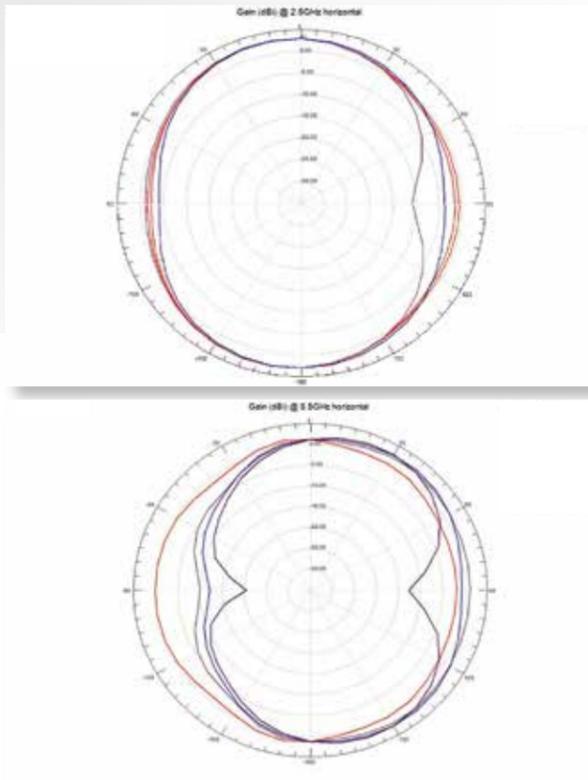


## Remote antennas, WLAN cards ...

### Remote antennas

Solid operator's cabins can considerably interfere with the WLAN connection. Remote antennas are recommended in this case, which are not attached directly to the vehicle computer, but rather to the vehicle roof, for example. They get better reception there.

So as to enable a configuration like this, Advantech-DLoG provides remote antennas from selected manufacturers. Various criteria are taken into consideration when choosing the remote antennas that are optimally attuned to our terminals and the respective customer application. These include technical data such as the antenna diagram, the frequency ranges supported or the antenna gain that describes the directional effect and the efficiency of an antenna. It is also checked whether the antenna model in question will be available in the long-term so that it can be subsequently delivered at any time. There are suitable mounting plates available to ensure a fast installation of the external antennas.



### Choice of wireless cards

Advantech-DLoG checks all wireless cards used by customers in advance using a special testing location on which roaming can be realistically simulated. The roaming properties in particular are subject to a strict control here, whereby particular attention is paid to fast roaming with different security settings. At the same time we ensure that the wireless cards support all current encryption and authentication processes. The user interface is also assessed regarding whether the parameters can be correctly set for the optimum adjustment of the wireless card to the environment, e.g. for roaming. Our WLAN cards support the Cisco Compatible Extensions program CCX from version 4 as well as all current WLAN security settings.

### Close collaboration with manufacturers

Advantech-DLoG works closely with the WLAN component manufacturers. Our WLAN specialists are involved early on in the development phase. They are invited to the first tests and are also beta testers who subject the new components to in-depth error checking. Their professional feedback contributes to quality improvement. Any defects that come to light when testing the wireless cards or their drivers are immediately communicated to the respective manufacturer so that they can be rectified. Advantech-DLoG also simulates customer scenarios, tests WLAN components in these environments, and communicates the results to the manufacturers. This ongoing communication and cooperation means that there is continuous optimization of the WLAN components used.

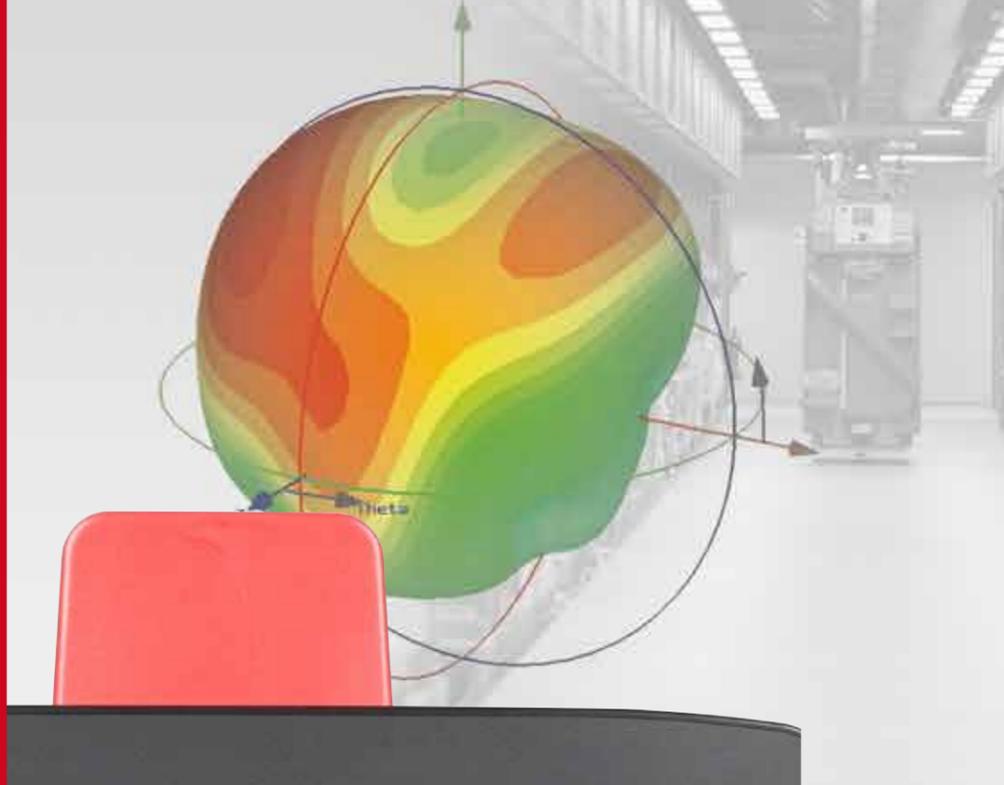
### Driver software for the WLAN cards

A driver is a piece of software that is used to enable a computer to communicate with the connected hardware. The driver is usually provided by the manufacturer of the respective hardware. From time to time, driver updates or even newly developed drivers are made available to improve the performance of the hardware or peripheral equipment.

WLAN cards can only work properly in conjunction with the appropriate driver software. Advantech-DLoG therefore tests and verifies each new driver before the software is released for users.

- ✓ WLAN planning
- ✓ Roaming
- ✓ Antennas
- ✓ WLAN cards
- ✓ Driver software

## Reduce Downtimes and Costs with Individual WLAN Solutions



### How to Optimize Warehouse WLAN

A modern warehouse has very high requirements in terms of efficiency. Wireless technologies enable the use of more efficient digital tools, such as barcode and RFID readers, as well as order picking systems, such as pick-by-voice. As a result, performance, efficiency, quality and reaction speed in warehouse and stock management can be considerably improved. Consequently, WLAN has become prevalent in warehouse logistics as it facilitates constant wireless contact to vehicle computers on forklifts or order pickers. This clears the way for real-time mobile data acquisition and data processing.

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## ... WLAN challenges, roaming, antennas ...

Having a WLAN connection that functions reliably throughout the warehouse is a prerequisite for maximum efficiency gain. Dead zones are counter-productive: if the vehicle computer loses its connection to the WLAN network then, depending on the system and infrastructure, it is necessary to log into the company network and logistics system to re-establish the connection. Every time this happens there is a productivity downtime of several minutes.

### Warehouse WLAN challenges

It generally proves challenging to achieve a stable and uninterrupted WLAN connection in warehouses and distribution warehouses. The wireless coverage is influenced not just by the premises themselves and their facilities (walls, ceilings, shelving etc.), but the type of products being stocked, and the quantity and positioning thereof also affect the WLAN connection. Metal surfaces, products containing water, and glasses can interfere with the wireless signal. Another challenge for the WLAN connection is the ever-changing layout of the various goods in stock. Shelves are emptied or refilled, new shelves are added, block storage units made up of crates, cardboard boxes or pallets are stacked up or dismantled: this means that the wireless requirements in the warehouse often change in a short space of time.

### How roaming works

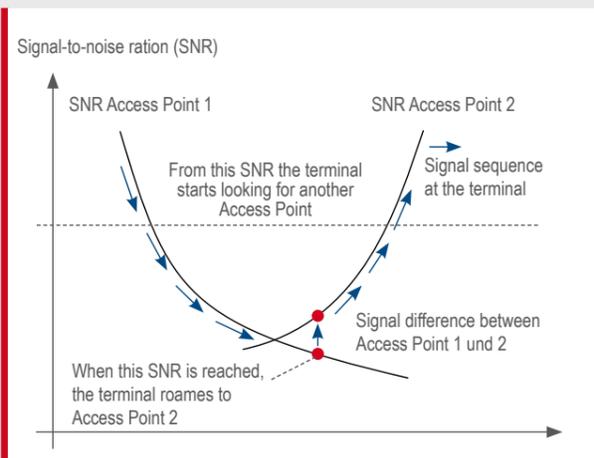
The transmission range of the WLAN stations, called access points, is limited. In order to achieve a consistent wireless transmission throughout the whole warehouse, several access points usually have to be installed.

If a forklift or an order picker terminal is moved through the warehouse, it passes through the transmission ranges of various access points along the way. A special handover procedure is used between these access points so that the wireless connection to the WLAN network is not interrupted. This procedure is called roaming.

In order to make the roaming as smooth as possible, various parameters must be taken into consideration. As a manufacturer of vehicle mounted terminals, Advantech-DLoG influences the following parameters:

- Antennas
- Optimization of the roaming preparation by actively searching for available access points
- Setting the roaming time
- Quick change from one access point to the next, e.g. by specifying the channels used

The vehicle PC continuously measures the signal quality of the access point to which it is already logged on. The signal-to-noise ratio (SNR) is a crucial factor in this. If the value is below a defined SNR value, meaning that the useful signal is too weak in relation to the noise level, the vehicle computer begins to search for other access points on all active channels.



The access points send out data packets, called beacon frames, at regular intervals to provide possible clients with information about the network. These beacon frames allow the forklift terminal to recognize which wireless access points are active on which channels. Advantech-DLoG terminals file this information in a table that contains the BSSID (Basic Service Set Identification, also referred to as Media Access Control Address or MAC address) as well as the channel on which the access point is sent. The terminals are able to select the best access point on which they can roam from this table. Saving and prioritizing the available access points is a special feature of our terminals that can optimize the selection parameters and help to conclude the roaming more quickly.

### Individual WLAN solutions are required

The basis for an optimum and consistent WLAN connection in warehouses is a wireless site survey. The type and positioning of the items in stock must be taken into consideration - after all, for example, a block warehouse with paper products stacked on wooden pallets behaves completely differently in terms of wireless signals than a warehouse with steel shelves full of metal containers.



Therefore, factors in the respective warehouse that could interfere with the wireless transmission must be taken into consideration during the planning phase. These include:

- Absorptions
- Blocks
- Refractions
- Permeations
- Reflections / multipath reception

The optimum positioning and transmission capacity of the access points is determined on the basis of this information, ensuring an optimal WLAN performance and preventing dead zones. **Both too high a power and too high a frequency of the access points can cause data losses.** Advantech-DLoG conducts wireless site surveys if required, makes suggestions regarding the selection of appropriate access points, and determines their ideal positioning.

In addition to an uninterrupted wireless transmission and the optimum roaming parameter settings, the right choice of wireless cards and antennas is very important for the performance of the WLAN network.

### Specially developed terminal antennas

The antenna is an important technical component for ensuring a stable WLAN connection. Even the best WLAN card is worthless without this. Choosing the right antenna with the ideal transmission and reception properties for the respective environment can optimize the signal for the transmission area.

In the demanding warehouse environment, however, there is no sure-fire formula with regard to wave propagation. Therefore, Advantech-DLoG does not use 'off-the-shelf' antennas. Our terminal antennas are developed especially for the terminals. This means that, unlike standard antennas, they are attuned to our terminals in the best possible way and achieve an optimal omnidirectional characteristic. The use of diversity antennas can be helpful for particularly difficult wireless environments. This means that two or more antennas are used to reduce interference effects and to guarantee the reliability and quality of the wireless reception.



The characteristic red protective cap guarantees high mechanical stability and protects the antennas from being damaged. This guarantees a stable WLAN connection, even in difficult conditions. In addition, these terminal antennas support both frequencies used by WLAN, 2.4 and 5 GHz, as well as the WLAN standard 802.11n.



The typical red antenna protective cap is also available in grey (back view).

### Interferences and diversity antennas

Just like an echo in the mountains, wireless waves are reflected by obstacles such as walls, shelves and vehicles. The reflected wireless waves can interfere with the original wireless wave and weaken it or, in certain cases, also completely obliterate it. This phenomenon is called interference.

These interferences cause phase shifts and time delays as well as a weakening or distortion of the signals that reach the antenna's active area. Furthermore, an antenna not only receives the original signal, but also the delayed, reflected signals, which further worsens the reception quality. This is called multipath interferences. If the diversity antennas are used here, the receptor can filter out a great deal of the signal interferences by intelligently connecting the signals to the various reception antennas.