LANCOM Active Radio Control 2.0 (ARC 2.0)

Optimizing a Wi-Fi network to meet all the different needs is a real challenge these days. The constantly growing number of end devices, new data-intensive applications, and increasing Wi-Fi user densities are putting huge strain on wireless networks—in particular at larger company sites, in schools and universities, at sports stadiums, exhibition and event halls, or hospitals.

The increasing complexity of IT and an ongoing shortage of skilled workers present our partners with the challenge of efficiently operating their Wi-Fi networks, while at the same time optimizing the radio channels, channel bandwidths and transmission power, and allowing for third-party external networks.

LANCOM Active Radio Control 2.0 now helps the Wi-Fi to do this job for itself! ARC 2.0 is a cloud-based, self-learning Wi-Fi optimization solution (patent-pending) that determines, visualizes, and implements the best possible configuration of your networks—however complex the conditions.

This innovative solution can also prioritize access points according to their load, so that real-world utilization patterns are used to provide capacity precisely where it is needed. Also new to the market is the integrated Wi-Fi forecast, which previews the Wi-Fi environment to be expected.

This allows us to provide our many years of expert know-how to you in the form of a best-in-class automated solution. What this gives you is maximum flexibility with full administration control at all times, even under the most complex conditions. You benefit from massive savings in time, resources, and costs.

Operating principle – How does ARC 2.0 work?

Full support as of firmware versions LCOS LX 6.10 REL and LCOS 10.72 REL. Look here for a list of all compatible devices.

ARC 2.0 produces results for a single site. It optimizes the Wi-Fi experience for all devices at an LMC project site or part thereof. The selected devices need to have an active LMC license.

ARC 2.0 operates in three phases:

1. First, a **scan is made of the Wi-Fi environment**. All supported devices temporarily switch to a scan mode and observe their radio environment. The scan data collected is transferred to the LMC. The Wi-Fi infrastructure cannot operate during this phase (duration: 2 – 5 min).
2. The **analysis of the collected data** then begins. The analysis is performed for each frequency band and distinguishes between Wi-Fi devices in its own installation and access points from external networks. Multi-BSSID detection is used for LANCOM devices, so different BSSIDs of the same devices are not counted multiple times.
3. The next stage is to **calculate an optimization** for the respective site. The basis for this is the data scanned from the radio environment and the priorities that are learned from the access points within the installation. The priorities are learned from the actual usage behavior of the clients connected to the access points. Calculations are based on preset technical usage schemes and also individual, user-defined detailed settings. Specially developed metrics are used to derive the optimal configuration for devices within the network, while allowing for external networks. This is presented as a forecast, which represents the expected radio environment after the optimization has been applied.

Changes to the configuration only take effect once they have been accepted by the administrator and rolled out by the LMC. As a result, the administrator retains control over the automation process at all times.

Visualization

The visualization is the core element of the ARC 2.0 automation solution. It contains two relationship charts which are graphical representations of the relationships within the Wi-Fi. For clarity, the 2.4-GHz, 5-GHz, and 6-GHz frequency bands and their related KPIs are shown separately.

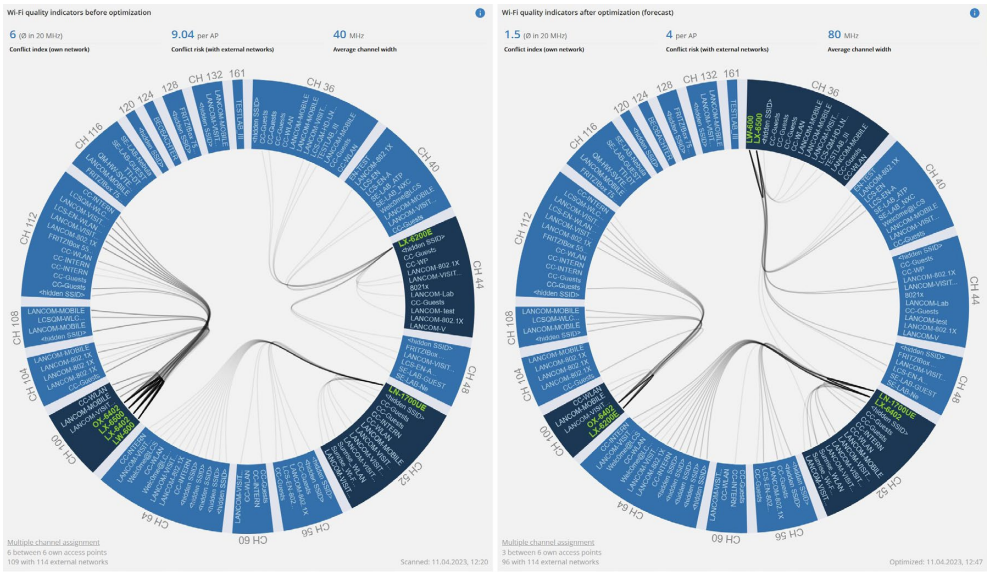

Figure 1:
ARC 2.0 circular display
(left: current Wi-Fi situation,
right: Wi-Fi forecast / future Wi-Fi
situation)

Relationship charts

The first circle represents the **current Wi-Fi situation** or that detected at the time of the ARC 2.0 environment scan (shown **left**).

→ The unique visualization in ARC 2.0 provides a direct overview of the network environment at the location and makes the possible causes of problems quickly identifiable.

The second circle (**on the right**) is a forecast that shows the **Wi-Fi situation that is to be expected** after optimization by ARC 2.0.

→ This intelligent automation allows for individual user configurations to achieve an optimized result in any network environment.

Representation and colors

→ Channels are shown as segments of the circle (channel width 20 MHz)
→ The channel number is next to the segment
→ Devices in your network are shown in green
→ External networks (third-party SSIDs) are shown in gray
→ Segments of the circle containing access points in your network are colored dark blue
→ Segments of the circle that only contain external networks are colored light blue

Access points that can receive each other's signal are connected by a line. A line thus represents a "channel conflict". A channel conflict means that a channel is occupied multiple times, which tends to be undesirable. Although the multiple occupancy of channels is not necessarily a problem from the perspective of a Wi-Fi protocol, this situation should be avoided as far as possible to maximize radio capacity.

Interactive tooltips provide additional information. These appear when you hover the cursor over the particular device or SSID name.

Channel conflicts cannot be completely avoided where more access points are operating than there are channels available at the installation site. When a tooltip is activated, the only channel conflicts displayed are those affecting the access point in question. The directions of the arrows indicate the respective transmission and reception directions.

Key performance indicators (KPIs)

Figure 2:
Analysis of the conflict situation

Above the relationship charts you see KPIs for the Wi-Fi analysis and forecast. These differentiate between the conflicts or multiple channel occupations that are internal to the network (conflict index) and the conflicts or multiple channel occupations that occur due to external networks (conflict risk).

Conflict index

The conflict index evaluates the channel distribution of your own Wi-Fi devices and shows potential multiple channel occupations. The lower this index, the less

your own Wi-Fi devices have to compete with each other for the medium in load situations.

Conflict risk

The conflict risk indicates the channel situation with regard to external networks. The lower this figure, the fewer are the multiple channel occupancies by Wi-Fi devices within the network and external to it. A lower value leads to more favorable medium access with regard to competing external networks in load situations.

Average channel width

The KPIs also show the average channel width of your installation. Channel widths are usually expected to be 20, 40, 80, or 160 MHz. Installations with an uneven distribution of channel widths will have values that deviate from the values mentioned previously.

Results of optimization

Figure 3: Optimization

In addition to the indicators described above, the automation solution provides another optimization indicator for the forecast, the ARC Index.

ARC Index

The ARC Index serves as an indicator for the quality of the optimization. An ARC Index of 100% means that the selected scheme can achieve the mathematical maximum

capacity under consideration of your individual configuration settings. Restrictions due to user-defined configuration specifications still make it possible to achieve an ARC Index of 100%. However, user-defined configuration specifications do cause the underlying maximum reference values to change.

An ARC Index of less than 100%, on the other hand, means that the calculated capacity of the selected optimization scheme does not correspond to the theoretically calculated maximum, and other optimization schemes will result in a better capacity.

The number and density of access points is considered when calculating the capacity. Installations with a smaller number or lower density of access points usually achieve a higher ARC Index with a larger channel width. On the other hand, installations with a larger number or higher density of access points usually produce a higher ARC Index with smaller channel widths, since this results in fewer multiple occupancies of channels and thus a higher usable capacity.

Figure 4:
Results of optimization

Summary of optimization results

After the optimization has been performed, a summary of the optimization results is displayed when the configuration settings are transferred to the LMC device profiles. This can also be accessed via the information symbol (i).

Configuration settings

The **main configuration settings** can be set individually for **each frequency band** and are located to the right of the visualization.

With the two controls **Optimize channels** and **Adjust transmitting power**, the different optimization tasks can be performed separately or together.

ARC 2.0 provides preset optimization schemes for common customer scenarios. These can be chosen in a selection box. The related technical parameters are displayed below the selection box.

Preset optimization schemes

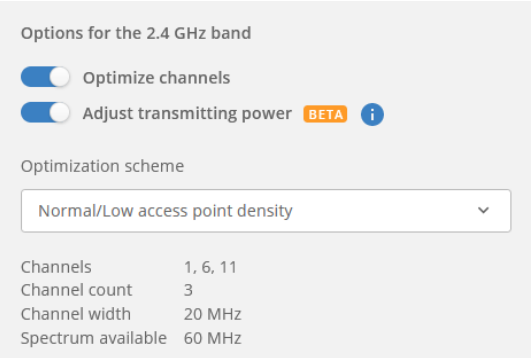

Figure 5:
Configuration settings; 2.4 GHz

The following optimization schemes are available for the 2.4-GHz frequency band:

→ **Automatic**

→ **Normal / low access point density**

→ **High access point density (higher capacity)**

While the “Low access point density” option uses the channel scheme CH 1-6-11, “High access point density” uses the CH 1-5-9-13 channel scheme. Channel bandwidth for all 2.4-GHz schemes is defined as 20 MHz, since 40-MHz channels are generally not recommended in this band.

Figure 6:
Configuration settings; 5 GHz

The following optimization schemes exist in the 5-GHz and 6-GHz bands:

→ **Automatic**

→ **Low access point density (higher bandwidth)**

→ **Normal access point density**

→ **High access point density (higher number of channels)**

This selection sets the channel bandwidth, among other things. In installations with a high density of access points, the channel bandwidth decreases while at the same time the number of used channels increases.

The channel bandwidths of the optimization schemes in the 5-GHz band are

→ for “low access point density” 80 MHz (160 MHz in 6 GHz),
→ for “normal access point density” 40 MHz (80 MHz in 6 GHz) and
→ for “high access point density” 20 MHz (40 MHz in 6 GHz).

The recommended **optimization scheme is “Automatic”**. Based on metrics specifically developed for ARC 2.0, the automatic mode makes complex decisions autonomously for the site being optimized. It selects the mathematically best optimization scheme for the underlying initial situation.

Adjust transmitting power

ARC 2.0 can automatically adjust the transmitting power of the devices at your site. This feature is marked as “BETA” and is currently available **for testing purposes only**.

If enabled, this option adjusts the transmitting power in your installation. In this case, the Wi-Fi forecast allows for previous adjustments to the transmitting power.

If the option is disabled, the current transmitting power of the devices is retained and the optimization makes no further changes.

Disabling the option does not restore the state before it was enabled! If individual transmitting power settings have already been adjusted, it is advisable to make a note of these in case a manual restoration to the previous configuration should be required.

Apply optimization, roll out, and scan again

The calculated optimizations only come into effect after the configuration settings have been transferred to the LMC profiles. Alternatively, these can also be rolled out directly.

Two variants are available here:

→ **Apply optimization** – the configurations are saved to the device profiles of the LMC. The new device configurations can then be rolled out at any time in order to activate the changes.
→ **Apply optimization and rollout** – the displayed configuration is written to the device profiles and rolled out directly. Within minutes, the new optimized configuration is updated to your Wi-Fi devices.

To start a new optimization run, a new environment scan must be carried out. This is done with the button **Rescan Wi-Fi environment**.

A new optimization is worthwhile as soon as there are significant changes to either the radio environment or the usage behavior of the clients.

After rolling out a configuration change, you should wait up to a minute before performing a new environment scan. This allows enough time for the new configuration to be successfully transferred to all devices and for the required operating data to be collected.

Visualization settings

The visualization settings allow you to filter or simplify the graphic display. For example, you can show or hide external networks. You can also choose between the display of all receivable devices or the display of all receivable devices that are on the same operating channel. Visualizing all receivable devices can help to check the installation of individual access points with regard to their direction of radiation, antenna alignment, and transmission power.

Simplified graphics are available for better browser performance. With 260 devices or more, this is activated automatically and a simplified relationship diagram is displayed.

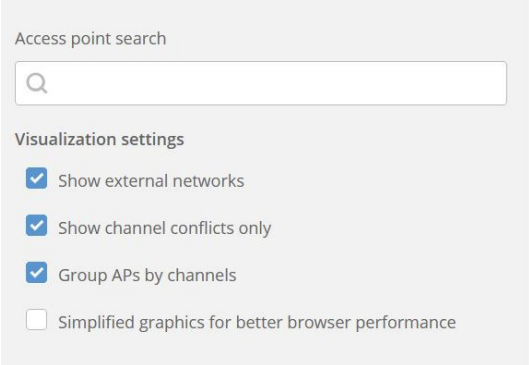

Figure 7:
Visualization settings

User settings

The detailed configuration allows you to specify local restrictions at your site without losing the advantage of the complex, automated optimization. Devices for optimization can be adapted to the individual conditions at the site with the help of user-defined configurations on the “Settings” tab. These settings are made separately for the 2.4-, 5- and 6-GHz bands.

Excluding devices

The selection box next to a device name allows the device to be excluded from channel optimization. It retains its current channel as well as the current channel bandwidth.

Excluding channels

The selection boxes for each channel allows complete channels to be excluded from channel optimization. These channels are not considered in subsequent optimizations.

Excluding particular channels on particular access points

The selection boxes within the table allow certain channels to be excluded for individual devices.

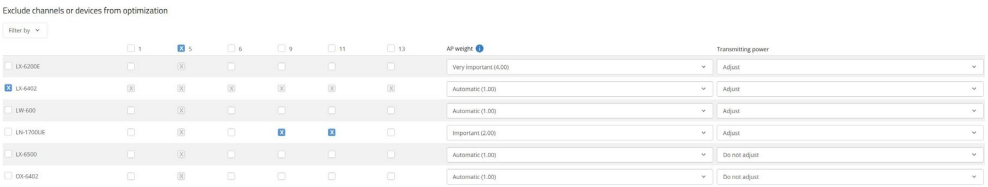

Figure 8:
Example of various user-defined settings to exclude channels and / or access points

Learning and prioritizing access points

AP weight

ARC 2.0 automatically allows for the individual usage behavior of the Wi-Fi clients in your installation. Access points that are subject to high usage are given priority in the channel distribution in such a way that they receive a channel with fewer conflicts. This usually results in a higher throughput for them. This operating mode is preset for each device via the “AP weight: Automatic” setting.

Automatic weight calculation uses learning to process historical device data and map it to an interval between 1.00 (low priority) and 4.00 (high priority). This automatic weighting is recalculated with each scan for the maximum possible accuracy.

Administrators can also prioritize devices manually: **Normal** (weight 1.00), **Important** (2.00) and **Very important** (4.00). Channel distribution is then carried out according to the manual specifications.

Transmitting power

The administrator has the option to explicitly exclude individual devices from the transmission power adjustment. This is done with the **Adjust** or **Do not adjust** control button, which can be set individually for each device. If no adjustment of transmitting power is required for the site, the “Adjust transmitting power” main switch can be disabled on the visualization page.

Optimization types

ARC 2.0 offers two different optimization methods, which can be selected on the tab **Settings > Global**. In small networks or where the number of external networks is relatively high, it may make sense for your devices to avoid channels used by external networks. This behavior is enabled by selecting the option “Consider external networks”. In larger networks, on the other hand, it may be worthwhile to carry out the channel distribution independently of existing external networks for capacity reasons, in order to be able to use the full available channel spectrum. This behavior enabled by ignoring external networks. The “Automatic” setting makes this decision individually for your site.

Glossary

Channel conflict

A “conflict” means that one Wi-Fi device can receive another Wi-Fi device on its operating channel. From a technical point of view, this corresponds to a multiple occupancy or utilization of the channel. Although Wi-Fi protocols allow for this situation and it is rarely problematic, it should be kept to a minimum for reasons of capacity.

Conflict index

Indicator that evaluates the quality of channel distribution of your own Wi-Fi devices and shows potential multiple channel occupations.

Conflict risk

Indicator for evaluating the potential multiple occupancy of channels by external networks.

Own network

All Wi-Fi devices that belong to the site installation and are selected in the ARC 2.0 device list.

External networks

All Wi-Fi devices that do not belong to the site being optimized. These are Wi-Fi devices that can be received in the immediate radio vicinity. This also includes your own Wi-Fi devices located at a different site.

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