10 Antenna rules

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Antenna rules

1. Antenna gain
A high antenna gain does not automatically mean a better connection. The high gain generates a small angle of radiation, which requires a more precise alignment.

2. Antenna selection
Think about selecting the correct antenna characteristics, particularly on the receiver side. While doing so, pay attention to the correct polarization.

3. Assembly height
An antenna, particularly outside, should be positioned as high as possible. This allows you to improve the range. This keeps the Fresnel zone clear – the higher, the better.

4. Antenna cable as short as possible
The antenna cable should be as short as possible to keep signal loss on the cable as low as possible. Bring the radio module closer to the antenna, e.g. in a small box.

5. Correct protection of antenna connections
Always protect connections on the outside cables, junctions and antennas with protective tape.

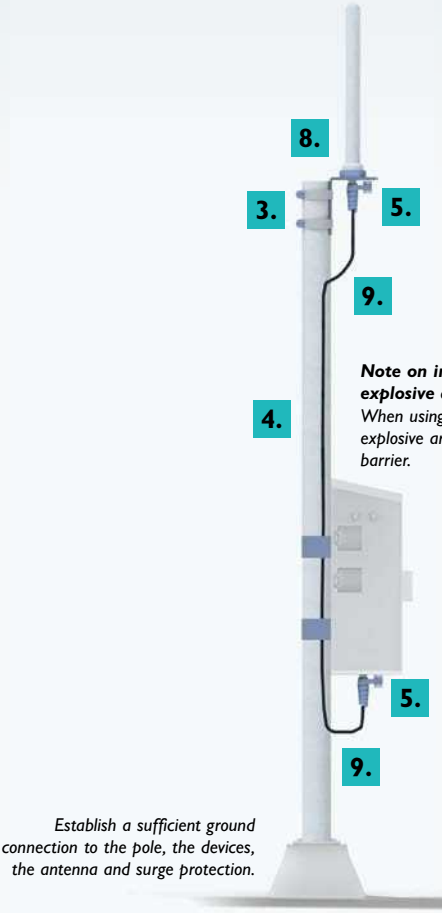
6. Antennas are not lightning arresters
Antennas on buildings are not used as lightning arresters. Select the position of the antenna carefully, use surge protection and do not route the antenna cable parallel to the lightning arrester.

7. Correct mounting
In the case of insufficient stability, the quality of your antenna alignment can be reduced. When mounting the antenna, also think about wind and other outside influences.

8. The right distance
Install the antenna in an open area, as far away as possible from any obstacles such as buildings, trees, other antennas or metal objects.

9. Connection to antenna from below
Outdoor antenna cables should always be connected to the antenna from below. Also use a conduit, if necessary.

10. Weather influences
Fog and rain have nearly no influence on the wireless path. In the case of ice and snow, on the other hand, you must make sure that the antennas are not covered with ice.



Note on installation in potentially explosive areas:
When using antennas in potentially explosive areas, set up an antenna barrier.

Establish a sufficient ground connection to the pole, the devices, the antenna and surge protection.

Explanations

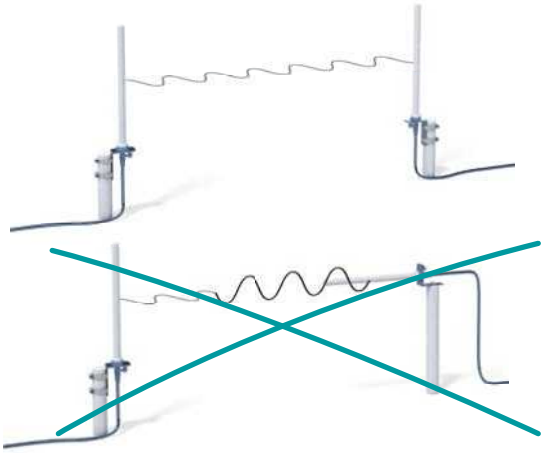
For 2: Antenna selection:

Areas of application for omnidirectional antennas

- Numerous devices in different directions (repeater or mesh networks)
- Versatile applications
- Applications without visual communication (in the case of a reflective environment, the signal can be received via alternate lines)

Areas of application for directional antennas

- Bridging large distances
- Point-to-point connections
- Stationary or linear applications
- Decoupling due to directivity and different polarization planes in the case of multiple point-to-point paths



Make sure the antennas have a uniform polarization plane.

Tip:

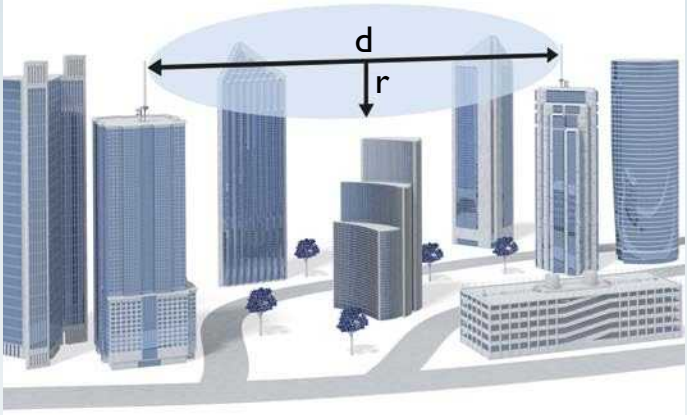
The characteristics of an antenna can be compared with various light sources:

- Bulb → OMNI antenna
- Flashlight → Directional antenna
- Laser pointer → Strong directional antenna, e.g. Yagi or parabolic

You can also combine omnidirectional and directional antennas. While doing so, make sure the antennas have a uniform polarization plane.

For 3: The assembly height (Fresnel zone)

The wireless path may also work if obstacles are within the Fresnel zone (house, tree, etc.). The decisive factor is the number of obstacles and the area they occupy in this zone. In practice, lower frequencies (e.g. 868 MHz) are better at penetrating obstacles.



Tip:

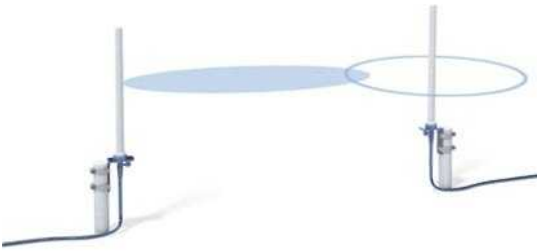
Use antennas with circular polarization in a strongly reflective environment. This type of antenna prevents polarization loss, allowing you to achieve higher gain in this environment. To improve the signal strength, you can also combine circularly and vertically polarized antennas.

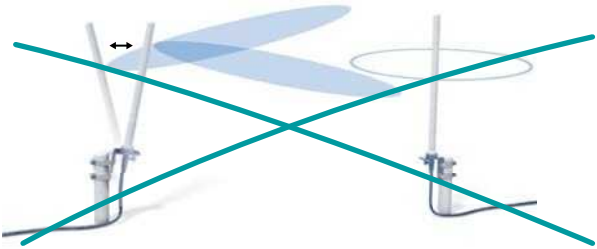
Wireless path distance (d)	Antenna height (r)		
	868/900 MHz	2.4 GHz	5 GHz
200 m	4.0 m	2.5 m	1.5 m
500 m	6.5 m	4.0 m	2.5 m
1000 m	9.0 m	5.5 m	4.0 m
2000 m	13.0 m	8.0 m	5.5 m
4000 m	18.5 m	11.0 m	8.0 m
10,000 m	29.0 m	–	–
20,000 m	41.5 m	–	–
30,000 m	50 m (900 MHz only)	–	–

Radius of the Fresnel zone depending on the frequency and distance. This yields the mounting height for antennas.

For 7: The correct mounting

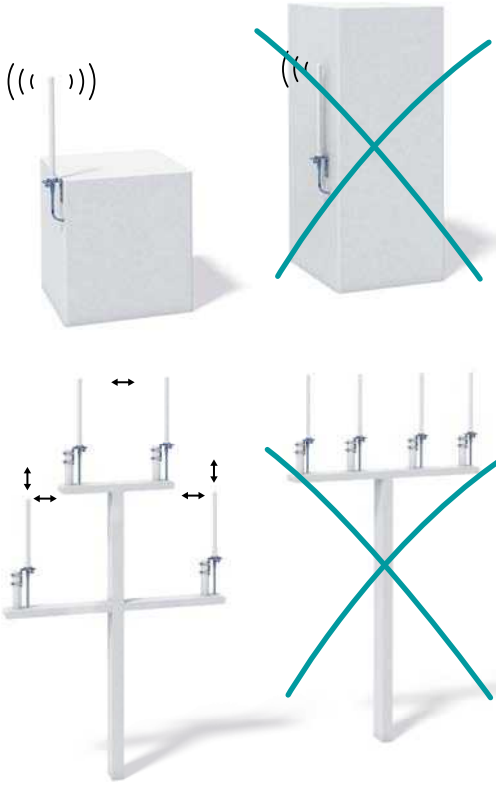
Note: Always tighten all screw connections so they are secure, ideally using a torque spanner. In particular when using directional antennas with a small apex angle, you should ensure that the antenna cannot be shifted by the wind.
If the antenna is moved by just one cm from its original position, this may result in a partial loss of the wireless signal, especially in the case of a long transmission path.





For 8: The right distance

An omnidirectional antenna must always be installed at a sufficient distance from obstacles (poles, building walls or metal walls).
If multiple radio modules are used, you have to make sure the antennas are spread out at sufficient distances from one another.



It is best to install the antennas above each other on a pole.

Frequency	**Minimum distance** (vertical and horizontal)
868/900 MHz	1.5 – 2.5 m
2.4 GHz	0.5 – 1.0 m
5 GHz	0.5 – 0.8 m

Further information on antennas and antenna accessories:
Simply type a web code into the search field on our website.

Web code: #0569

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