WHITE PAPER

Installations near antennas and sensitive radio equipment

June 2026

AXIS COMMUNICATIONS

Summary

While Axis products are certified to global electromagnetic compatibility (EMC) standards, specialized environments often present challenges that exceed standard testing parameters.

To prevent mutual interference, Axis devices shouldn't be installed close to radio communication antennas. You should also use robust cable shielding and intentional placement of the device cabling.

Recommendations:

- Install the device and its power injector more than 3 m (10 ft) away from radio communication antennas. This protects both systems from radiated interference.
- Use shielded Ethernet cables to mitigate conducted interference. We recommend SF/FTP cables, which have the highest level of shielding, but S/FTP cables are also acceptable.
- For extra protection, you can run the shielded cable through a grounded metal conduit and place it as far as possible from the radio equipment.

Specific regional, local, or industry-specific standards may exist that differ from the general certifications held by Axis products. In environments with extreme electromagnetic sensitivity, we recommend you to perform on-site testing to ensure the installation meets the particular requirements of that environment.

Table of Contents

1 Introduction

Sensitive radio communication transmitters and receivers can be disturbed by electronic equipment. This physical phenomenon is known as electromagnetic interference (EMI).

This white paper provides background and general guidance for installing Axis devices in locations with antennas and sensitive radio equipment. It explains the underlying principles of electromagnetic compatibility (EMC) and the rationale behind the installation recommendations, so you can make informed decisions when you plan and carry out an installation.

2 Electromagnetic compatibility and certifications

Electronic devices both emit and receive electromagnetic energy. Electromagnetic compatibility (EMC) is the ability of a device to operate as intended in its electromagnetic environment without causing interference to other nearby equipment or being adversely affected by external electromagnetic sources.

The concept of EMC thus encompasses two distinct but related aspects: emissions and immunity.

- Electromagnetic emissions – the energy that a device radiates or conducts into its surroundings
- Electromagnetic immunity – a device's ability to maintain correct functionality when exposed to external interference

Regulatory bodies in most countries require electronic products to meet established EMC standards before the products are brought to market. These standards prescribe specific limits on emissions and define the minimum levels of immunity required for operation. While Axis devices are tested and certified to comply with the applicable EMC standards for their intended environments, compliance with general standards doesn't guarantee flawless performance in every scenario. Installations located near powerful radio transmitters or high-gain antennas often present conditions that exceed standard testing parameters. In such instances, adherence to rigorous installation practices is as critical as the performance of the device itself.

Furthermore, specific regional, local, or industry-specific standards may exist that differ from the general certifications held by Axis products. In environments with extreme electromagnetic sensitivity, we recommend you to perform on-site testing to ensure the installation meets the particular requirements of that environment.

3 Pathways of interference

Electromagnetic interference (EMI) can reach electronic equipment through two primary coupling paths: radiated through the air or conducted through cables.

Radiated interference travels through the air as electromagnetic waves. The intensity of this interference decreases significantly with distance.

Conducted interference travels along the length of interconnected cables. A cable running near an antenna can act as an unintentional antenna itself, picking up electromagnetic energy and carrying it directly into a device. The longer the exposed cable and the closer it runs to the source of interference, the more energy it picks up.

While these two types of interference behave differently, they are often linked. A signal that starts in the air can be picked up by a nearby cable and turned into conducted interference. By understanding these two paths, we can better protect an installation through a combination of smart equipment placement and careful cable management.

4 Interference and shielding

Effective installation practices are based on an understanding of how electromagnetic energy interacts with cables and devices.

4.1 Cables as unintentional antennas

Any conductor carrying an alternating electrical signal radiates electromagnetic energy into its surroundings. Conversely, any conductor exposed to an electromagnetic field will have a voltage induced within it. This physical principle explains why an unshielded Ethernet cable positioned near a transmitting antenna can capture significant interference by acting as an unintentional receiving antenna. The efficiency of this energy capture depends on the physical length of the cable relative to the wavelength of the interfering signal. For instance, a signal at 150 MHz has a wavelength of approximately 2 meters, meaning a cable between 50 and 100 centimeters in length can resonate with that frequency and maximize interference. The orientation of cables also matters, as a cable running parallel to an antenna's radiated field captures more energy than one positioned perpendicularly.

4.2 How distance and shielding minimize coupling

Maintaining a physical separation from high-power antennas is a fundamental protective measure. Electromagnetic field strength follows the inverse square law in the far field, where doubling the distance from a source reduces the field strength to approximately one quarter of its original intensity. This mathematical relationship explains why moving a device or cable just a little further away can reduce interference significantly.

Since distance alone can't always eliminate interference in high-density environments, effective cable shielding and routing are also important. Shielded cables are used to intercept and divert electromagnetic energy. These cables have a conductive layer of aluminum foil or copper braid to surround the signal-carrying conductors. When an electromagnetic field encounters this barrier, the field induces a current within the shield rather than within the internal wires. Provided the shield is correctly grounded at both ends, the current is diverted safely to the ground.

4.3 Shielded cable types

Shielded cables are engineered to mitigate the effects of conducted interference. The shield, which consists of a layer of braided metal or foil surrounding the internal conductors, serves to absorb and divert electromagnetic energy away from the signal-carrying wires.

Different cable architectures offer varying degrees of protection.

- F/UTP cables utilize a single foil shield and can be suitable in low-interference environments where basic protection is sufficient.
- S/FTP cables, which feature a braided shield around the assembly and individual foil shields for each pair, are more effective across a broader frequency range.
- SF/FTP cables represent the highest standard, employing both foil and braided shields to protect against a wide spectrum of interference.

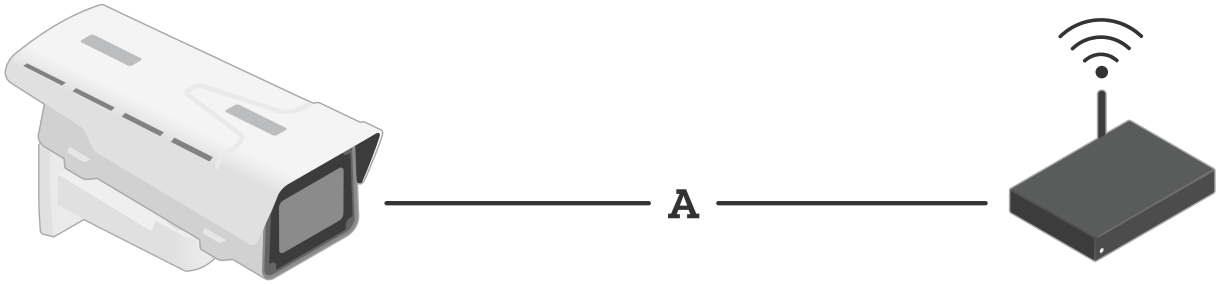
You can also further enclose these cables within an extra, grounded metal conduit. This extends the electromagnetic barrier along the entire path of the installation. The conduit serves as a rigid outer shield. If you bond it to a metal structure using appropriate clamps, it ensures that induced currents are conducted away from the data signal. Materials with low resistivity, such as copper or aluminum, are the most effective for this purpose.

5 Recommendations

Maintaining electromagnetic compatibility requires a combination of spatial planning and hardware protection. These guidelines outline the necessary precautions to minimize electromagnetic disturbances.

5.1 Keep distance between devices and antennas

To minimize electromagnetic interference, electronic equipment should be kept at a distance from radio equipment. Axis devices, including any power injectors, should be installed away from radio communication antennas. We recommend a distance of at least 3 m (10 ft).



The distance A should be at least 3 m (10 ft).

Maintaining this separation protects both systems. The Axis device can disturb the radio equipment, and if the radio equipment generates strong fields (because of high transmission power) it could potentially also impair the Axis device's performance. Axis devices generally aren't certified to be installed in locations where strong electromagnetic fields are present.

Axis devices are tested and certified to comply with applicable EMC standards for their intended environments. They are certified according to global standards, but local or industry-specific limits might vary. For installations in highly EMC-sensitive environments, it is the responsibility of the installer to verify performance through site-specific testing.

5.2 Protect the network cable

The shorter the distance between an antenna and an Axis device, the more you need to protect the device's cabling by implementing robust shielding and managing the placement. The Ethernet cable can otherwise work as a carrier of disturbances.

Always use shielded Ethernet cables. We recommend SF/FTP cables, which have the highest level of shielding. S/FTP cables are also acceptable.

For extra protection, you can insert the Ethernet cable in a thin metal conduit and place it as far as possible from the antennas and isolated from any power cables. The conduit should be made of a material with low resistivity, typically copper or aluminum. Try to minimize the free cable length close to the device by having the conduit end near the device. It's also helpful if you can secure the conduit to a metal structure by use of metal clamps. This can effectively ground the conduit and neutralize unwanted currents.

About Axis Communications

Axis enables a smarter and safer world by improving security, safety, operational efficiency, and business intelligence. As a network technology company and industry leader, Axis offers video surveillance, access control, intercoms, and audio solutions. These are enhanced by intelligent analytics applications and supported by high-quality training.

Axis has around 5,000 dedicated employees in over 50 countries and collaborates with technology and system integration partners worldwide to deliver customer solutions. Axis was founded in 1984, and the headquarters are in Lund, Sweden.