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Technical article

Wireless Communication: Rugged vs. smart

Different WLAN Requirements: Industrial Areas vs. Near-industrial Areas

Wireless communication over wireless LAN is increasingly becoming an integral part of our working life. WLAN is not only omnipresent in the office environment, but also plays an ever-greater role in industrial applications, especially when it comes to automation. The exact WLAN requirements, though, differ considerably between the near-industrial office environment and the industrial environment.

WLAN for harsh industrial Environment

When used in an industrial environment, WLAN devices must withstand harsh environmental conditions with high temperature fluctuations, strong vibrations, dust and water. The focus is therefore on the hardware. Warranting consideration is that the WLAN standard according to IEEE 802.11 does not fully meet the demanding requirements of industry. That is why industrial-grade WLAN is also characterized by special features that are required in the automation environment. Both determinism and fast cycle times in the millisecond range are necessary to reliably use PROFINET. Siemens, for example, offers additional functions specially for industry.

On the hardware side, components with a high degree of protection are indispensable for a smooth WLAN operation in industrial applications, since harsh environmental conditions often prevail outside of the control cabinet. The IP protection class indicates how resistant the respective device is to the penetration of solid and liquid substances. This protection is essential for industrial applications, since penetrating substances can cause serious malfunctions. The classification is conducted by the International Electrotechnical Commission (IEC).

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In addition to ruggedness, the size and flexibility of the devices play a not insignificant role in the industrial environment. A high space requirement and effort during the installation are essential factors in the overall cost consideration. That is why we recommend WLAN components that are at the same time rugged, space-saving and easy to install. For example, the new SCALANCE W778 access points and W738 client modules from Siemens. With IP65 protection class, a rugged housing, securely screwed M12 connections for Ethernet and a redundant power supply as well as N-Connect antenna connections, both are ideally suited for the use in harsh environments.

In addition, these new products feature a compact design and offer a variety of installation options; from direct wall mounting to a flat installation to a vertical installation onto a top-hat DIN rail.

Thus, the most cost-effective attachment method for the respective space conditions can always be selected. These flexible installation options and their optimized spare parts inventory recommend the devices for universal use – in a control cabinet as well as cabinet-free outside.

Flexibly usable, compact access points and client modules with IP65 protection class: SCALANCE W778 and W738

IP stands for ingress protection and is followed by a two-digit code. The first digit relates to protection against solid substances. These are measured according to different grain sizes all the way down to dust. Numbers range from zero indicating no protection to six indicating the highest level of protection. The second digit indicates the protection against liquids. The classification ranges from no protection to protection against dripping water to protection against immersion. This classification is stepped from zero to nine, with nine indicating the highest level of protection. IP65 devices therefore have maximum dust protection and a very high level of protection against liquids including water jets. For the use outside of the control cabinet, IP65 is generally preferred, since contact with water is a possibility in production processes. For regular indoor applications, though, this does not go beyond the water jets.

Besides that, both great temperature fluctuations and demanding mechanical stress can be expected in an industrial automation environment. This is where an especially rugged and fail-safe device design pays dividends – one that can withstand severe climatic conditions as well as shock and vibration. This also applies to the antennas and the accessories. Because the respective industrial requirements can only be fully met, if all WLAN components are perfectly matched to one another. In addition to its access points and client modules of the SCALANCE W product family, Siemens offers a wide range of accessories with different characteristics and degrees of protection – for every application.

1st digit	Solid particle protection	2nd digit	Liquid ingress protection
0	No protection	0	No protection
1	Diameter > 50 mm	1	Vertically falling drops
2	Diameter > 12.5 mm	2	Dripping water when tilted
3	Diameter > 2.5 mm	3	Spraying water
4	Diameter > 1.0 mm	4	Splashing of water
5	Dust protected	5	Water jets
6	Dust tight	6	Powerful water jets / flooding
		7	Temporary immersion
		8	Continuous immersion
		9	Powerful water and steam jets

IP protection classes for the classification of the protection against solids and liquids

WLAN for the near-industrial Area

The use of WLAN in near-industrial areas with moderate environmental conditions, however, results in requirements very different from those of typical industrial applications. These uses can be found, for example, in assembly facilities, meeting rooms or engineering departments that are realized close to the productions, and also in open warehouses.

In contrast to the production level, the clients in the network here are not firmly defined. Data are exchanged between computer workstations and changing mobile communication devices such as notebooks or tablet computers, which are used by different people. Hence, a central network management is important for the convenient administration of user

Frequency bands and gross data rates of the different WLAN standards according to IEEE 802.11

IEEE 802.11	a/h	b	g	n	ac
Frequency band	5 GHz	2.4 GHz	2.4 GHz	2.4 + 5 GHz	5 GHz
Gross data rate	54 Mbps	11 Mbps	54 Mbps	600 Mbps	1733 Mbps

Access point with integrated controller function and high data rates thanks to WLAN standard IEEE 802.11ac Wave 2: SCALANCE W1750D direct access point

groups and access rights. For instance, access data and consent declarations can be queried prior to granting access using the authentication method "Captive Portal". By means of an integrated firewall, users and WLAN clients can be filtered according to policies and role assignments to prioritize specific applications or limit the bandwidth.

The data rates in these applications are significantly higher, because the file formats are larger compared to the industrial communication and more complex data are sent simultaneously. For industrial applications, the WLAN standards IEEE 802.11a/b/g/n with gross data rates up to 600 Mbit/s are currently fully adequate. In the near-industrial environment, on the other hand, IEEE 802.11ac Wave 2, with very high data rates up to 1733 Mbit/s, is increasingly establishing itself. With it, even video streaming runs smoothly, which requires enormous bandwidths. Furthermore, the WLAN communication remains stable even if many users are active in the network at the same time.

Since access points in near-industrial environments are generally mounted on suspended ceilings or discreetly to walls, a flat, light and modern design – harmoniously fitting into the space concept – is preferred here.

All of these requirements for centralized administration, Gigabit data rates and design are combined, for example, in the direct access point SCALANCE W1750D from Siemens. Usually, an additional controller is required to manage large WLAN networks. However, the direct access point with its integrated virtual controller allows a direct management of up to 64 access points, without any additional hardware or separate licenses.

The network is individually scalable and can be conveniently expanded by single or multiple devices.

The WLAN standard IEEE 802.11ac operates in the 5 GHz frequency band, which offers more non-overlapping channels than the 2.4 GHz band, but is not yet available everywhere for the office environment. A flexible change to established 2.4 GHz frequency bands is only possible with an additional wireless interface that supports both frequencies with 11n. The W1750D also offers this option. The ARM function (adaptive radio management) also enables an automatic adaptation of the bands and channels. With it, clients operating in the 2.4 as well as 5 GHz bands can be evenly distributed among the bands, which increases the stability as well as the availability and performance of the network. For industrial applications, on the other hand, an automatic radio field optimization would be fatal, because it can lead to unpredictable plant conditions during the real-time operation required in the PROFINET environment.

The right Devices for the particular Application

When selecting the components for the WLAN, it is therefore important to distinguish between the industrial requirements on the one hand, and the near-industrial ones on the other. This is the only way to ensure an efficient, cost-optimized WLAN operation with the right devices for the particular application. New for the harsh industrial environment are rugged access points and clients with IP65 protection class, which are also available in a compact design and can be flexibly mounted. For the near-industrial environment, on the other hand, the latest IEEE 802.11ac Wave 2 access points offer the necessary management functionality in addition to the highest data rates.

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