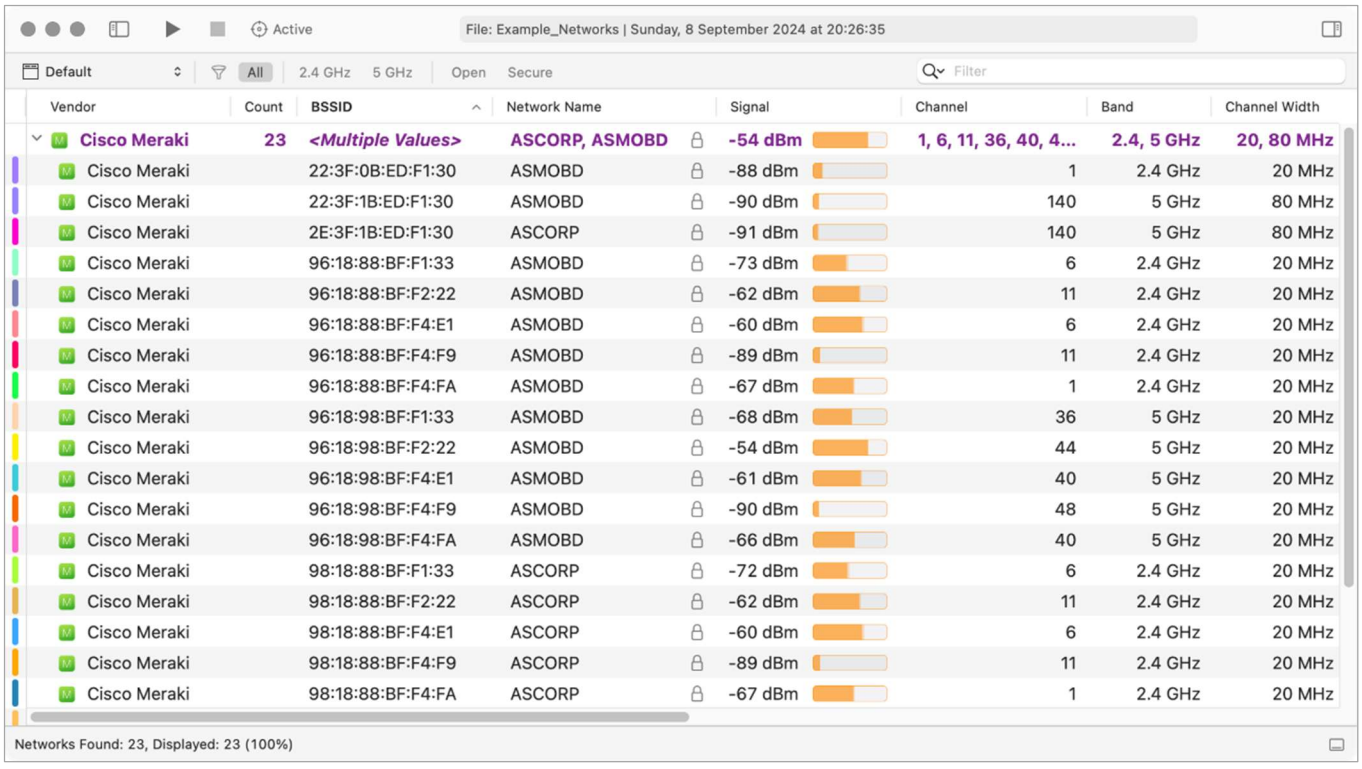

Figure 12-7 - Networks organized by access point vendor

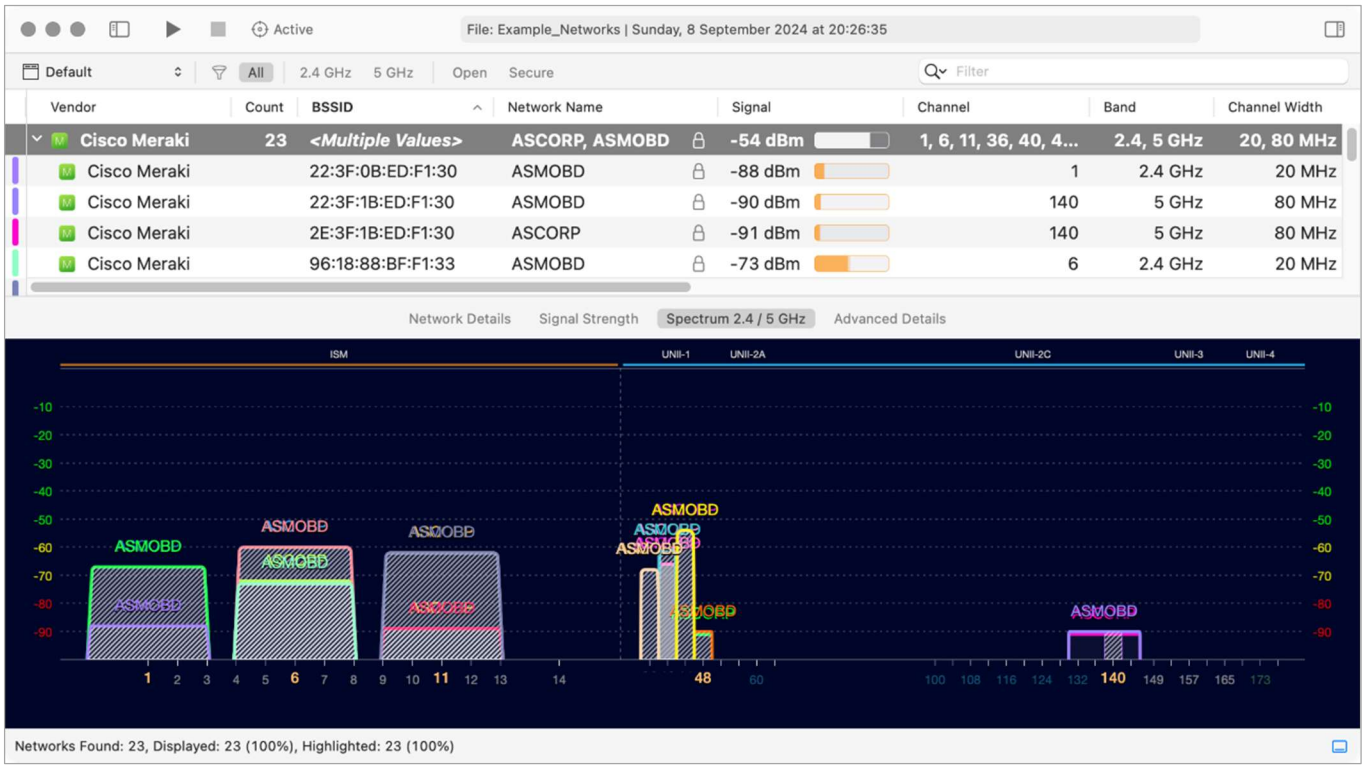

Figure 12-8 - Networks organized by vendor spectrum view with the vendor selected

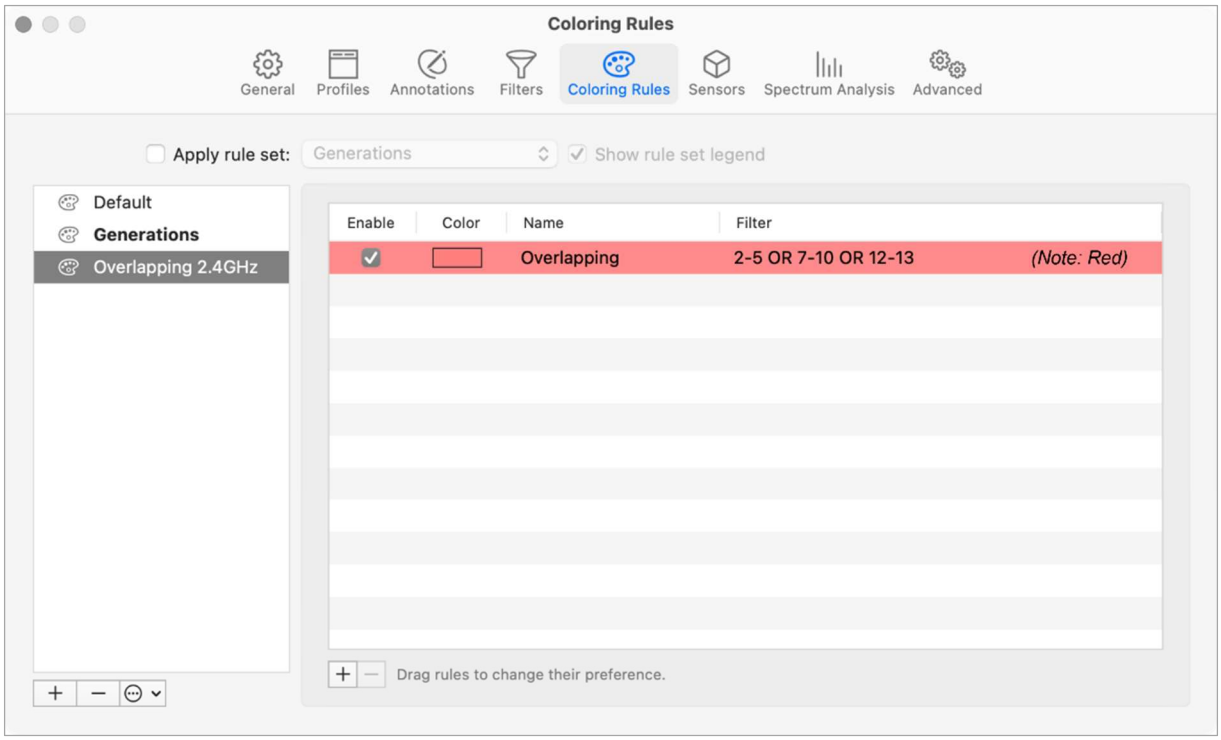

Figure 12-9 - Example coloring rule definition for 2.4 GHz overlapping channels

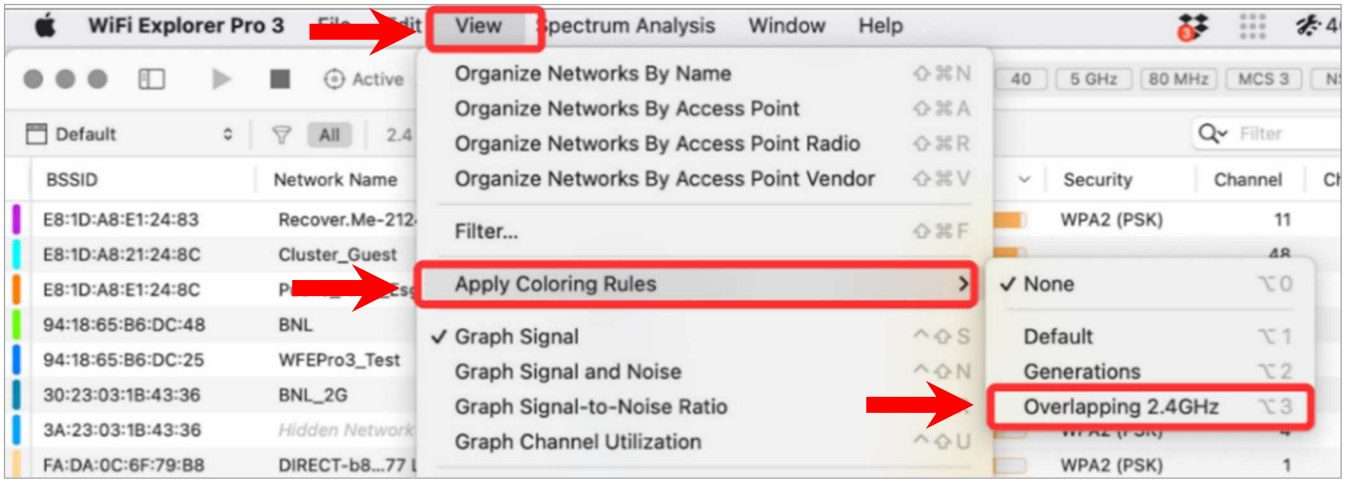

Figure 12-10 - Selecting coloring rule set for 2.4 GHz overlapping channels

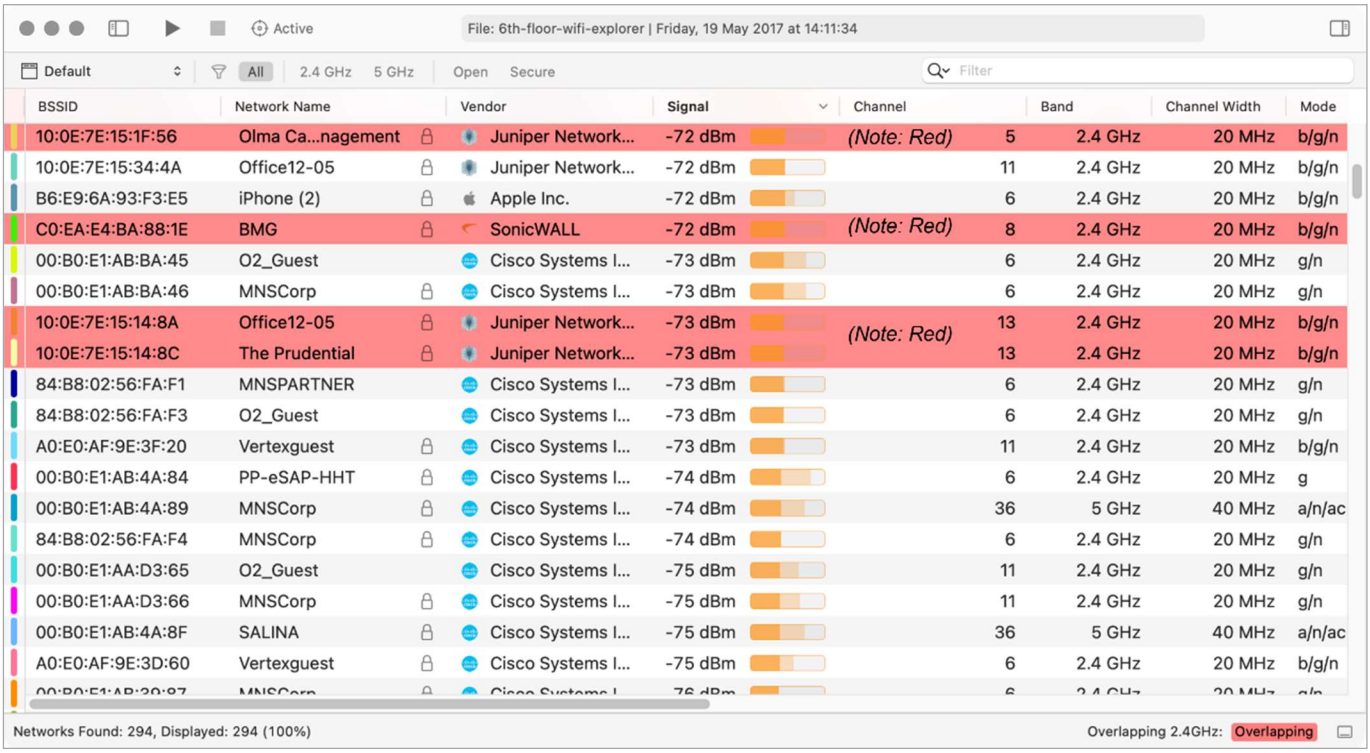

Figure 12-11 - Coloring rule for 2.4 GHz overlapping channels applied to networks table

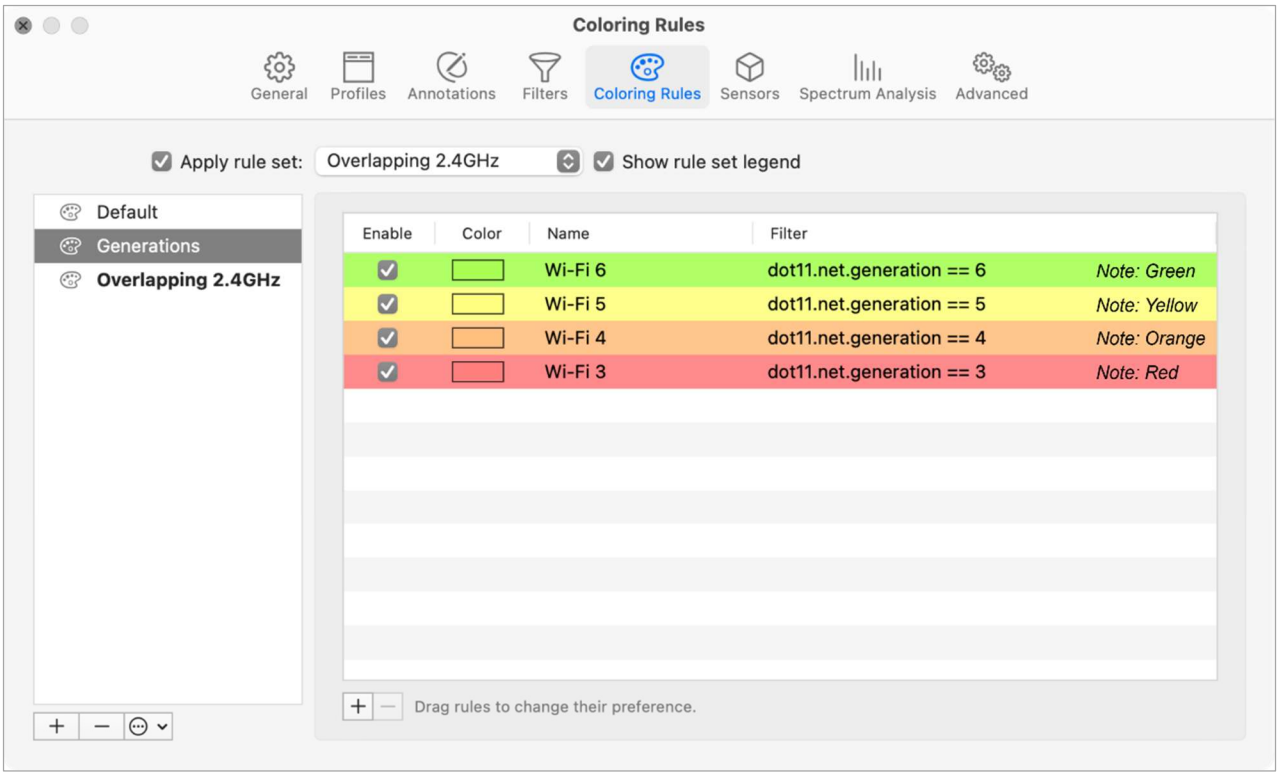

Figure 12-12 - The *Coloring Rules* settings tab

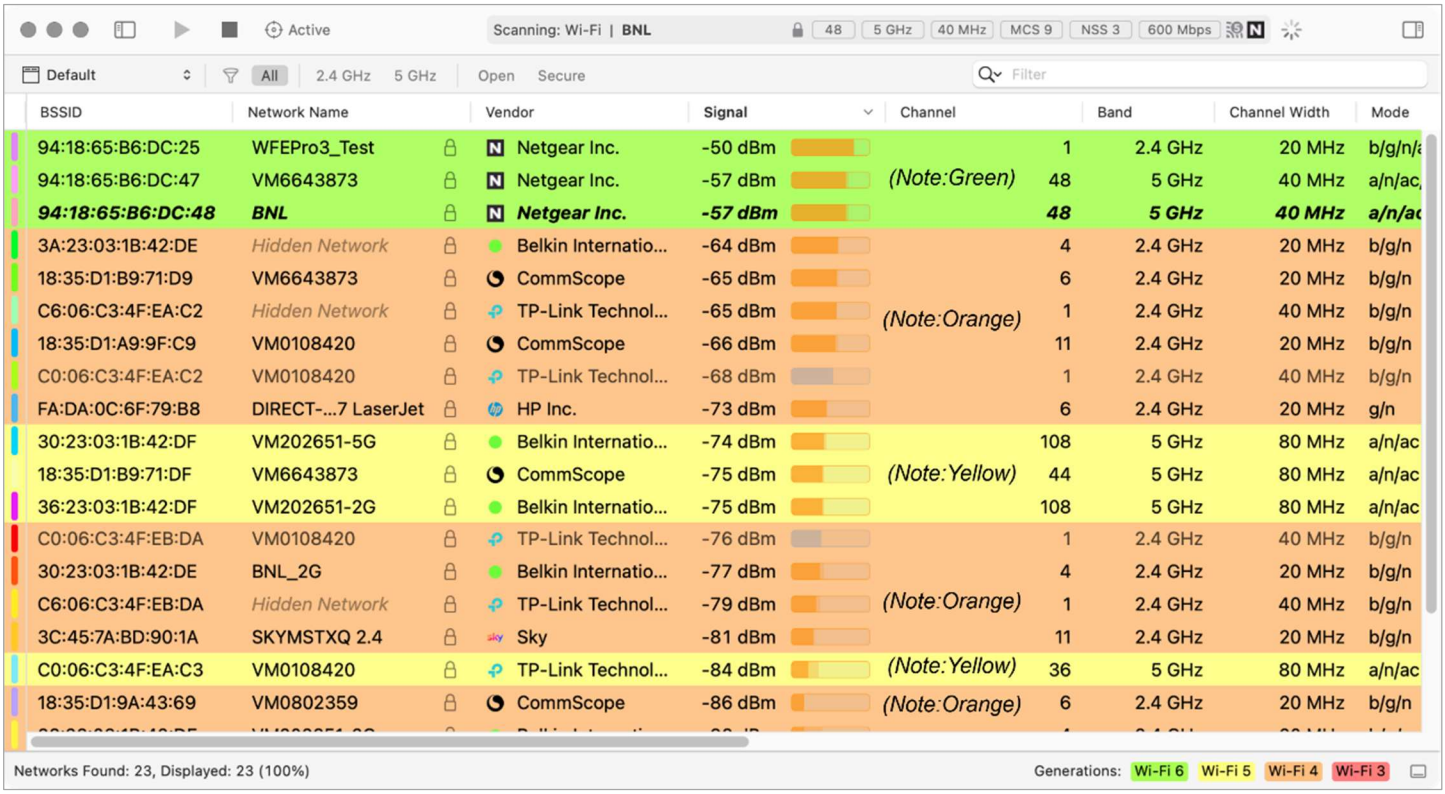

Figure 12-13 - *Networks Area* with Generations coloring rule applied

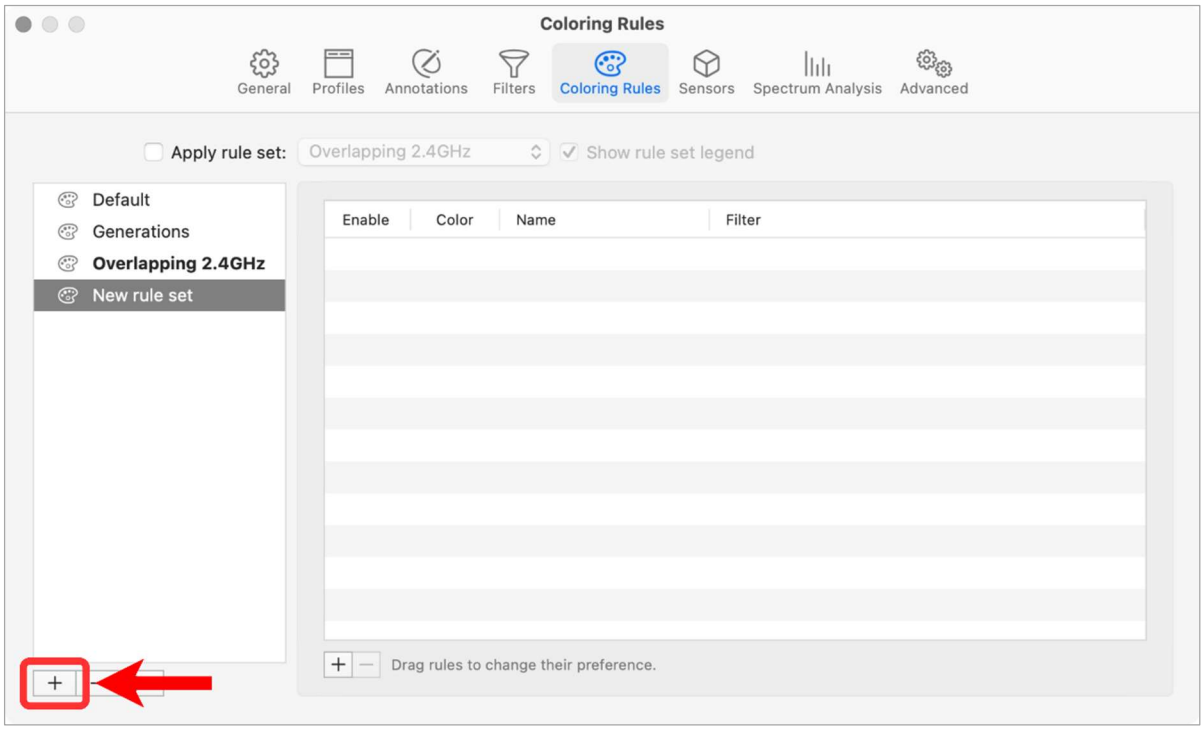

Figure 12-14 - Adding a new coloring rule set

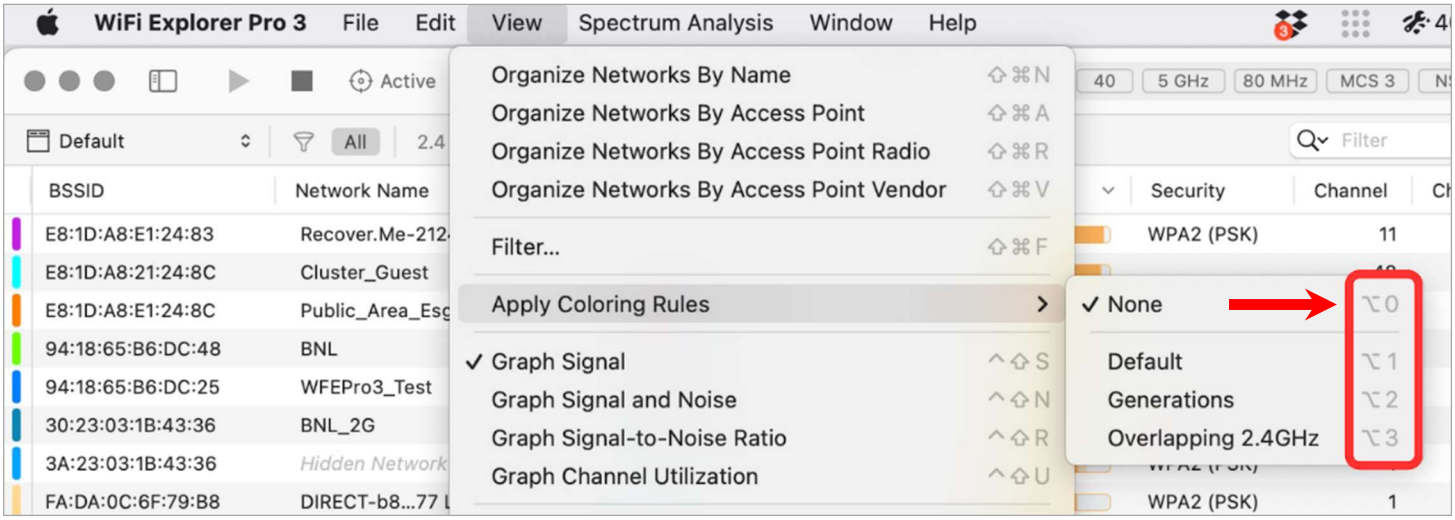

Figure 12-15 - Coloring rule set selection shortcuts

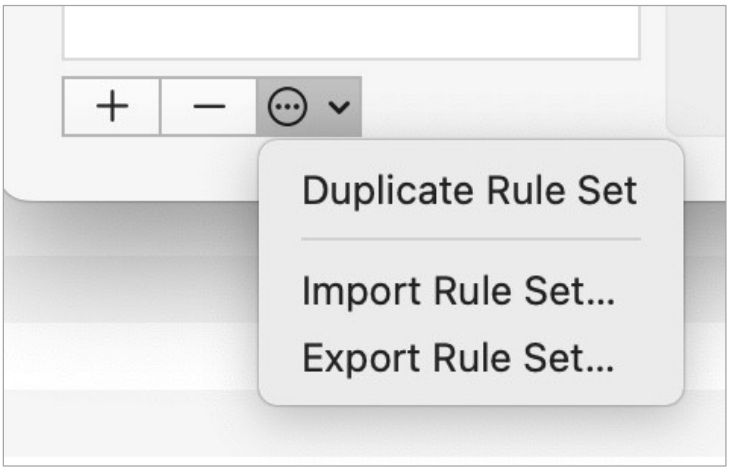

Figure 12-16 – The coloring rule sets list *More* button options

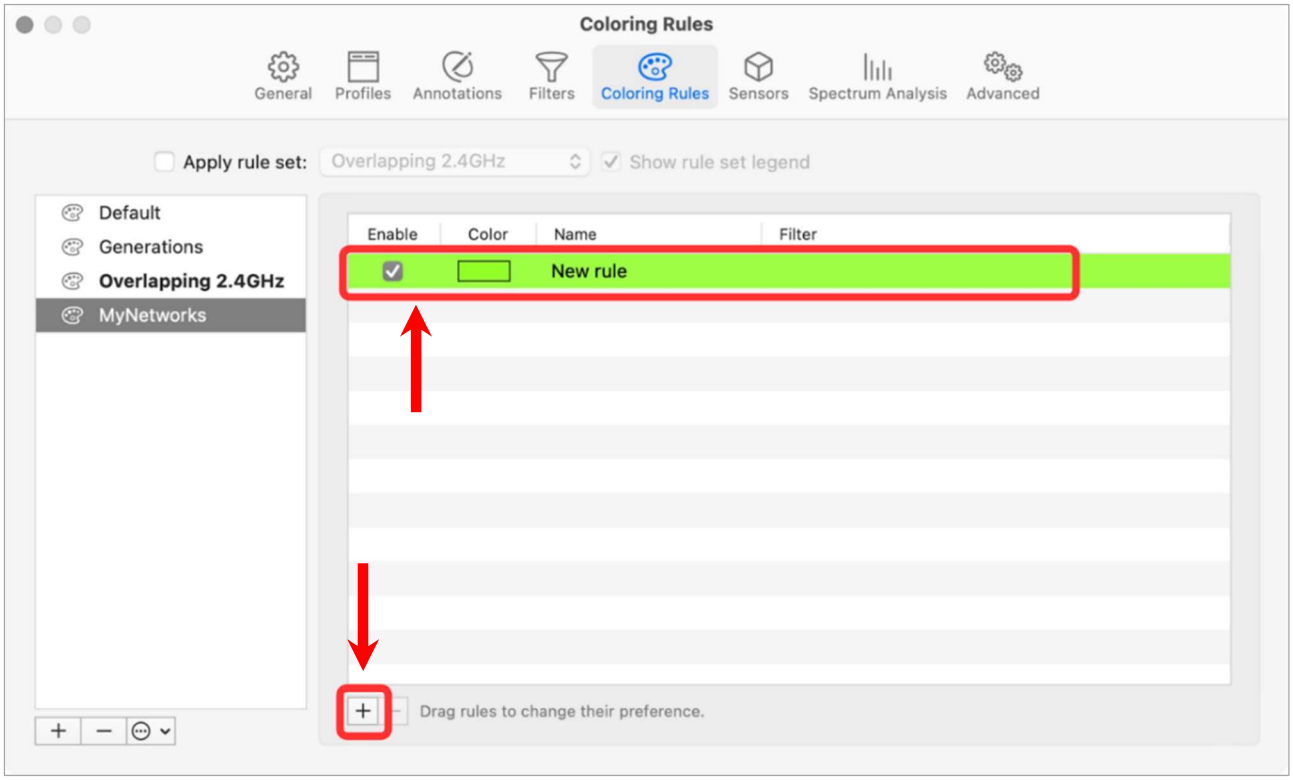

Figure 12-17 - Adding a new rule to a coloring rule set

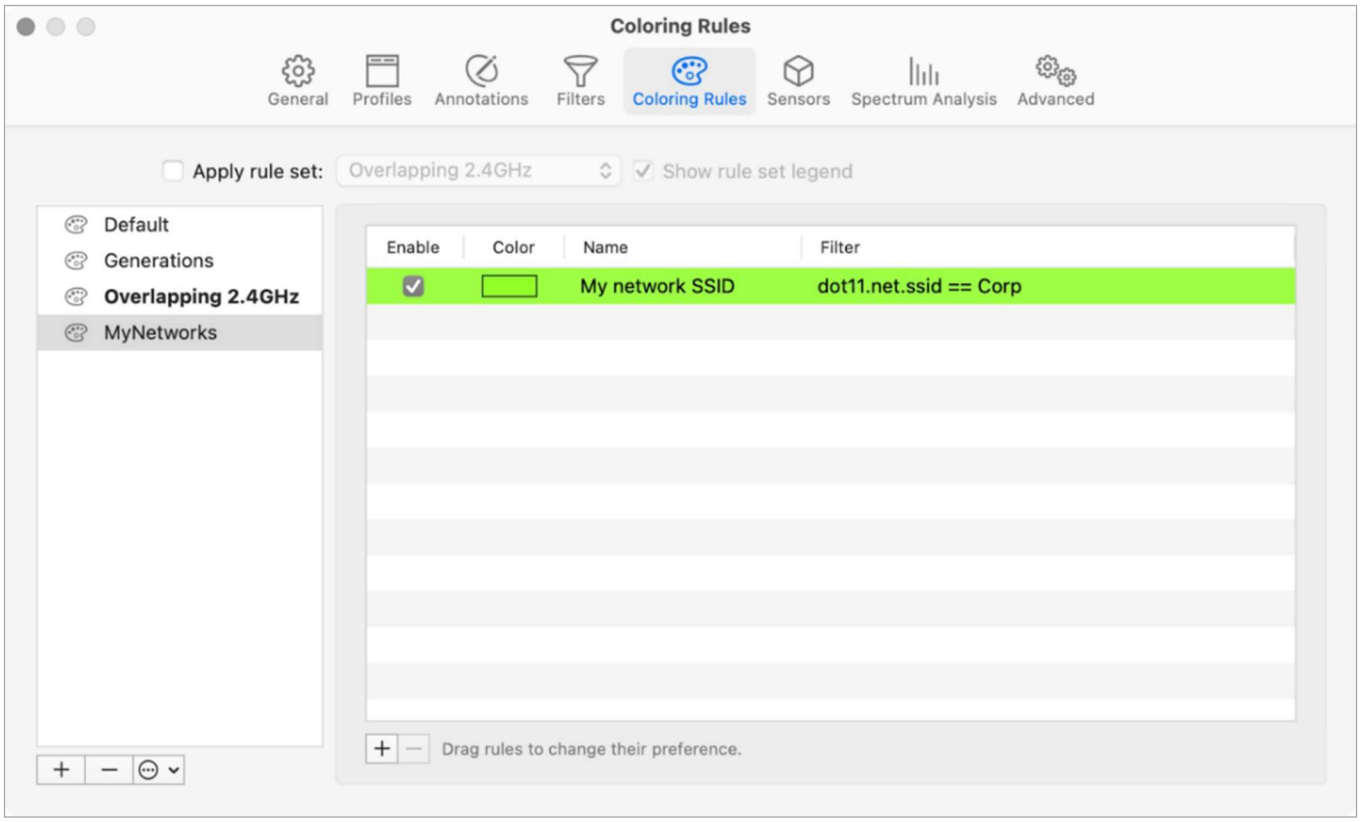

Figure 12-18 - A sample rule to colorize a specific SSID

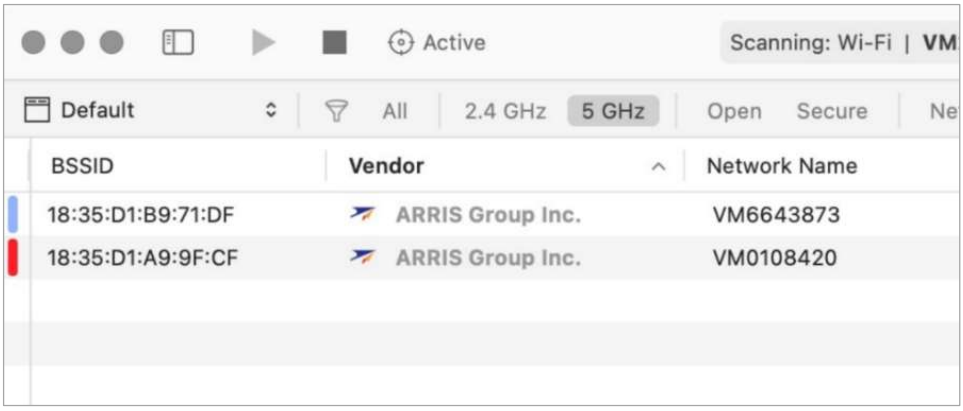

Figure 12-19 - Networks table showing Arris Group Inc. devices

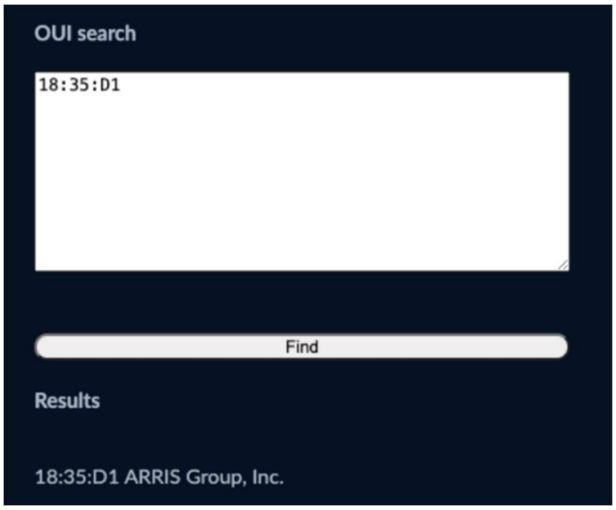

Figure 12-20 - Online lookup of the 18:35:D1 OUI details

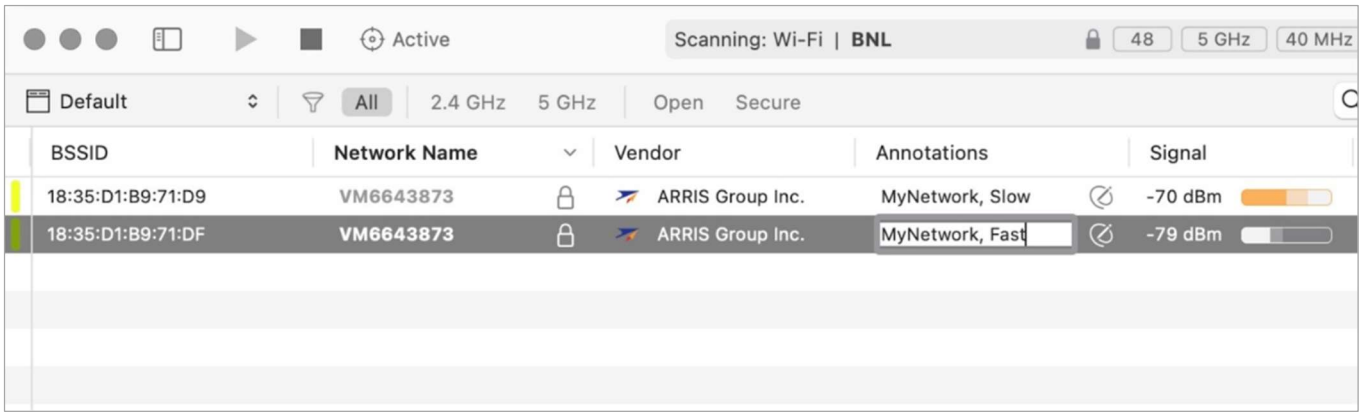

Figure 12-21 - Simple addition of annotations

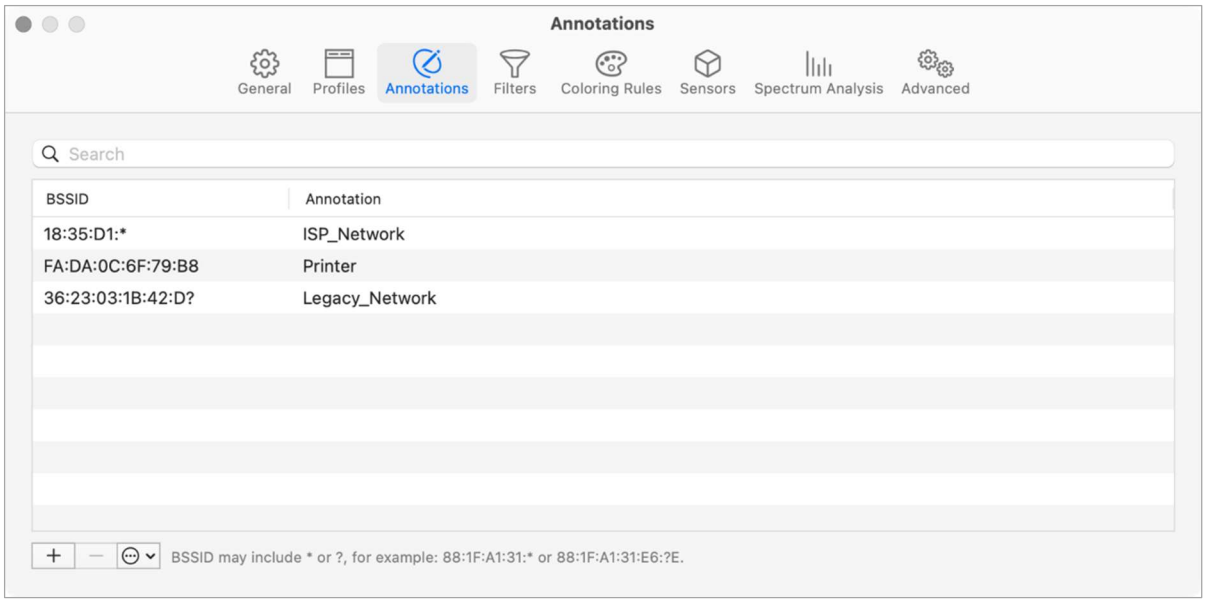

Figure 12-22 - The *Annotations* settings tab showing three annotation examples

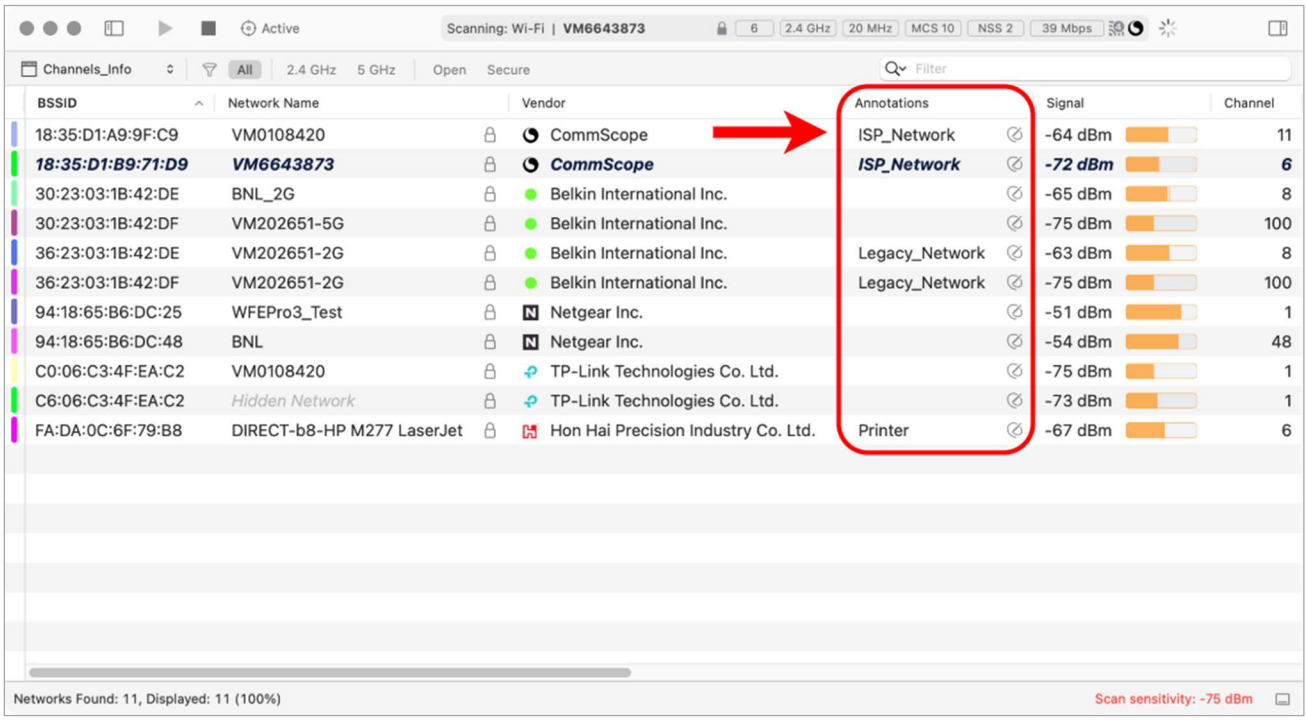

Figure 12-23 - *Annotations* example results in the networks table

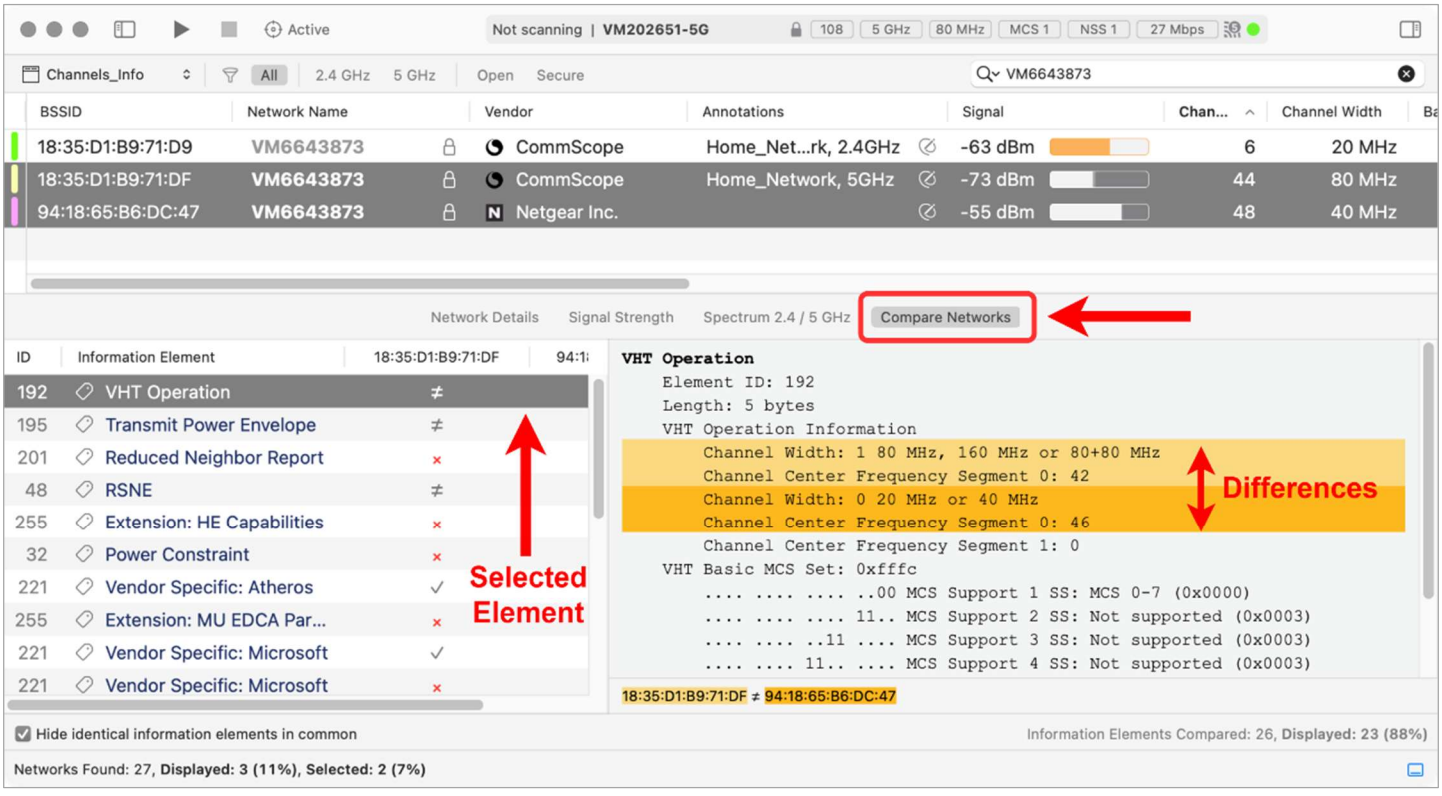

Figure 12-24 - *Network Compare* example

Chapter 13 - Inspectors

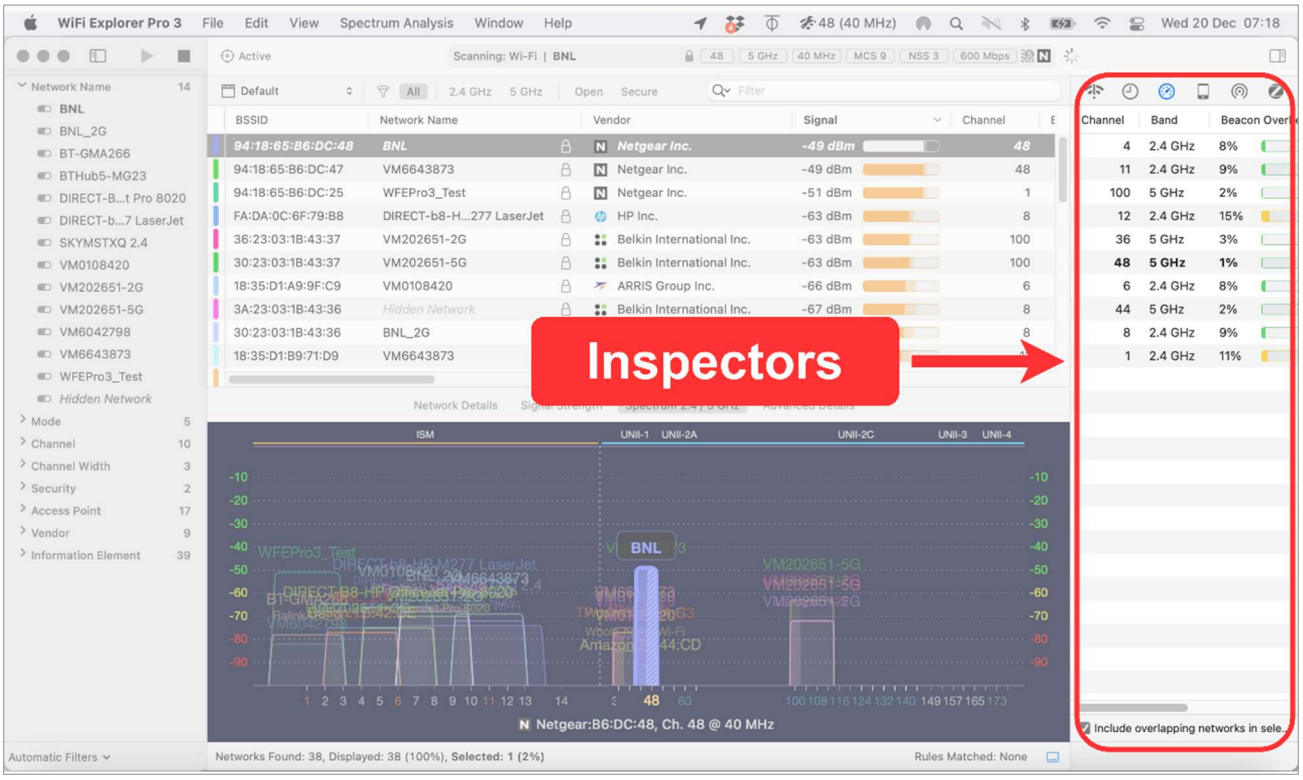

Figure 13-1 - *Inspectors* UI location

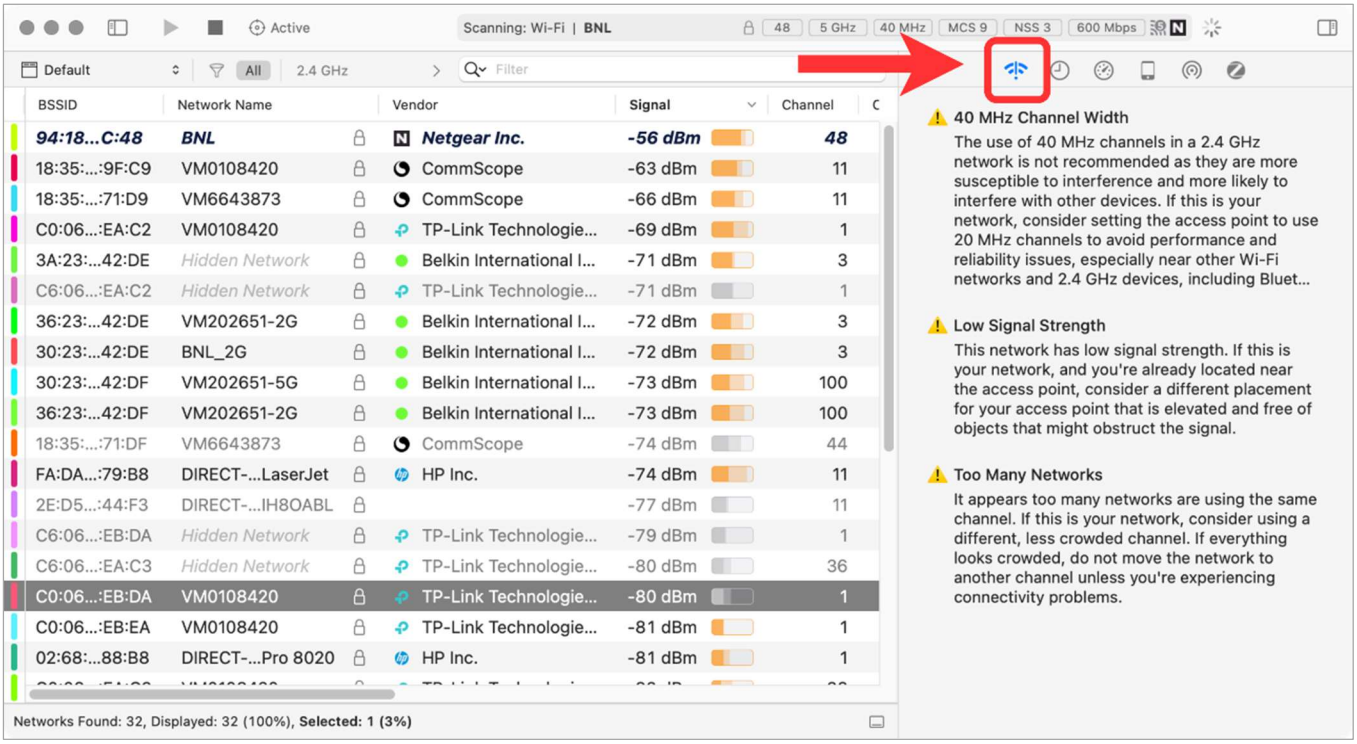

Figure 13-2 - *Issues Inspector* example showing multiple issues for a selected network

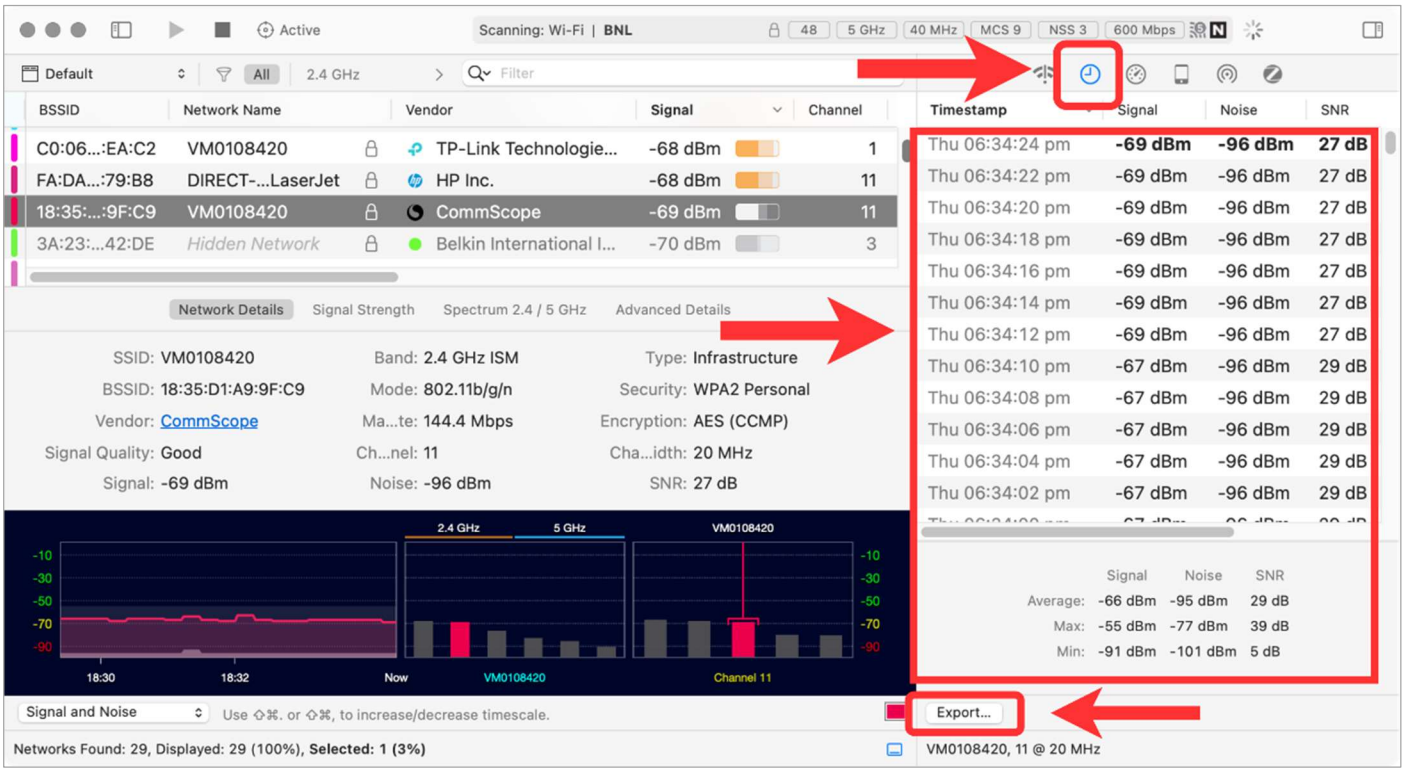

Figure 13-3 - *History Inspector* showing historical data for a selected network

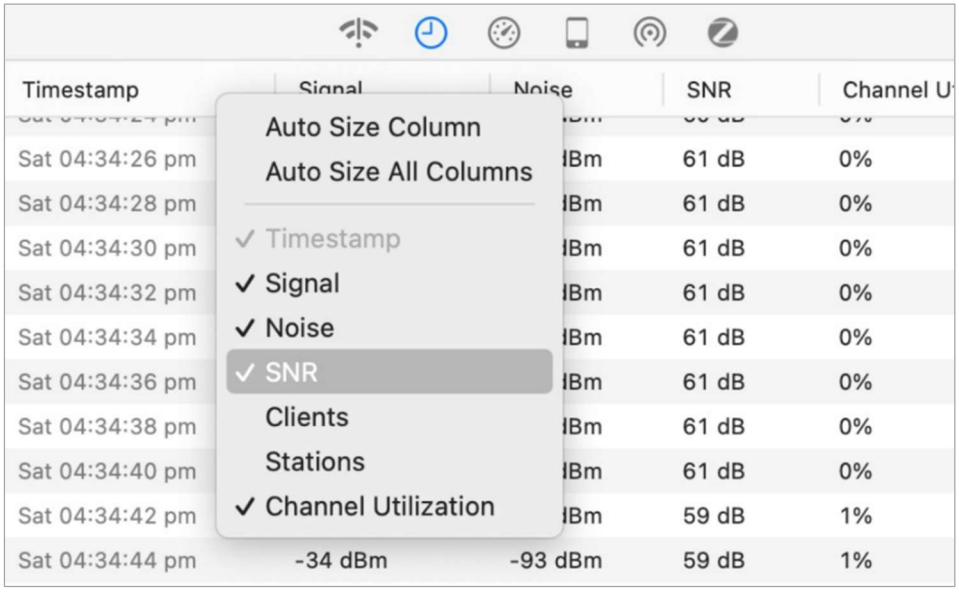

Figure 13-4 - *History Inspector* column display options

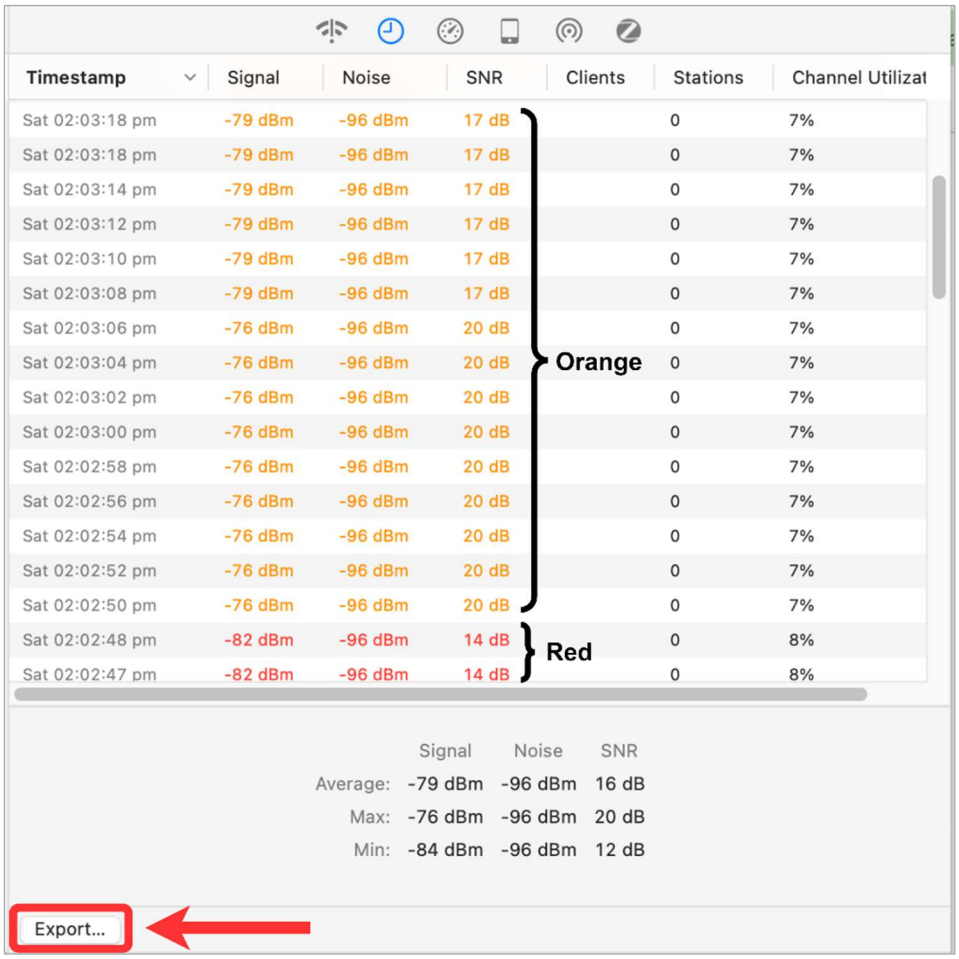

Figure 13-5 - *History Inspector* with all columns enabled

VM6042798_Cisco-1A-A6-9C

Timestamp	SSID	BSSID	Channel	Channel Width	Signal (dBm)	Noise (dBm)	SNR (dB)	Stations	Channel Utilization (%)
Fri 05:52:48 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-83	-96	13	1	16
Fri 05:52:49 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-83	-96	13	1	16
Fri 05:53:02 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16
Fri 05:53:03 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16
Fri 05:53:06 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16
Fri 05:53:27 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16
Fri 05:53:29 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16
Fri 05:53:31 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16
Fri 06:06:38 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16
Fri 06:06:43 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16
Fri 06:06:44 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16
Fri 06:06:46 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16
Fri 06:06:48 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16
Fri 06:06:50 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16
Fri 06:06:52 am	VM6042798	0A:1F:26:1A:A6:9C	11	20 MHz	-82	-96	14	1	16

Figure 13-6 - History Inspector exported CSV data shown in a spreadsheet app

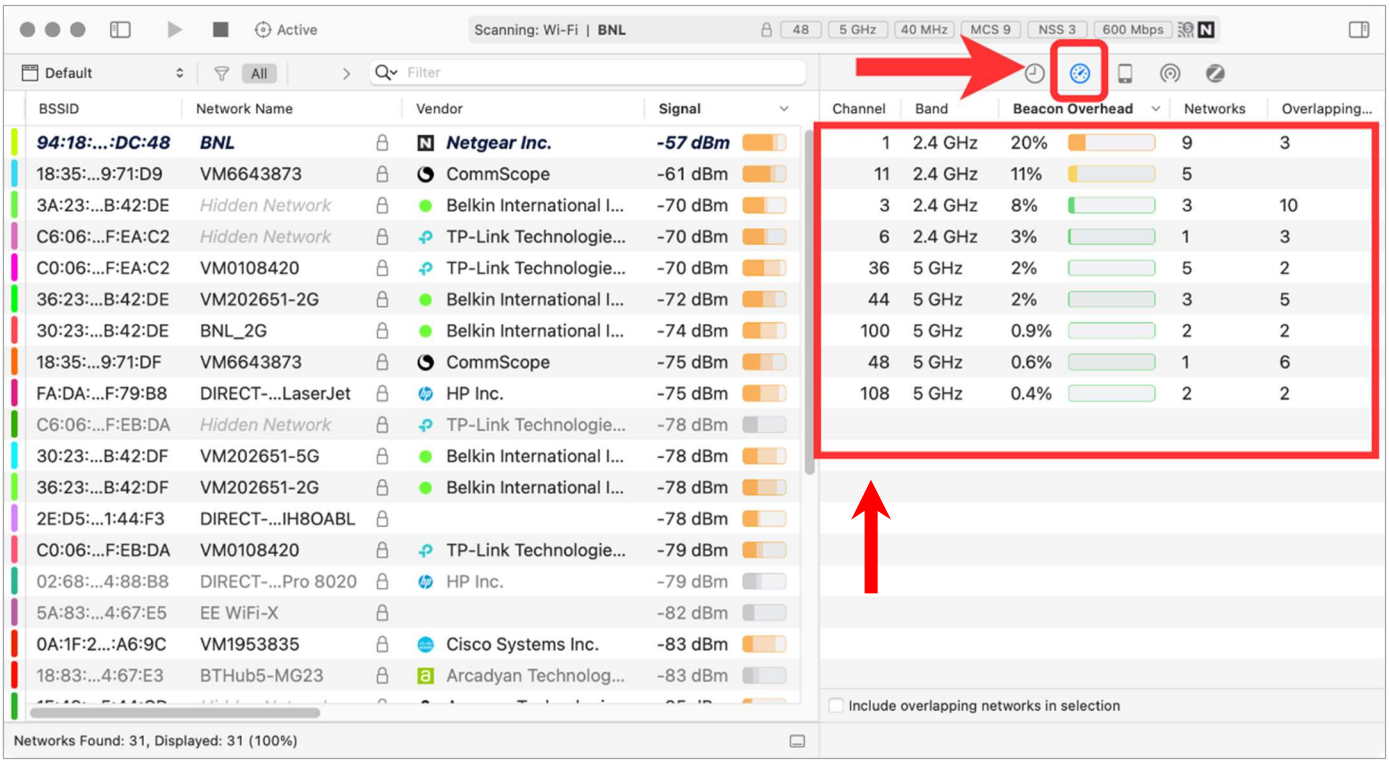

Figure 13-7 - *Utilization Inspector* summary data

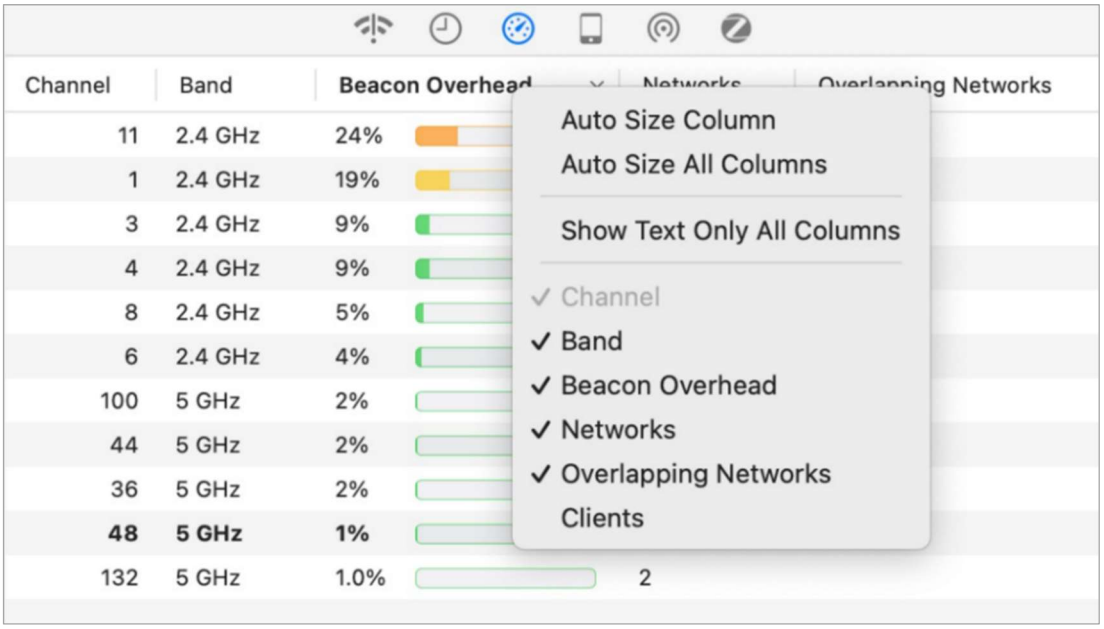

Figure 13-8 - *Utilization Inspector* column display options

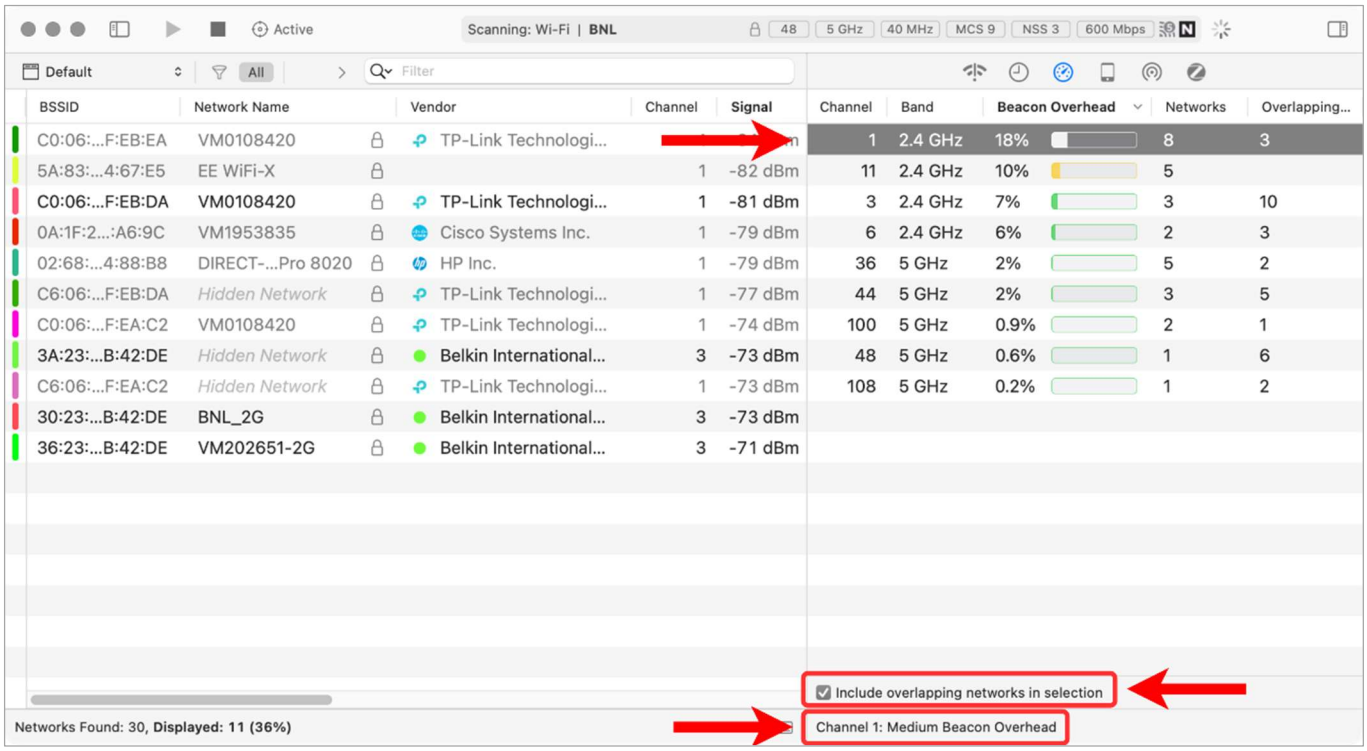

Figure 13-9 - *Utilization Inspector* with selected entry

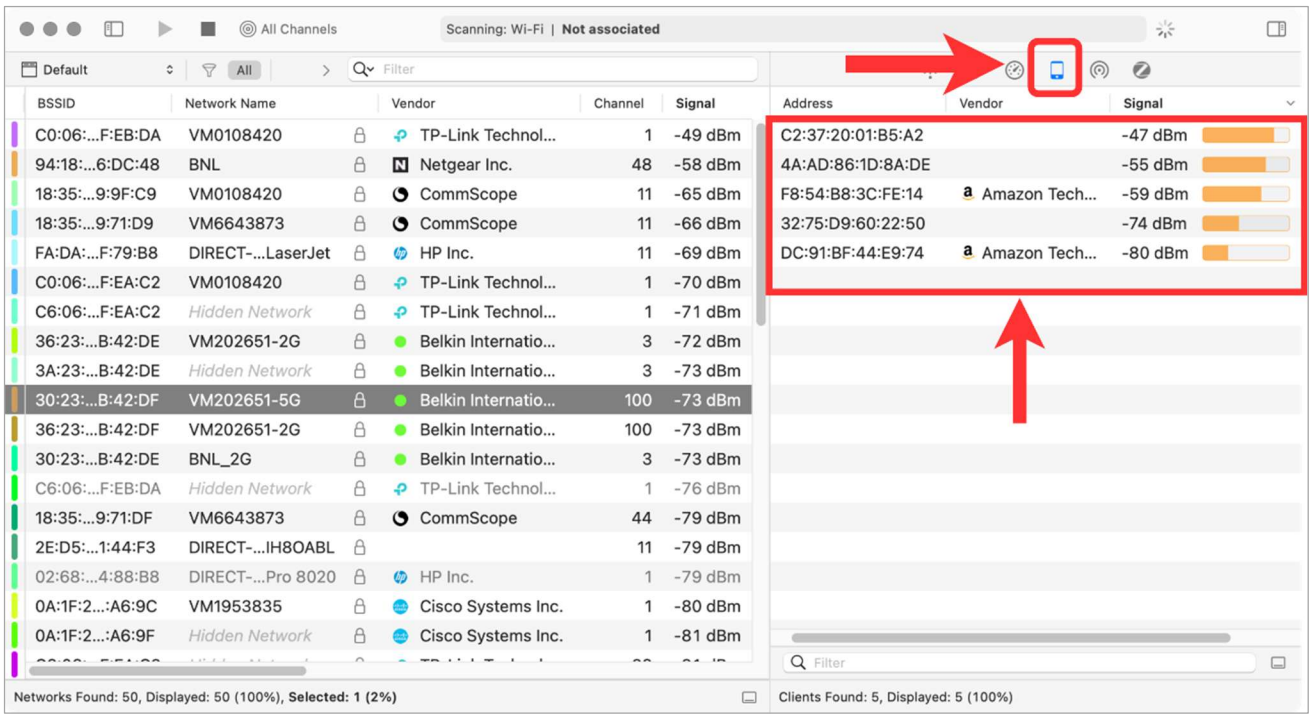

Figure 13-10 - *Clients Inspector* showing client data for a selected network

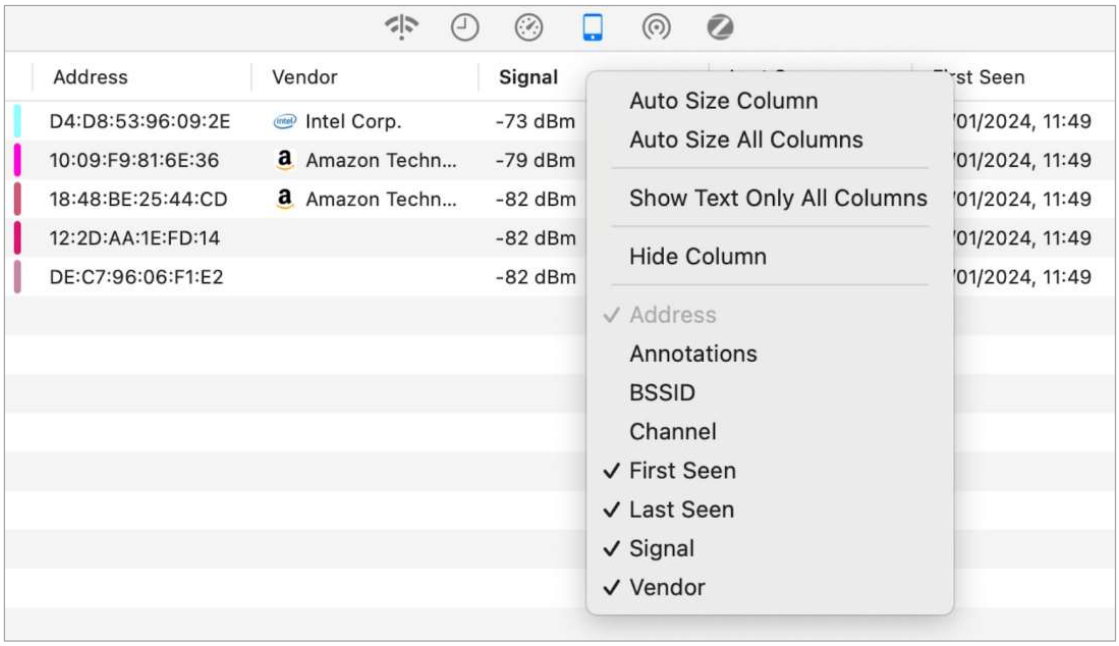

Figure 13-11 - *Clients Inspector* column display options

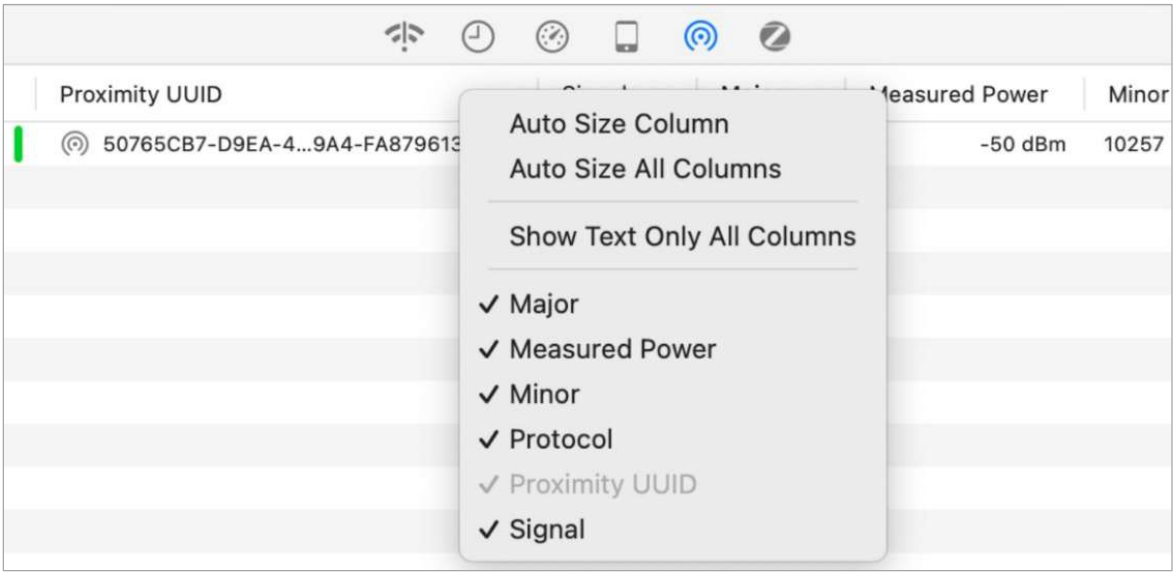

Figure 13-12 - Proximity Beacons Inspector column display options

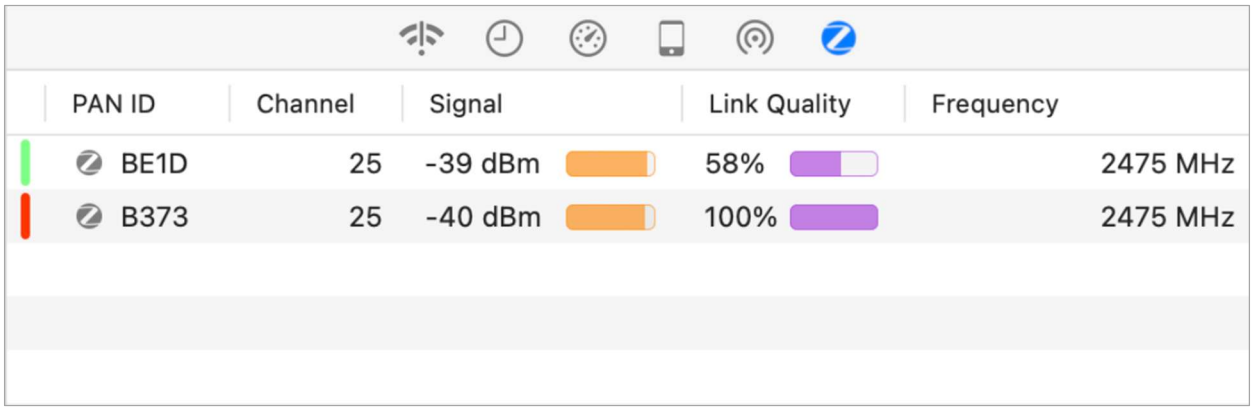

Figure 13-13 - Zigbee network discovery

Chapter 14 - Troubleshooting Workflow

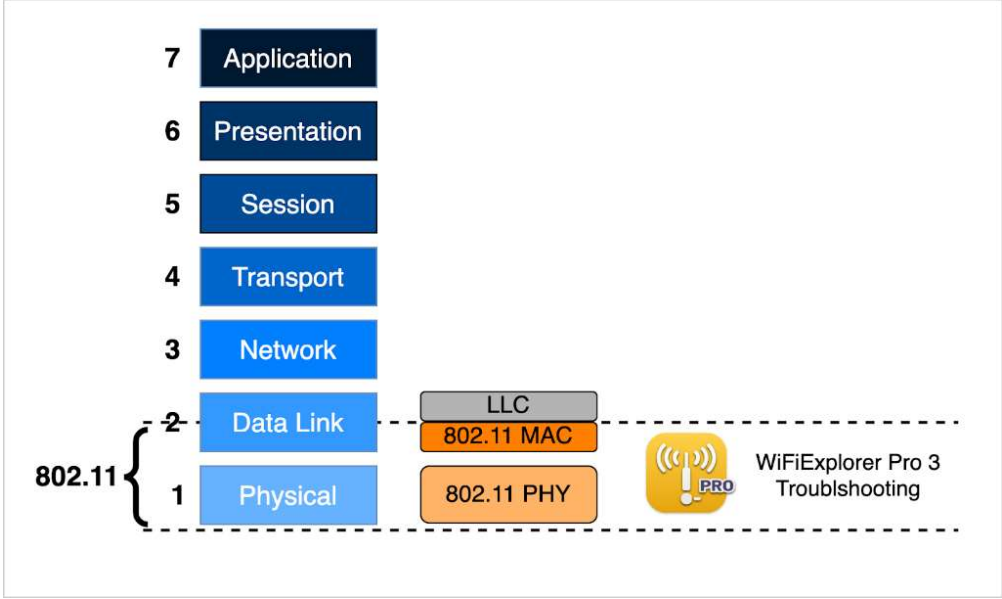

Figure 14-1 - WFE Pro 3 capabilities within the OSI seven-layer model

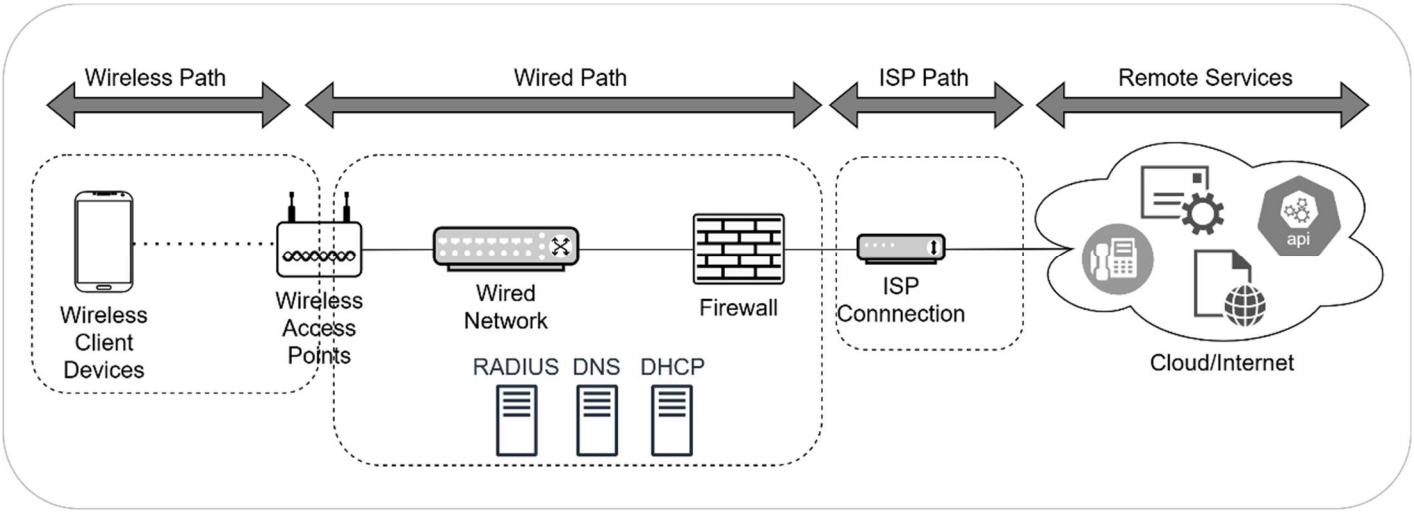

Figure 14-2 - Simplified network model

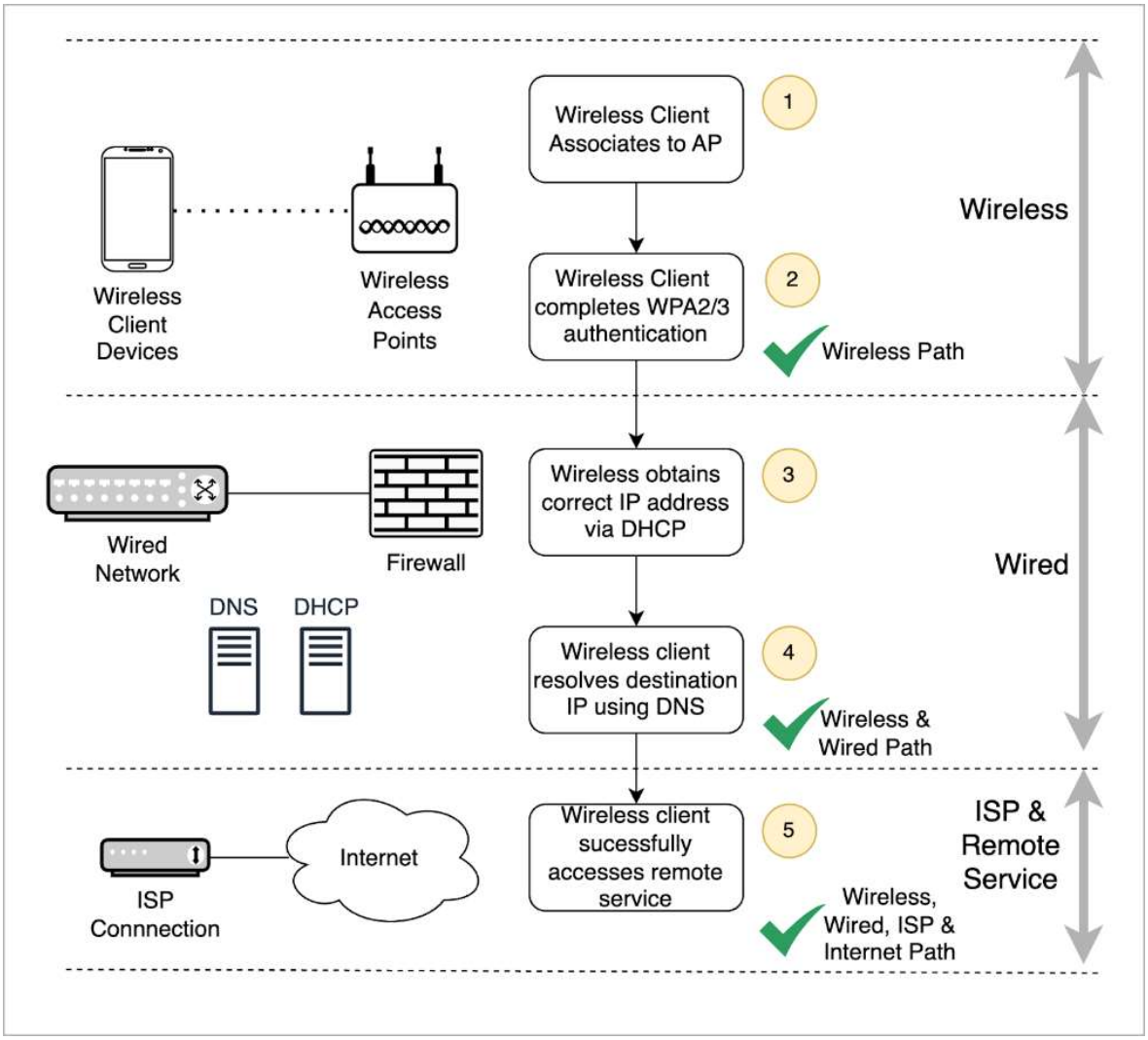

Figure 14-3 - Connectivity flow & dependencies

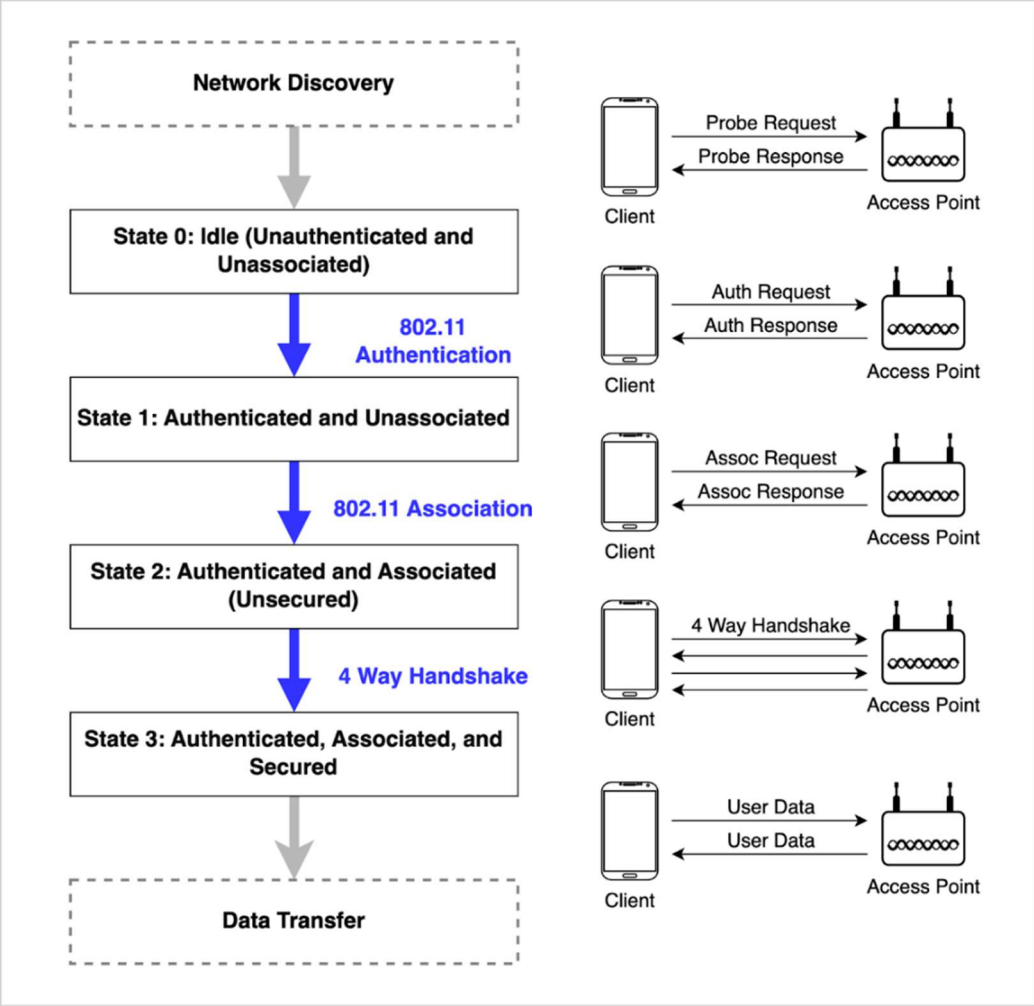

Figure 14-4 - 802.11 state machine

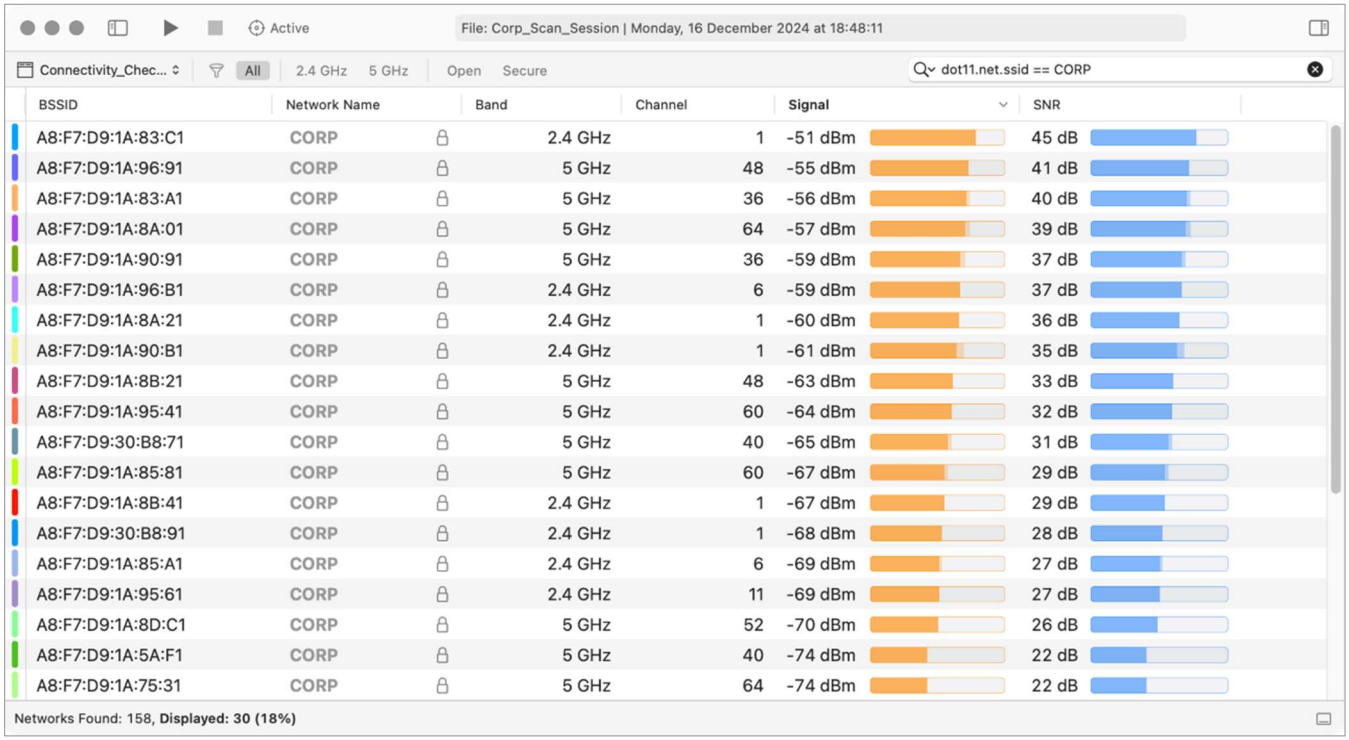

Figure 14-5 - CORP SSID checking

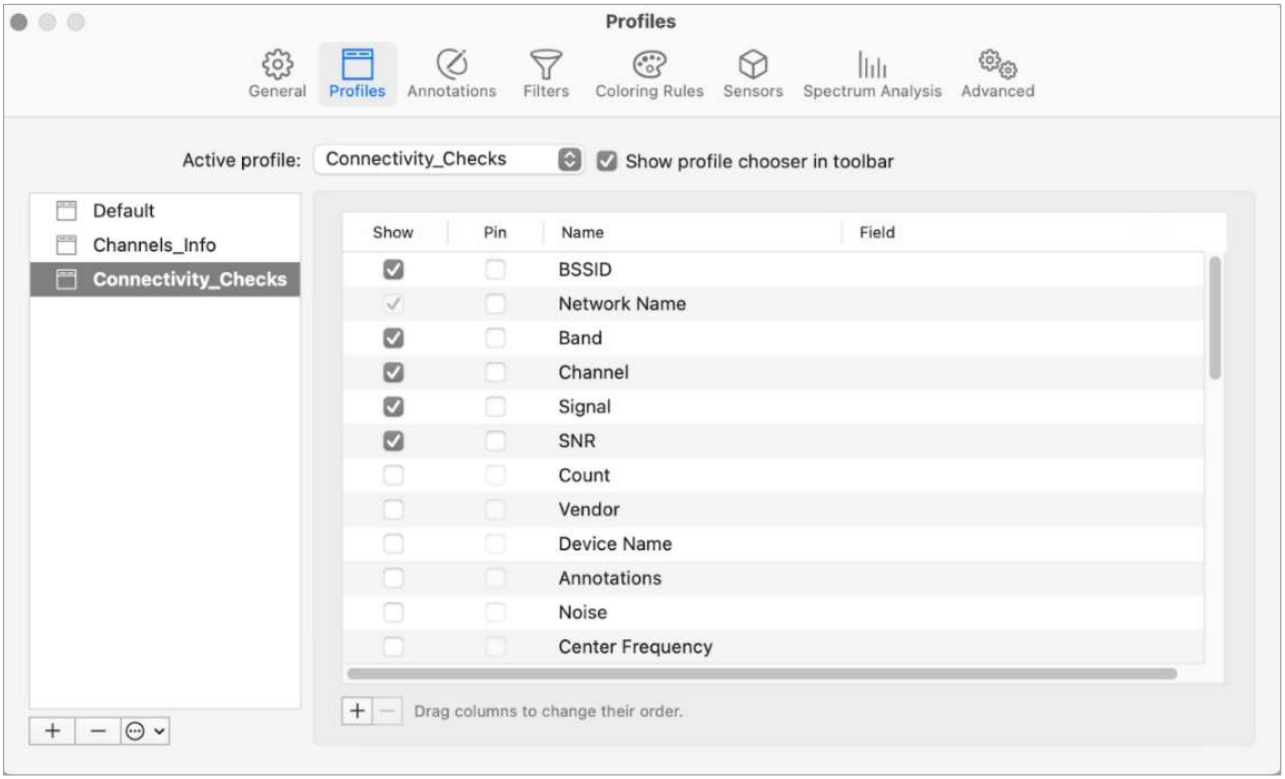

Figure 14-6 - Connectivity checks profile

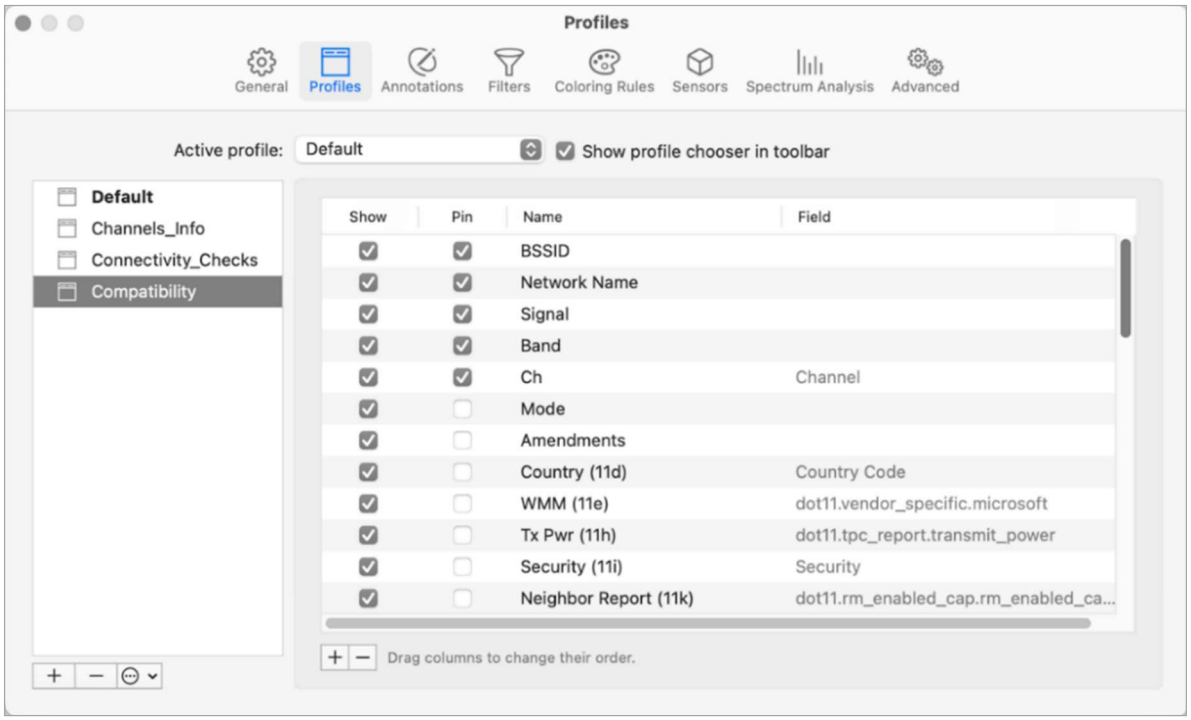

Figure 14-7 - Compatibility profile (1/2)

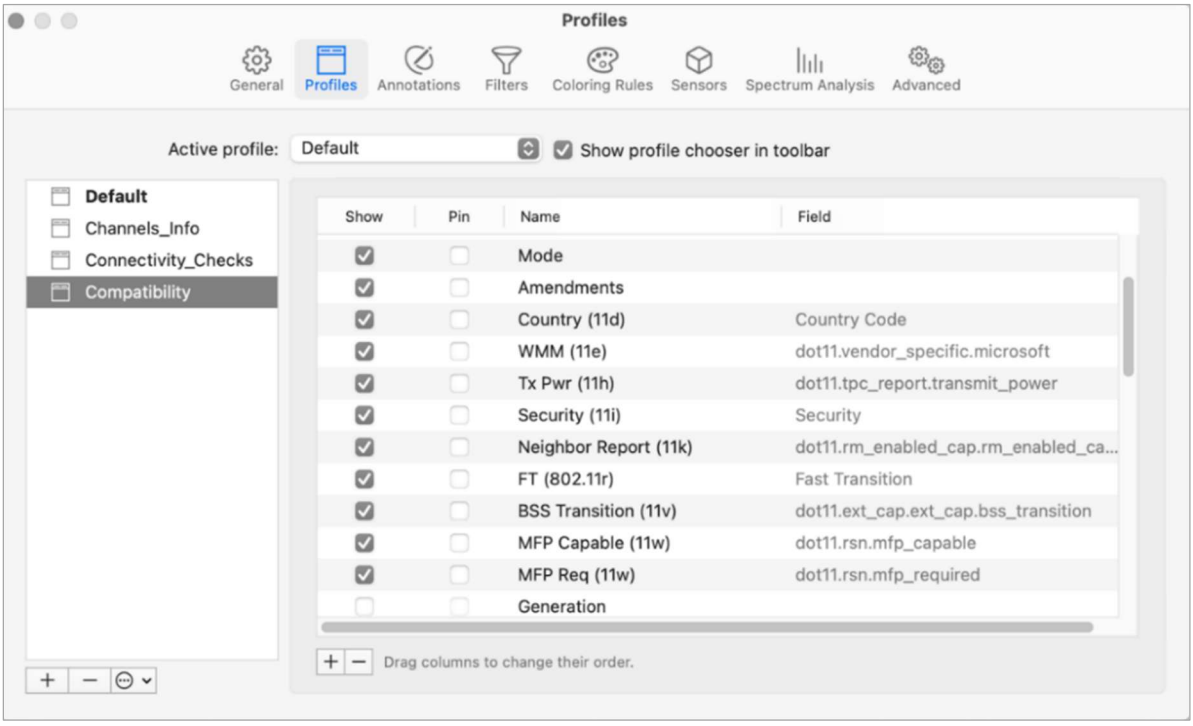

Figure 14-8 - Compatibility profile (2/2)

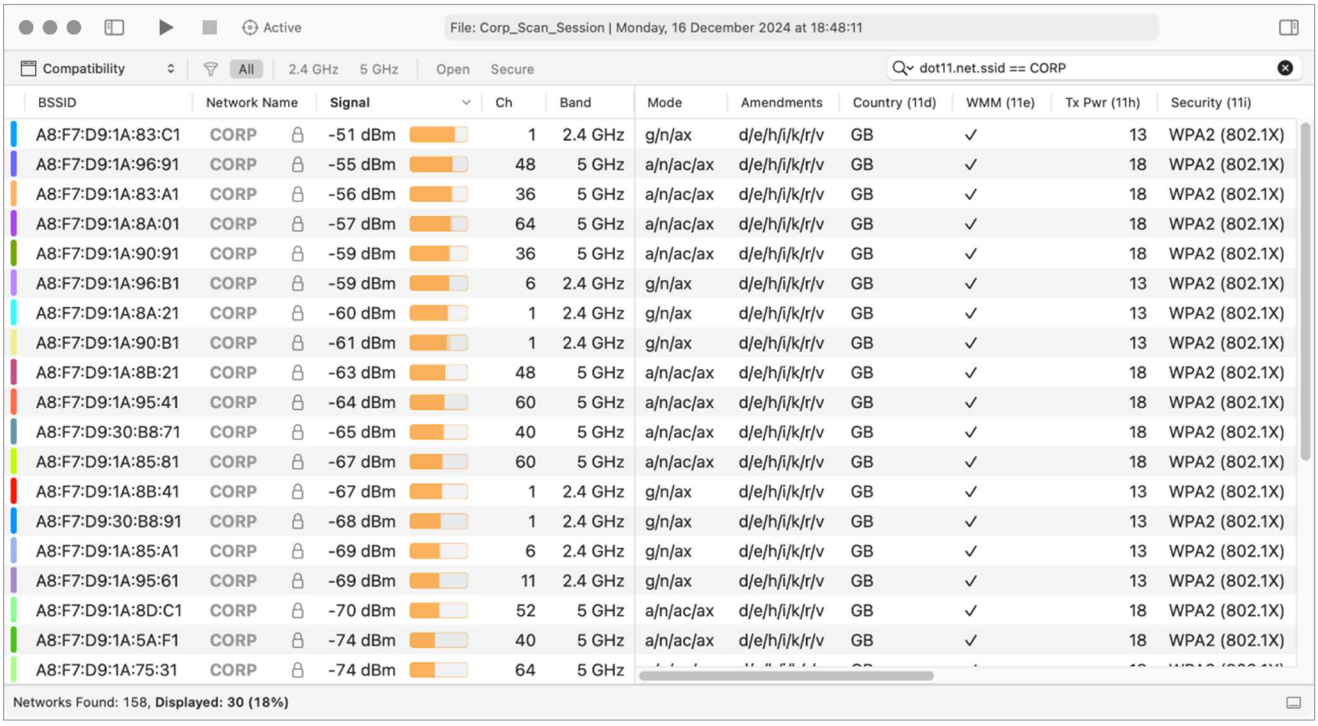

Figure 14-9 - 802.11 feature (amendments) checks (1/2)

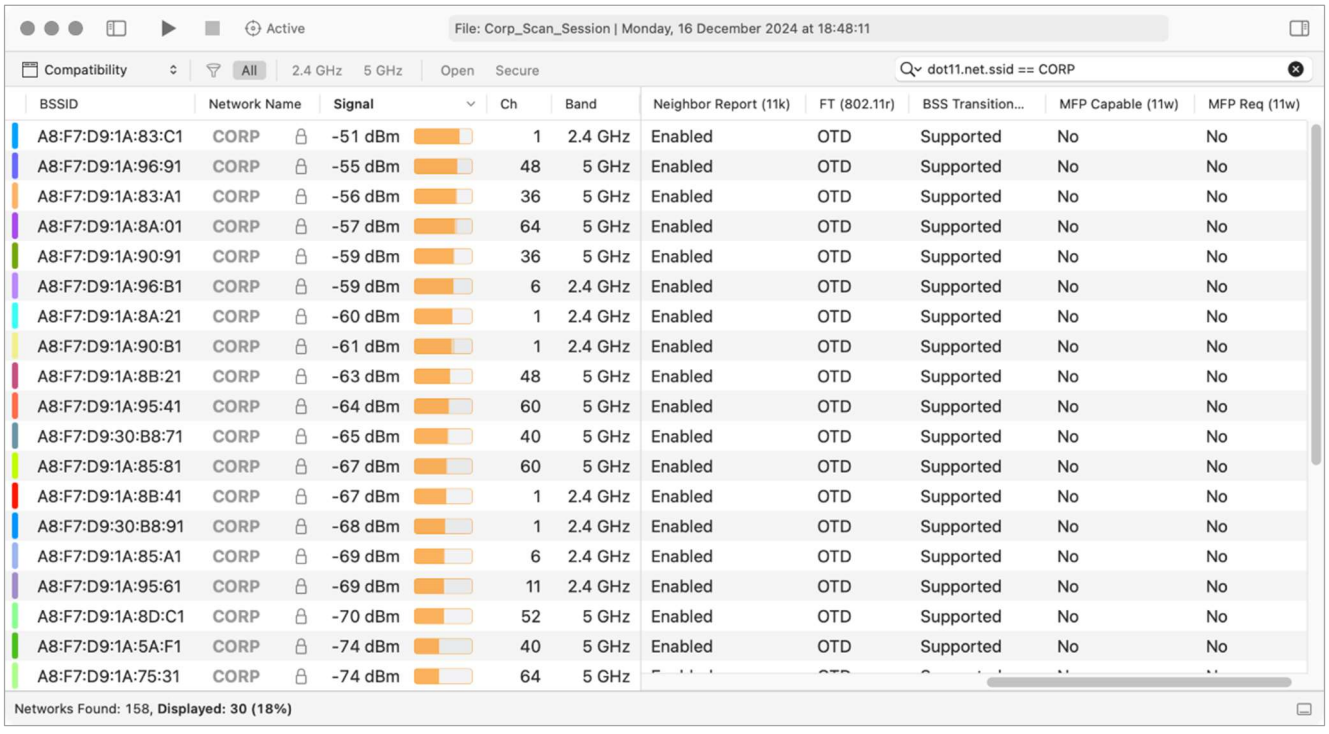

Figure 14-10 - 802.11 feature (amendments) checks (2/2)

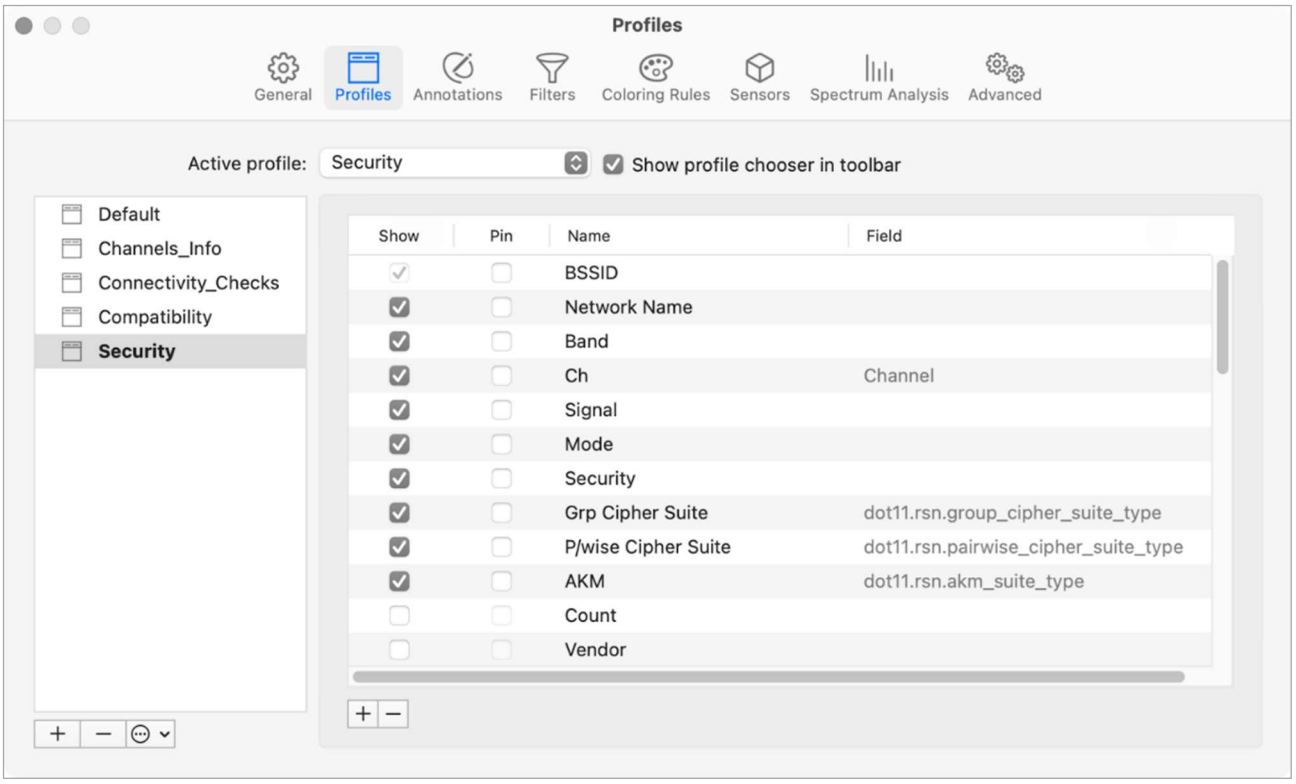

Figure 14-11 - Security profile

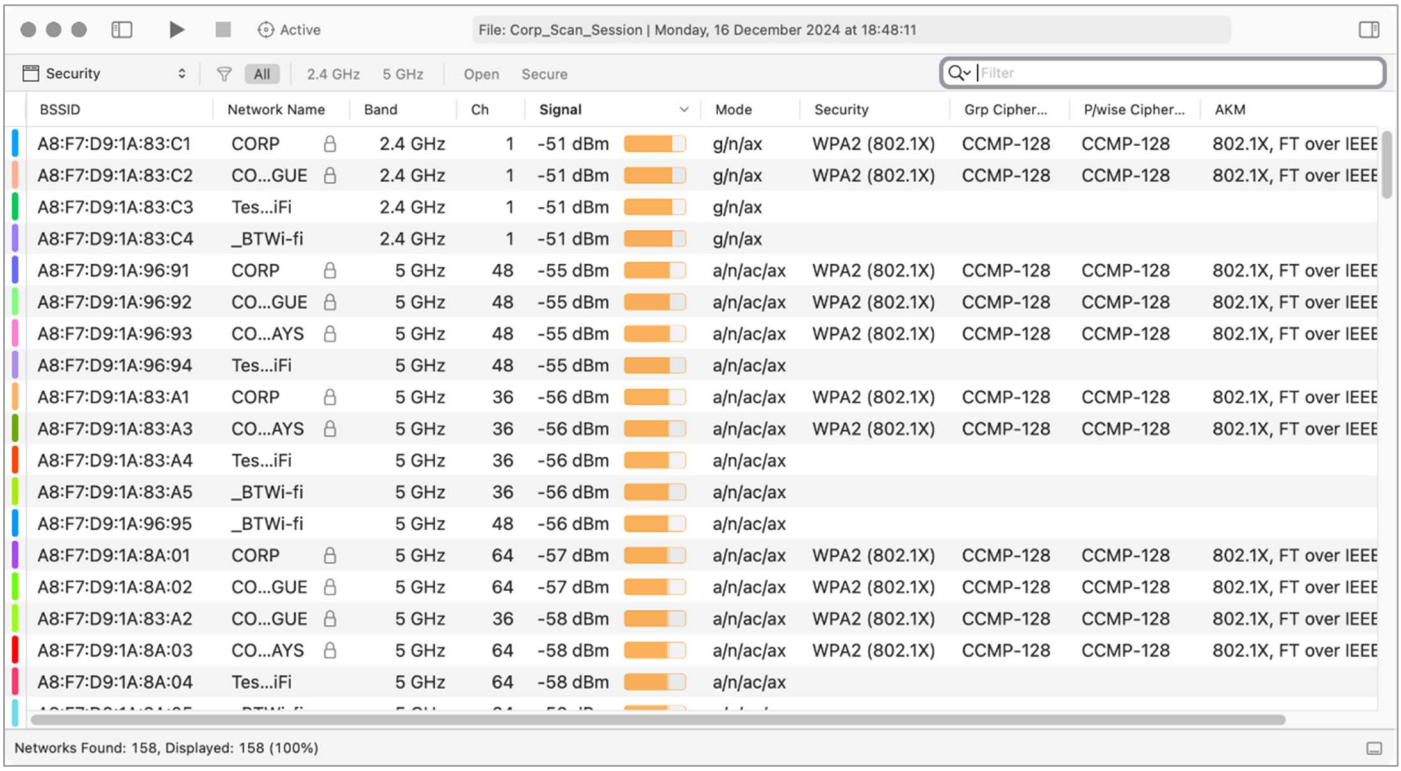

Figure 14-12 - Security check #1

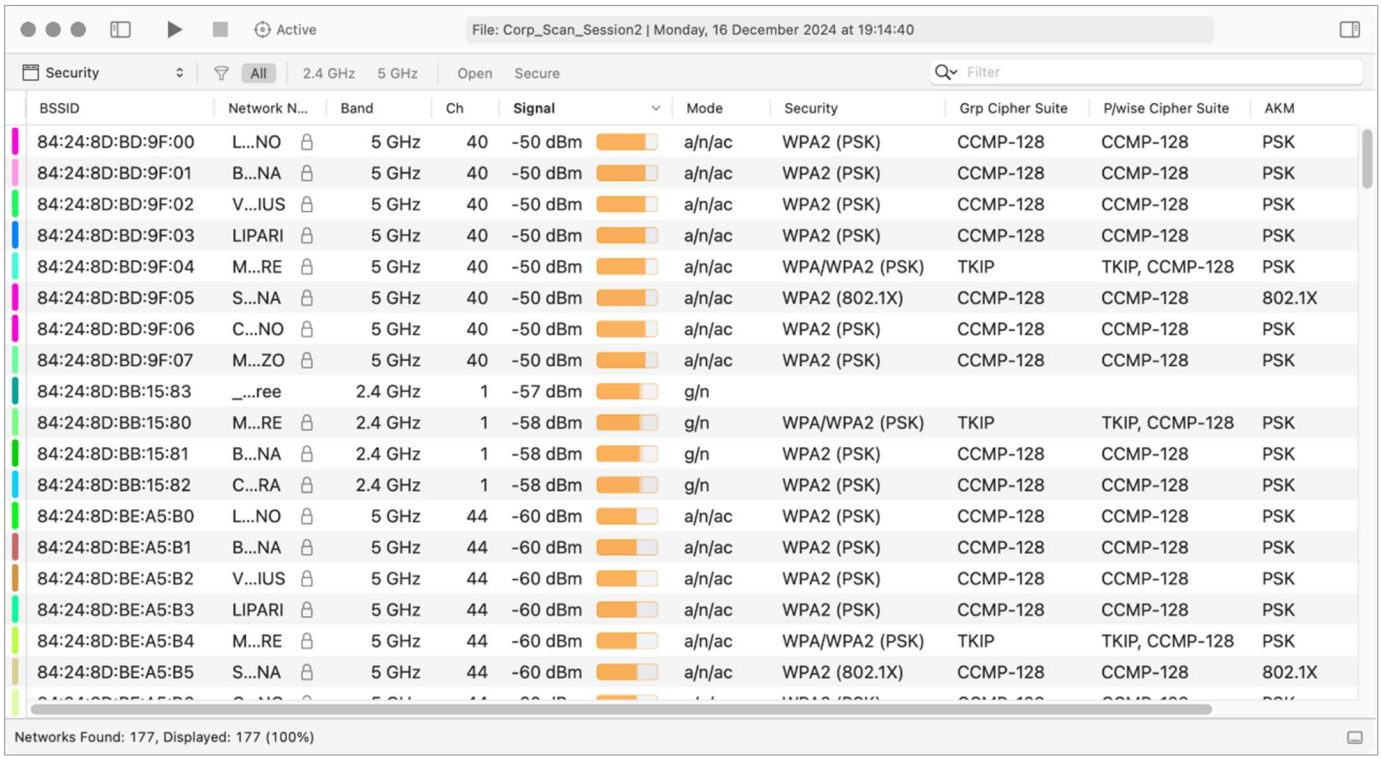

Figure 14-13 - Security check #2

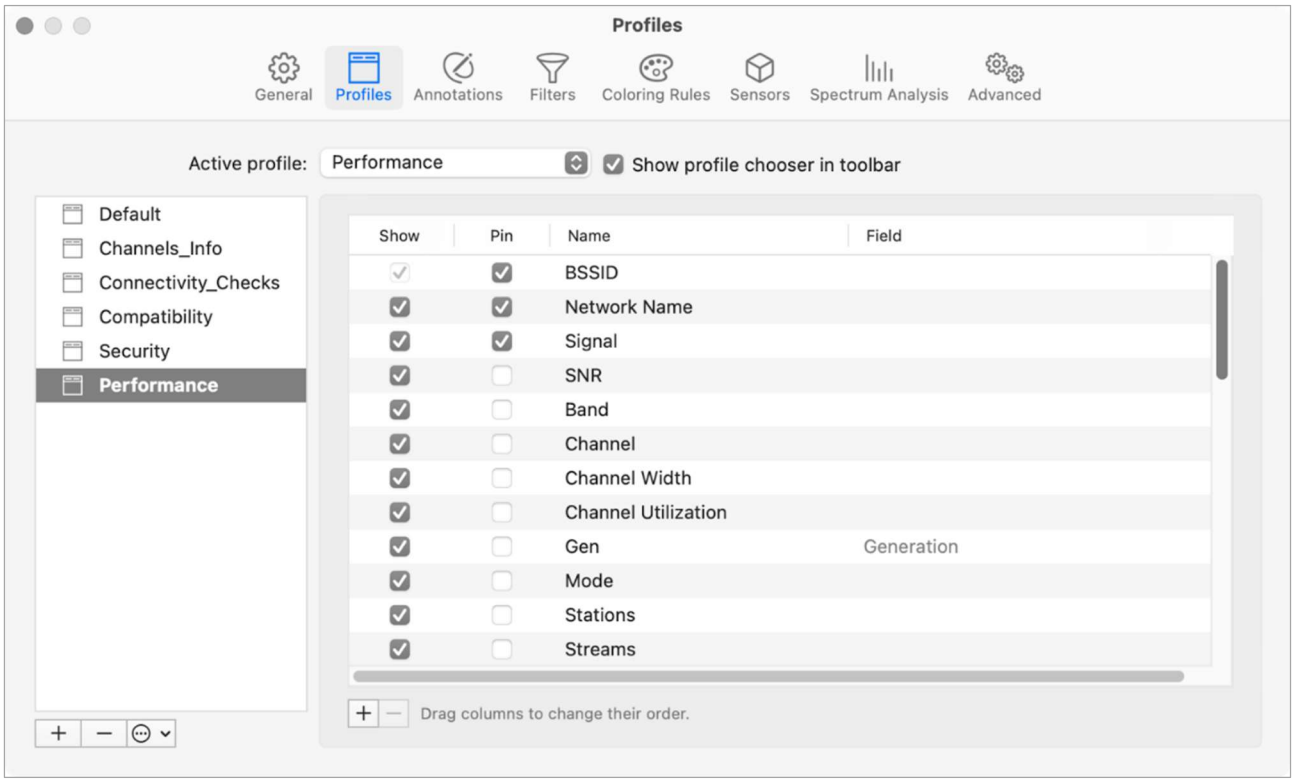

Figure 14-14 - Performance profile (1/2)

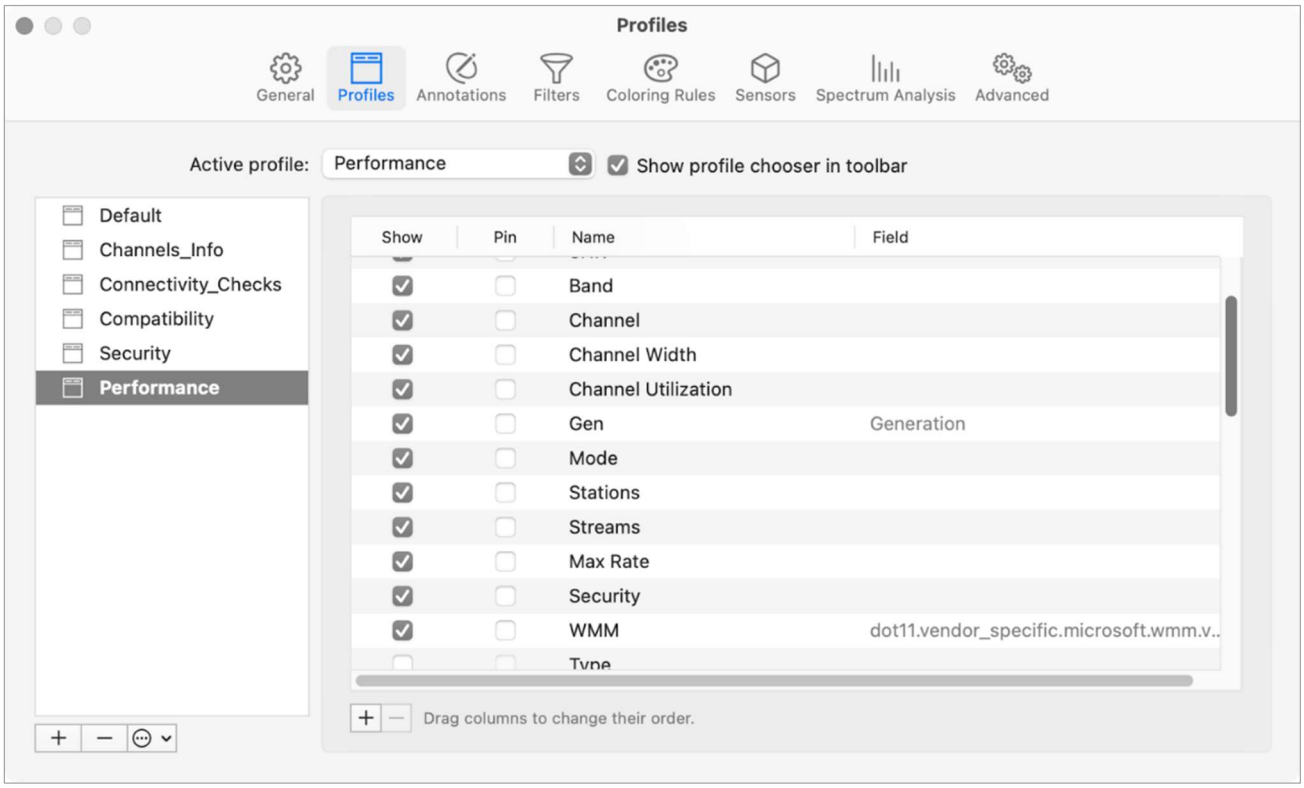

Figure 14-15 - Performance profile (2/2)

Figure 14-16 - Performance profile example (1/2)

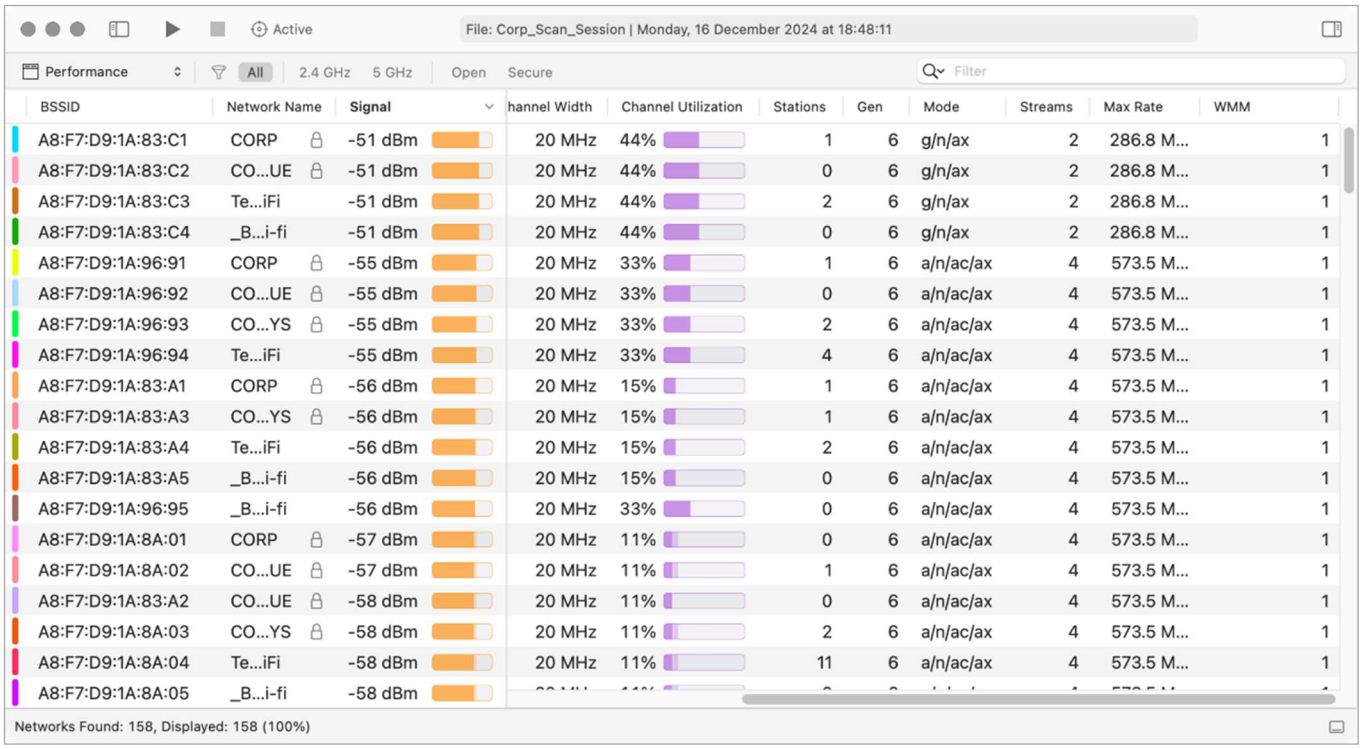

Figure 14-17 - Performance profile example (2/2)

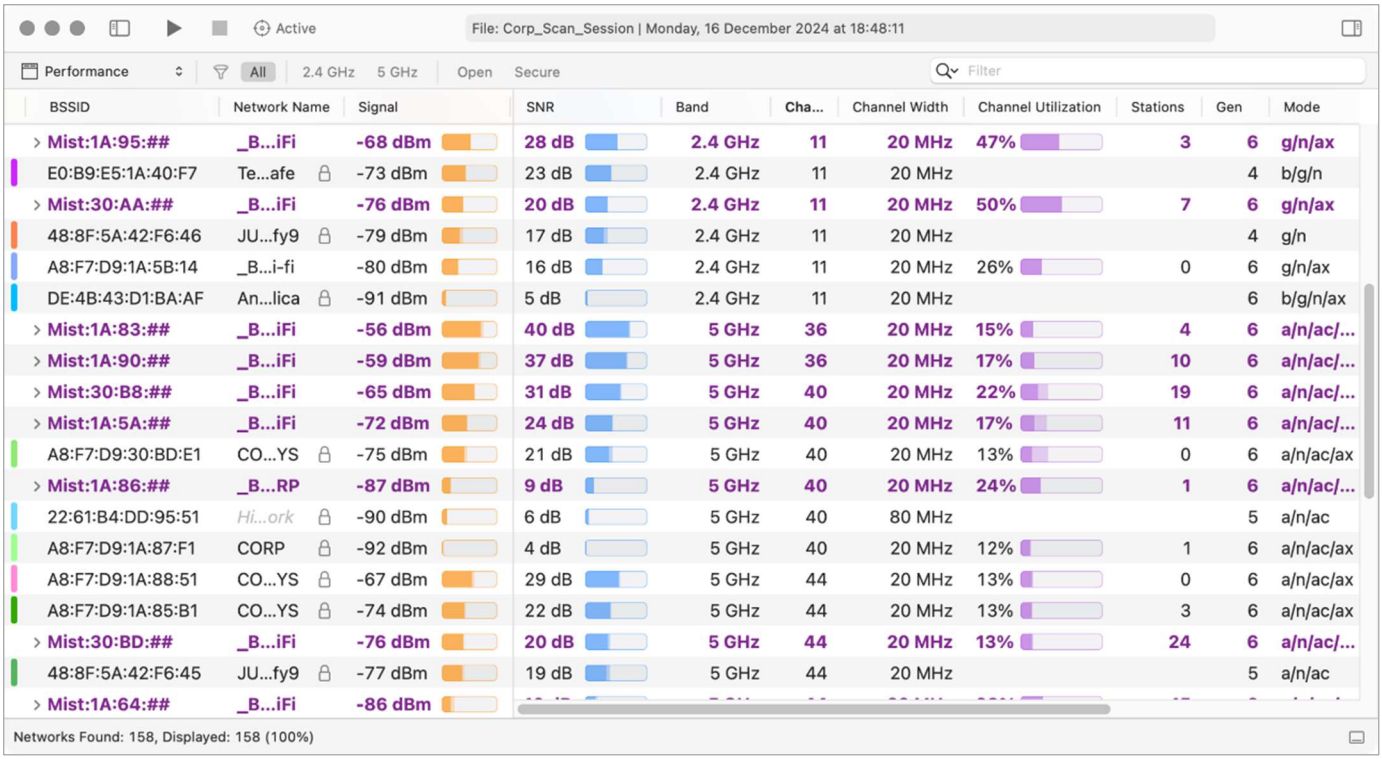

Figure 14-18 - Performance profile example - consolidated, per radio view

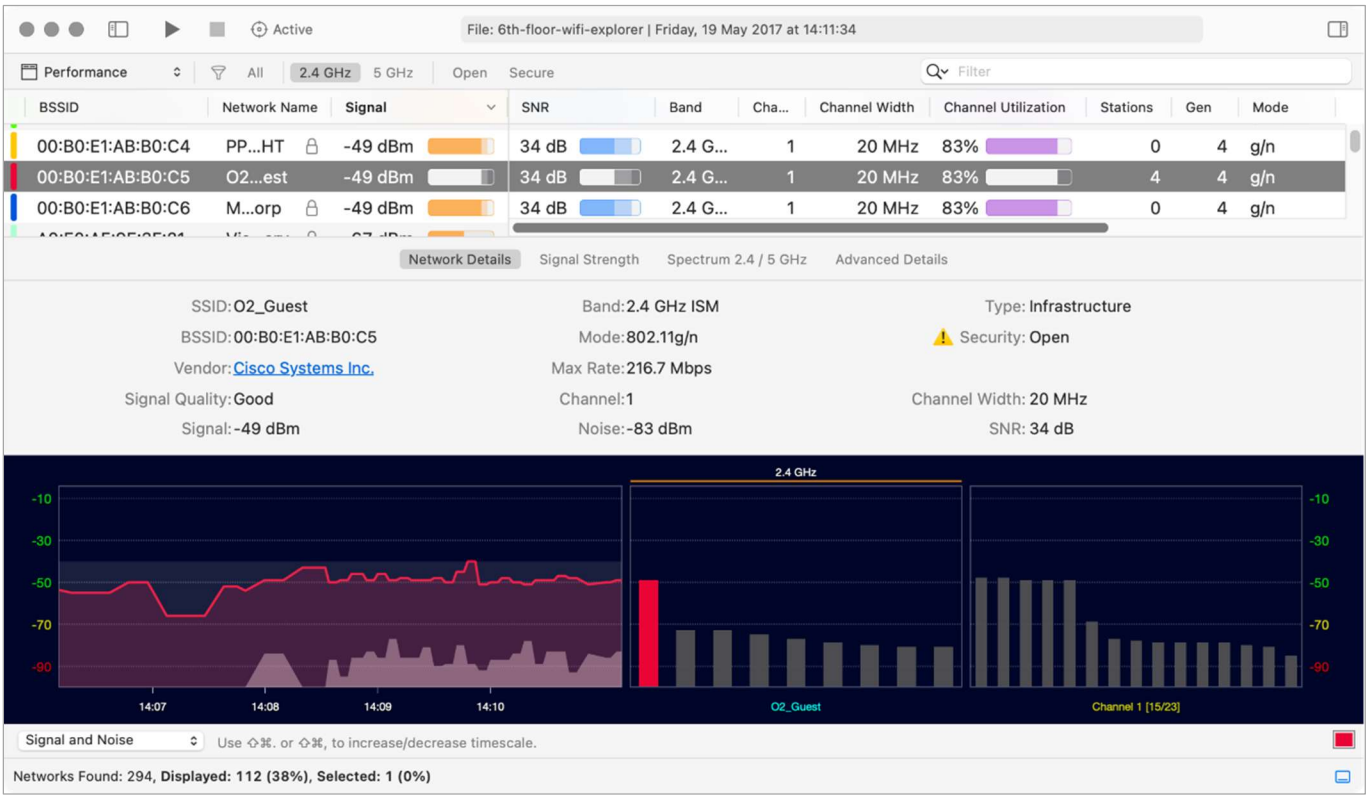

Figure 14-19 - Network Details view for an SSID under investigation

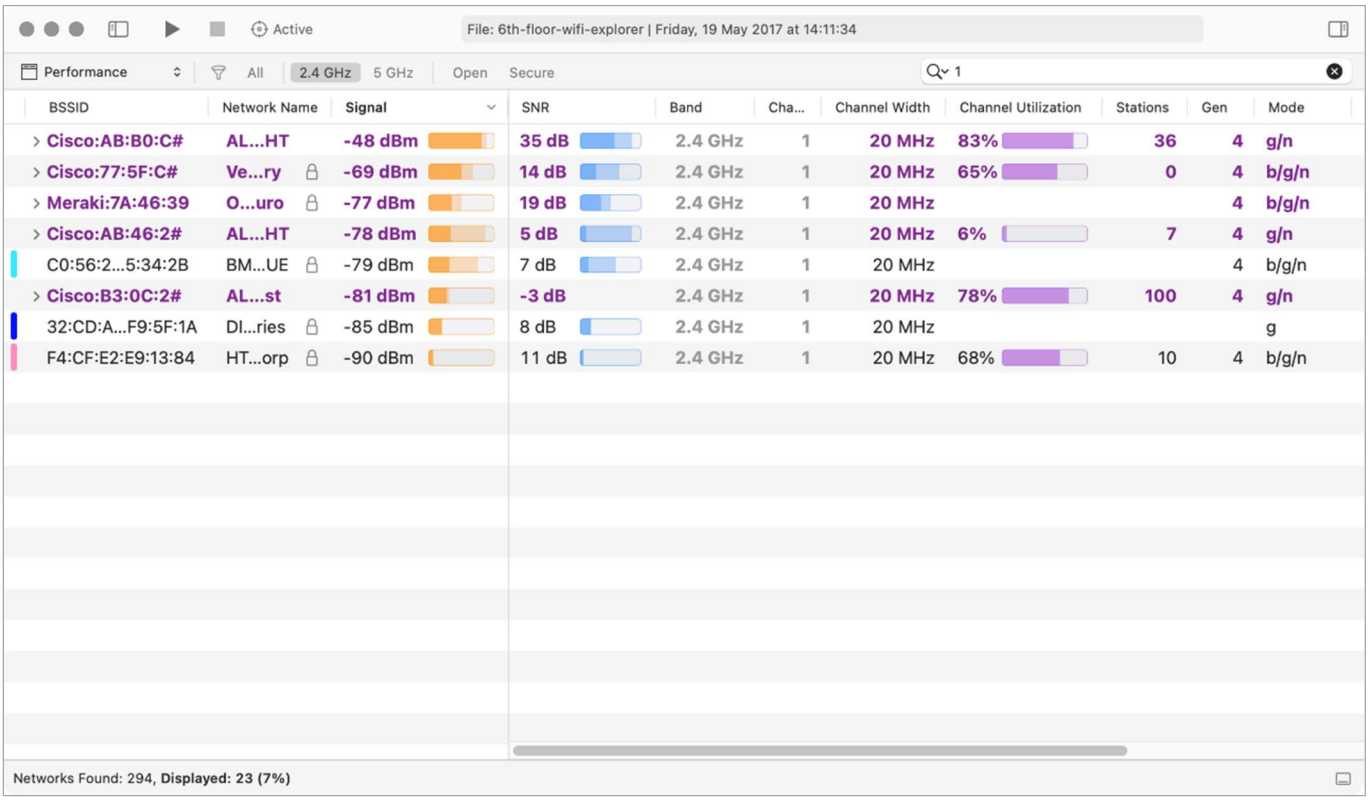

Figure 14-20 - Consolidated view using *View > Organize Networks By Access Point Radio*

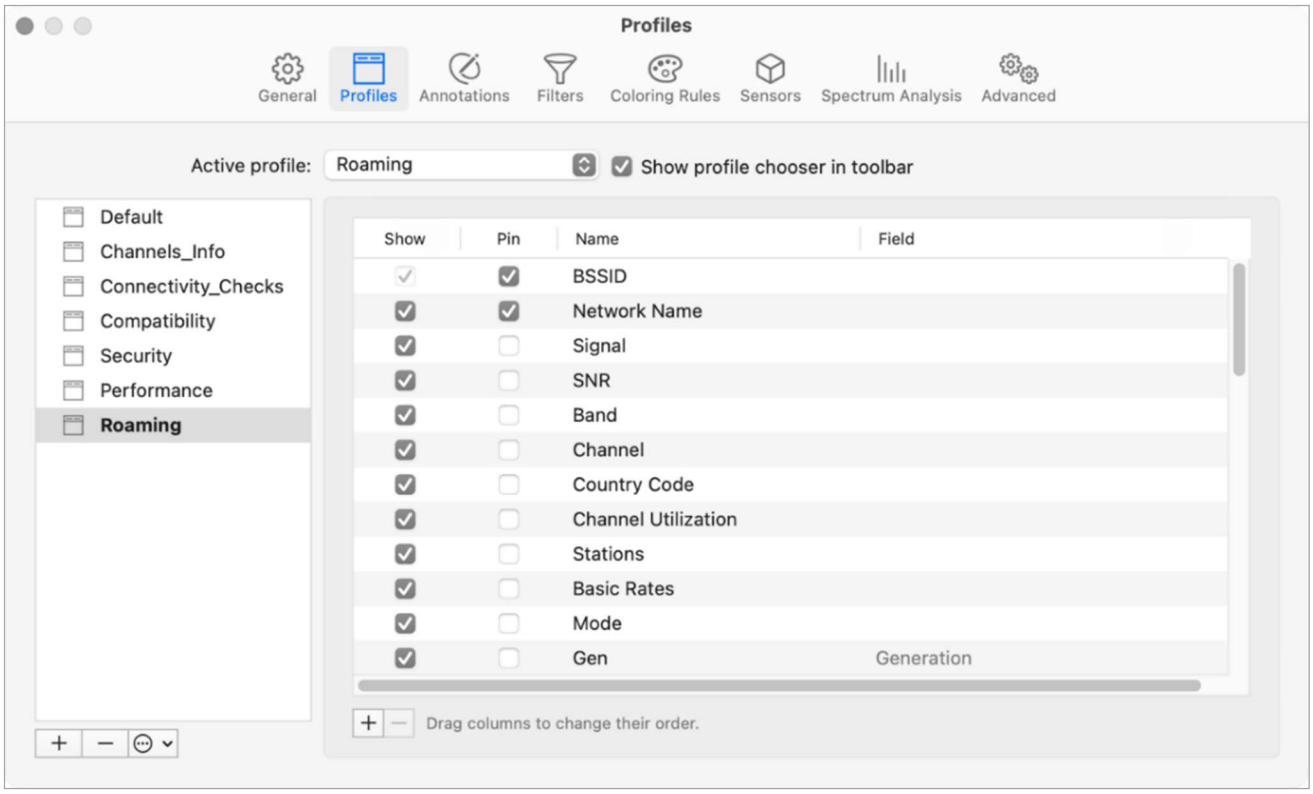

Figure 14-21 - Roaming profile (1/2)

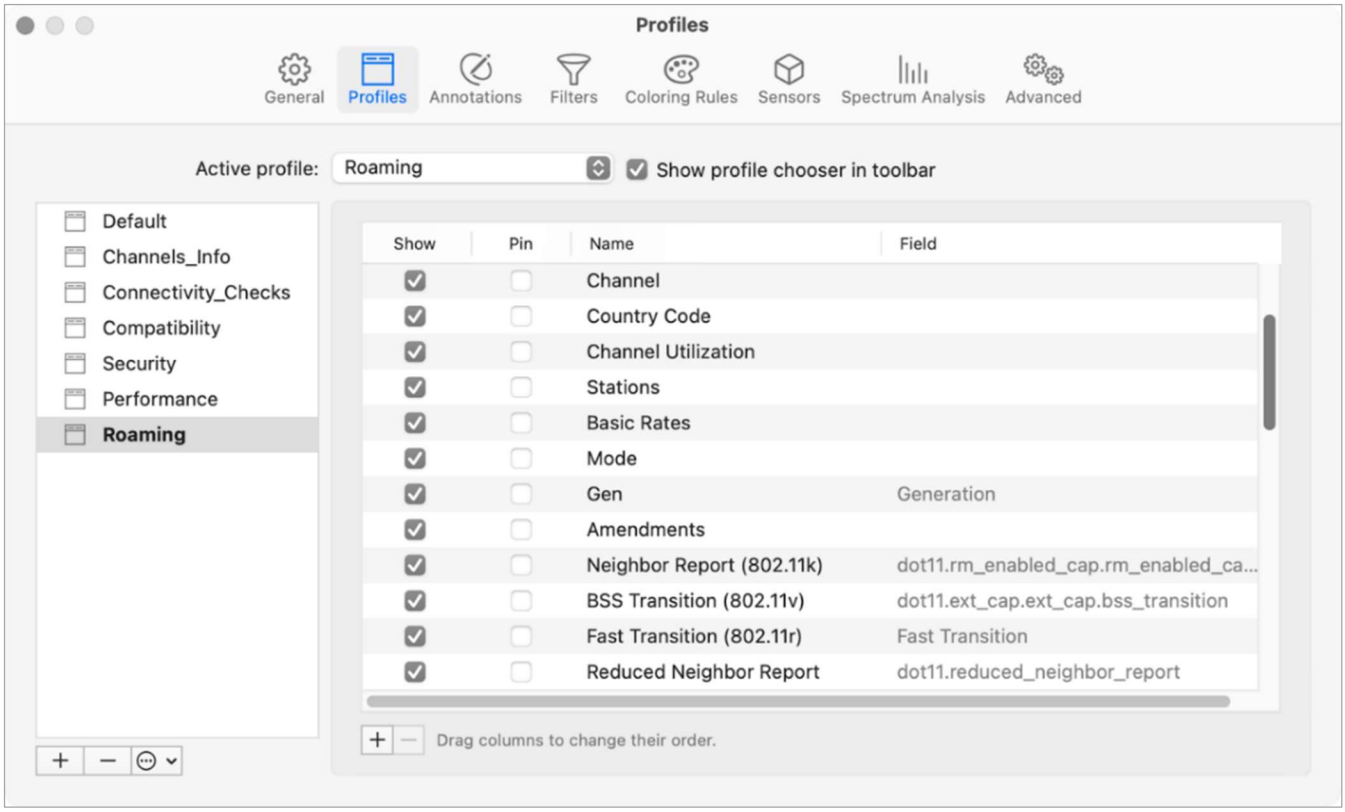

Figure 14-22 - Roaming profile (2/2)

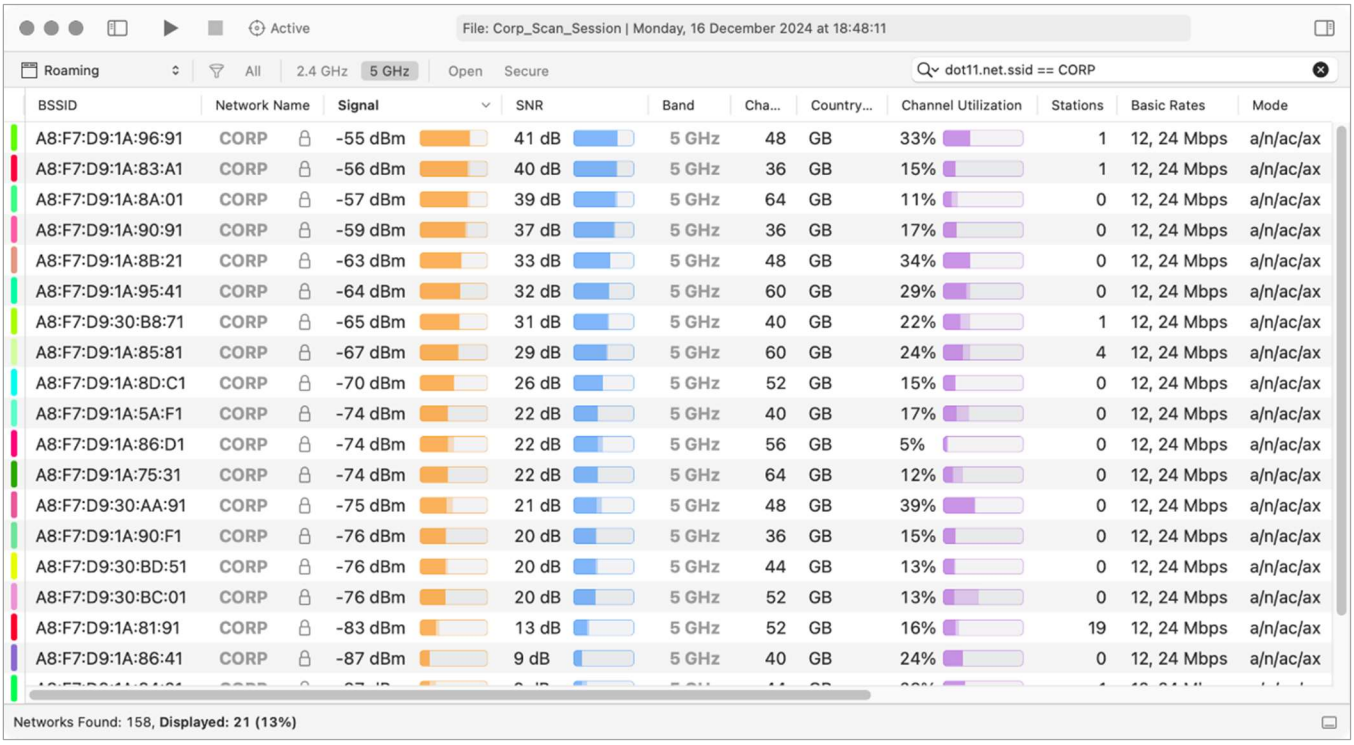

Figure 14-23 - Networks table with Roaming profile applied (1/2)

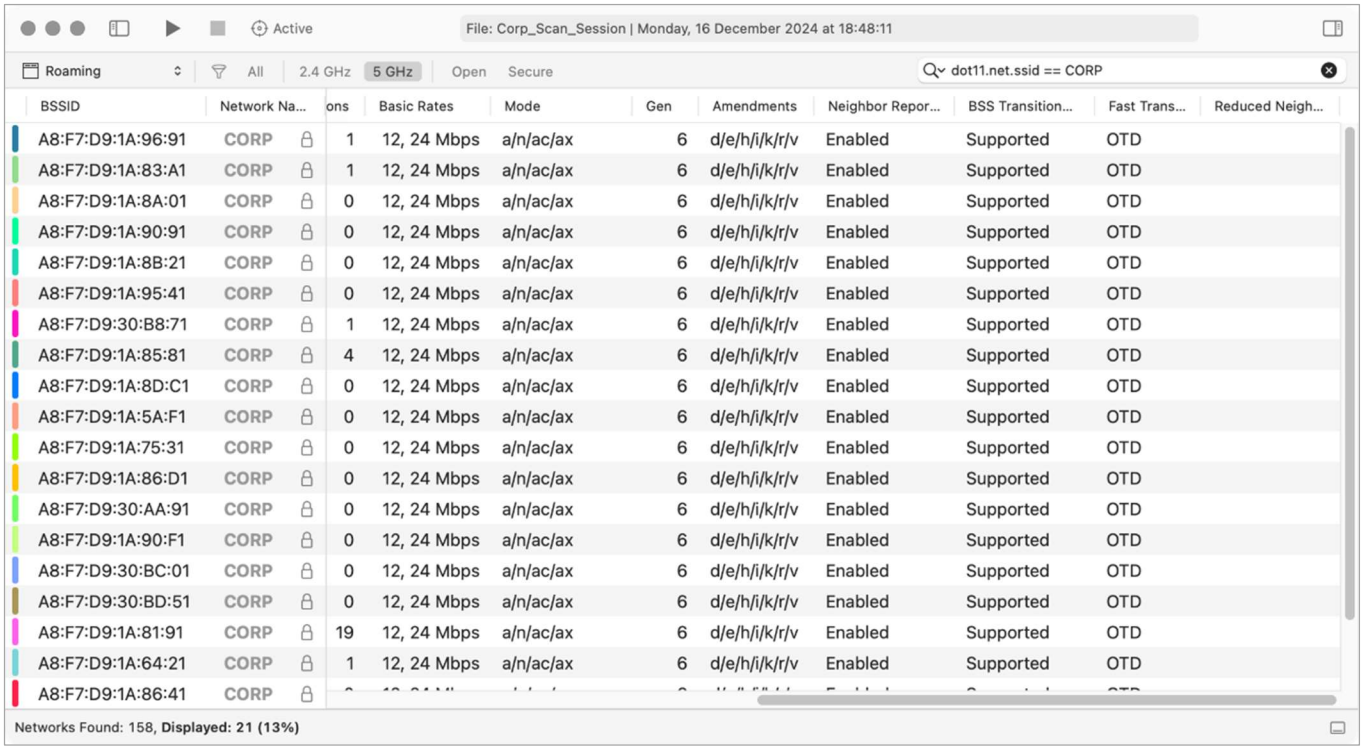

Figure 14-24 - Networks table with Roaming profile applied (2/2)

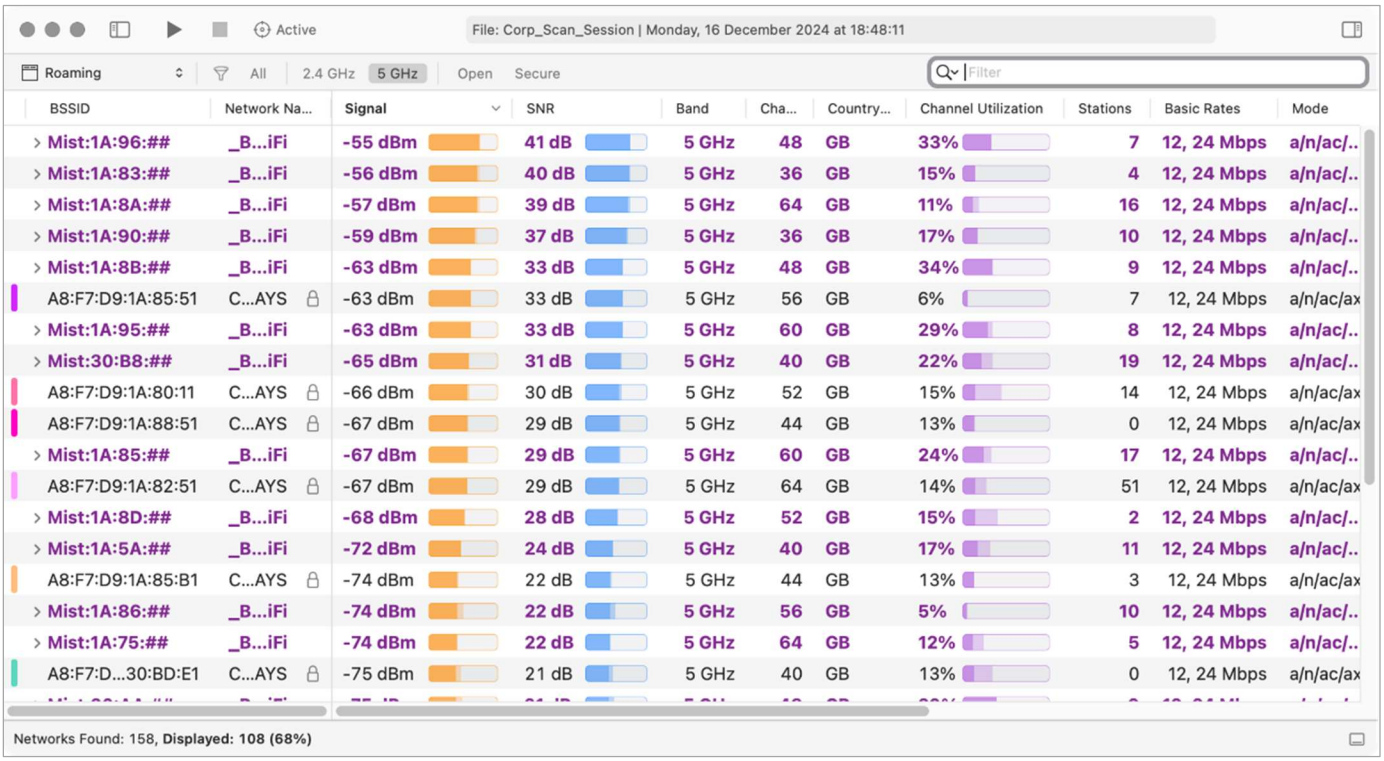

Figure 14-25 - Networks table organized by AP radio with Roaming profile applied

Chapter 15 - Data Export & Reporting

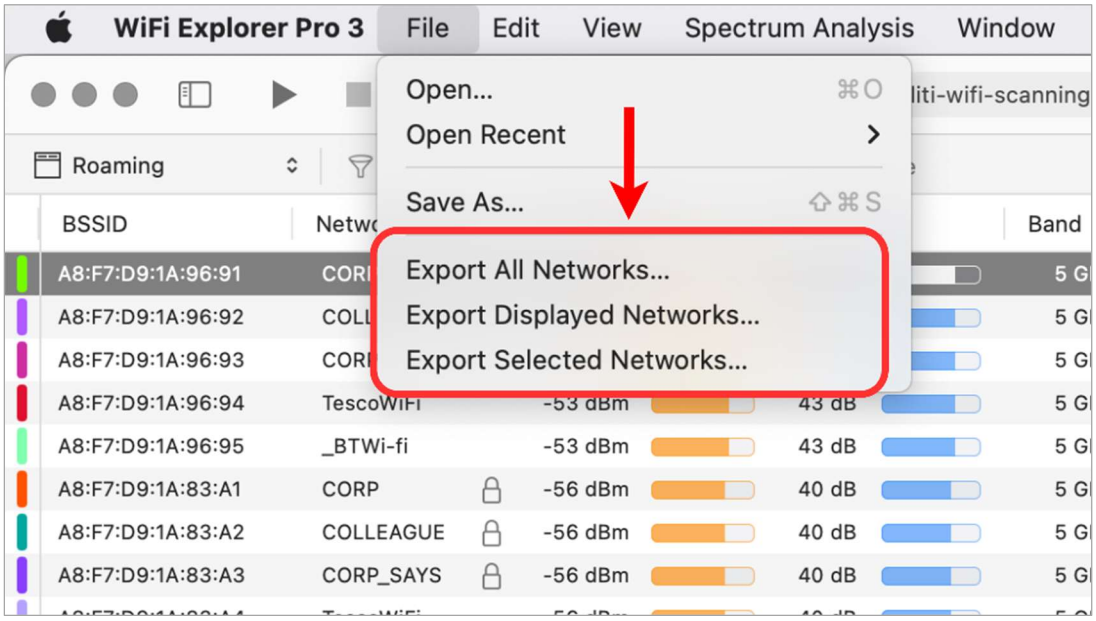

Figure 15-1: Export options available via the *File* menu

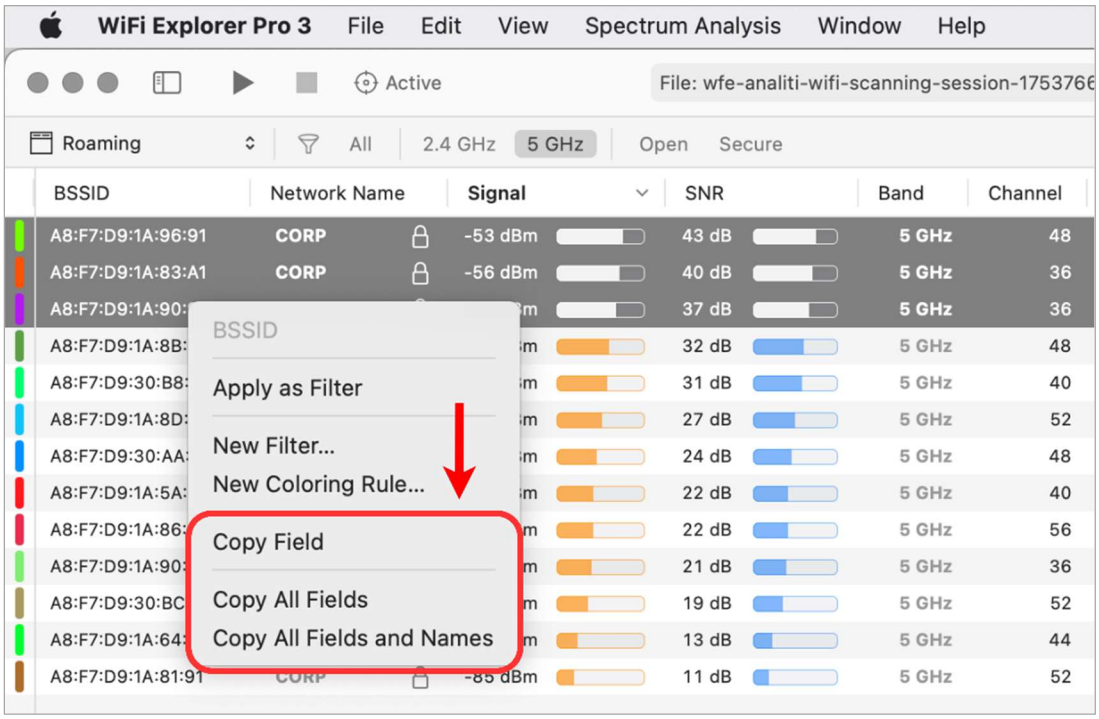

Figure 15-2: Copy options available via Control-click

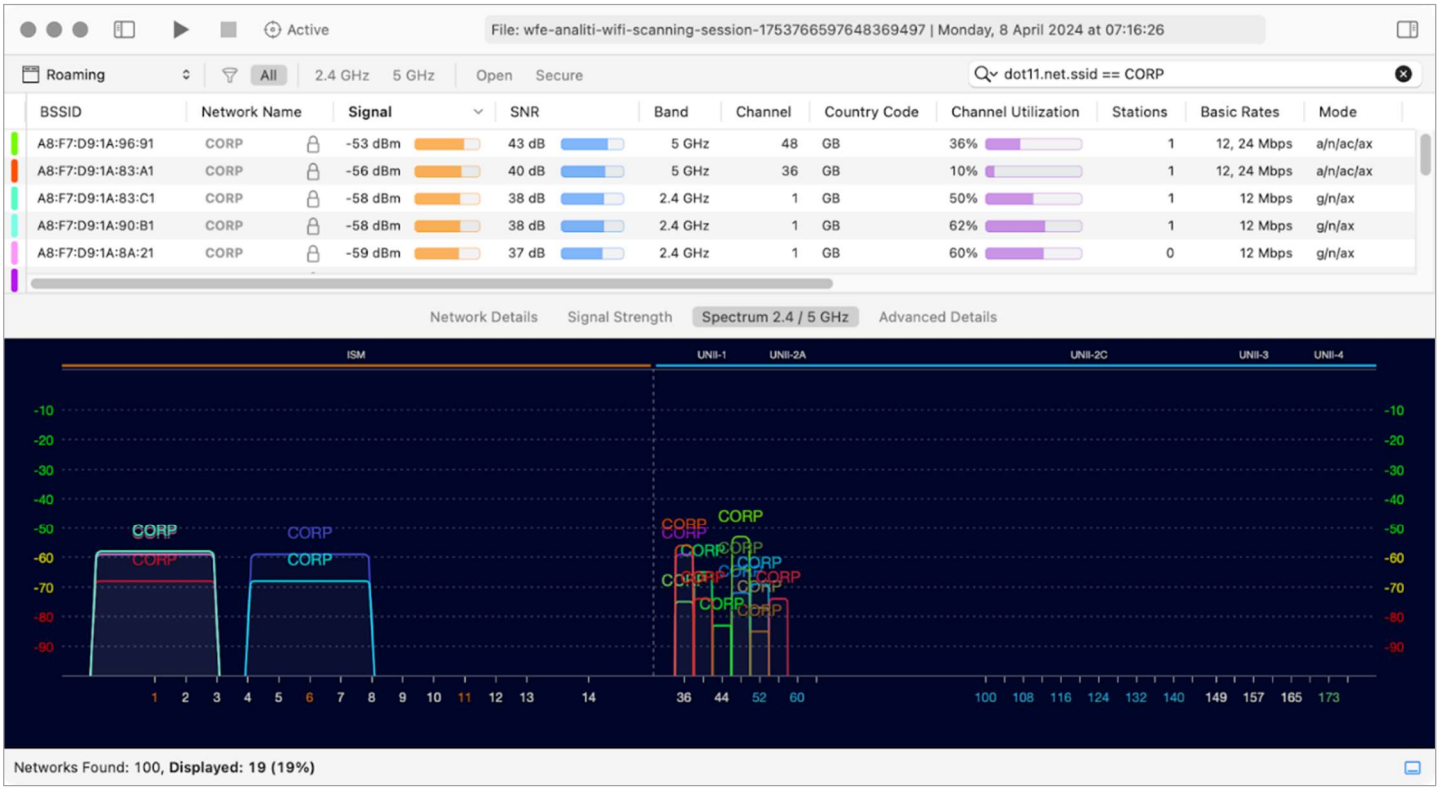

Figure 15-3: Spectrum 2.4/5 GHz panel used for drag and drop

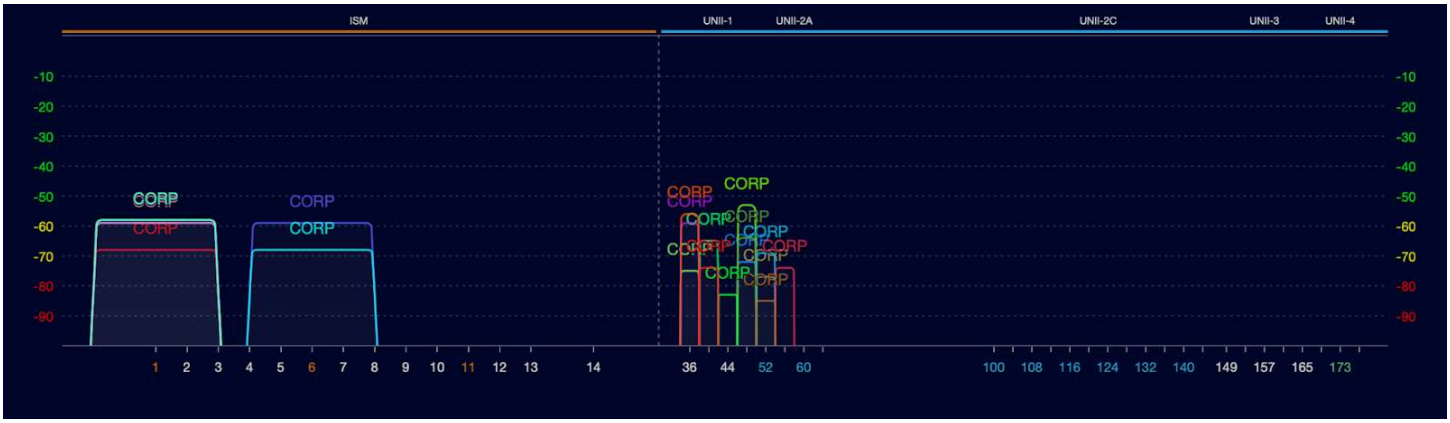

Figure 15-4: Resulting image from panel image drag and drop

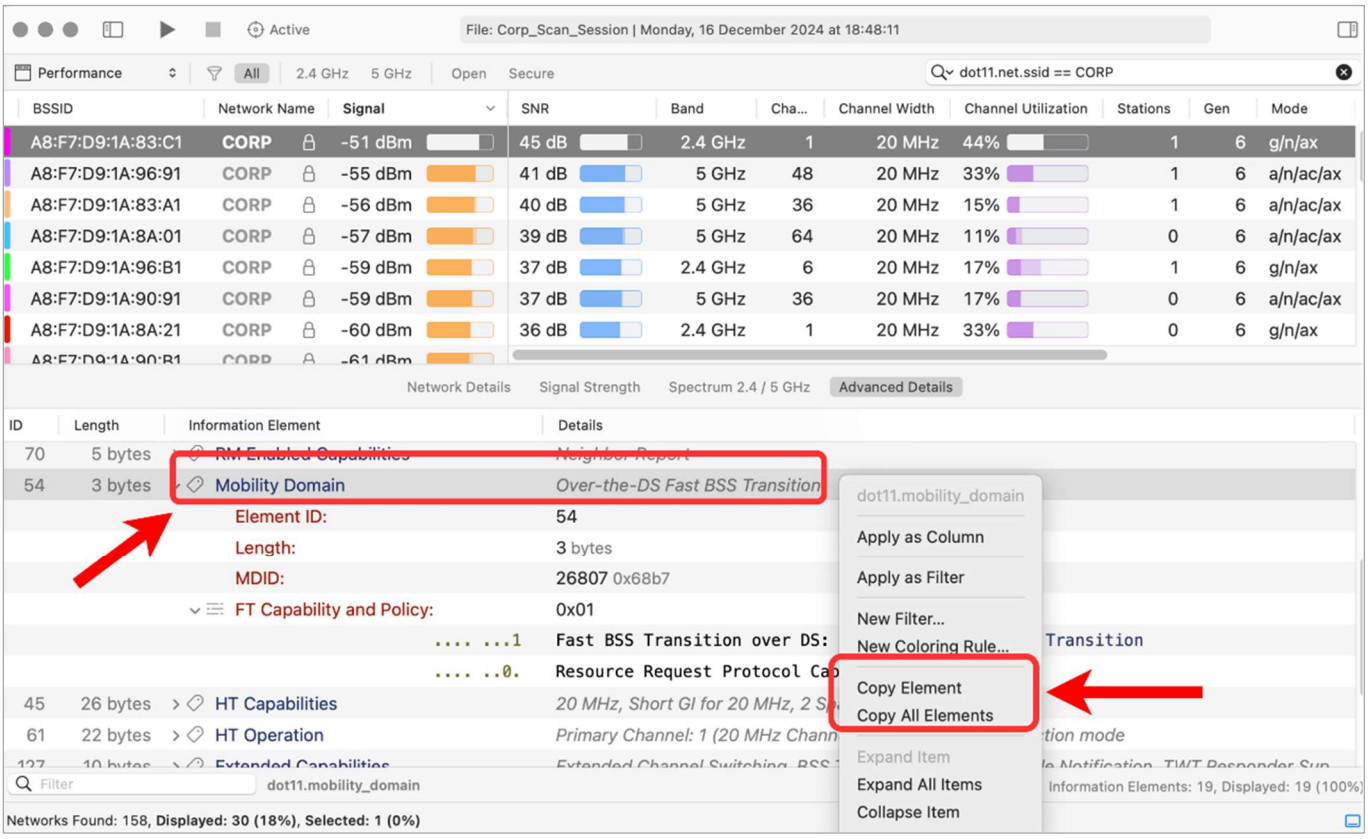

Figure 15-5: Information element data copy options

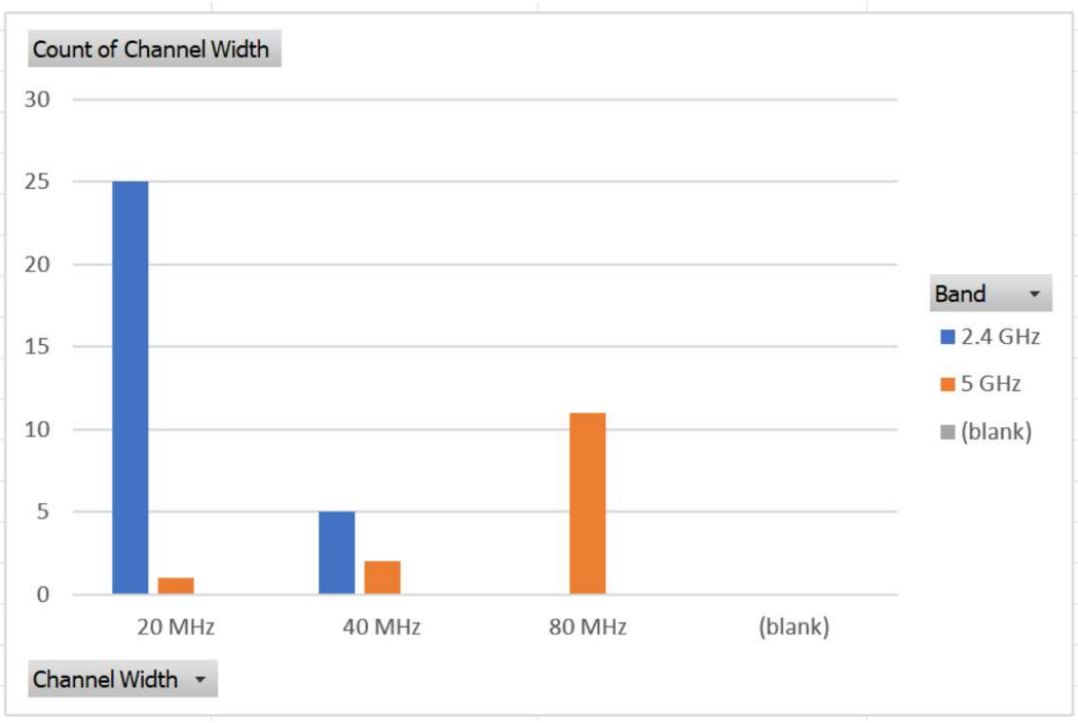

Figure 15-6 - Sample report created from CSV data using Excel

Chapter 16 - RF Environment Auditing

No screenshots.

Chapter 17 - Raspberry Pi Sensor

Figure 17-1 - microSD reader (USB-A) with microSD card

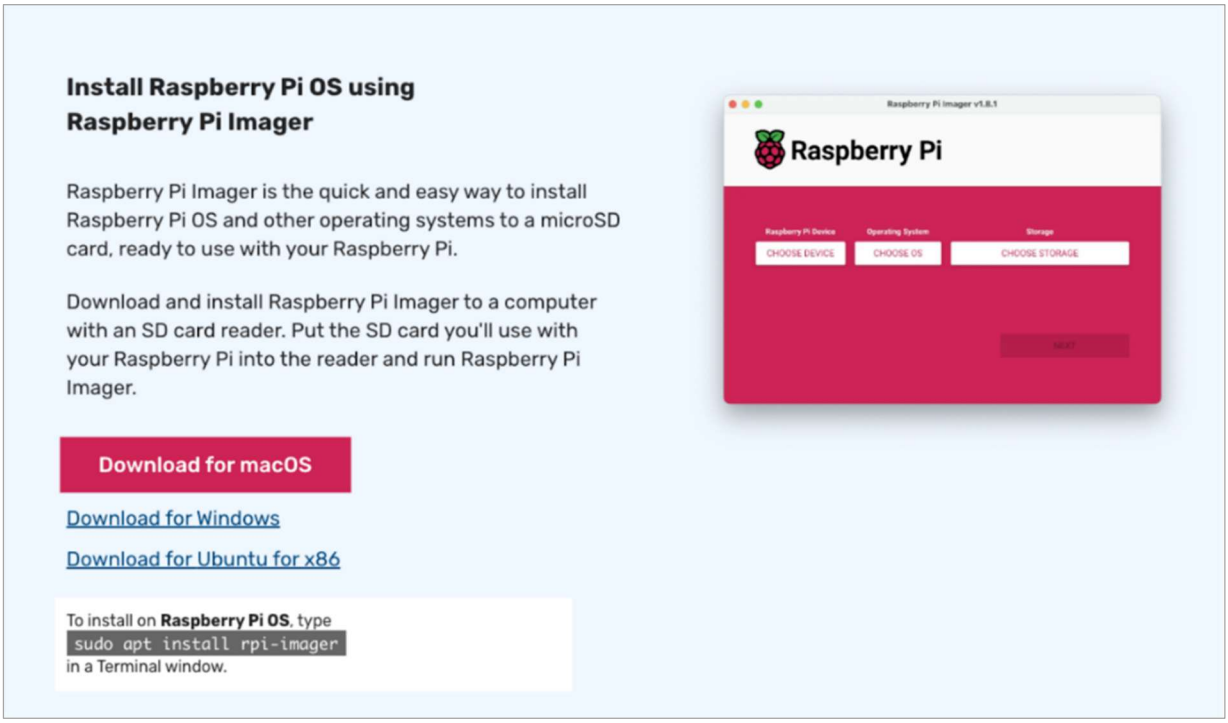

Figure 17-2 - Screenshot of Raspberry Pi Imager download page

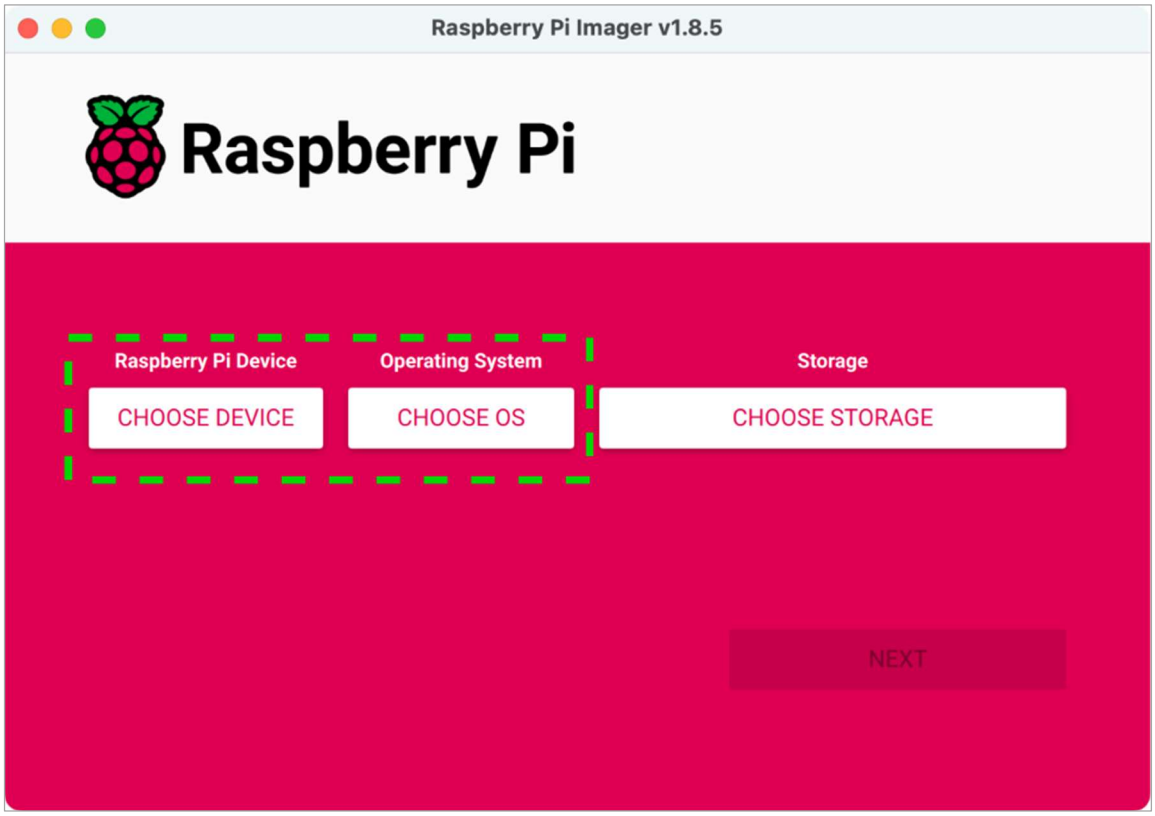

Figure 17-3 - Choose device & OS

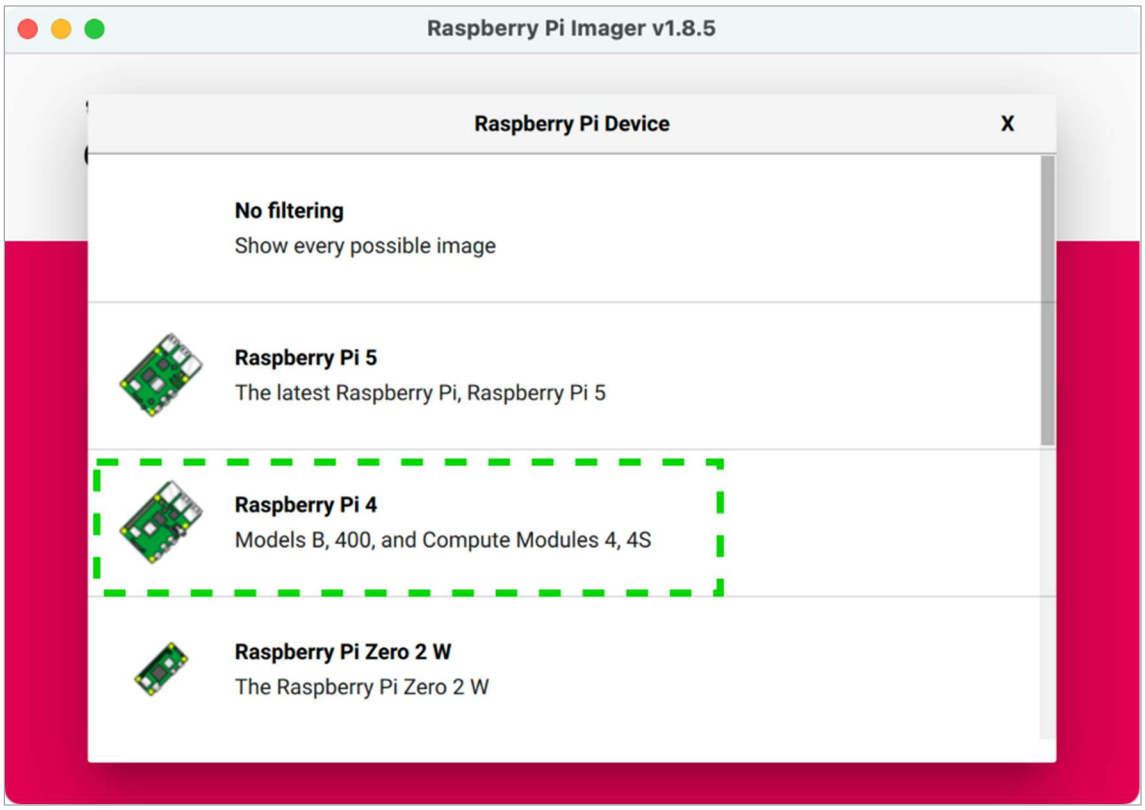

Figure 17-4 – Select the RPi4 (or your particular model)

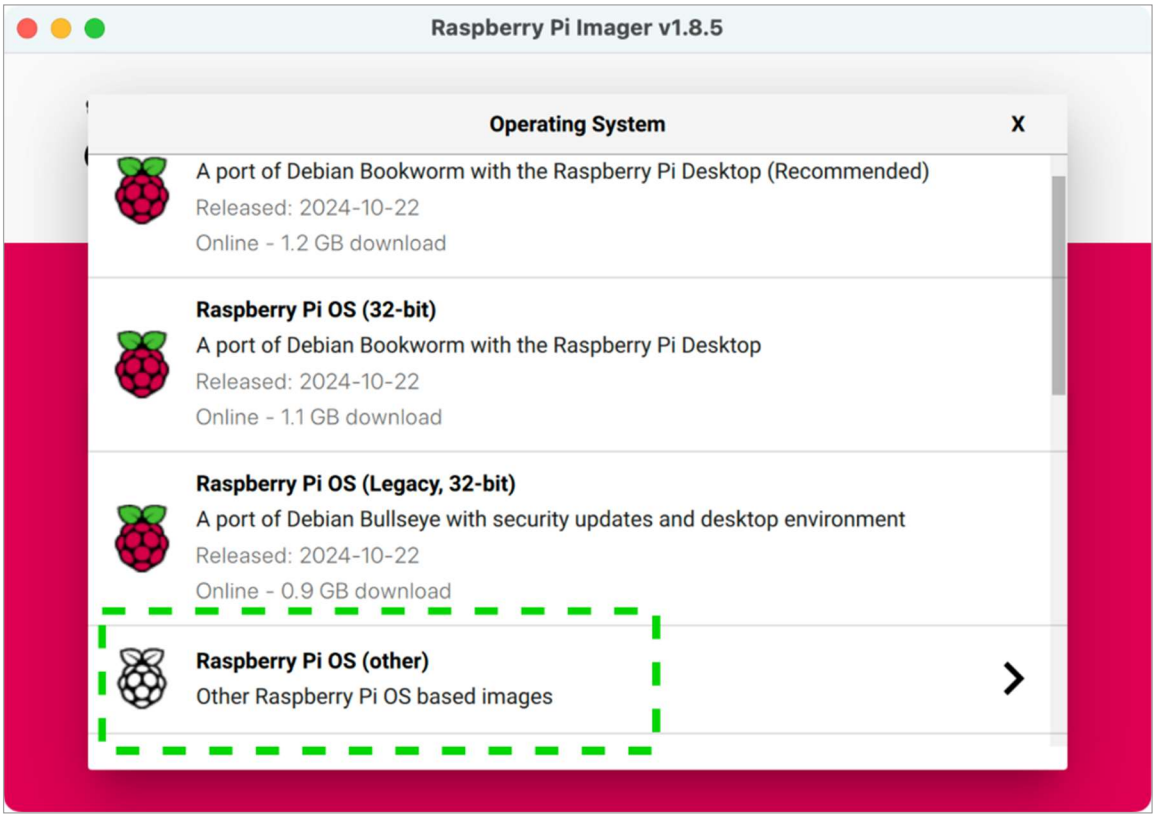

Figure 17-5 – Select the "Raspberry Pi OS (other)" option

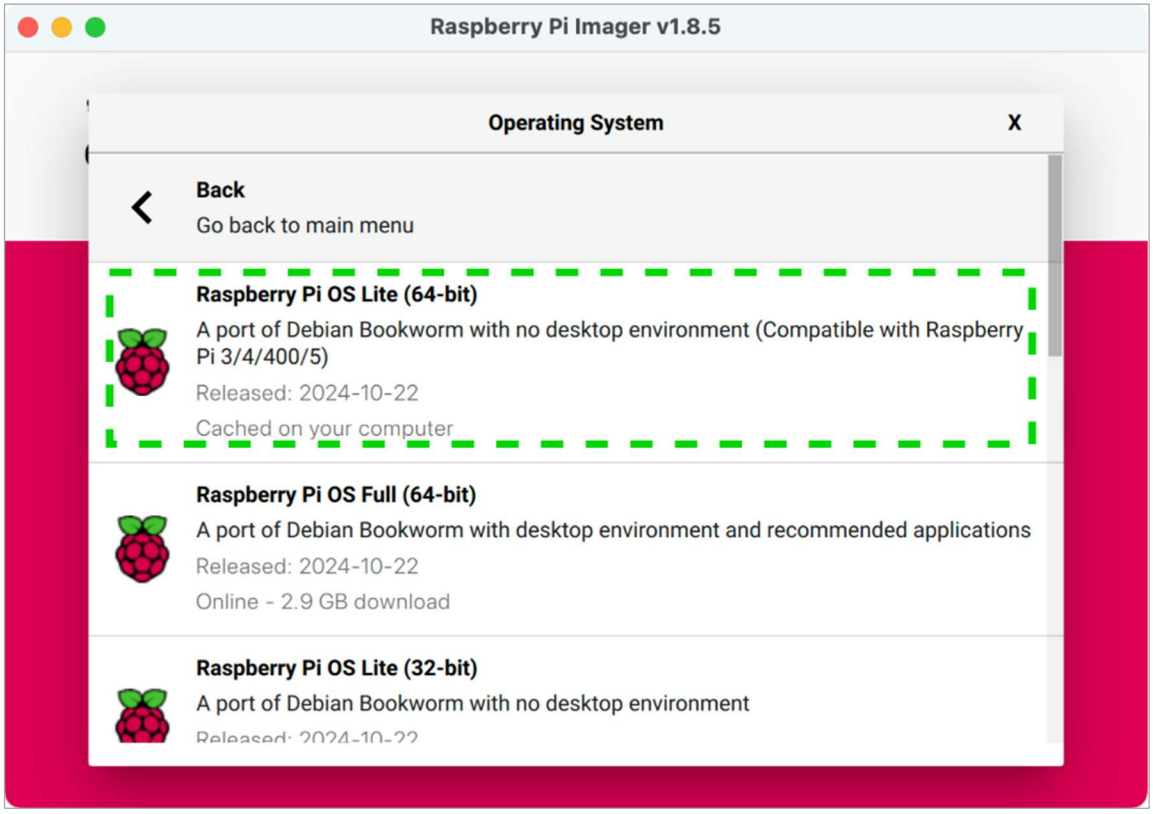

Figure 17-6 – Select the "Raspberry Pi OS Lite" option (no desktop required)

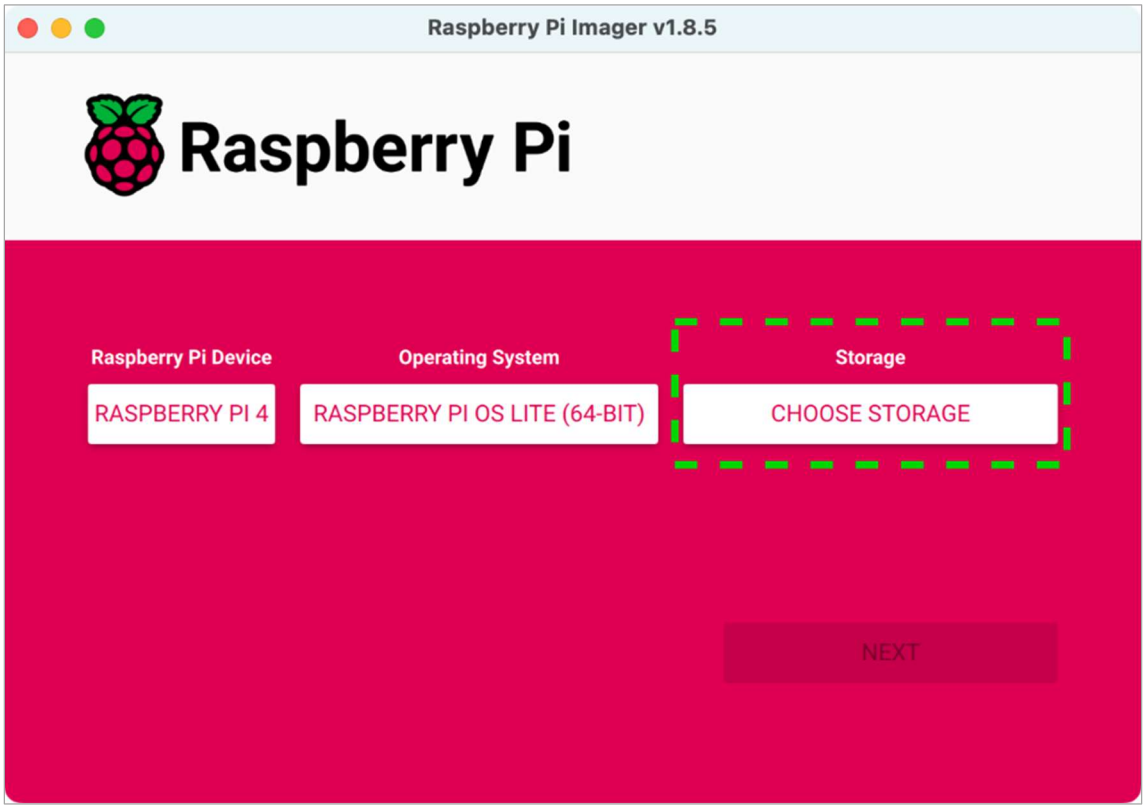

Figure 17-7 – Identify location of microSD to burn

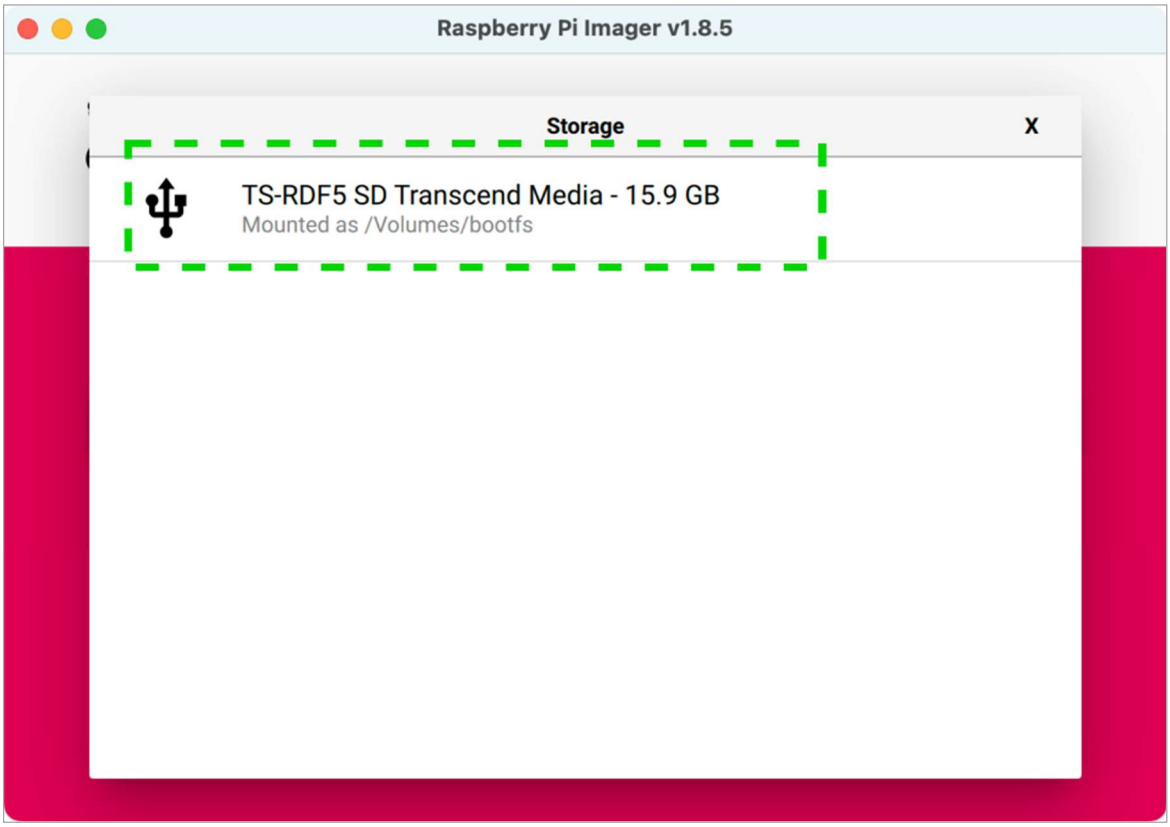

Figure 17-8 – Select the microSD card

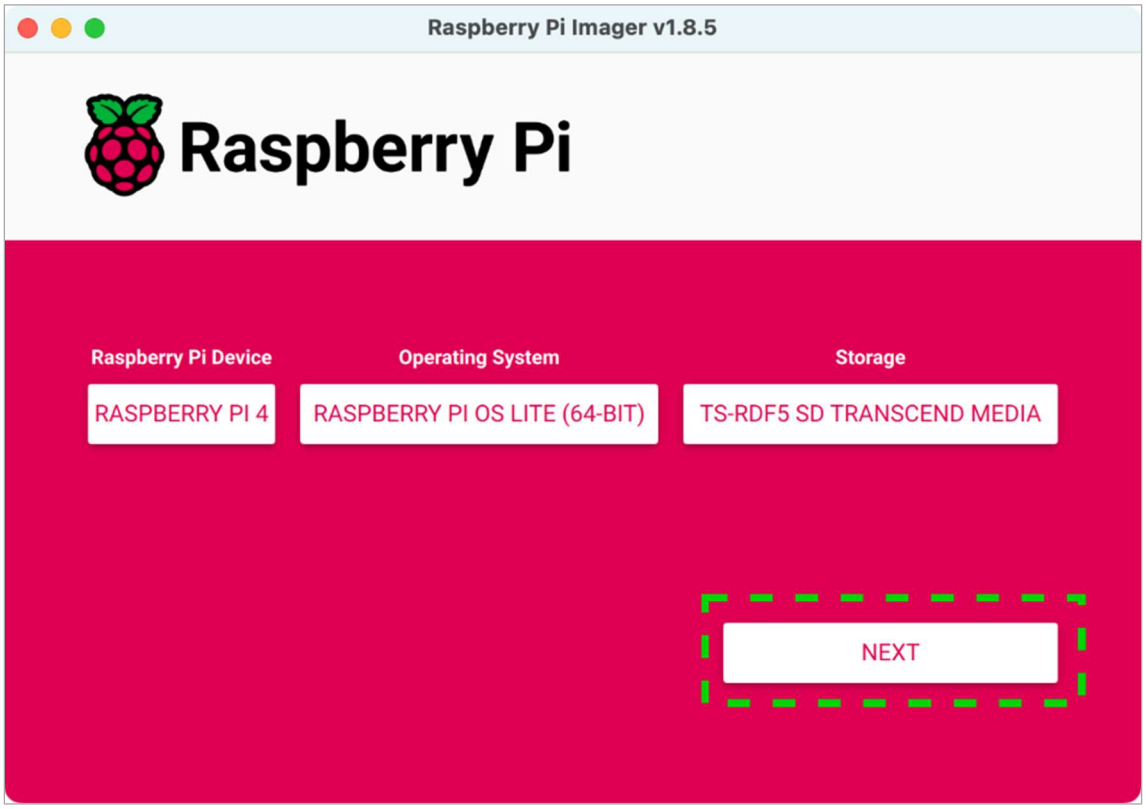

Figure 17-9 – Hit next

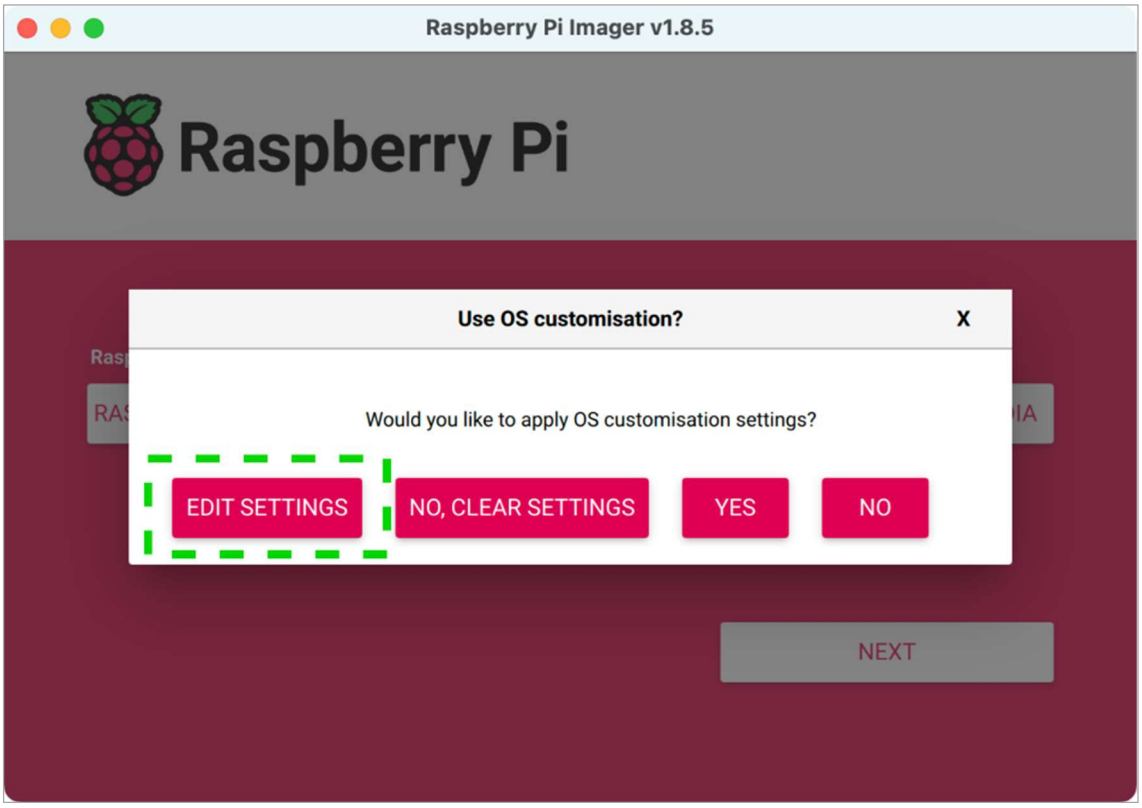

Figure 17-10 – Edit the OS customization settings

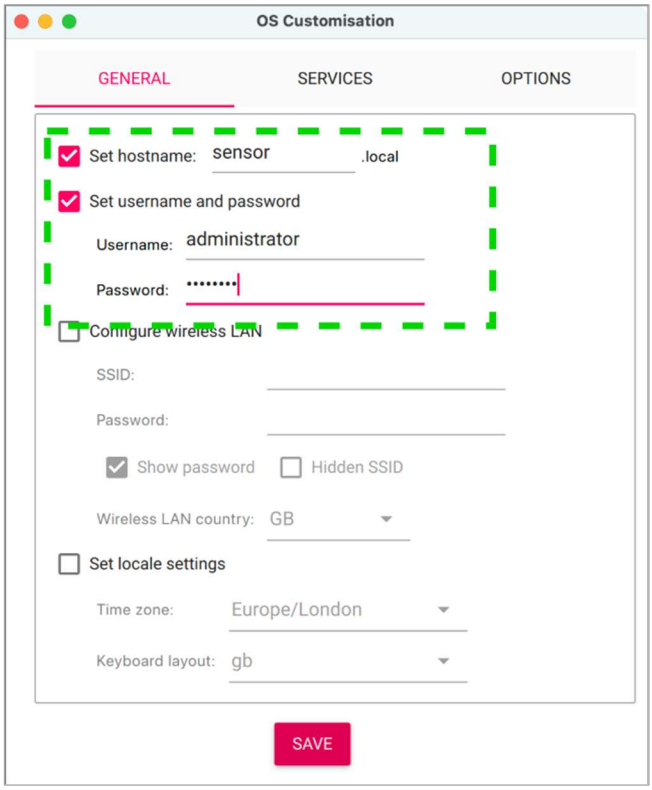

Figure 17-11 – Give the sensor a name and an administrative username and password

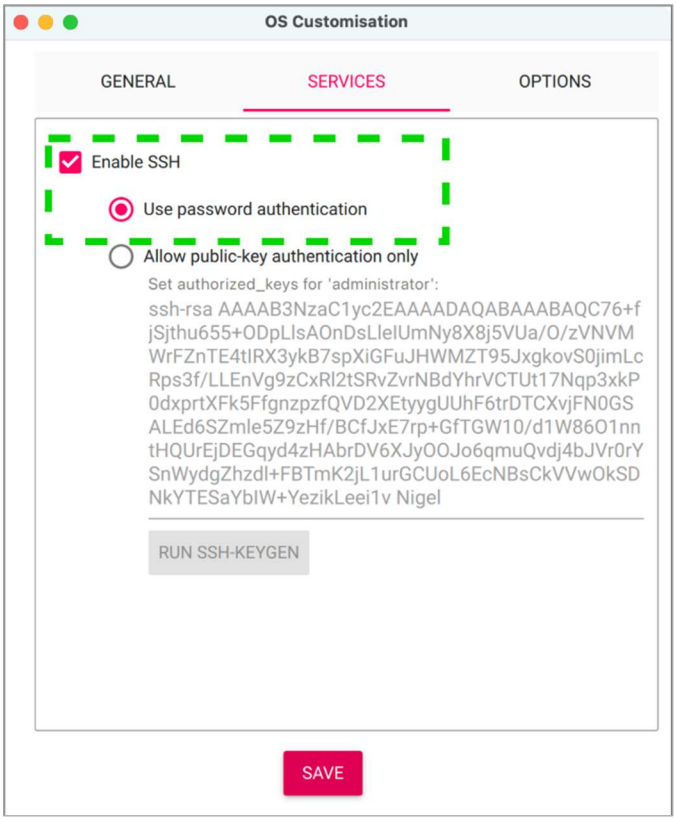

Figure 17-12 – Enable SSH for remote access to the sensor

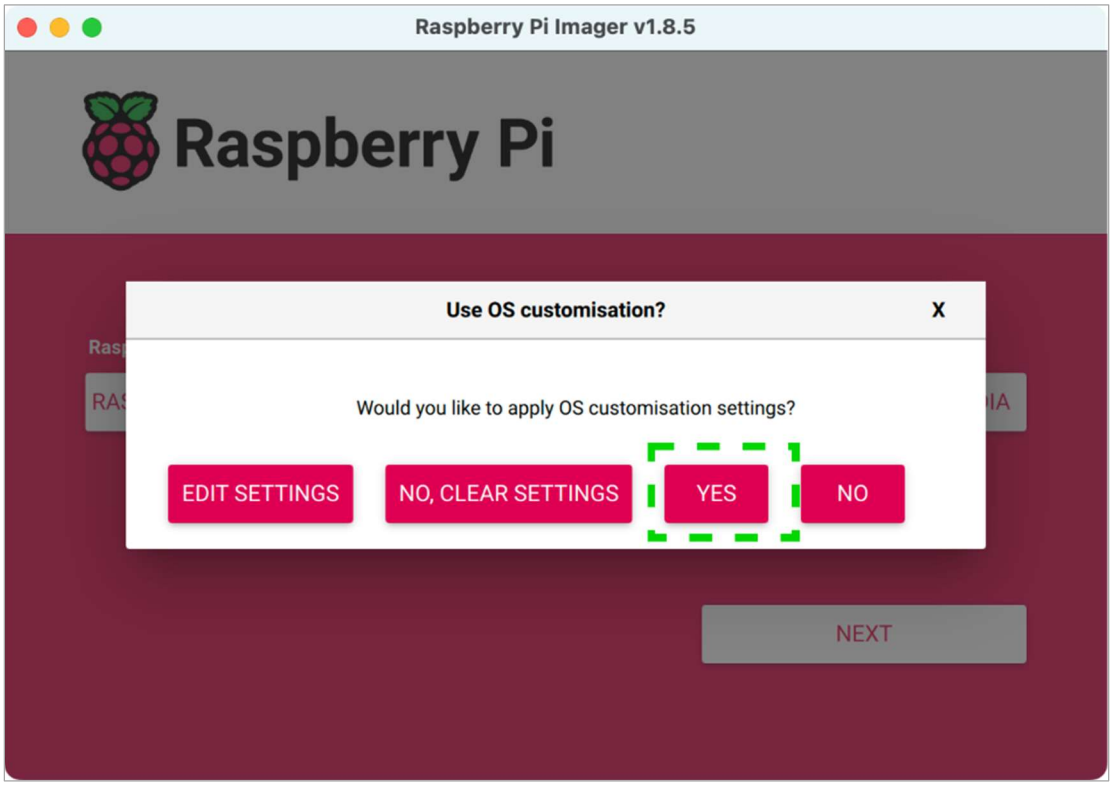

Figure 17-13 – Apply the OS settings updates

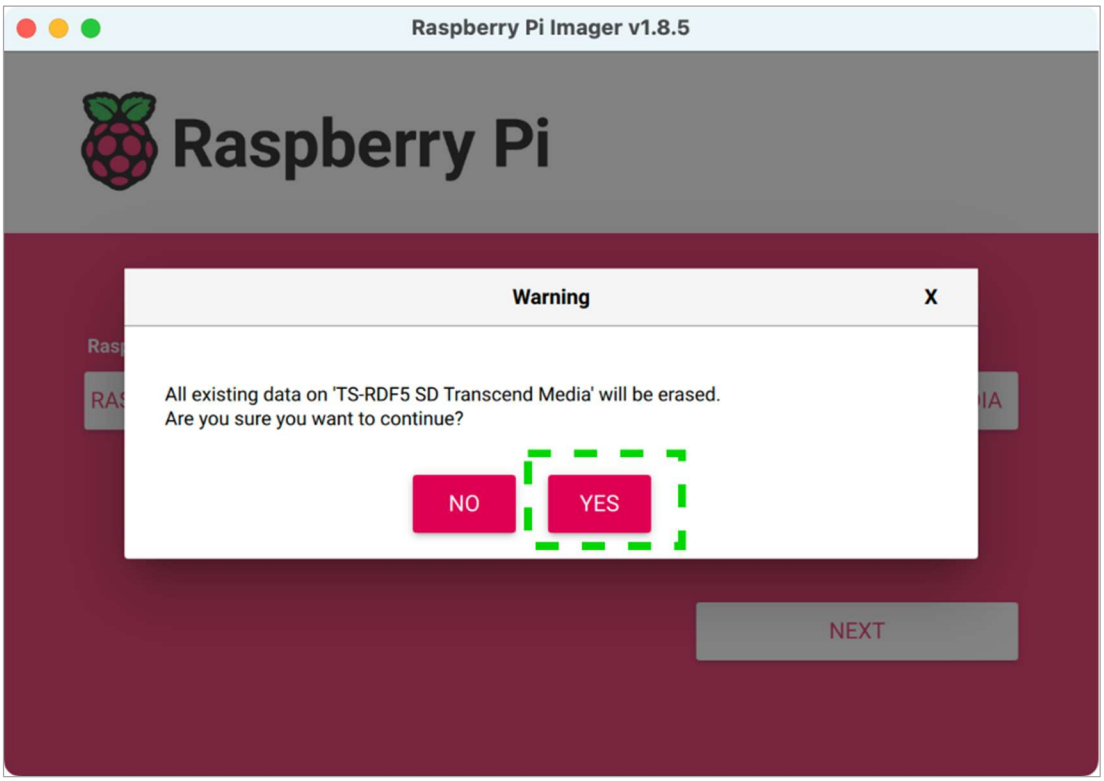

Figure 17-14 – Confirm that the burn process can begin

Figure 17-15 – The image is written to the microSD card

Figure 17-16 – The new image is verified to ensure it was correctly written to the microSD

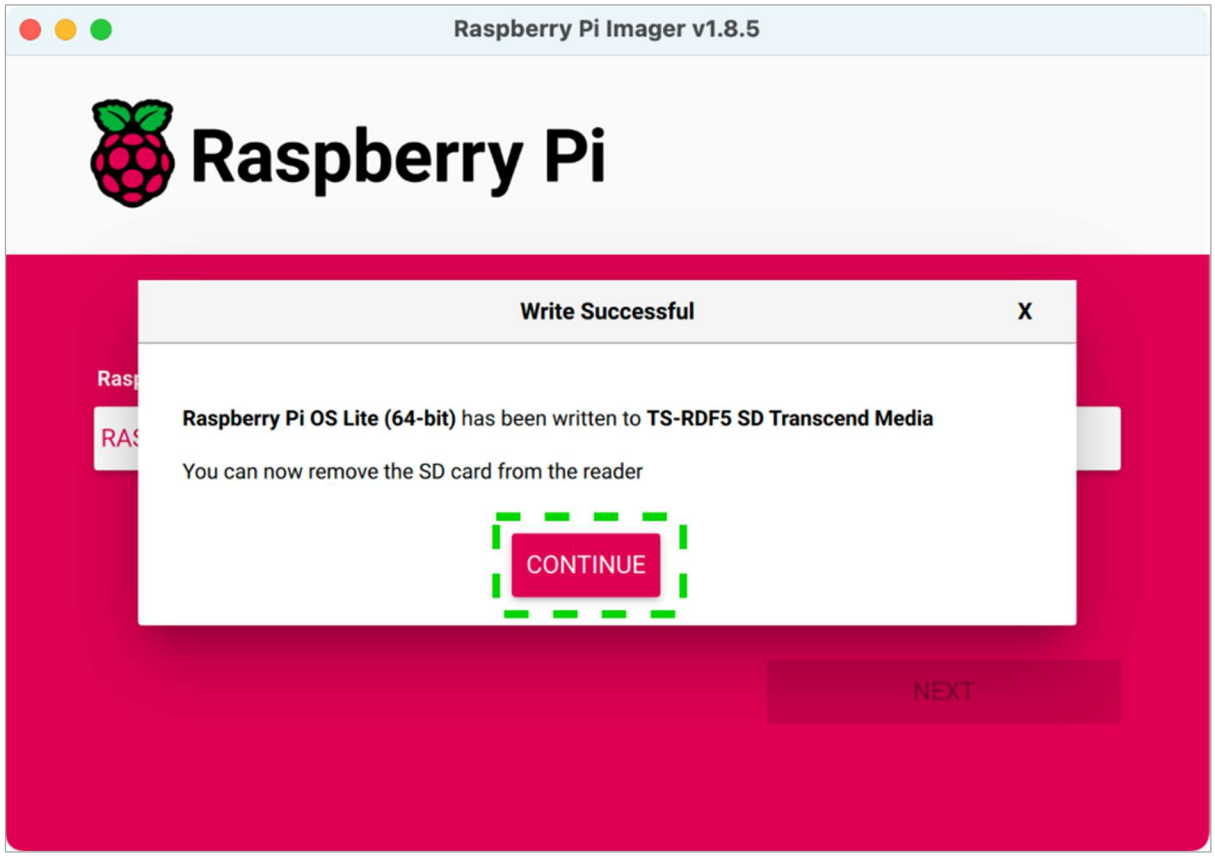

Figure 17-17 – Final confirmation that the burn process is complete

```
nigelbowden@nigel ~ % ping sensor.local
PING sensor.local (192.168.1.90): 56 data bytes
64 bytes from 192.168.1.90: icmp_seq=0 ttl=64 time=7.004 ms
64 bytes from 192.168.1.90: icmp_seq=1 ttl=64 time=7.330 ms
64 bytes from 192.168.1.90: icmp_seq=2 ttl=64 time=4.296 ms
64 bytes from 192.168.1.90: icmp_seq=3 ttl=64 time=7.265 ms
64 bytes from 192.168.1.90: icmp_seq=4 ttl=64 time=3.246 ms
64 bytes from 192.168.1.90: icmp_seq=5 ttl=64 time=2.702 ms
64 bytes from 192.168.1.90: icmp_seq=6 ttl=64 time=7.256 ms
64 bytes from 192.168.1.90: icmp_seq=7 ttl=64 time=3.202 ms
^C
--- sensor.local ping statistics ---
8 packets transmitted, 8 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 2.702/5.288/7.330/1.971 ms
nigelbowden@nigel ~ %
```

Figure 17-18 – Verify that the sensor is reachable over its Ethernet port using ping

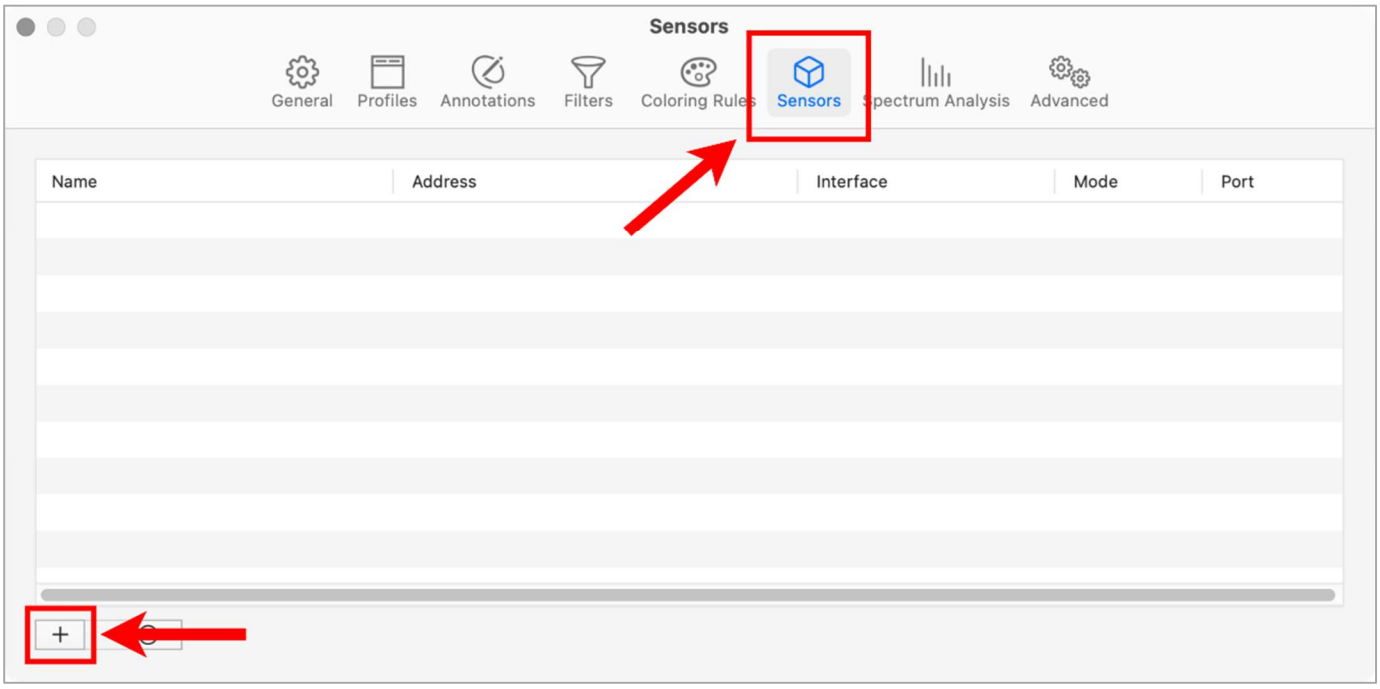

Figure 17-19 – Hit the "+" button on the *Sensors* settings tab

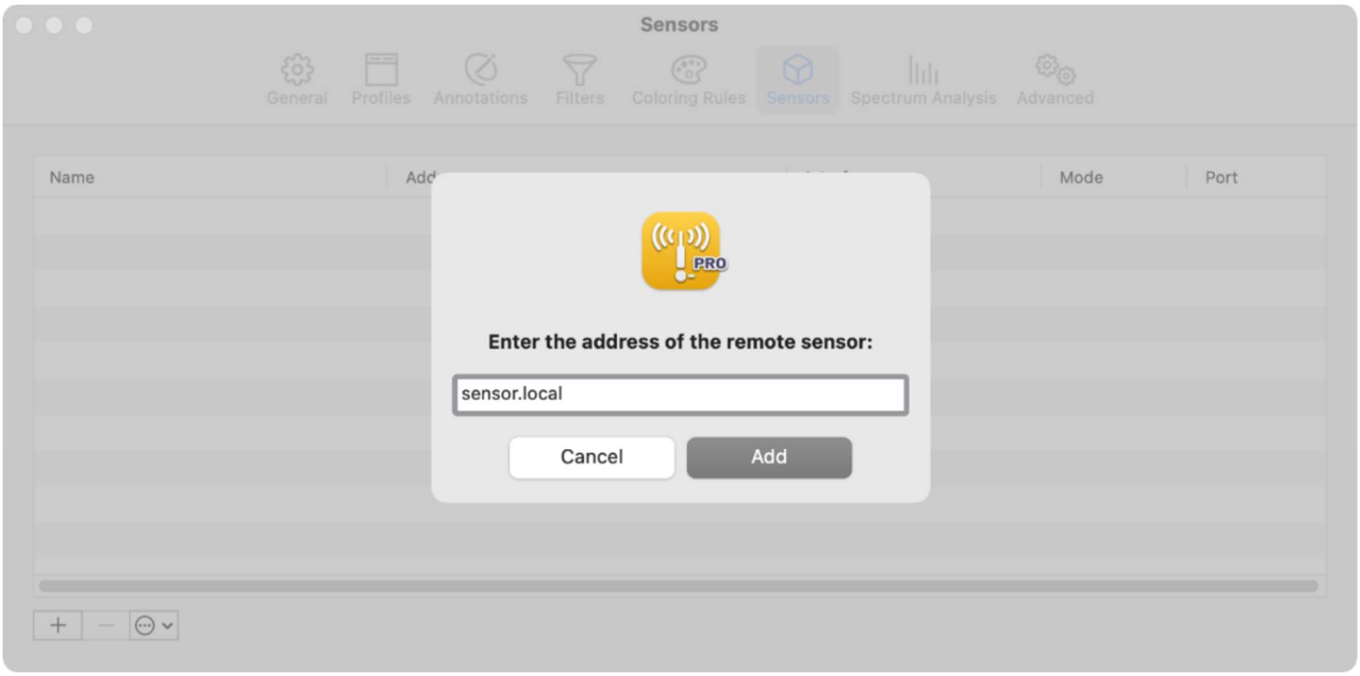

Figure 17-20 – Enter the sensor's name or IP address

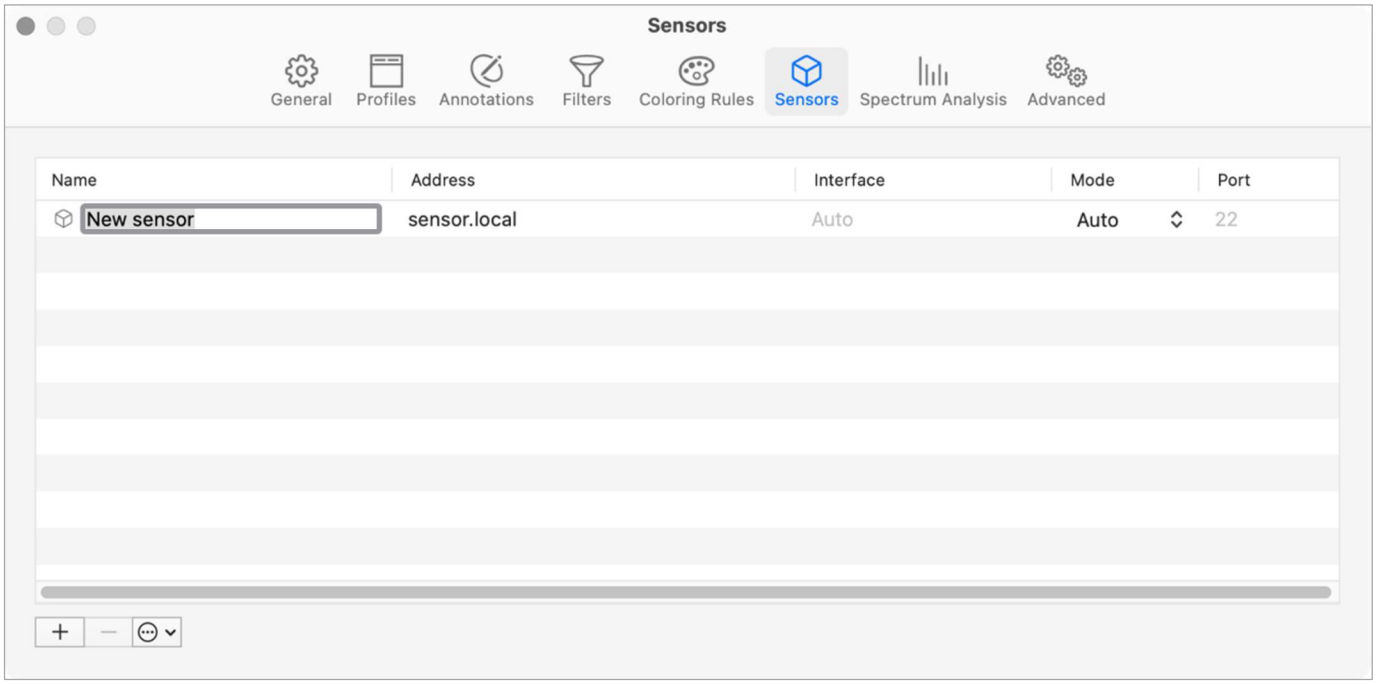

Figure 17-21 – Click on the Name field and enter the chosen name for the sensor

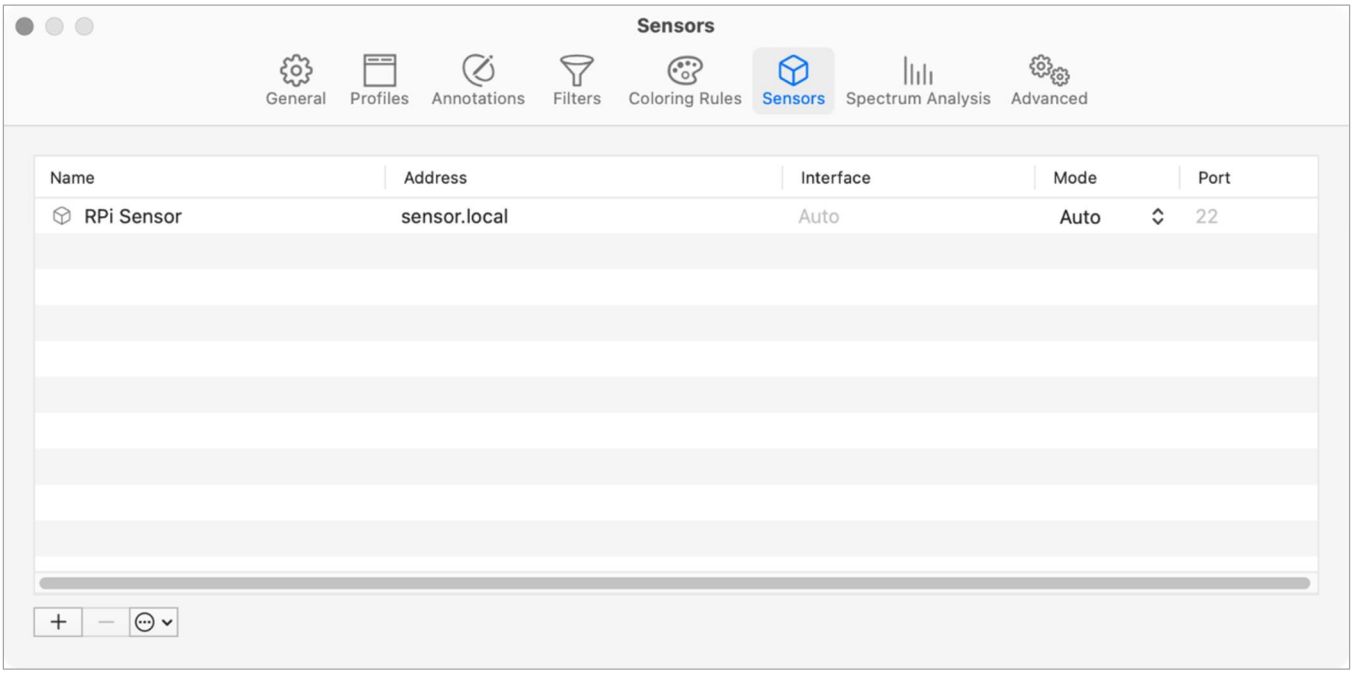

Figure 17-22 – The final sensor name

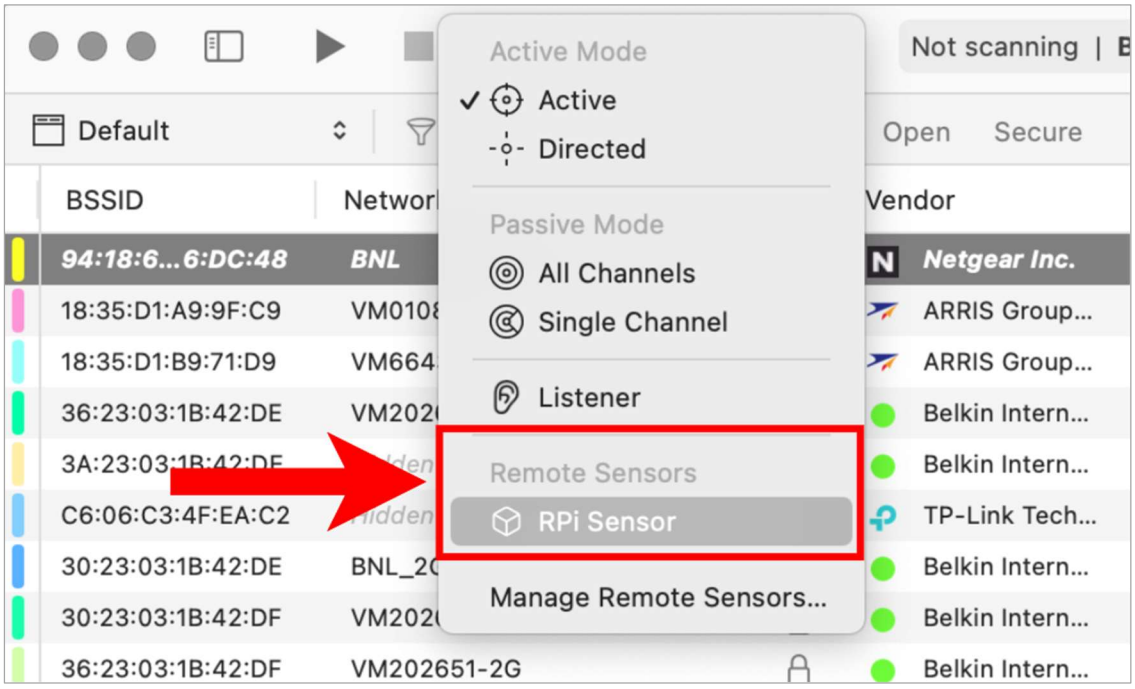

Figure 17-23 – Choose sensor in scan selector

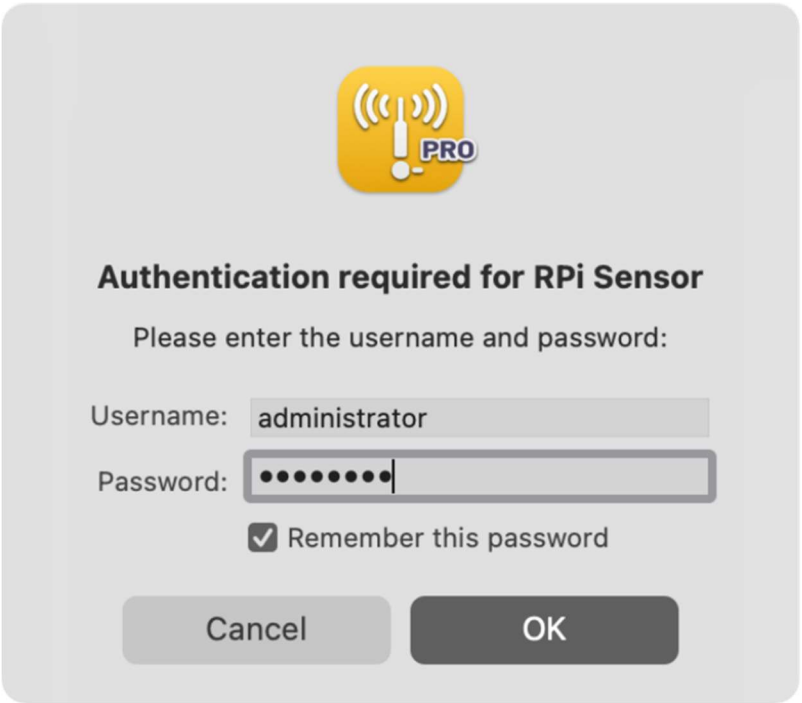

Figure 17-24 – When the sensor is chosen in the scan selector, enter the login credentials

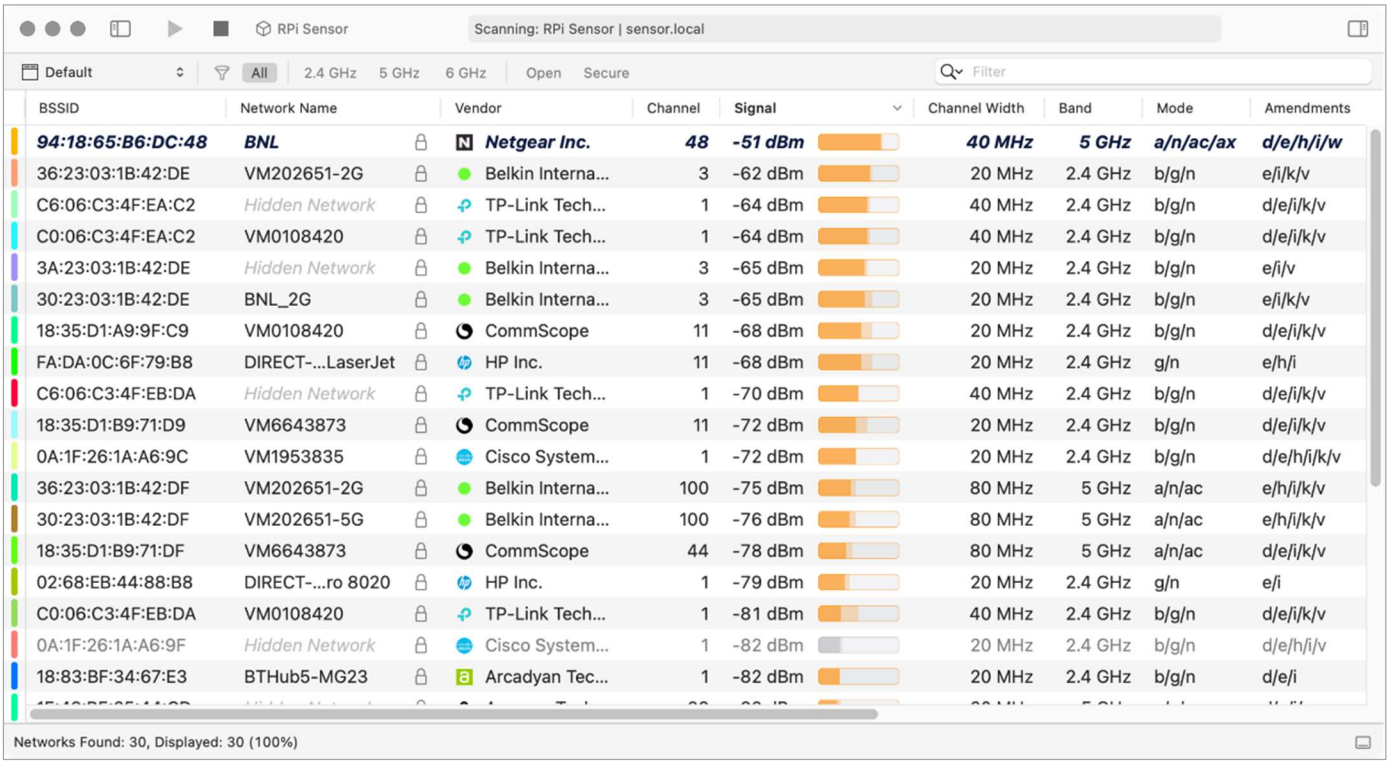

Figure 17-25 - Observe the RPi sensor scan results after a few seconds