



Addendum LCOS 8.76

LCOS
[LANCOM OPERATING SYSTEM]

LANCOM
Systems

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1 Addendum to LCOS version 8.76

The document describes the new functions and changes to LCOS version 8.76 over the previous version.

1.1 WLAN

1.1.1 Spectral scan

In addition to connecting computers to the Internet, professional users are increasingly using wireless local area networks (WLAN) for business-critical applications. Examples include the accessing of patient files, the online monitoring of production facilities, and the transmission of video and audio data (ideally with perfect synchronization). The reliability and performance of WLAN systems are thus increasingly important.

The rising significance and usage of WLAN for data transmission is resulting in more and more scenarios where the equipment and systems of various users are crowding the WLAN frequency ranges. These may include, for example, microwave ovens, cordless telephones, Bluetooth devices and video transmitters, with their signals occurring on a continual or intermittent basis. The simultaneous usage of a frequency band or frequency range gives rise to interference that can disrupt or negatively impact the reliability and performance of a WLAN. This type of interference can result in data packets or connections being lost. If the interference is too strong, the complete failure of the WLAN may result.

It is therefore becoming increasingly important to use targeted analysis to check the frequency ranges. These checks should identify the interference or other interference factors, and introduce countermeasures as required. It can also be used to ensure that the WLAN is working properly and operating interference free.

Targeted analysis can also clarify or identify the following:

- Proper, fault-free operation of the WLAN
- Occurrence of interference
- Display or identify the bands with interference
- Strength of the interference signal
- Regularity or frequency of the interference signal
- Type, and possibly source, of the interference signal

The WLAN-related frequency ranges are subject to spectral analysis. Results are displayed graphically, i. e. in the form of real-time diagrams or real-time overviews of frequencies and interference. However, graphical analyses of a spectral range are open to some freedom of interpretation. A scenario such as the following would therefore be fairly commonplace. You ascertain that the frequency currently being used is being subjected to interference that is continual and of constant signal strength. However, you are not able to ascertain unequivocally which room or building the signal is coming from, nor the type of equipment which is transmitting the interfering signal.

Functions of the software module

The "Spectral Scan" software module enables you to run a spectral analysis directly on the access point. There is not need to purchase any additional software or hardware as the integrated functionality can be used to analyze the frequency ranges and bands in question. This gives you a graphical overview of the frequency response characteristics within your WLAN at all times so that you can detect interference and safeguard against it.

Clicking menu option **Tools > Spectral scan** in WEBconfig opens the dialog shown below:

Spectral Scan

Interfaces Radio-Bands Subbands

WLAN-1: 2.4GHz/5GHz Band-1+2+3 Start

This page is used to start and stop the spectrum analyser.

Depending on the current state of the analyser, there will be different buttons and selections available:

Selection "Radio-Bands"
This selection defines which radio bands will be analysed once the spectrum analyser is started. In case it is running already the selection will be shown greyed-out.

Selection "Subbands"
If 5 GHz is selected as one of the radio bands the selection of subbands will be displayed to allow further specification of the frequency range to be analysed. The selection will be shown greyed-out if the spectrum analyser is running already.

Button "Start"
The spectrum analyser is started on the respective WLAN module by pressing this button. For each selected frequency band one additional window will be opened to display the results of the spectrum analyser. As long as the spectrum analyser is active, the WLAN module is unavailable for data transfers.

Button "Stop"
Stopping the spectrum analyser will revert the state of the WLAN module to the previous settings.

Button "Show"
This button will open one window for each selected frequency band to display the results of the spectrum analyser.

⚠ When the WLAN module is disabled (**Setup > Interfaces > WLAN > Operational**), a message is displayed and the spectral scan cannot be started. Configure the access point for "Base station" operation or ensure that a WLAN controller configures the access point.

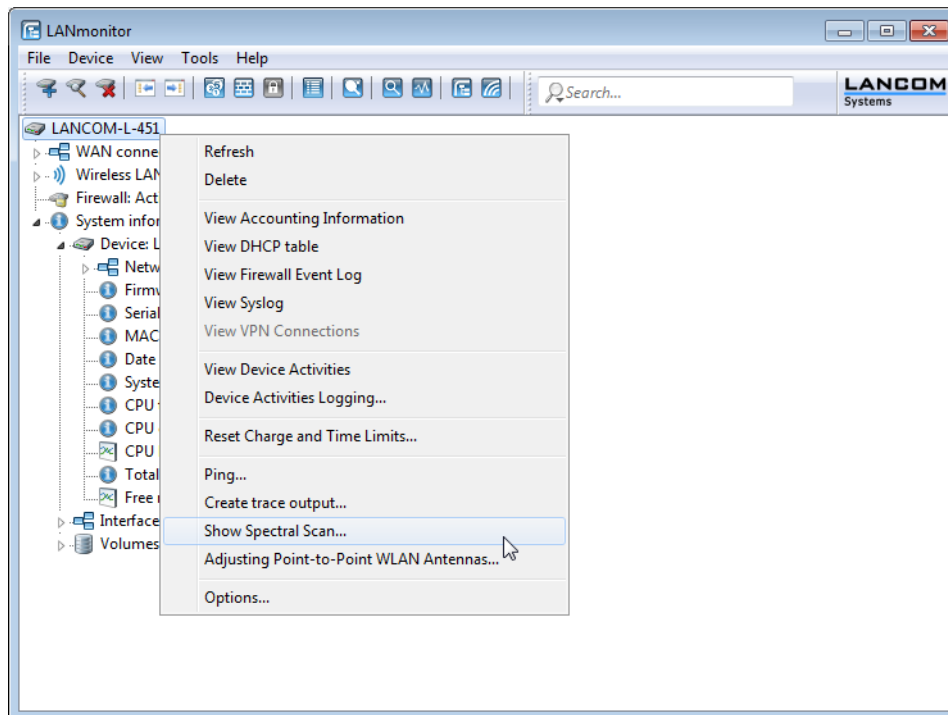
The following entries, buttons and selection menus are available here:

- **Interfaces:** Shows the selected WLAN module for analysis.
- **Radio bands:** Use this selection menu to set which frequency band(s) you wish to analyze. The relevant field is grayed out once the spectral scan has started on this module.
- **Sub-bands:** This selection menu is only enabled if '5GHz' or '2.4GHz/5GHz' is selected in **Radio bands**. You are then able to specify which sub-bands of the 5GHz band are included in the analysis.
- **Start:** Clicking this button starts the spectral scan on the relevant WLAN module. A separate window opens for each of the selected frequency bands.
- **Stop:** This buttons ends the analysis. The WLAN module then returns to the previous mode and is available again with its usual functionality.

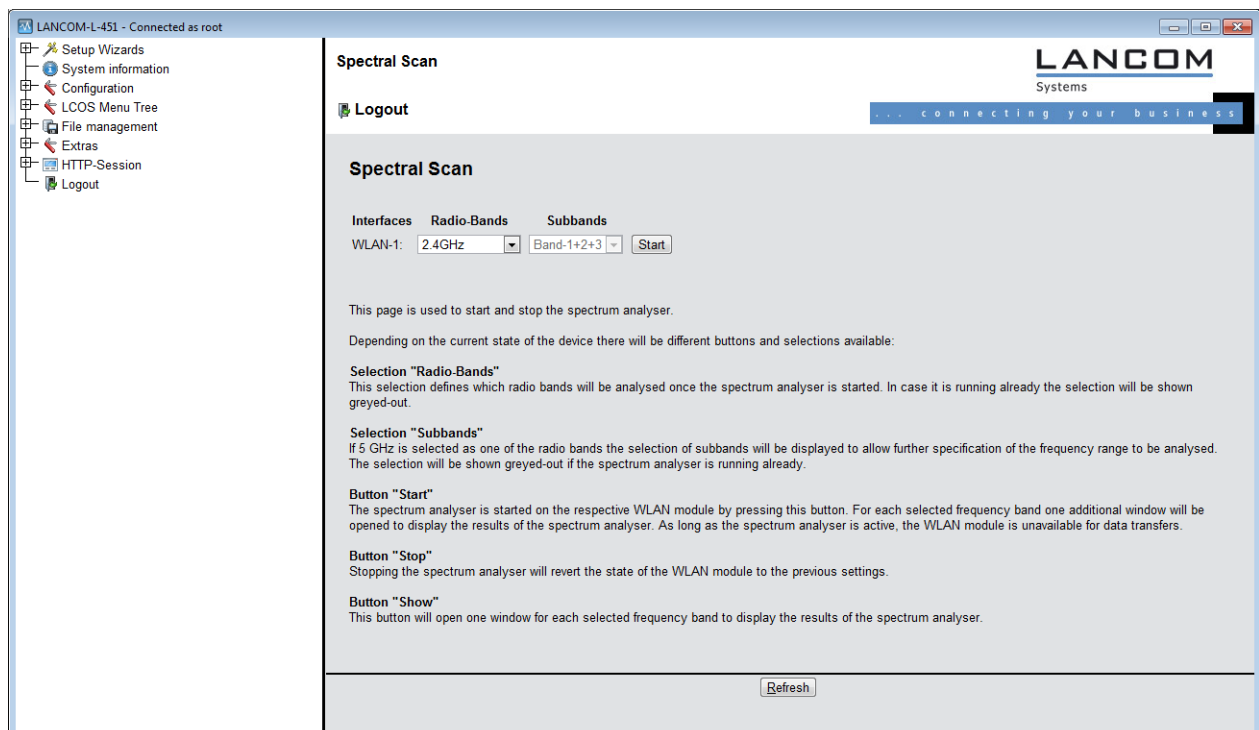
⚠ This button is not shown until after the module is started.

- **Show:** Once the spectral scan has started, click this button to open a display window for every frequency band selected. Click the button repeatedly to open multiple windows.

The spectral scan can also be started from the LANmonitor. To do this, right-click the relevant device in the list and select **Show spectral scan** in the context dialog.



A browser window opens showing you the same entries, buttons and selection menus as those in WEBconfig.



ⓘ During the analysis, the WLAN module being analyzed does not send any data or transmit any SSID.

! Only LANCOM L-4xx access points support the "Spectral Scan" function.

Spectral scan analysis window

! The spectral scan is displayed in a browser application. For this to work properly, your browser must support the latest version of WebSockets, and the HTML5 element `<canvas>`. The browser in LANmonitor meets all of these requirements.

In the separate analysis window of the spectral scan, there are different ways to show the frequencies and frequency ranges together with the potential interference. The following buttons are available at the top of the window:

- **Current:** Shows or hides the curve of the values being measured.
- **Maximum:** Shows or hides the maximum values of the ongoing spectrum scan in relation to the currently set history range.
- **Average:** Shows or hides the average values of the ongoing spectrum scan in relation to the currently set history range.
- **History:** Shows or hides the values last measured.
- **Number of history values:** Determines the number of results last measured that are displayed. You are able to show at least the last 5 and at most the last 50 measuring points for every frequency.
- **Last channel:** Shows or hides the channel last used.
- **Frequency:** Switches the display on the X-axis between WLAN channel and frequency.

The window contains two graphical views showing the readings in a different manner. The top diagram shows on the Y-axis the signal strength in dBm, and on the X-axis either the WLAN channel or the relevant frequency. The lower diagram contains the analysis progression over time in the form of a waterfall diagram, with the Y-axis showing the time and the X-axis again showing the WLAN channel or the relevant frequency. These view formats depict both continuous and occasional interference on the frequencies, so helping you to take appropriate action to improve the connection (e. g. by changing the channel or identifying and eliminating the interference source). For example, certain interference sources such as microwave devices, DECT telephones (working in the 2.4GHz frequency range) and audio-video transmitters exhibit very typical transmit patterns that occur prominently in both diagrams.

On the lower border of the window is a slider denoted **Time slider**. This enables you to extend or limit the time period analyzed in the waterfall diagram. Alternatively, you can use the input box to the right of the slider to select how many readings you would like to display in the waterfall diagram. The web application can display up to 300 readings in the waterfall diagram using the time slider. The readings from a maximum of 24 hours can be placed into intermediate storage.

Below are some example analysis results showing graphically other settings in a different way:

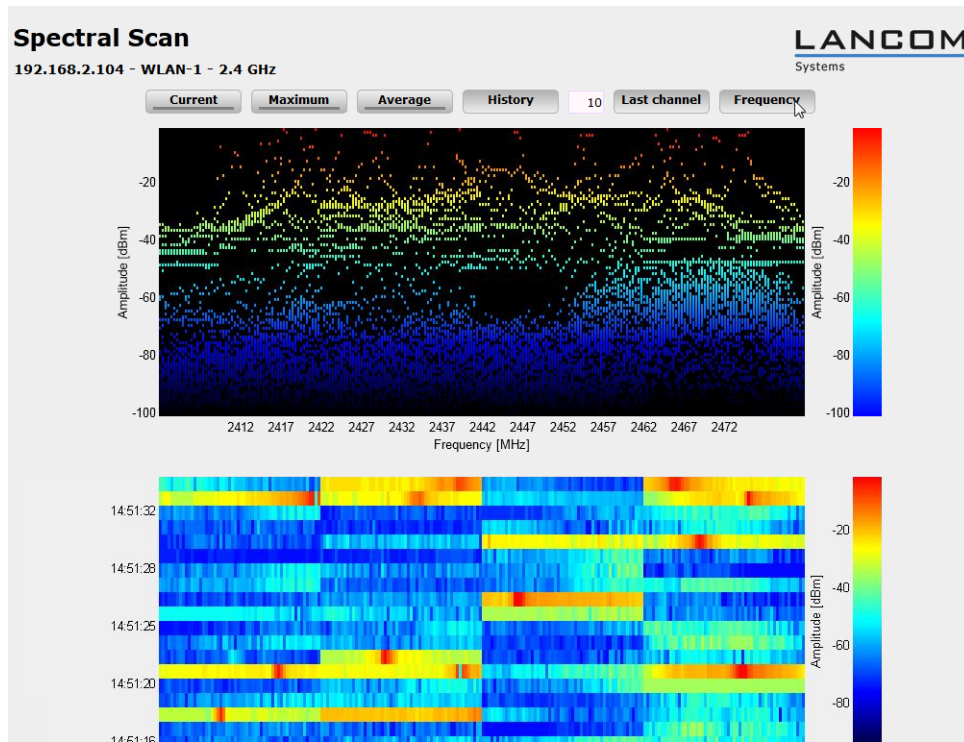


Figure 1: Spectral scan, frequency display of the last 10 history values

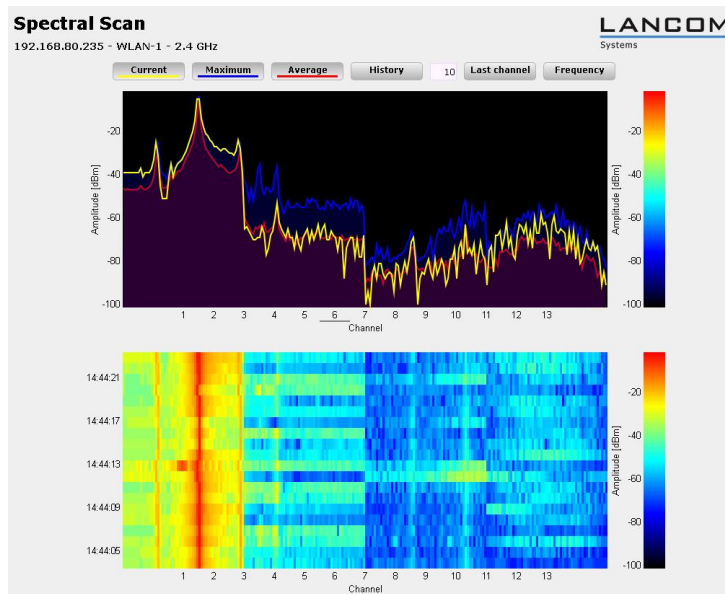


Figure 2: Spectral scan, channel display of Current, Maximum and Average, interference from radio camera

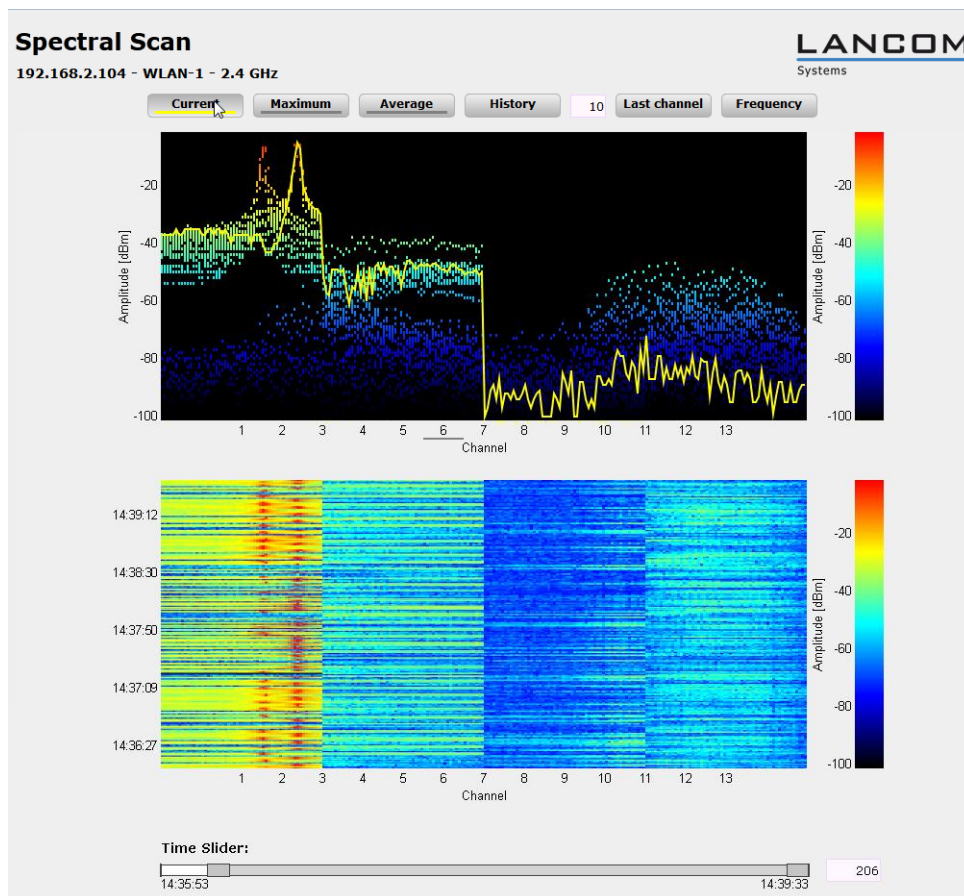


Figure 3: Spectral scan, channel display of Current, last 10 history values and "Time Slider", interference from baby phone

Additions to LANmonitor

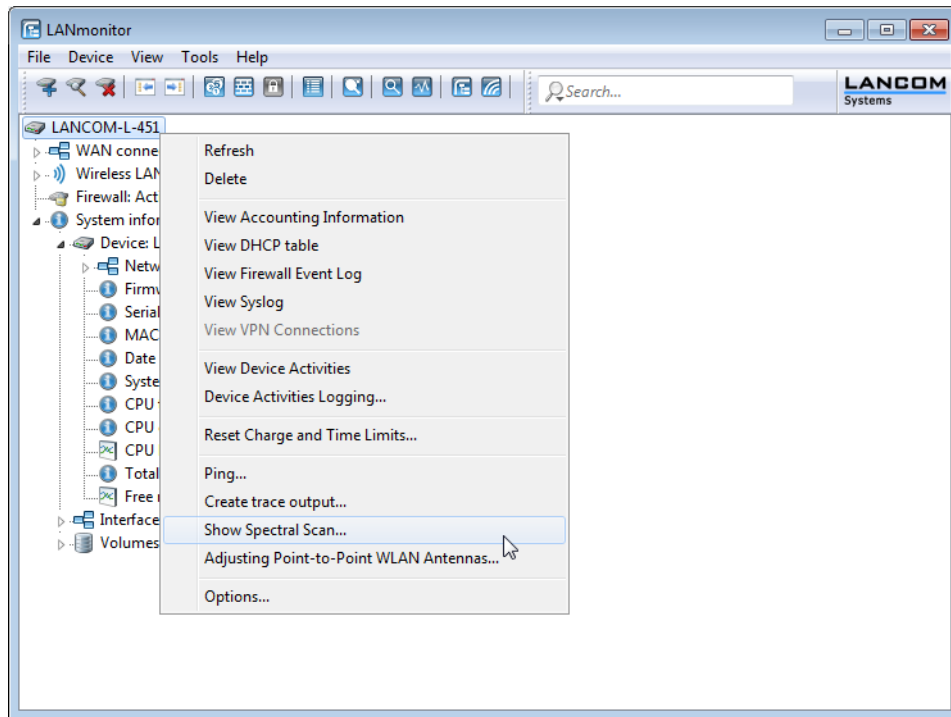
LANmonitor application concepts

This section contains different application concepts for LANmonitor, such as querying CPU and memory utilization via SNMP, and performing spectral scans.

Spectral scan

The "Spectral Scan" software module enables you to run a spectral analysis directly on the access point. There is not need to purchase any additional software or hardware as the integrated functionality can be used to analyze the frequency ranges and bands in question. This gives you a graphical overview of the frequency response characteristics within your WLAN at all times so that you can detect interference and safeguard against it.

Right-click the relevant device in the list and select **Show spectrum analyzer** in the context dialog.



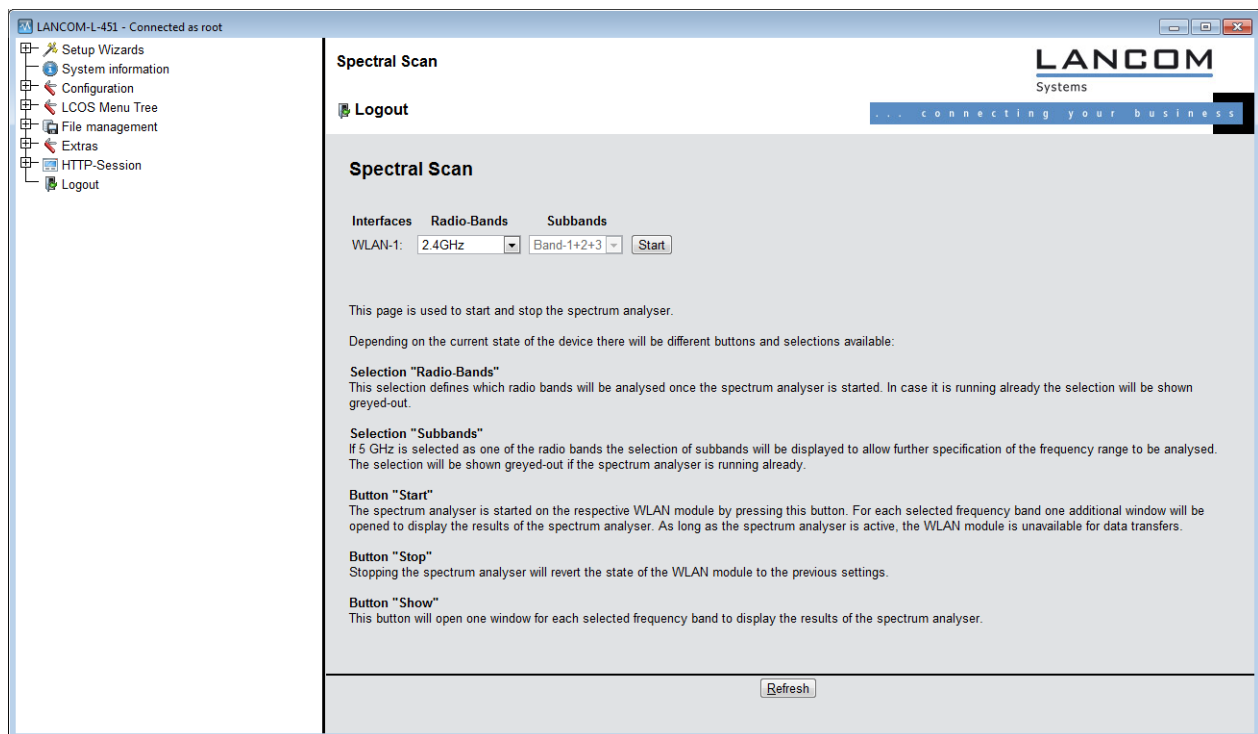
The following entries, buttons and selection menus are available here:

- **Interfaces:** Shows the selected WLAN module for analysis.
- **Radio bands:** Use this selection menu to set which frequency band(s) you wish to analyze. The relevant field is grayed out once the spectral scan has started on this module.
- **Sub-bands:** This selection menu is only enabled if '5GHz' or '2.4GHz/5Ghz' is selected in **Radio bands**. You are then able to specify which sub-bands of the 5GHz band are included in the analysis.
- **Start:** Clicking this button starts the spectral scan on the relevant WLAN module. A separate window opens for each of the selected frequency bands.
- **Stop:** This buttons ends the analysis. The WLAN module then returns to the previous mode and is available again with its usual functionality.

! This button is not shown until after the module is started.

- **Show:** Once the spectral scan has started, click this button to open a display window for every frequency band selected. Click the button repeatedly to open multiple windows.

! Please refer to Section [Spectral scan analysis window](#) for further information on the diagrams displayed.



! During the analysis, the WLAN module being analyzed does not send any data or transmit any SSID.

! Only LANCOM L-4xx access points support the "Spectral Scan" function.

Additions to the Setup menu

Operation mode

All LANCOM wireless devices can be operated in various modes.

SNMP ID:

2.23.20.7.3

Telnet path:

Setup > Interfaces > WLAN > Operational

Possible values:

Access Point: As a base station (access point), the device establishes the link to a wired LAN for the WLAN clients.


Station: As a station (client), the device itself locates the connection to another access point and attempts to register with a wireless network. In this case the device serves to connect a wired device to a base station over a wireless link.

Managed AP: As a managed access point, the device searches for a central WLAN controller from which it can obtain a configuration.

Probe: In 'Probe' mode, the spectral scan uses the radio module of the access point. The device cannot transmit or receive data in this mode. On startup of the spectral scan, the device automatically switches to 'Probe' mode so that this setting need not be configured manually.

Default:**LANCOM Wireless Router:** Access Point**LANCOM Access Points:** Managed AP**Probe settings**

This table contains the settings for the spectral scan.

 The device cannot transmit or receive data in this mode.

SNMP ID:

2.23.20.15

Telnet path:**Setup > Interfaces > WLAN****Ifc**

Opens the settings for the physical WLAN interface.

SNMP ID:

2.23.20.15.1

Telnet path:**Setup > Interfaces > WLAN > Probe-Settings****Possible values:**

Selection from the available physical WLAN interfaces.

Radio bands

Here you can select which frequency bands for spectral scanning.

SNMP ID:

2.23.20.15.2

Telnet path:**Setup > Interfaces > WLAN > Probe-Settings****Possible values:**

2.4GHz

5GHz


2.4GHz/5GHz

Default:

2.4GHz

Subbands 2.4GHz

Determine here which subbands of the 2.4GHz frequency are to be analyzed.

 The spectral scan only takes this field into account when either '2.4GHz' or '2.4GHz/5GHz' is set in **Radio bands**.

SNMP ID:

2.23.20.15.3

Telnet path:**Setup > Interfaces > WLAN > Probe-Settings****Possible values:**

Band-1
Band-2
Band-3
Band-1+2
Band-1+3
Band-2+3
Band-1+2+3

Default:

Band-1

Channel list 2.4GHz

Determine in this field the channel list for the spectral scan in the 2.4GHz frequency band. Individual channels are separated with commas.

There is no need to change the default values of the spectral scan for operations. The spectral scan scans 20MHz-wide frequency ranges. Due to the 5MHz gaps between the individual 20MHz-wide channels in the 2.4GHz radio band, the channels specified result in a continuous scan of the entire 2.4GHz radio band. In the 5GHz band, the channel bandwidth is also 20MHz, and the individual channels lie next to each other with no overlapping. When no channels are specified, all channels are scanned which results in a complete scan in the 5GHz band.

SNMP ID:

2.23.20.15.4

Telnet path:**Setup > Interfaces > WLAN > Probe-Settings****Possible values:**

Max. 48 characters
from ABCDEFGHIJKLMNOPQRSTUVWXYZ@{ }~!\$%&'()*+,-./:;<=>?[\]^_0123456789

Default:

1,5,9,13

Subbands 5GHz

Determine here which subbands of the 5GHz frequency are to be analyzed.



The spectral scan only takes this field into account when either '5GHz' or '2.4GHz/5GHz' is set in **Radio bands**.

SNMP ID:

2.23.20.15.5

Telnet path:**Setup > Interfaces > WLAN > Probe-Settings****Possible values:**

Band-1

Band-2

Band-3

Band-1+2

Band-1+3

Band-2+3

Band-1+2+3

Default:

Band-1

Channel list 5GHz

Determine in this field the channel list for the spectral scan in the 5GHz frequency band. Individual channels are separated with commas.

SNMP ID:

2.23.20.15.6

Telnet path:

Setup > Interfaces > WLAN > Probe-Settings

Possible values:

Max. 48 characters

from ABCDEFGHIJKLMNOPQRSTUVWXYZ@{}~!\$%&'()+-./,:;<=>?[\\]^_0123456789

Default:

Blank

Channel dwell time

Determine here the number of milliseconds the spectral scan dwells on a channel.

The web application can display up to 300 readings in the waterfall diagram using the time slider. The readings from a maximum of 24 hours can be cached. The default value is generally adequate. Only lower the value when you need a more accurate resolution, and when the performance of your browser and PC is high enough to process the faster display of the readings.

SNMP ID:

2.23.20.15.7

Telnet path:

Setup > Interfaces > WLAN > Probe-Settings

Possible values:

Max. 10 characters

from 0 to 9

Default:

250

1.1.2 WLAN band steering

The IEEE 802.11 standard contains virtually no criteria by which a WLAN client should select the access point for a connection. While there are general guidelines according to which preference is given to an access point with a higher

RSSI value (i. e. the received signal strength), for example, WLAN clients do not, in practice, adhere strictly to these definitions or the general guidelines. If both 2.4GHz and 5GHz are used to broadcast an SSID, there is normally no way of influencing the client as regards the preferred frequency band.

The steering of WLAN clients is based on the principle that many clients determine the available access points by means of an active scan. Active scanning here means that a client sends probe requests containing the network ID to which the client is to connect. Access points with this ID then send a test response, enabling the client to create a list of available access points. The vast majority of WLAN clients only connect to access points from which they have received a probe response, and this can be used to steer their selection process.

There are multiple, sometimes very advanced, criteria for steering. One of these criteria relates to the wireless frequency ranges used for client communication. Modern dual-band WLAN clients are expected to prefer the 5GHz frequency band over the (now) overcrowded 2.4GHz band. Band steering is the term given to purposefully assigning a WLAN client a particular frequency band or range.

The list of detected or "seen" clients contains all clients from which the access point has received a test request packet. In combination with the radio frequency on which the WLAN client sends the test request, this list is one of the bases on which the access point decides whether to respond to the request or not.

Other criteria depend on the reported client IDs and the configuration of the devices. It may be the case, for example, that fewer SSIDs are reported on the preferred frequency band than are on the one with the lower preference. Similarly, too low a transmit strength when SSIDs are reported can result in the client not receiving any probe responses at all on the preferred frequency band. For the latter scenario, it is important to ensure that the access point does not suppress probe responses on the less favored frequency band. The minimum signal strength responsible here can be set in the following ways :

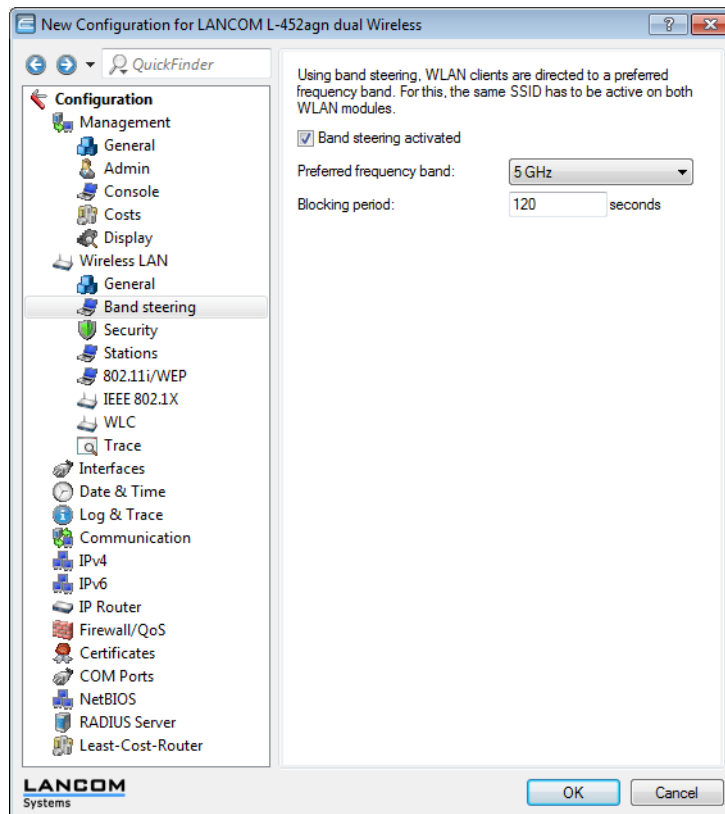
- **LANconfig: Wireless LAN > General > Logical WLAN settings > Network > Minimum client signal strength**
- **WEBconfig: Setup > Interfaces > WLAN > Network > Minimum station strength**

In LANconfig you can use **Wireless LAN > Band steering** to enable and manage the access point's band steering function.

Additions to LANconfig

Band steering

This dialog enables you to configure the settings for band steering in LANconfig.



The following functions are available in **Wireless LAN > Band steering**:

- **Band steering enabled:** Enables or disables this function.
- **Preferred frequency band:** Specifies the frequency band to which the device steers WLAN clients. Possible values:
 - **2.4GHz:** The device routes clients to frequency band 2.4GHz.
 - **5GHz:** The device routes clients to frequency band 5GHz.
- **Block time:** The time for which the access point steers the WLAN client to the preferred frequency band. The default value is 120 seconds.

Additions to the Setup menu

Client steering

This is where you determine the 'WLAN band steering' settings of the WLAN clients registered at the access point.

SNMP ID:

2.12.87

Telnet path:

Setup > WLAN

Operating

This option enables 'client steering' in the access point.

SNMP ID:

2.12.87.1

Telnet path:

Setup > WLAN > Client-Steering

Possible values:

Yes

No

Default:

No

Criteria

Determine here the criteria by which the access point controls the WLAN client.

SNMP ID:

2.12.87.2

Telnet path:

Setup > WLAN > Client-Steering

Possible values:

Radio-Band

Default:

Radio-Band

Preferred band

Determine here the preferred frequency band that the access point steers the WLAN client to.

SNMP ID:

2.12.87.3

Telnet path:

Setup > WLAN > Client-Steering

Possible values:

5GHz

2.4GHz

Default:

5GHz

Probe request ageout seconds

Determine here the time (in seconds) that the connection of a WLAN client is to remain stored in the access point. When this time expires, the access point deletes the entry from the table.



This value should be set low if you are using clients in the WLAN that, for example, often switch from dual-band to single-band mode.

SNMP ID:

2.12.87.3

Telnet path:**Setup > WLAN > Client-Steering****Possible values:**

Max. 10 characters

From 0 to 9

Special values:

0: The visible probe requests are deemed invalid immediately.

Default:

120

Additions to the Status menu**Seen clients****SNMP ID:**

1.3.45

Telnet path:**Status > WLAN > Client**

This table contains the following status values:

Num-ProbeRsp-OK

Number of probe responses sent to and received by this client.

Num-ProbeRsp-Bad

Number of probe responses sent to and not received by this client (Tx errors)

Num-ProbeRsp-suppressed

Number of probe responses sent to this client either because its signal strength was below the threshold or because band steering suppressed the response.

Band

Displays the WLAN band on which the client last communicated.

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