SIEMENS

SIMATIC RF600

RFID systems RF600

System Manual

Introduction 1

Safety Information 2

System overview 3

RF600 system planning 4

RF660R reader 5

Antennas 6

Transponder/tags 7

Accessories 8

Appendix A

09/2005 Edition, J31069 D0171-U001-A0-7618

Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

Danger

indicates that death or severe personal injury **will** result if proper precautions are not taken.

Warning

indicates that death or severe personal injury **may** result if proper precautions are not taken.

Caution

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

Caution

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

Notice

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

Warning

This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Automation and Drives
Postfach 48 48
90437 NÜRNBERG
GERMANY

Order No.:
Edition 09/2005

Table of contents

1 Introduction 1-1

1.1 Preface 1-1

1.2 Navigating in the system manual 1-3

2 Safety Information 2-1

2.1 General safety instructions 2-1

3 System overview 3-1

3.1 RF System SIMATIC RF600 3-1
3.1.1 Application areas of RF600 3-2
3.1.2 Features 3-3

4 RF600 system planning 4-1

4.1 Overview 4-1

4.2 Antenna configurations 4-2
4.2.1 Antenna configuration example 4-2
4.2.2 Possibilities and application areas for antenna configurations 4-3
4.2.3 Tag orientation in space 4-6
4.2.4 Specified minimum and maximum spacing of antennas 4-7
4.2.5 Mutual interference of readers (antennas) 4-9
4.2.6 Reading range 4-10
4.2.7 Increasing the probability of identification for tags - Antenna switching 4-11

4.3 Environmental conditions for transponders 4-12
4.3.1 Basic rules 4-12

4.4 The response of electromagnetic waves in the UHF band 4-13
4.4.1 The effect of reflections and interference 4-13
4.4.2 Influence of metals 4-14
4.4.3 Influence of liquids and non-metallic substances 4-15

4.5 Regulations applicable to frequency bands 4-16
4.5.1 Regulations for UHF frequency bands in Europe 4-16
4.5.2 Regulations for UHF frequency bands in the USA 4-18

4.6 Guidelines for electromagnetic compatibility (EMC) 4-19
4.6.1 Overview 4-19
4.6.2 What does EMC mean? 4-20
4.6.3 Basic rules 4-20
4.6.4 Propagation of electromagnetic interference 4-23
4.6.5 Prevention of interference sources 4-27
4.6.6 Equipotential bonding 4-28
4.6.7 Cable shielding 4-29

5 RF660R reader 5-1

5.1 Description 5-1
5.1.1 Ordering data 5-2

5.1.2 Design of the RF660R reader ... 5-3
5.1.3 Status displays ... 5-4
5.1.4 Pin assignment of the serial interfaces ... 5-5
5.1.5 Pin assignment and connections of the digital I/O interface ... 5-6
5.1.6 Power supply ... 5-8
5.1.7 Grounding connection ... 5-9
5.2 5-10
5.3 Installation /Mounting ... 5-10
5.3.1 Mounting/Installation ... 5-10
5.4 Configuration/integration ... 5-10
5.4.1 Configuration ... 5-10
5.4.2 Transmission protocols ... 5-12
5.5 Maintenance and service ... 5-13
5.6 Technical specifications ... 5-14
5.6.1 Technical specifications of RF660R ... 5-14
5.7 Dimension drawings ... 5-17
5.7.1 Dimension drawings ... 5-17
5.8 Certificates and approvals ... 5-18
5.8.1 FCC information ... 5-18
5.8.2 Compliance distance for RF Exposure ... 5-18
6 Antennas ... 6-1
6.1 RF660A antenna ... 6-1
6.1.1 RF660A description ... 6-1
6.1.2 Application Planning ... 6-4
6.1.3 Installation /Mounting ... 6-6
6.1.4 Connecting an antenna to a reader ... 6-9
6.1.5 Technical specifications ... 6-10
7 Transponder/tags ... 7-1
7.1 Mode of operation of transponders ... 7-1
7.2 Transponder classes and generations ... 7-2
7.3 Electronic Product Code (EPC) ... 7-4
8 Accessories ... 8-1
8.1 Wide-range power supply unit for SIMATIC RF systems ... 8-2
8.1.1 Features ... 8-2
8.1.2 Scope of supply ... 8-4
8.1.3 Ordering data ... 8-4
8.1.4 Safety Information ... 8-4
8.1.5 Connecting ... 8-5
8.1.6 Technical specifications ... 8-6
8.1.7 Modification possibilities ... 8-8
8.1.8 Pin assignment of DC outputs and mains connection ... 8-8
8.1.9 Dimension drawing ... 8-9
A.1 Certificates and approvals ... A-1
A.2 Service and support ... A-4
A.3 Contact partners ... A-5
A.4 Training ... A-5

Introduction

1

1.1 Preface

Purpose of this document

This system manual contains the information needed to plan and configure the system.

It is intended both for programming and testing/debugging personnel who commission the system themselves and connect it with other units (automation systems, further programming devices), as well as for service and maintenance personnel who install expansions or carry out fault/error analyses.

Where this documentation is valid

This documentation is valid for all supplied variations of the SIMATIC RF600 system and describes the state of delivery as of September 2005.

Conventions

The following terms/abbreviations are used synonymously in this document:

- Reader, read/write device, write/read device
- Tag, transponder, mobile data memory, data carrier, SmartLabel
- Communication module, interface module

History

Edition	Remarks
09/2005	First Edition

Declaration of conformity

The EC declaration of conformity and the corresponding documentation are made available to authorities in accordance with EC directives. Your sales representative can provide these on request.

Observance of installation guidelines

The installation guidelines and safety instructions given in this documentation must be followed during commissioning and operation.

1.2 Navigating in the system manual

Structure of contents	Contents
Table of Contents	Organization of the documentation, including the index of pages and chapters
Introduction	Purpose, layout and description of the important topics.
Safety Information	Refers to all the valid technical safety aspects which have to be adhered to while installing, commissioning and operating the product/system and with reference to statutory regulations.
System overview	Overview of all RF identification systems, system overview of SIMATIC RF600
RFID system planning	Information about possible applications of SIMATIC RF600, support for application planning, tools for finding suitable SIMATIC RF600 components.
Readers	Description of readers which can be used for SIMATIC RF600
Antennas	Description of antennas which can be used for SIMATIC RF600
Transponders	Description of transponders which can be used for SIMATIC RF600
Appendix	Service and support, contact partners, training centers
List of abbreviations	List of all abbreviations used in the document

Safety Information

2

2.1 General safety instructions

Caution

Please observe the safety instructions on the back cover of this documentation.

SIMATIC RFID products comply with the salient safety specifications to IEC, EN, UL and CSA. If you have questions about the admissibility of the installation in the designated environment, please contact your service representative.

Caution

Alterations to the devices are not permitted.

Failure to observe this requirement shall constitute a revocation of the radio equipment approval, CE approval and manufacturer's warranty.

Repairs

Repairs may only be carried out by authorized qualified personnel.

Warning

Unauthorized opening of and improper repairs to the device may result in substantial damage to equipment or risk of personal injury to the user.

System expansion

Only install system expansion devices designed for this device. If you install other upgrades, you may damage the system or violate the safety requirements and regulations for radio frequency interference suppression. Contact your technical support team or your sales outlet to find out which system upgrades are suitable for installation.

Caution

If you cause system defects by installing or exchanging system expansion devices, the warranty becomes void.

System overview

3

3.1 RF System SIMATIC RF600

SIMATIC RF600 is an identification system that operates in the UHF range. UHF technology supports large write/read distances with passive tags.

The SIMATIC RF660-R read/write devices (readers), fitted for example on the gate of a warehouse, automatically record every movement of goods, and signal these to the host systems. The data are filtered and compressed there by data management software in order, for example, to generate the receiving department transaction for the ERP system. At the same time, the delivery can be automatically checked for correctness and completeness prior to storage by means of the electronic delivery list.

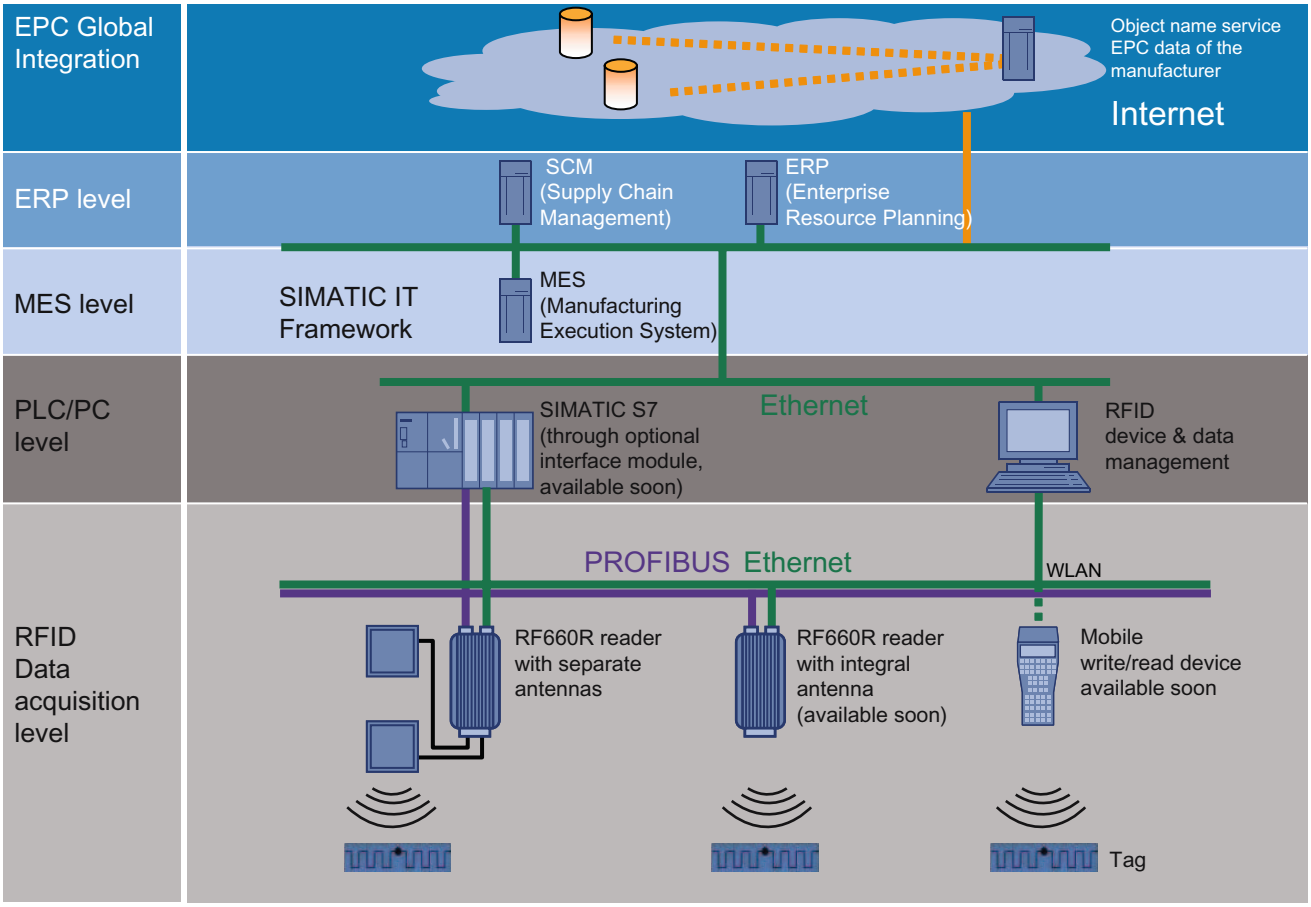


Figure 3-1 System overview of SIMATIC RF600

3.1.1 Application areas of RF600

RFID (radio frequency identification) permits interruption-free tracking and documentation of all delivered, stocked and shipped goods in the incoming goods, warehouse, production logistics and distribution departments. A small data medium - referred to as SmartLabel or tag - is adhered to every item, package or palette, and contains all important information. The data medium receives the power it requires via an antenna which is also used for data transmission.

Equipped with a rugged casing to the high IP 65 degree of protection and suitable for use over a wide range of temperatures, the reader is also a match for the demands of harsh industrial conditions in, for example, warehouses or on loading ramps.

3.1.2 Features

The RF600 identification system has the following performance features:

RFID system RF600	
Type	Contactless RFID (Radio Frequency IDentification) system in the UHF band
Transmission frequency	865-868 MHz (Europe) 902-928 MHz (USA)
Read/write distance	Europe: < 3.5 m USA: < 4 m

Data carrier/tags	
Memory	Up to 2048 bits
Type	Smart Labels Container tag (available soon) Heat-resistant data medium (available soon)
Standards	EPCglobal Class 1, Gen 2 ISO 18000-6B

Software	
Data Manager	PC software for • Configuration and diagnostics • Interfacing to IT systems
Configuration software	PC software for parameterizing the RF660R reader
System requirements	Windows XP with Net Framework 1.1

RF600 system planning

4

4.1 Overview

You should observe the following criteria for implementation planning:

- Antenna configurations
- Environmental conditions for transponders
- The response of electromagnetic waves in the UHF band
- EMC directives

4.2 Antenna configurations

4.2.1 Antenna configuration example

The following diagram shows an example of a portal configuration. The antenna are positioned at the height at which the tags are expected which are to be identified. The maximum width of the portal that is recommended for reliable operation is 4 m.

The diagram shows a configuration with two antennas. Up to four antennas can be used depending on the local conditions.

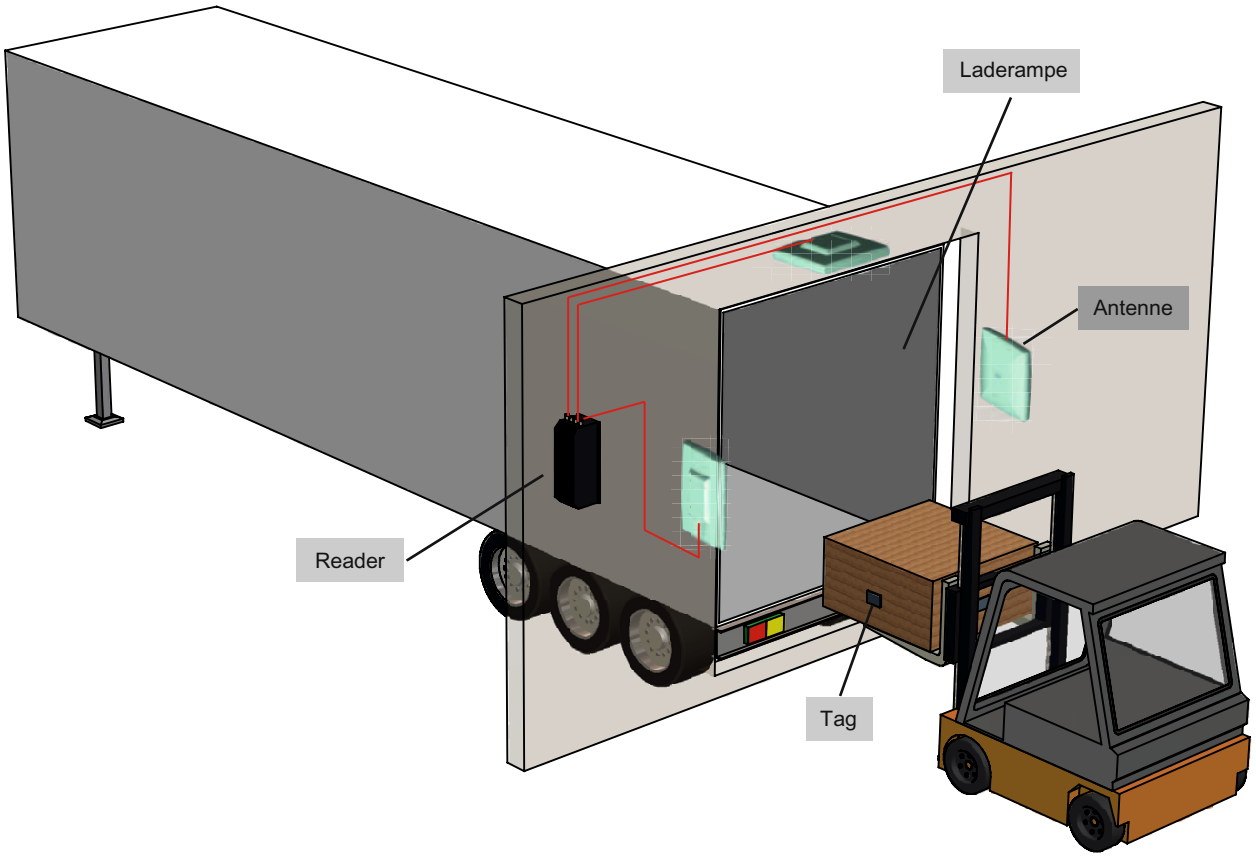
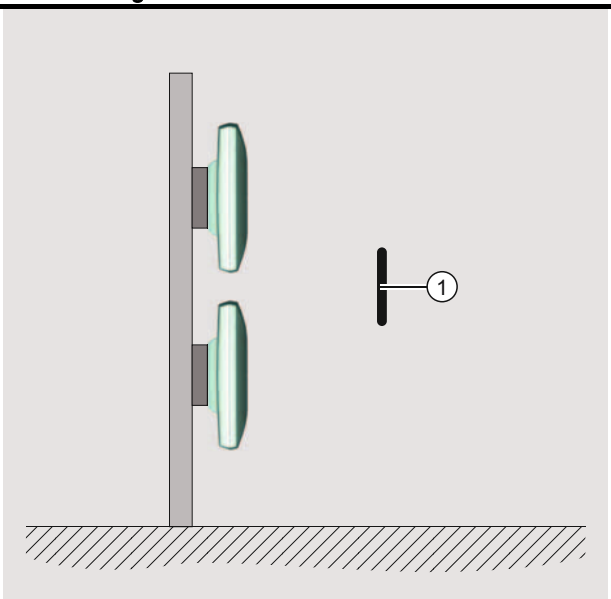
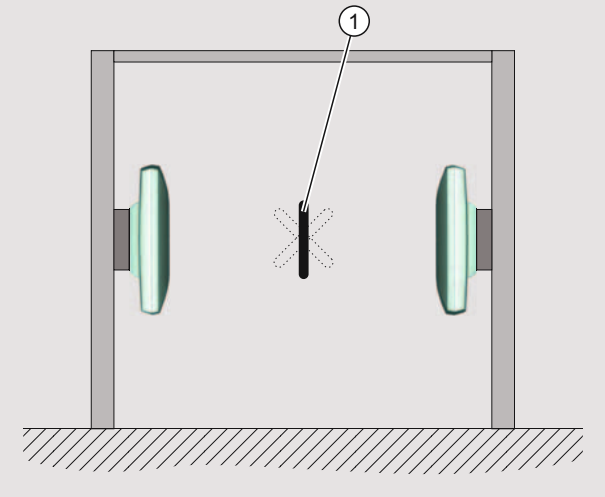


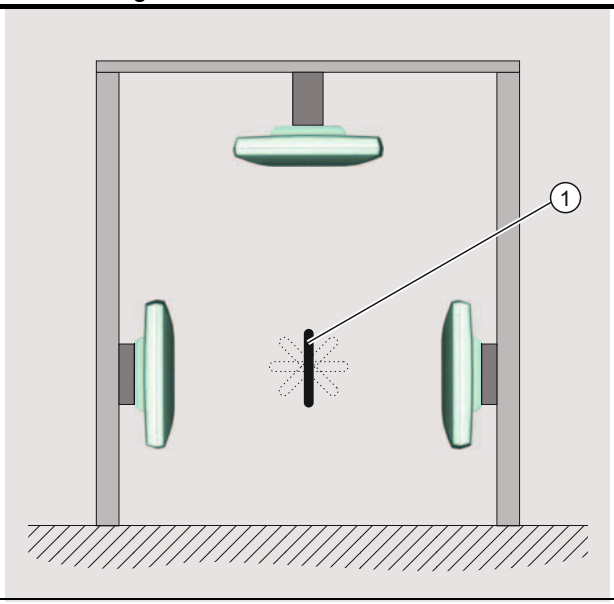
Figure 4-1 Typical gate configuration

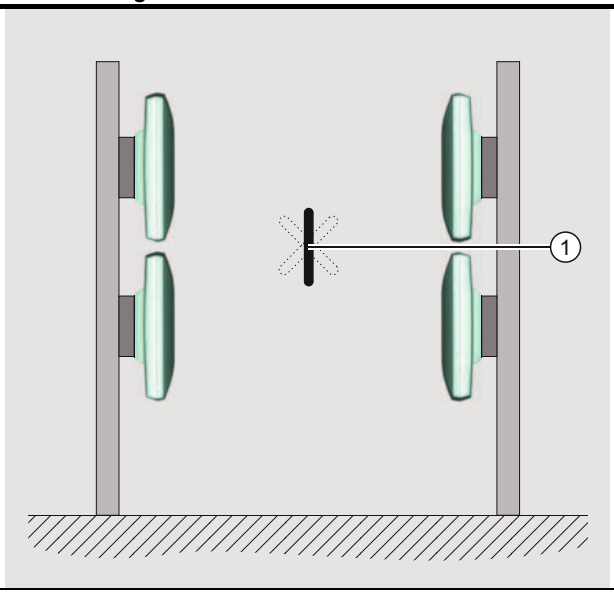
4.2.2 Possibilities and application areas for antenna configurations

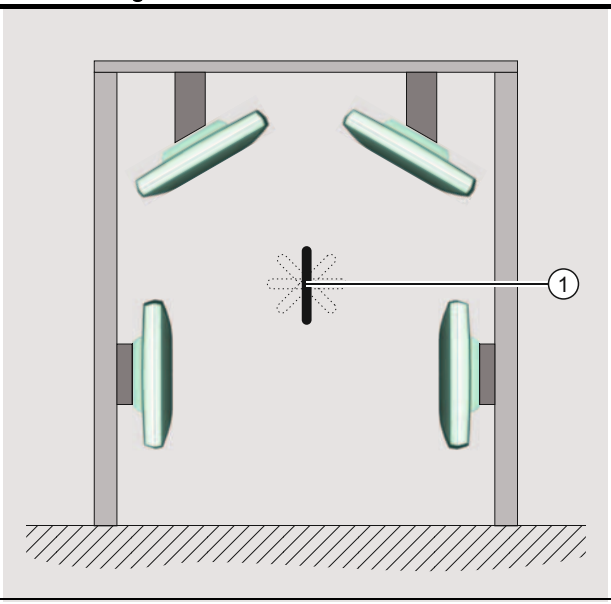
Some basic antenna configurations and possible fields of application are shown below.

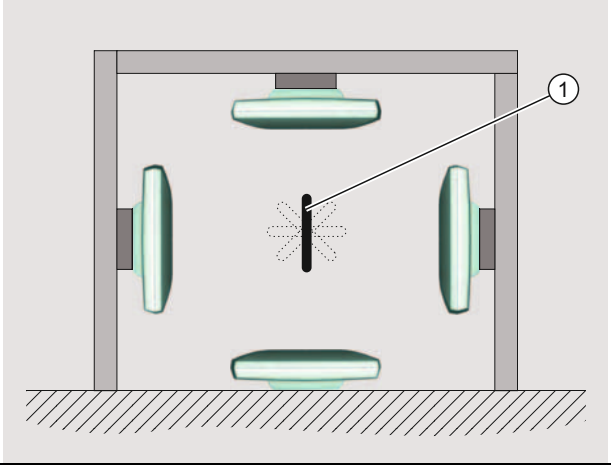
Antenna configuration 1:	Description/ application areas
	This arrangement of antennas is appropriate when the tags to be read are only located on one side of the items to be identified, e.g. when palettes are to be identified on which the tags to be read must be on a prespecified side. ① Tag

Antenna configuration 2:	Description/ application areas
	Preferred application: In the identification of goods in loading portals. The tag is located in the field of radiation of two antennas; for reliable tag reading, the height of the tag above floor level must therefore be known with reasonable accuracy. ① Tag

Antenna configuration 3:	Description/ application areas
	Preferred application: In the identification of goods in loading portals. Similar to configuration 2, but with additional reading reliability when the tag is at an angle to the vertical. ① Tag

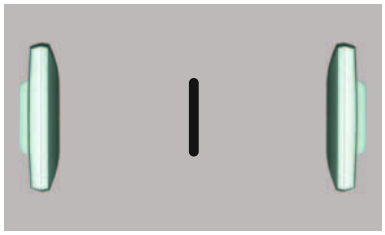
Antenna configuration 4:	Description/ application areas
	Preferred application: In the identification of goods in loading portals. The tag is located in the field of radiation of all four antennas, so the tag position can vary more than in configuration 2 for reliable tag identification. ① Tag

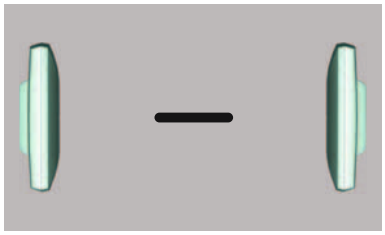
Antenna configuration 5:	Description/ application areas
	Preferred application: In the identification of goods in loading portals. Similar to configuration 4, but the reliability of tag identification is improved as a result of the four antennas at separate locations, so the tag position is not critical. ① Tag

Antenna configuration 6:	Description/ application areas
	This tunnel configuration is suitable for conveyor belt applications. The goods with the tags to be read are moving forwards on a conveyor belt but the alignment of the tags relative to the antennas is not clearly defined. One of the antenna is located on the floor and radiates vertically upwards in the direction of the conveyor belt. A relatively high reading reliability is achieved due to the use of four antennas. ① Tag

4.2.3 Tag orientation in space

The alignment of the tag antenna to the antenna of the reader affects the reading range. For maximum performance and to achieve the maximum reading range, the tag antenna should therefore be aligned in parallel with the reader antenna:

Parallel tag alignment	Large reading range
	Maximum probability of identification of tags.

Perpendicular tag alignment	Minimal reading range
	Minimum probability of identification of tags.

4.2.4 Specified minimum and maximum spacing of antennas

Specified minimum spacing of antennas

The following diagram shows the specified minimum and maximum spacings for mounting antennas:

A minimum spacing of 50 cm is necessary between the antenna and liquids or metals. The distance between the antenna and the floor should also be at least 50 cm.

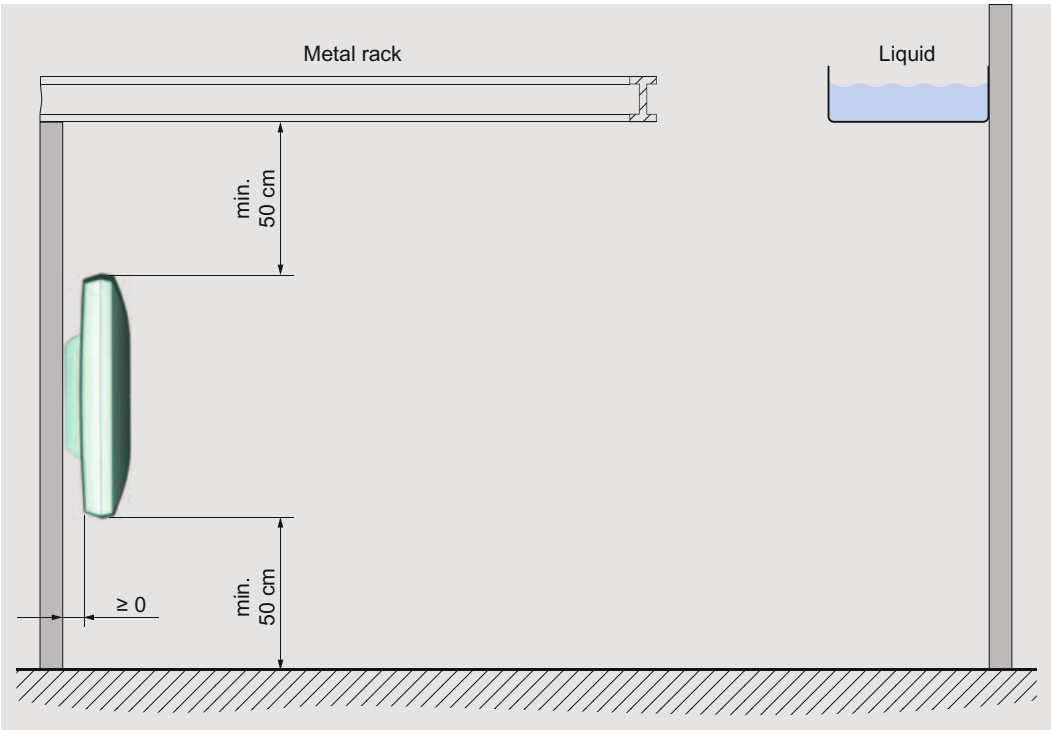


Figure 4-2 Distance to the environment

The distance between two antennas mounted alongside each other or one above the other should be at least 20 to 50 cm.

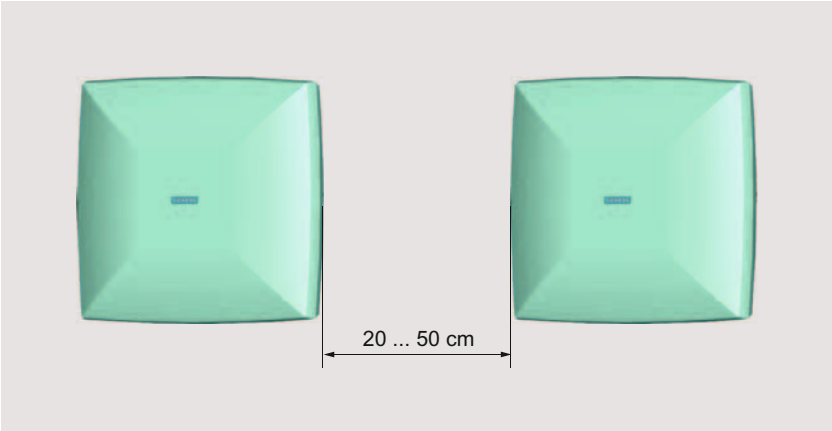


Figure 4-3 Antennas mounted adjacently horizontally or vertically

For a portal configuration, the distance between two antennas that are connected to the same reader is up to 3.5 m (in Europe) or 4 m (in the USA).

Figure 4-4 Portal configuration

4.2.5 Mutual interference of readers (antennas)

Using more than one reader

When several RFID readers are used, there is a danger that RFID tags can also be read by other readers. It must be ensured that the tag can only be identified by the appropriate reader.

Technical faults between readers can then only occur when they transmit on the same channel, i.e. in the same frequency range of a frequency band.

To prevent this, the RF660R reader uses the "Listen before talk" technique in Europe or frequency hopping between many different channels in the USA.

4.2.6 Reading range

The reading range between the reader (antenna) and the transponder is affected by the following factors:

The reading range depends on	Description
Transmit power of the reader	The higher the transmit power of the reader, the larger the reading range.
Tag size and type	The larger the tag antenna, the larger the power input area and therefore the larger the reading range.
Absorption factor of the materials	The higher the absorption of the surrounding material, the smaller the reading range.
Antenna amplification	The bigger the antenna amplification, the larger the reading range.
Production quality of the tag	The better the tag has been matched to the operating frequencies during manufacturing, the greater the reading range
Reflection characteristics of the environment	In a multiple-reflection environment, the reading range can be significantly higher than in a low-reflection environment.

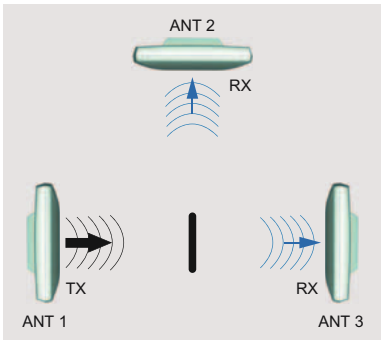
.

4.2.7 Increasing the probability of identification for tags - Antenna switching

To achieve a high probability of reading tags, the antenna switching function has been implemented in the RF600R reader:

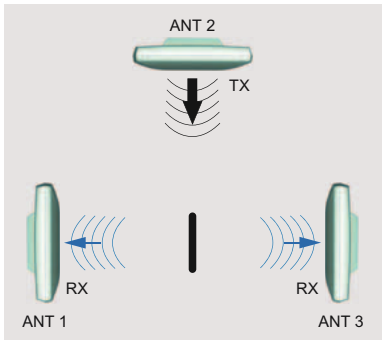
At a given time, the system transmits on one antenna and receives on the other antennas. As long as the antenna is receiving signals from further tags, the system continues to transmit on the same transmit antenna until all responding tags have been identified. Subsequently, or if no tags respond, the system activates another antenna as the transmit antenna. After all the antenna have transmitted at least once, or when the settling time is excessively long, the reader activates frequency hopping (in the USA) or channel selection (in Europe).

Cycle 1



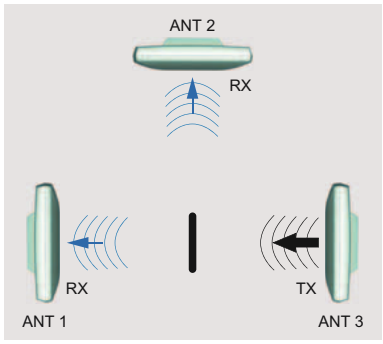
Antenna 1 transmits
Antenna 2 and 3 receive

Cycle 2



Antenna 2 transmits
Antenna 1 and 3 receive

Cycle 3



Antenna 3 transmits
Antenna 1 and 2 receive

4.3 Environmental conditions for transponders

4.3.1 Basic rules

The transponder must not be placed directly on metal surfaces or on containers of liquid. For physical reasons, a minimum distance must be maintained between the tag antenna and conductive material. A minimum distance of 5 cm is recommended. The tag function is improved with greater distances (between 5 and 20 cm).
The best performance is achieved when the tag is mounted on a non-conductive material such as plastic or wood.

Exception:
Tags that are designed for direct mounting on metal.

4.4 The response of electromagnetic waves in the UHF band

4.4.1 The effect of reflections and interference

Reflections and interference

Electromagnetic waves in the UHF band behave and propagate in a similar manner to light waves, that is they are reflected from large objects such as ceilings, floors, walls and windows and interfere with each other. Due to the nature of electromagnetic waves, interference can lead to wave amplification which can produce an increased reading range. In the worst case, interference can also result in waves being extinguished which causes holes in reader coverage.

Reflections can also be beneficial when they cause electromagnetic waves to be routed around objects to a certain extent (deflection). This can increase the reading probability.

Due to these electromagnetic characteristics, it is extremely difficult in the multiple-reflection environment that is usually found in the real environment on site, to determine propagation paths and field strengths for a particular location.

Reducing the effect of reflections/interference on tag identification

- Reducing the transmit power:
  To reduce interference to a minimum, we recommend that the transmit power of the reader is reduced until it is sufficient for an identification rate of 100 %
- Increasing the number of antennas to 3 or 4:
  More antennas in a suitable antenna configuration can prevent gap in reader coverage

4.4.2 Influence of metals

Metal can have an effect on the electromagnetic field depending on the arrangement or environment. The effect ranges from a hardly determinable influence through to total blocking of communication. The term metal in this context also includes metallized materials that are either coated with metal or shot through with metal to such an extent that UHF radiation cannot penetrate or only to a minimal extent.

The effect of metal on the electromagnetic field can be prevented as follows:

- Do not mount tags on metal
- Ensure there are no metallic objects at close range to the antenna
- Ensure there are no metallic objects in the propagation field of the antenna and transponder

Tags mounted directly onto metal

In general, tags must not be mounted directly onto metallic surfaces. Due to the nature of the magnetic field, a minimum distance must be maintained between the tag antenna and conductive materials.

The minimum distance to metal must be greater than 5 cm. The larger the distance, the better the function of the transponder.

Exception:
Tags that are designed for direct mounting on metal.

4.4.3 Influence of liquids and non-metallic substances

Non-metallic substances can also affect the propagation of electromagnetic waves.

When non-metallic substances or objects are located in the propagation field that can absorb UHF radiation, these can alter the antenna field depending on their size and distance and can even extinguish the field entirely.

The high-frequency damping effect of water and materials with a water content, ice and carbon is high. Electromagnetic energy is partly reflected and absorbed.

Liquids and petroleum-based oils have low HF damping. Electromagnetic waves penetrate the liquid and are only slightly weakened.

4.5 Regulations applicable to frequency bands

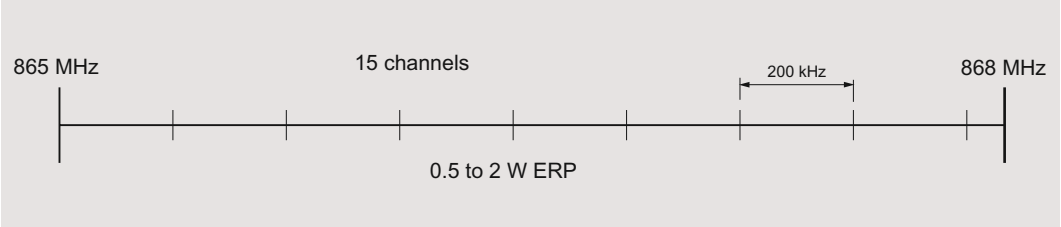
4.5.1 Regulations for UHF frequency bands in Europe

Regulations for frequency bands according to EN 302 208

ETSI (European Telecommunications Standards Institute)

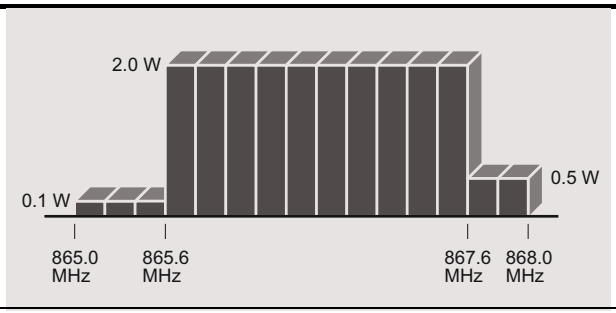
Specifications of European standard EN 302 208:

- UHF band: 865 to 868 MHz
- Radiant power: max. 2 W (ERP)
- Channel bandwidth: 200 kHz
- Number of channels: 15
- Listen before talk



Channel assignment

- The UHF band from 865 to 868 MHz is subdivided into three sub bands:

Sub bands	Frequency range	Output
	865.0 to 865.5 MHz	0.1 W ERP
	865.6 to 867.6 MHz	2,0 W ERP
	867.6 to 868.0 MHz	0,5 W ERP

Listen before talk

With this technique, the reader checks whether a channel is assigned before transmission to prevent collisions. The reader will only transmit when a channel is free. The reader can transmit for up to ?? seconds on this channel and must then pause for at least ?? seconds or jump immediately to an unassigned channel on which it can transmit for a further ?? seconds.

Regulations for frequency bands according to EN 300 220 (short range device)

For those countries in which the RFID directive according to EN 302 208 has not yet been implemented, this alternative exists which is based on the older "Short range device" directive:

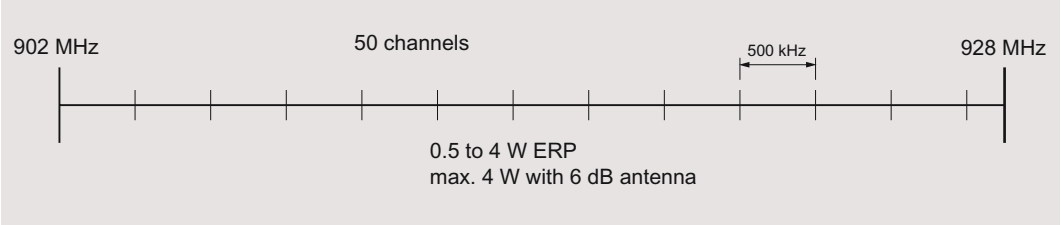
EN 300 220 (short range device)	
Frequency range	865.6 to 868 MHz
Number of channels	12
Transmit power	Max. 0.5 W ERP
Duty cycle (frequency assignment period)	10 % (6 min./h)

4.5.2 Regulations for UHF frequency bands in the USA

USA

FCC (Federal Communications Commission)

- UHF band: 902 to 928 MHz
- Radiant power: max. 4 W (EIRP)
- Number of channels: 50
- Frequency hopping



Frequency hopping

This technique should prevent mutual interference between readers. The reader changes its transmission channel in a random or programmed sequence (FHSS - Frequency Hopping Spread Spectrum). The 50 available channels mean that the probability is low that two readers will be operating on the same frequency

4.6 Guidelines for electromagnetic compatibility (EMC)

4.6.1 Overview

These EMC Guidelines answer the following questions:

- Why are EMC guidelines necessary?
- What types of external interference have an impact on the system?
- How can interference be prevented?
- How can interference be eliminated?
- Which standards relate to EMC?
- Examples of interference-free plant design

The description is intended for "qualified personnel":

- Project engineers and planners who plan system configurations with RFID modules and have to observe the necessary guidelines.
- Fitters and service engineers who install the connecting cables in accordance with this description or who can rectify defects in this area in the event of interference.

Warning

Failure to observe notices drawn to the reader's attention can result in dangerous conditions in the plant or the destruction of individual components or the entire plant.

4.6.2 What does EMC mean?

The increasing use of electrical and electronic devices is accompanied by:

- Higher component density
- More switched power electronics
- Increasing switching rates
- Lower power consumption of components due to steeper switching edges

The higher the degree of automation, the greater the risk of interaction between devices.

Electromagnetic compatibility (EMC) is the ability of an electrical or electronic device to operate satisfactorily in an electromagnetic environment without affecting or interfering with the environment over and above certain limits.

EMC can be broken down into three different areas:

- Intrinsic immunity to interference:
  immunity to internal electrical disturbance
- Immunity to ambient interference:
  immunity to external electromagnetic disturbance
- Degree of interference emission:
  emission of interference and its effect on the electrical environment

All three areas are considered when testing an electrical device.

The RFID modules are tested for conformity with the limit values required by the CE and RTTE guidelines. Since the RFID modules are merely components of an overall system, and sources of interference can arise as a result of combining different components, certain guidelines have to be followed when setting up a plant.

EMC measures usually consist of a complete package of measures, all of which need to be implemented in order to ensure that the plant is immune to interference.

Note

The plant manufacturer is responsible for the observance of the EMC guidelines; the plant operator is responsible for radio interference suppression in the overall plant.

All measures taken when setting up the plant prevent expensive retrospective modifications and interference suppression measures.

The salient national specifications and regulations must be observed. They are not covered in this document.

4.6.3 Basic rules

It is often sufficient to follow a few elementary rules in order to ensure electromagnetic compatiblity (EMC). The following rules must be observed:

Shielding by enclosure

- Protect the device against external interference by installing it in a cabinet or housing. The housing or enclosure must be connected to the chassis ground.
- Use metal plates to shield the device against electromagnetic fields.
- Use metal connector housings to shield data conductors.

Wide-area ground connection

- Bond all passive metal parts to chassis ground, ensuring large-area and low-HF-impedance contact.
- Establish a large-area connection between the passive metal parts and the central grounding point.
- Don't forget to include the shielding bus in the chassis ground system. That means the actual shielding busbars must be connected to ground by large-area contact.
- Aluminium parts are not suitable for ground connections.

Plan the cable installation

- Break the cabling down into cable groups and install these separately.
- Always route high-voltage and signal cables through separated ducts or in separate bundles.
- Feed the cabling into the cabinet from one side only and, if possible, on one level only.
- Route the signal cables as close as possible to chassis surfaces.
- Twist the feed and return conductors of separately installed cables.
- Cable routing of HF cables:
  Avoid installing cables in parallel over long distances and maintain minimum distances between the cables (at least 25 cm)

Shielding for the cables

- Shield the data cables and connect the shield at both ends.
- Shield the analog cables and connect the shield at one end, e.g. on the drive unit.
- Always apply large-area connections between the cable shields and the shielding bus at the cabinet inlet and make the contact with clamps.
- Feed the connected shield through to the module without interruption.
- Use braided shields, not foil shields.

Line and signal filter

- Use only line filters with metal housings
- Connect the filter housing to the cabinet chassis using a large-area low-HF-impedance connection.
- Never fix the filter housing to a painted surface.
- Fix the filter at the control cabinet inlet or in the direction of the source.

4.6.4 Propagation of electromagnetic interference

Three components have to be present for interference to occur in a system:

- Interference source
- Coupling path
- Interference sink

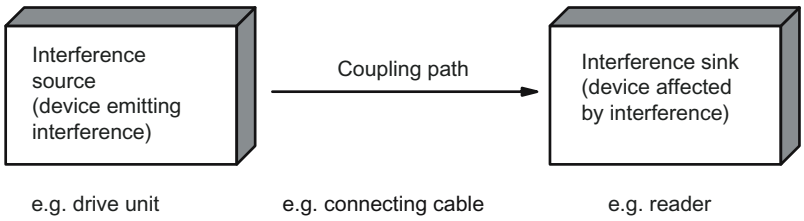


Figure 4-5 Propagation of interference

If one of the components is missing, e.g. the coupling path between the interference source and the interference sink, the interference sink is unaffected, even if the interference source is transmitting a high level of noise.

The EMC measures are applied to all three components, in order to prevent malfunctions due to interference. When setting up a plant, the manufacturer must take all possible measures in order to prevent the occurrence of interference sources:

- Only devices fulfilling limit class A of VDE 0871 may be used in a plant.
- Interference suppression measures must be introduced on all interference-emitting devices. This includes all coils and windings.
- The design of the system must be such that mutual interference between individual components is precluded or kept as small as possible.

Information and tips for plant design are given in the following sections.

Interference sources

In order to achieve a high level of electromagnetic compatibility and thus a very low level of disturbance in a plant, it is necessary to recognize the most frequent interference sources. These must then be eliminated by appropriate measures.

Table 4-1 Interference sources: origin and effect

Interference source	Interference results from	Effect on the interference sink
Contactors, electronic valves	Contacts	System disturbances
	Coils	Magnetic field
Electrical motor	Collector	Electrical field
	Winding	Magnetic field
Electric welding device	Contacts	Electrical field
	Transformer	Magnetic field, system disturbance, transient currents
Power supply unit, switched-mode	Circuit	Electrical and magnetic field, system disturbance
High-frequency appliances	Circuit	Electromagnetic field
Transmitter (e.g. service radio)	Antenna	Electromagnetic field
Ground or reference potential difference	Voltage difference	Transient currents
Operator	Static charge	Electrical discharge currents, electrical field
Power cable	Current flow	Electrical and magnetic field, system disturbance
High-voltage cable	Voltage difference	Electrical field

What interference can affect RFID?

Interference source	Cause	Remedy
Switched-mode power supply	Interference emitted from the current infeed	Replace the power supply
Interference injected through the cables connected in series	Cable is inadequately shielded	Better cable shielding
	The reader is not connected to ground.	Ground the reader
HF interference over the antennas	caused by another reader	• Change the operating mode of the reader. • Position the antennas further apart. • Erect suitable damping materials between the antennas. • Reduce the power of the readers.
	External sources of interference that use or transmit on the same frequency range.	Use the frequency hopping technique

Coupling paths

A coupling path has to be present before the disturbance emitted by the interference source can affect the system. There are four ways in which interference can be coupled in:

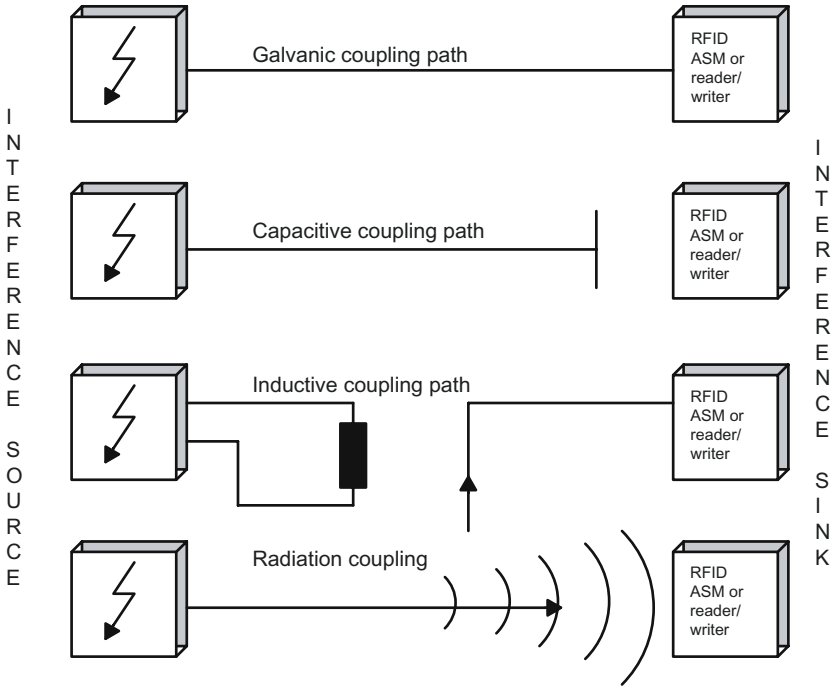


Figure 4-6 Ways in which interference can be coupled in

When RFID modules are used, different components in the overall system can act as a coupling path:

Table 4-2 Causes of coupling paths

Coupling path	Invoked by
Conductors and cables	Incorrect or inappropriate installation
	Missing or incorrectly connected shield
	Inappropriate physical arrangement of cables
Control cabinet or housing	Missing or incorrectly wired equalizing conductor
	Missing or incorrect earthing
	Inappropriate physical arrangement
	Components not mounted securely
	Unfavorable cabinet configuration

4.6.5 Prevention of interference sources

A high level of immunity to interference can be achieved by avoiding interference sources. All switched inductances are a frequent source of interference in plants.

Suppression of inductance

Relays, contactors, etc. generate interference voltages and must therefore be suppressed using one of the circuits below.

Even with small relays, interference voltages of up to 800 V occur on 24 V coils, and interference voltages of several kV occur on 230 V coils when the coil is switched. The use of freewheeling diodes or RC circuits prevents interference voltages and thus stray interference on conductors installed parallel to the coil conductor.

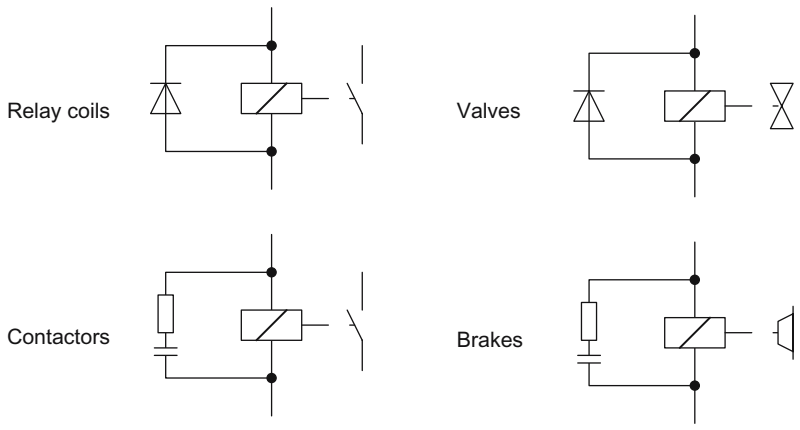


Figure 4-7 Suppression of inductance

Note

All coils in the cabinet should be suppressed. The valves and motor brakes are frequently forgotten. Fluorescent lamps in the control cabinet should be tested in particular.

4.6.6 Equipotential bonding

Potential differences between different parts of a plant can arise due to the different design of the plant components and different voltage levels. If the plant components are connected across signal cables, transient currents flow across the signal cables. These transient currents can corrupt the signals.

Proper equipotential bonding is thus essential.

- The equipotential bonding conductor must have a sufficiently large cross section (at least 10 mm^2).
- The distance between the signal cable and the associated equipotential bonding conductor must be as small as possible (antenna effect).
- A fine-strand conductor must be used (better high-frequency conductivity).
- When connecting the equipotential bonding conductors to the centralized equipotential bonding strip, the power components and non-power components must be combined.

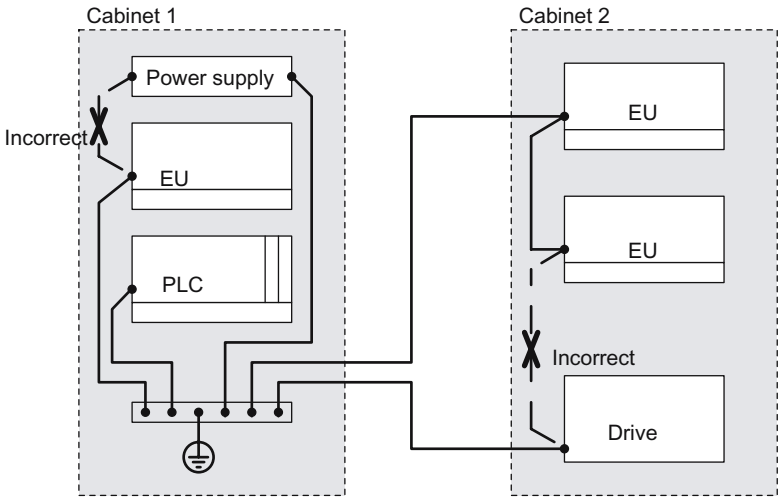


Figure 4-8 Equipotential bonding

The better the equipotential bonding in a plant, the smaller the chance of interference due to fluctuations in potential.

Equipotential bonding should not be confused with protective earthing of a plant. Protective earthing prevents the occurrence of excessive contact voltages in the event of device faults.

4.6.7 Cable shielding

Signal cables must be shielded in order to prevent coupling of interference.

The best shielding is achieved by installing the cables in steel tubes. However, this is only necessary if the signal cable is routed through an environment prone to particular interference. It is usually adequate to use cables with braided shields. In either case, however, correct connection is vital for effective shielding.

Note

An unconnected or incorrectly connected shield has no shielding effect.

As a rule:

- For analog signal cables, the shield should be connected at one end on the receiver side
- For digital signals, the shield should be connected to the enclosure at both ends
- Since interference signals are frequently within the HF range (> 10 kHz), a large-area HF-proof shield contact is necessary

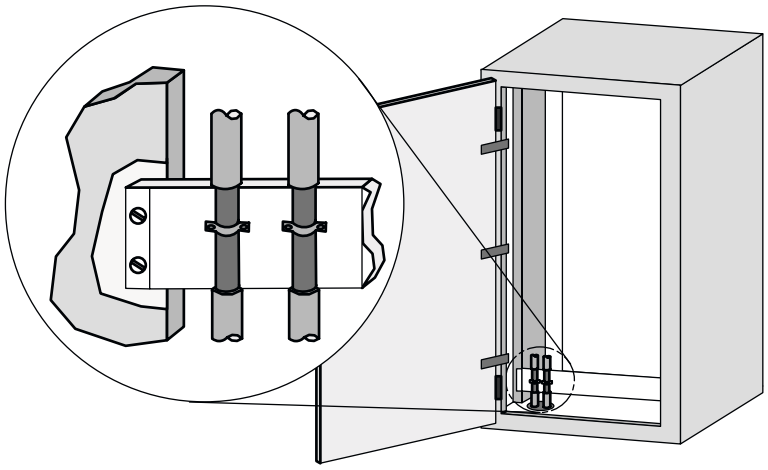


Figure 4-9 Cable shielding

The shielding bus should be connected to the control cabinet enclosure in a manner allowing good conductance (large-area contact) and must be situated as close as possible to the cable inlet. The cable insulation must be removed and the cable clamped to the shielding bus (high-frequency clamp) or secured using cable ties. Care should be taken to ensure that the connection allows good conductance.

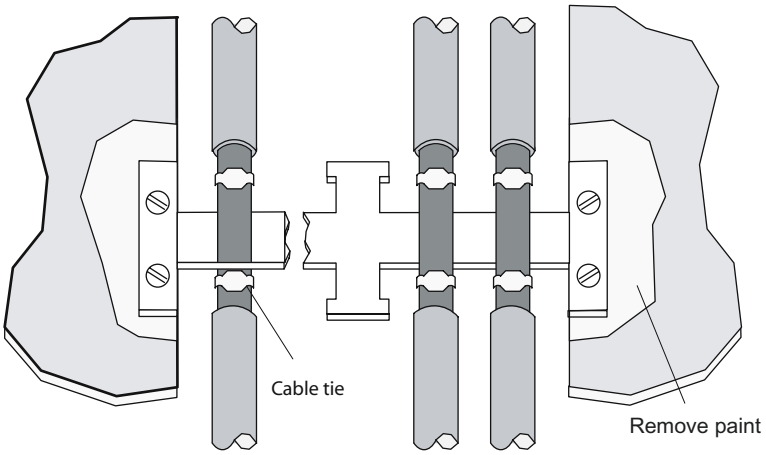


Figure 4-10 Connection of shielding bus

The shielding bus must be connected to the PE busbar.

If shielded cables have to be interrupted, the shield must be continued via the corresponding connector housing. Only suitable connectors may be used for this purpose.

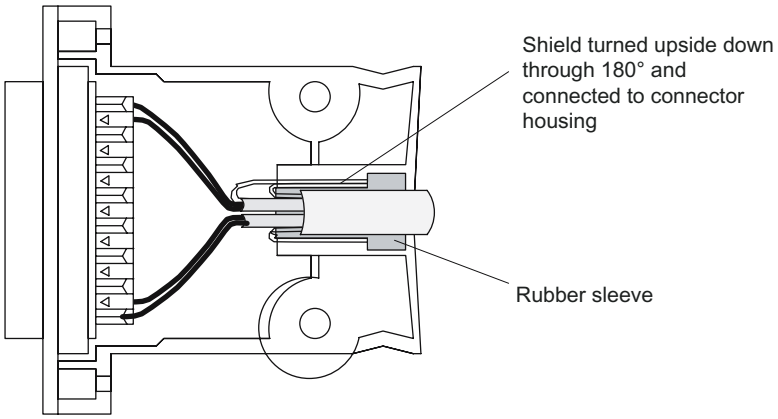


Figure 4-11 Interruption of shielded cables

If intermediate connectors, which do not have a suitable shield connection, are used, the shield must be continued by fixing cable clamps at the point of interruption. This ensures a large-area, HF-conducting contact.

RF660R reader

5

5.1 Description

SIMATIC RF660R is a stationary reader for connecting up to 4 external antennas. A rugged housing with high IP65 degree of protection means that the device is a universal and reliable partner in harsh production environments, on conveyor systems, in warehouses, or directly at the loading gate.

Figure 5-1 RF660R reader

Highlights

- The tags are read in accordance with the requirements of the EPCglobal Class 1, Gen 1/2 and ISO/IEC 18000-6B standards
- Supports low-cost SmartLabels as well as reusable, rugged data media
- High reading speed: many tags can be read simultaneously (mass recording), rapidly moving tags are reliably recorded
- Suitable for the 865 to 868 MHz UHF bands in Europe and the 902 to 928 MHz UHF band in North America
- Up to 4 antennas can be connected and configured in operating mode
- Readers and antennas to the high IP65 degree of protection
- Can be used for a high temperature range
- Antenna switching for high reading probability
- Flexible system integration:
  - Serial (RS 232)
  - SIMATIC integration (RS 422 over communication module; available soon)
  - Ethernet (TCP/IP)

5.1.1 Ordering data

Description	Machine-Readable Product Code
SIMATIC RF660R	

5.1.2 Design of the RF660R reader

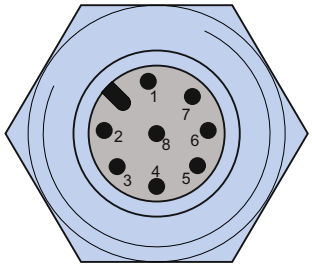
	Item No.	Description
	(1)	Status LED
	(2)	Industrial Ethernet (RJ45 connector)
	(3)	RS 422 interface (8-pin M12 connector)
	(4)	RS 232 interface (5-pin M12 connector)
	(5)	Digital I/O (8-pin M12 connector)
	(6)	Power, 24 V DC; (4-pin M12 connector)

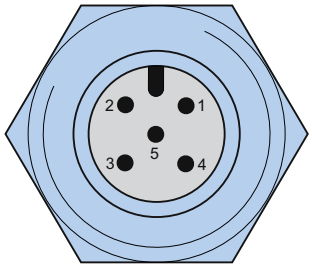
	Description
	4 antenna connections ANT 1 to ANT 4 (RTNC connector)

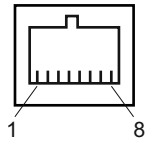
5.1.3 Status displays

Status displays	LEDs	Color	Meaning
	Power on	Green	Power supply ON (also lit for undervoltage/overvoltage)
	Tag Detect	Yellow	LED is lit as soon as any tag is in the field
	System Error	Red	Reader is not active. Rebooting is necessary (operating voltage Off → On.)

5.1.4 Pin assignment of the serial interfaces

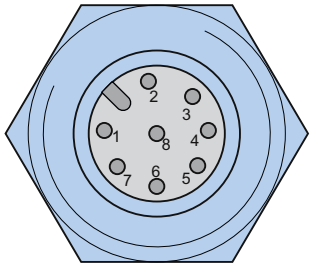
RS 422 connector	Pin	Meaning
	1 2 3 4 5 6 7 8	GND not connected RS422_RX_PLUS RS422_RX_MINUS RS422_TX_MINUS RS422_TX_PLUS GND housing

RS 232 connector	Pin	Meaning
	1 2 3 4 5 6 7 8	GND RS232_TX GND RS232_RX GND not connected not connected not connected

Industrial Ethernet	Pin	Meaning
	1 2 3 4 5 6 7 8	Transmit Data (+) Transmit Data (-) Receive Data (+) Terminated Terminated Receive Data (-) Terminated Terminated

5.1.5 Pin assignment and connections of the digital I/O interface

Pin assignment

Digital I/O socket	Pin	Meaning
	1 2 3 4 5 6 7 8	Input USER_IN (0) Input USER_IN (1) Input USER_IN (2) GND (IN) Output USER_OUT (0) Output USER_OUT (1) Output USER_OUT (2) Housing

Connections

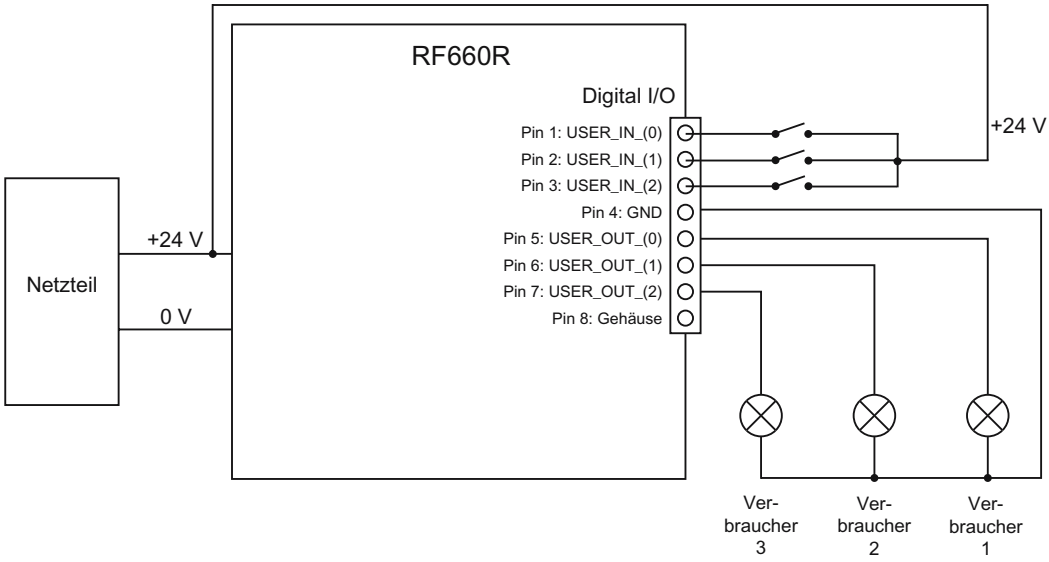


Figure 5-2 Connections for digital I/O

Output USER_OUT (0), (1), (2):

(1) These are high-side switches that switch V_{cc} (+24V) at low resistance ('active high').

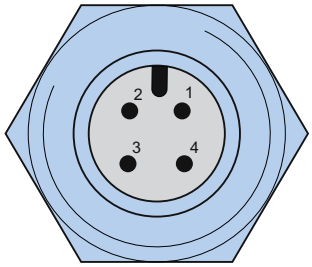
(2) Each output is rated for 0.5 A current and is electronically protected.

(3) The 0 V rail is Pin 4 (GND).

(4) Each pin of the 8-pin connector can carry a load of up to 2 A, this means that three digital outputs can be operated simultaneously with up to 0.5 A.

5.1.6 Power supply

Pin assignment of the power connections

Power connector	Pin	Meaning
	1 2 3 4	Ground (0V) +24 V +24 V Ground (0V)

5.1.7 Grounding connection

A low-impedance earth connection ensures that interference signals generated, for example, by external power supply cables or signal cables are safely discharged to earth.

Required tool for protective earth terminal: TORX T20 screwdriver

Ground connection/protective earth terminal	
The protective earth terminal (M4 threads) (1) on the device (large surface, large-area contact) has to be connected with the protective earth conductor of the plant or the cabinet in which the reader is to be installed. The minimum conductor cross-section may not be less than 2.5 mm2.	

5.2

5.3 Installation /Mounting

5.3.1 Mounting/Installation

Mounting/installing the device

The positions of the fixing holes for the device are shown in the "Dimension drawing" section.

Examples of mounting types		
Material	**Hole diameter**	**Fixing**
Concrete	8 mm diameter 60 mm depth	Rawlplug: 8 mm diameter, 50 mm length Screws: 4 mm diameter, 50 mm length
Plasterboard (min. 13 mm thick)	14 mm diameter	Tilting rawlplug: 4 mm diameter, 50 mm length
Metal (min. 2 mm thick)	5 mm diameter	M4 metal screws: 4 mm diameter, 15 mm length

Warning

Ensure that the wall or ceiling can hold four times the total weight of the device.

5.4 Configuration/integration

5.4.1 Configuration

Three communication interfaces are available for integrating the device into system environments/networks:

- Ethernet
- RS 422 and
- RS 232

The communication interfaces transfer the data to IT, ERP and SCM systems on SIMATIC PLCs or PCs (also used for configuration and diagnostics).

Simple process controls (e.g. a traffic signal) can be directly implemented using the read/write device via three digital inputs and outputs with 24 V each.

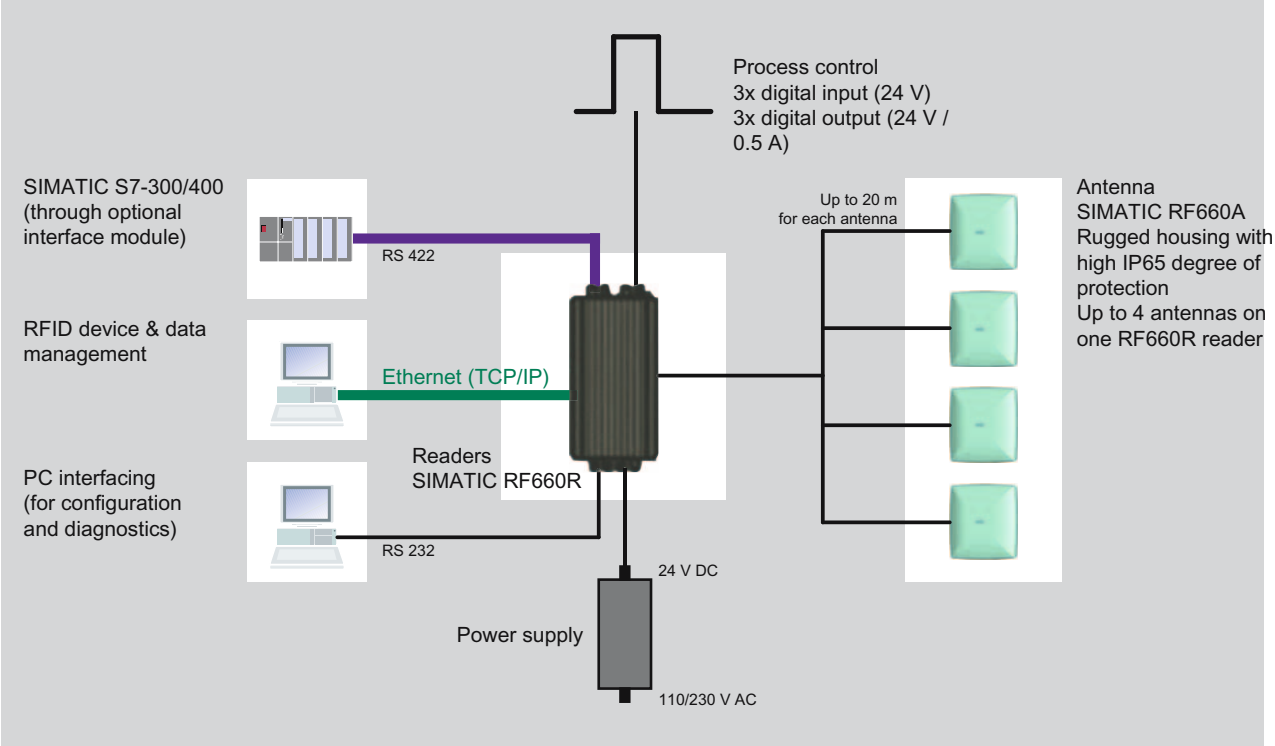


Figure 5-3 Configuration overview of the RF660R reader

Note

Maximum cable lengths for the RS232 interface

The maximum cable lengths for reliable, fault-free data transfer are as follows:

- Transfer rate 115.2 kbit/s: Maximum cable length: 10 m
- Transfer rate 57,6 kbit/s: Maximum cable length: 20 m

5.4.2 Transmission protocols

Transmission protocols

The following transmission protocols are available: 3964R protocol and TCP/IP.

RS232 communication

	XML protocol
Transmission rates	115200 bps
Start bits	1
Data bits	8
Parity	Odd
Stop bits	1

RS422 communication

	3964R protocol
Transmission rate	9600, 19200, 38400, 57600, 115200 bps (autobauding)
Start bits	1
Data bits	8
Parity	Odd
Stop bits	1

Ethernet communication

The Ethernet interface offers automatic selection between 10BaseT and 100BaseTX.

Shielded Twisted-Pair patch cables with standard RJ45 connectors are recommended for a reliable connection.

5.5 Maintenance and service

5.6 Technical specifications

5.6.1 Technical specifications of RF660R

Table 5-1 Technical specifications of RF660R

General Technical Specifications	
Weight	3.7 kg (with cover 3.8 kg)
Dimensions (L x W x H) in mm	320 x 145 x 100 without connections
Material	Aluminum

Frequencies	
European frequency range	865 ... 868 MHz (10 subchannels LBT at 2 W ERP, 15 subchannels LBT at 0.1 W ERP)
North American frequency range	902 ... 928 MHz (50 channels, frequency hopping)
Frequency accuracy	max.± 10ppm
Channel spacing	Channel spacing (FHSS), 200 kHz > FHSS> 500 kHz
Modulation methods	DSB Modulation & SSB Modulation Encoding, Manchester or Pulse Interval (PIE)
Identification rate	99.5 % at maximum reading distance and with a receiver data transfer rate of 80 Kbyte/s.

Transmission and reading characteristics		
Max. reads/s	**EPC Generation 2**	**ISO 18000-6B**
• Europe - Single Tag Note: The LBT and frequency channel schedule can affect this value	Up to 100 reads/s as part of the collision arbitration cycle	Up to 100 tips, single tag only > 50 as part of the collision arbitration cycle
• USA - Single Tag Note: The rate of frequency hopping can affect this value	Up to 600 reads/s as part of the collision arbitration cycle	Up to 120 tips, single tag only > 50 as part of the collision arbitration cycle
Bulk Read Capacity	**EPC Generation 2**	**ISO 18000-6B**
Max. number of tags	max. 1000	max. 75
Europe	Up to 500 tags/s	Up to 45 tags/s
USA	Up to 1000 tags/s	Up to 75 tags/s
Data Transmission Rate	**EPC Generation 2**	**ISO 18000-6B**
Reading (incl. TCP/IP) tag-to-reader link frequency	320 kbps at 3 m 80 kbps at 5 m 40 kbps at 5 m	160 kbps at 3 m 40 kbps at 5 m
Reading (incl. TCP/IP) reader-to-tag mean data transfer rate	128 kbps at 3 m 53,3 kbps at 5 m 26,7 kbps at 5 m	40 kbps at 5 m
Time required to program an individual EPC tag with a 96-bit ID using WRITE	min. 110 to 130 ms	Up to 60 ms
Time required to program an individual EPC tag with a 96-bit ID using BLOCK_WRITE or WRITE4BYTE	22 to 25 ms	approx. 25 ms
Identification rate (%)	**EPC Generation 2**	**ISO 18000-6B**
Single tag under ideal conditions	> 99,9 %	> 99,9 %
Single tag under normal conditions	99,5 %	99,5 %
Transfer capacity	**Europe**	**USA**
• Range	0.1 to 2 W ERP	0.4 to 4 W EIRP
Reading distance	**Europe**	**USA**
• Antennas mounted on opposing sides	max. 10 m (with 2 x 2 antennas)	max. 10 m (with 2 x 2 antennas)
• Antennas mounted on the same side	max. 5 m (with 2 antennas)	max. 5 m (with 2 antennas)
Data transmission rate of reader • Read • Write	 Approx. bytes/s Approx. bytes/s	
Object speed • Read • Write	 Approx. m/s (byte) Approx. m/s (byte)	

Approvals	• Radio to R&TTE- guidelines EN 300 330, EN 301 489 ????? • CE, EMC, FCC, cULus • IEC60950, including US and Canadian variants of it • FCC CFR47 Part 15.247 • ETSI EN 302-208 • Degree of protection acc. to EN 60529 (IP65)

• **Mechanical Environmental Conditions**	
Shock	EN 60 721-3-7, Class 7 M2
Total shock response spectrum	Type II
Vibration	EN 60 721-3-7, Class 7 M2
• **Climatic Conditions**	
Ambient temperature in operation	-25 °C to +55 °C
• Ambient temperature for transport and storage	-40 °C to +85 °C
Electromagnetic compatibility	

Status displays on the device	
Power On	Green LED
Tag Presence	Yellow LED
Error	Red LED
Interfaces	
Antenna connections	4x RTNC connector Output values: 4 W with 4 dB cable attenuation and 6 dB antenna amplification. Minimum output voltage: 100 mW
Max. independently operating antenna channels	2
Ethernet 10BaseT or 100BaseTx	1x RJ45 connection according to IEEE 802.3 and ISO 8802-3
RS422	1x connector (8-pin M12). Bit rate between 2400 and 115200 bps. For integration in SIMATIC
RS232	1x connector (5-pin M12). Bit rate between 2400 and 115200 bps.
Digital inputs	3x sockets (8-pin M12).
Digital outputs (short-circuit proof)	3x sockets (8-pin M12) Power supply: 24 V; 1 A Fuse: 24 V; 0.5 A
Power supply	24 V DC (4-pin M12) 20 to 30 V (2.2 A)

5.7 Dimension drawings

5.7.1 Dimension drawings

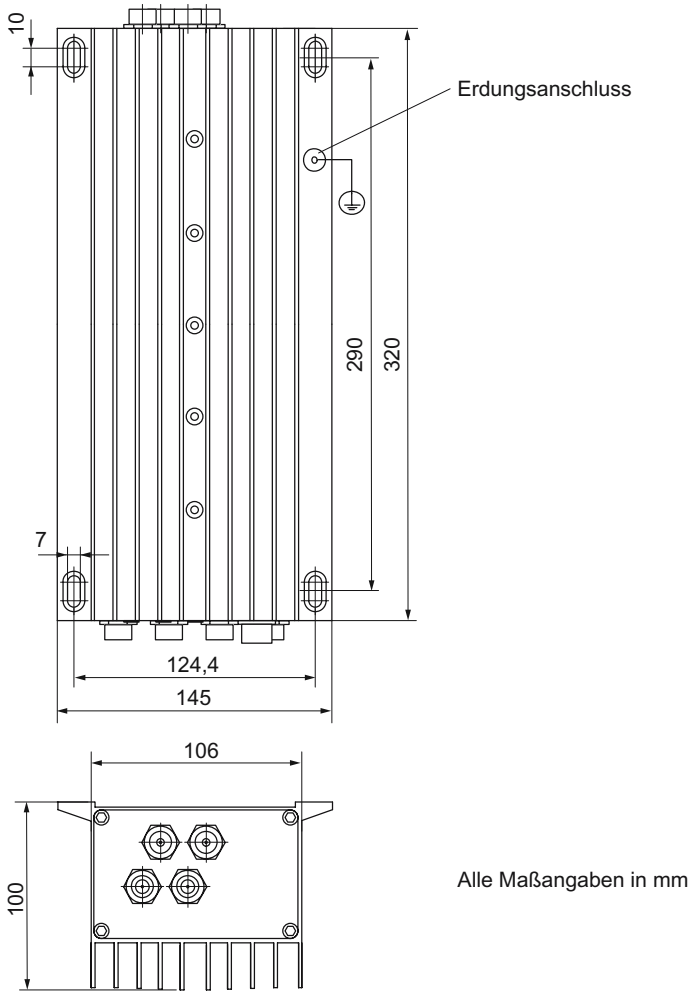


Figure 5-4 Dimension drawing of the reader

5.8 Certificates and approvals

5.8.1 FCC information

Siemens SIMATIC RF660R

FCC ID: NXW-RF660

This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

Caution

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

5.8.2 Compliance distance for RF Exposure

The Transmitter is within the Health Canada and FCC limits for General Population/Uncontrolled Exposure to electromagnetic waves at a minimum operating distance of 23 cm. The installation design shall thus be such as to maintain a minimum distance of 23 cm between the antennas and users or other persons.

Antennas

6

6.1 RF660A antenna

6.1.1 RF660A description

The RF660A is a stationary antenna, specially designed for the RF660R reader.

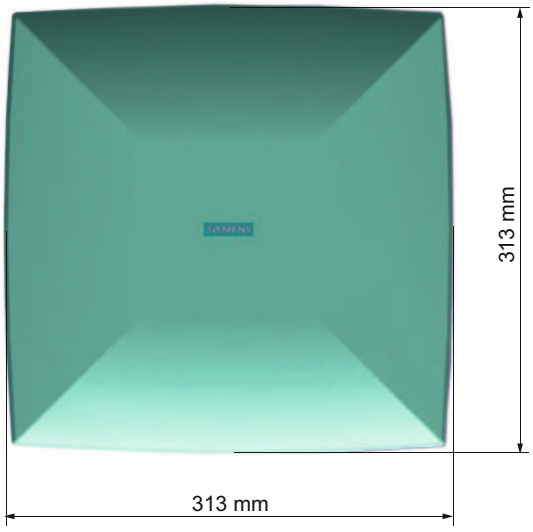
The antenna is available in two different frequency ranges that have been specified for the regions of Europe and USA.

Frequency range

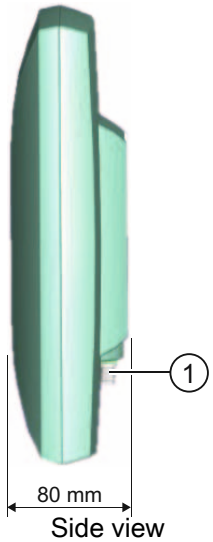
- The antenna for Europe operate in the frequency range of 865 to 868 MHz
- The antenna for the USA operate in the frequency range of 902 to 928 MHz

Design of the RF660A

The antenna is installed in a rectangular plastic housing.



Front view



Side view

① RTNC connection

Radiating/receiving characteristic

The characteristic curve is shown for horizontal alignment and for a frequency of 865 MHz.

The radiating/receiving angle of the antenna is defined by the angle between the two 3dB points.

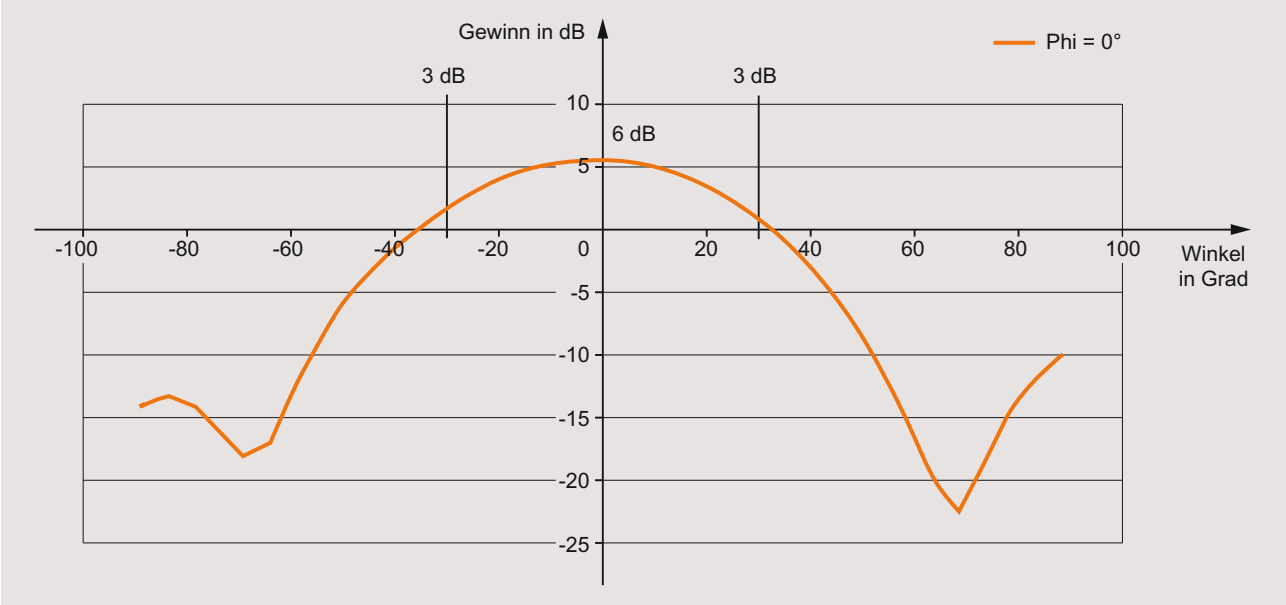


Figure 6-1 Effective range of radiation (at 865 MHz, horizontal alignment)

Ordering data

Description	Machine-Readable Product Code
RF660A for Europe	6GT2 810-0AA00
RF660A for USA	6GT2 810-0AA01

6.1.2 Application Planning

Specified minimum spacing of antennas

The following diagram shows the specified minimum and maximum spacings for mounting antennas:

A minimum spacing of 50 cm is necessary between the antenna and liquids or metals. The distance between the antenna and the floor should also be at least 50 cm.

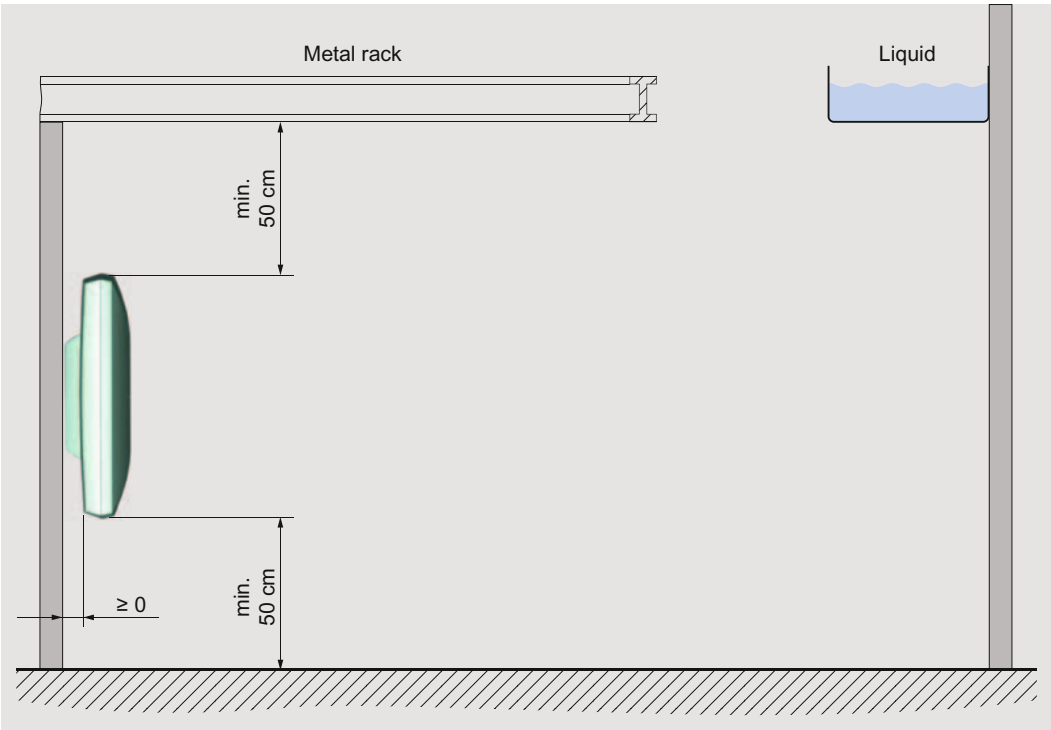


Figure 6-2 Distance to the environment

The distance between two antennas mounted alongside each other or one above the other should be at least 20 to 50 cm.

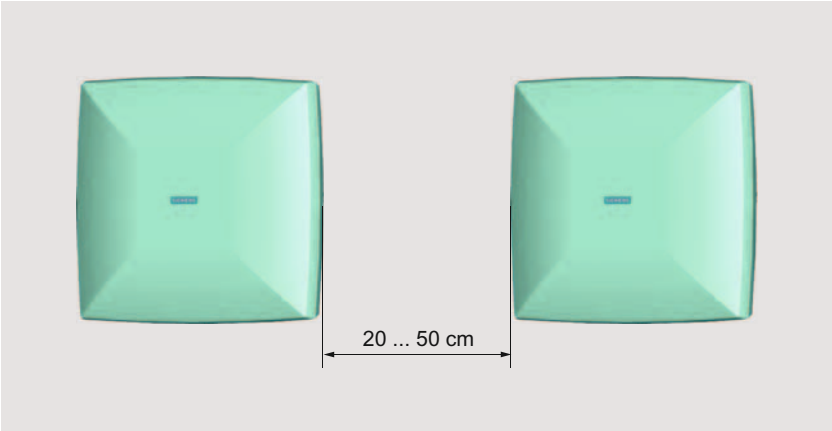


Figure 6-3 Antennas mounted adjacently horizontally or vertically

For a portal configuration, the distance between two antennas that are connected to the same reader is up to 3.5 m (in Europe) or 4 m (in the USA).

Figure 6-4 Portal configuration

6.1.3 Installation /Mounting

The RF660A antenna can be fixed to any firm support.

Mounting types

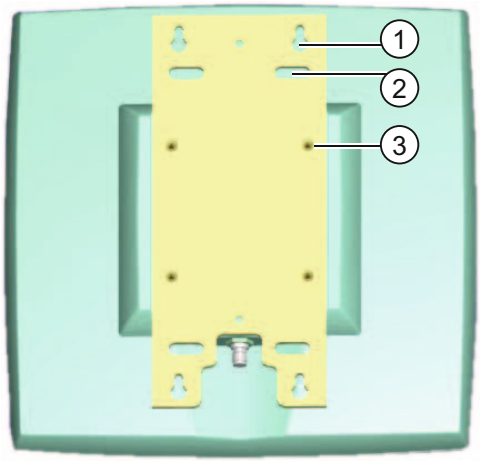
Two systems are available for fixing the antenna:

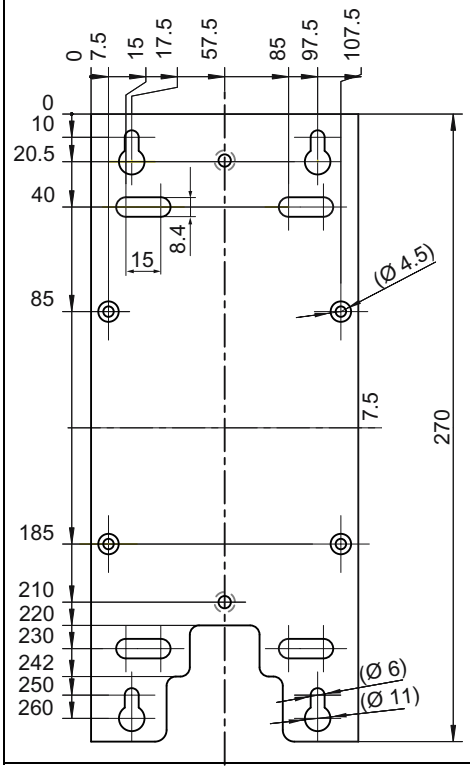
- Rigid fixing with VESA 100 x 100
- Flexible fixing with VESA 75 x 75

Fixing with VESA 100 x 100

Rigid fixing with an antenna adapter plate is suitable for:

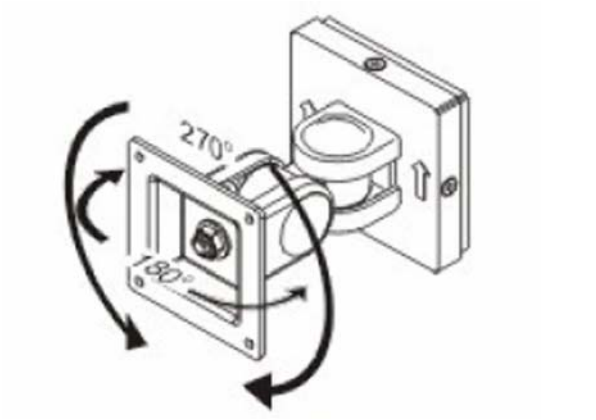
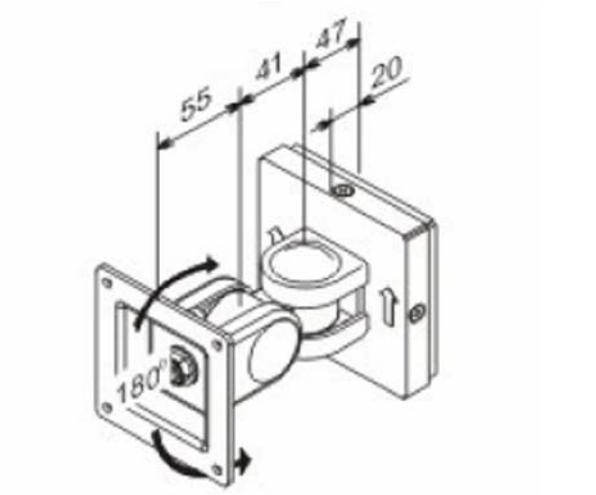
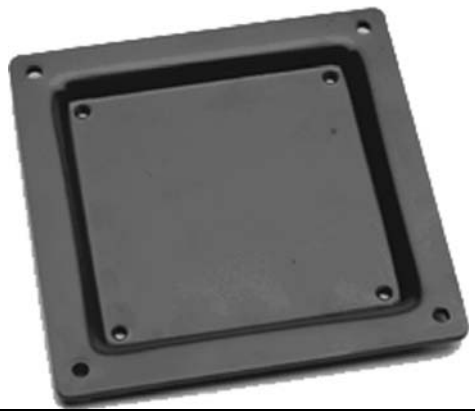
- Wall mounting on solid foundations
- Mast mounting

Antenna with antenna adapter plate	Description
	① Keyhole for wall mounting (4 x) ① Elongated hole for mast mounting (4 x) ③ Standardized VESA fixing holes (4 x)

Antenna with antenna adapter plate	Description
	Dimensions for fixing holes All dimensions in mm

Fixing with VESA 75 x 75

Flexible mounting is possible using the VESA 75 x 75 mounting set.

VESA 75 x 75 mounting set	Description
	Swivel range of wall mounting
	Distances for wall mounting
	VESA adapter plate from VESA 75 x 75 to VESA 100 x 100

VESA 75 x 75 mounting set	Description

6.1.4 Connecting an antenna to a reader

Connecting an RF660A

Preassembled standard cables in lengths of 10 m and 20 m with the optimal impedance are available for connection.

The cable between antenna and reader can be up to 20 m in length.

Notice

Only use original Siemens antenna cables

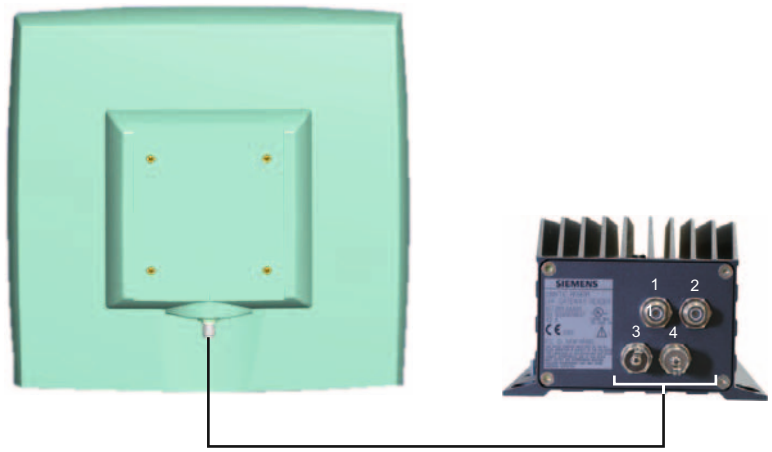


Figure 6-5 Rear of antenna with RTNC connection

When less than four antennas are used, we recommend that the antennas are connected to the reader as follows.

Number of antennas	Connections on the reader
2 antennas	ANT 1, ANT 2
3 antennas	ANT 1, ANT 2, ANT 3

6.1.5 Technical specifications

	RF660A antenna 865-868	RF660A antenna 902-928
Frequency range	865-868 MHz	902-928 MHz
Impedance	50 Ohm nominal	50 Ohm nominal
Antenna amplification	5-7 dBil	> 6 dBic
VSWR	2:1 max.	2:1 max.
Polarization	RH circular	RH circular
Radiating/receiving angle	55°-60°	60° - 75°
Connector	RTNC	RTNC
Degree of protection	IP 65	IP 65
Permissible ambient temperature	-25° C to +75° C	-25° C to +75° C

Transponder/tags

7

7.1 Mode of operation of transponders

The tag/transponder mainly comprises a microchip with an integral memory and a dipole antenna.

The principle of operation of a passive RFID transponder is as follows:

- Diversion of some of the high-frequency energy emitted by the reader to supply power to the integral chip
- Commands received from reader
- Responses are transmitted to the reader antenna by modulating the reflected radio waves (backscatter technique)

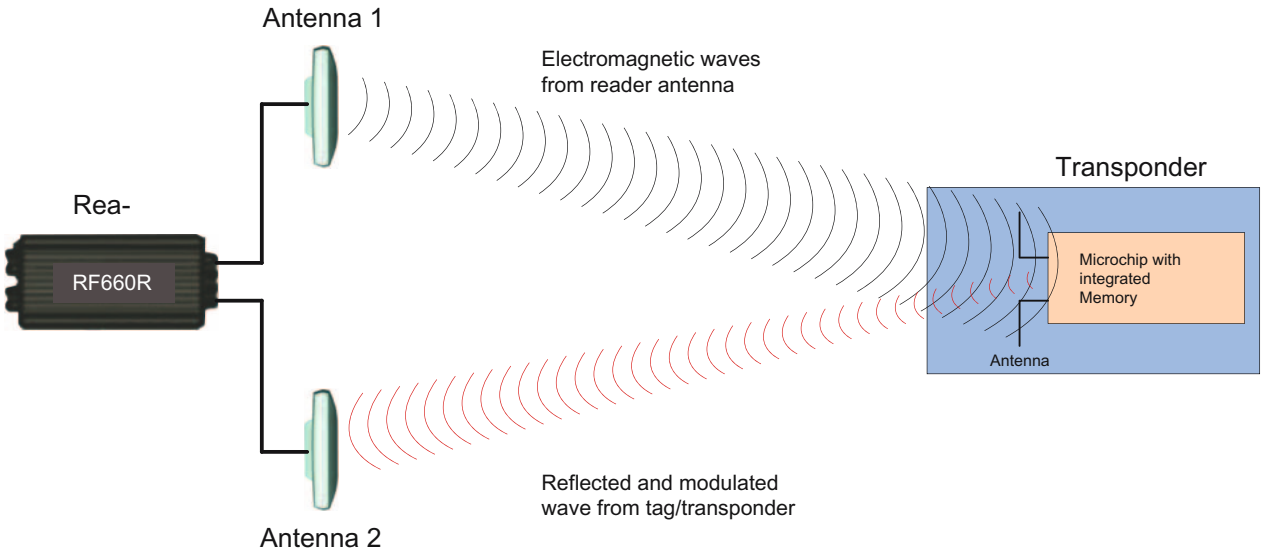


Figure 7-1 Mode of operation of transponders

The transmission ranges achieved vary in accordance with the size of the tag and the corresponding dipole antenna. In general the following rule applies: The smaller the tag and therefore the antenna, the shorter the range.

7.2 Transponder classes and generations

The transponder classes are distinguished by the different communication protocols used between the reader and transponder. Transponder classes are mostly mutually incompatible.

The following transponder classes are supported by the RF 600 system:

- EPC Global Class 1, 1b with full EPC Global Profile
- EPC Global Class 1, Generation 2 with full EPC Global Profile
- ISO 18000-6B with full ISO profile

EPC Global

EPC Global groups tags into the following classes and generations:

EPC class	Definition	Programming	Supported by RF 600
Class 0	Passive read-only tags	Programming by the manufacturer	No
Class 1	Passive single-write tags	Programming by the customer (cannot be reprogrammed)	Yes
Class 2	Passive rewritable tags	Freely programmable	No
Class 3	Semi-passive tags		
Class 4	Active tags		

Characteristic	Generation 1	Generation 2
Frequency	860-930 MHz	860-960 MHz
Memory capacity	64 or 96 bits	96-256 bits
Can be programmed on site	Yes	Yes
Programming	Class 0: Read-only Class 1: written once; read many times	Yes
Other characteristics	_	Reading is faster and more reliable than for Generation 1. Enhanced compliance with global standards.

ISO 18000-6

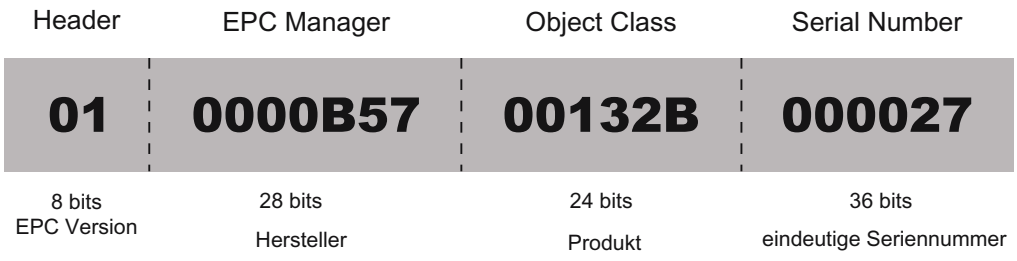
Specification of the transponder/tags in accordance with ISO 18000-6 refers to implementation of the air-interface protocol. There are two versions: ISO 18000-6 Type A and ISO 18000-6 Type B.

	Type B	**Type A**
Frequency range	860 to 960 MHz	860 to 960 MHz
Transmission procedure	Bi-phase modulation and Manchester encoding	Pulse Interval Encoding (PIE)
Anti-collision techniques	Adaptive binary tree technique	ALOHA technique
Protocol	Reader talks first	Reader talks first
Supported by RF 600	Yes	No

7.3 Electronic Product Code (EPC)

The Electronic Product Code (EPC) supports the unique identification of objects (e.g. retail items, logistical items or transport containers). This makes extremely accurate identification possible. In practical use, the EPC is stored on a transponder (tag) and scanned by the reader.

Different EPC versions exist from 64 to 204 bits. The structure of a 96-bit EPC is shown below :



- **Header:** This identifies the EPC identification number that follows with regard to length, type, structure and version of the EPC
- **EPC manager number:** This identifies the company/corporation.
- **Object class**: Corresponds to the article number.
- **Serial number:** Consecutive number of the article

Accessories

8

Accessories		Order No.
Antenna cable	Up to 20 m	
Cable	RS 422: Up to 50 m RS 232: Up to 10 m Ethernet: Up to 20 m	
Mounting set	Yes, 2 different types	
Further accessories	Documentation on CD-ROM	
Wide-range power supply unit for SIMATIC RF systems		

8.1 Wide-range power supply unit for SIMATIC RF systems

8.1.1 Features

Wide-range power supply unit for RF systems	
	(1) DC output 1 (2) DC output 2 (3) Mains connection
Features	
• Wide-range input for use worldwide • Dimensions without mains cable: 175 x 85 x 35 mm • Dimensions including mains cable: 250 x 85 x 35 mm • CE compatible • Mechanically and electrically rugged design • Secondary side: 24V DC / 3A • Short-circuit and no-load stability • Suitable for frame mounting • 3 designs for use in the EU, UK, USA	

Description

The wide-range power supply unit for SIMATIC RF systems is a universal compact power supply and provides the user with an efficient, cost-saving solution for many different mid-range power supply tasks.

The primary switched power supply is designed for use on single-phase AC systems. The two DC outputs (sockets) are connected in parallel and protected by a built-in current limiting circuit against overload and short-circuits.

The device is vacuum cast, prepared for applications of Safety Class 2 and satisfies the low-voltage guideline as well as the current EU standards for CE compliance.

8.1.2 Scope of supply

- Wide-range power supply unit for SIMATIC RF systems
- 2 m mains cable (country-specific)
- Protective cover for flange outlet
- Operating instructions

8.1.3 Ordering data

Wide-range power supply unit for SIMATIC RF systems (100 - 240 V AC / 24 V DC / 3 A) with 2 m connecting cable with country-specific plug	EU: 6GT2 898-0AA00 UK: 6GT2 898-0AA10 US: 6GT2 898-0AA20
24 V-connecting cable, length 5 m	6GT2 491-1HH50

8.1.4 Safety Information

Warning

Danger to life

It is not permitted to open the device or to modify the device.

The following must also be taken into account:

- Failure to observe this requirement shall constitute a revocation of the CE approval and manufacturer's warranty.
- For installation of the power supply, compliance with the DIN/VDE requirements or the country-specific regulations is essential.
- The field of application of the power supply is limited to "Information technology in electrical office equipment" within the scope of validity of the EN 60950/VDE 0805 standard.
- When the equipment is installed, it must be ensured that the mains socket outlet is freely accessible. The housing can reach a temperature of +25 °C without any adverse consequences. It must, however, be ensured that the power supply is covered in the case of an ambient temperature of more than +25°C to protect persons from contact with the hot housing. Adequate ventilation of the power supply must be maintained under these conditions.

8.1.5 Connecting

- There are three different (country-specific) mains cables for the EU, UK and US.
  The appropriate mains cable must be connected to the primary input of the power supply.
- The wide-range power supply unit has total insulation (Safety Class 2)
- Can be mounted using four fixing holes

8.1.6 Technical specifications

Table 8-1 General technical specifications

Insulation stability (prim./sec.) $U_{ins\ p/s}$		3.3 kV_{AC}
Insulation resistance R_{ins}		>1 GΩ
Leakage current I_{leak}	U_{in}= 230 V_{AC}, f = 50 Hz	< 200 µA
Safety class (SELV)	Designed for installation in devices of Safety Class 2	
Mains buffering t_h	U_{in}= 230 V_{AC}	≥50 ms
Ambient temperature		-25 °C to +55 °C
Surface temperature	Module top, centrally	max. 96 °C
Storage temperature		-40 °C to +85 °C
Self-heating on full-load		max. 45 K
Interference immunity ESD HF fields Burst Surge HF injection Mains quality test	EN 61000-4-2, 4-3 up to 4-6, 4-11	 Air discharge: 15 kV 10 V/m symmetrical: 2 Symmetrical: 1 10 V_{rms}
Cooling		Free convection
Dimensions L x W x H		tbd x 85.0 x 35.0 mm
Weight		720 g
Housing / casting		UL 94-V0
Power supply class	according to CSA	Level 3

Table 8-2 Technical specifications for the input

Rated input voltage U_{in}	EN 60950 / UL 60950	100 to 240 V AC 120 to 353 V_{DC}
Input voltage range U_{in}		94 to 264 V AC 120 to 375 V_{DC} (UL: 353 V_{DC})
Input frequency f_{in}		50/60 Hz
Radio interference level		EN 55011/B
Switching frequency f_{sw}		approx. 70 kHz typ.
Length of cable		2 m

Table 8-3 Technical specifications of the output

Output voltage tolerance ΔU_{out}	U_{in}= 230 V_{AC}	U_{outnom} ≤ +2 %/-1 %
Overvoltage protection		$U_{out\ nom}$ +20 % typ.
Noise ΔU_{LF}	U_{in}= min., BW: 1 MHz	≤ 1 % U_{out}
Noise ΔU_{HF}	U_{in}= min., BW: 20 MHz	≤ 2 % U_{out}
Line Regulation Load Regulation	U_{in}= min./max. I_{out}= 10...90...10 %	≤ 1,0 % ≤ 1,0 %
Short-circuit current I_{max}	I_{nom} = 4 A (+50°C)	105 up to 130 % I_{nom}
Settling time t_R load variations	I_{out}= 10...90...10 %	< 5 ms
Temperature coefficient ε	T_A= -25 °C to +70 °C	0.01 %/K
Overload behavior P_{over}		Constant current
Short-circuit protection/ No-load response		Continuous/no-load stability
Derating	T_A> +50 °C to +70 °C	max. 2 %/K
Connector type	Flanged connector Fa. Binder, Order No.:09-3431-90-04	4 pins

Table 8-4 Output configurations

Input	Outputs U1 = U2	ILoad = I1 + I2	Efficiency (%)	Remarks
110 V AC	24 V DC	0A		No-load stability
110 V AC	24 V DC	3A	≥ 88	
220 V AC	24 V DC	0A		No-load stability
220 V AC	24 V DC	3A	≥ 90	

Table 8-5 Compliance with standards

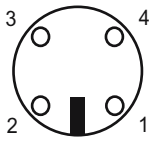
Name	Standard	Values
Electrical safety	EN 60950 / UL 60950 / CAN/CSA 22.2 950, 3 Edition	
Conducted interference	EN 61000-6-3 EN 55011	Class B
Emitted interference	EN 61000-6-3 EN 55011	Class B

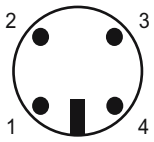
All values are measured at full-load and at an ambient temperature of 25 °C (unless specified otherwise).

8.1.7 Modification possibilities

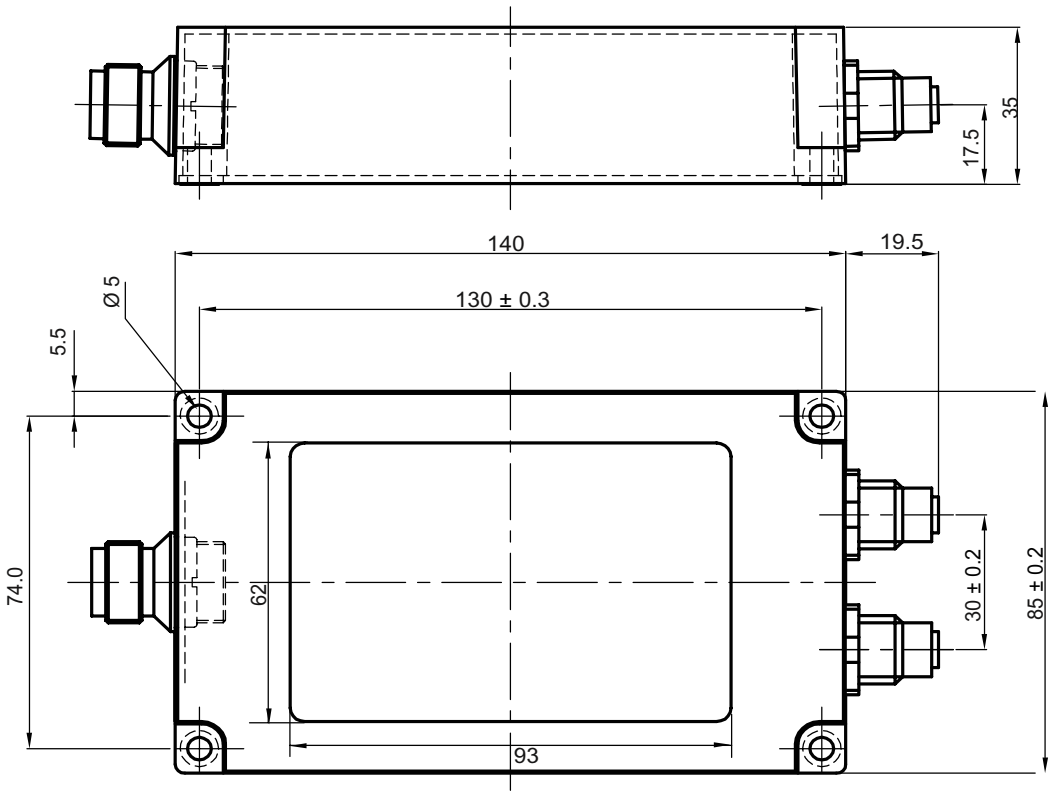
- Output voltages
- Insulation strength up to 4 kV_{AC}
- Heatsink
- DIN rail mounting

8.1.8 Pin assignment of DC outputs and mains connection

DC outputs	Assignment
	(1) Ground (0V)
	(2) +24 V DC
	(3) +24 V DC
	(4) Ground (0V)

Mains connection	Assignment
	(1) 100 to 240 V AC
	(2) n.c.
	(3) 100 to 240 V AC
	(4) n.c.

8.1.9 Dimension drawing



Units of measurement:

All dimensions in mm

Appendix

A

A.1 Certificates and approvals

Notes on CE marking

The following applies to the system described in this documentation:
The CE marking on a device is indicative of the corresponding approval:

DIN ISO 9001 certificate

The quality assurance system for the entire product process (development, production, and marketing) at Siemens fulfills the requirements of ISO 9001 (corresponds to EN29001: 1987).

This has been certified by DQS (the German society for the certification of quality management systems.)

EQ-Net certificate no.: 1323-01

Certification for the USA, Canada and Australia

Safety

One of the following markings on a device is indicative of the corresponding approval:	
	Underwriters Laboratories (UL) to UL 60950 Standard (I.T.E), or to UL508 (IND.CONT.EQ)
	Underwriters Laboratories (UL) according to Canadian standard C22.2 No. 60950 (I.T.E) or C22.2 No. 142 (IND.CONT.EQ)
	Underwriters Laboratories (UL) according to standard UL 60950, Report E11 5352 and Canadian standard C22.2 No. 60950 (I.T.E) or UL508 and C22.2 No. 142 (IND.CONT.EQ)
	UL recognition mark
	Canadian Standard Association (CSA) per Standard C22.2. No. 60950 (LR 81690) or per C22.2 No. 142 (LR 63533)
	Canadian Standard Association (CSA) per American Standard UL 60950 (LR 81690) or per UL 508 (LR 63533)

EMC

USA	
Federal Communications Commission Radio Frequency Interference Statement	This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
Shielded Cables	Shielded cables must be used with this equipment to maintain compliance with FCC regulations.
Modifications	Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.
Conditions of Operations	This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CANADA	
Canadian Notice	This Class B digital apparatus complies with Canadian ICES-003.
Avis Canadien	Cet appareil numérique de la classe b est conforme à la norme NMB-003 du Canada.

AUSTRALIA	
	This product meets the requirements of the AS/NZS 3548 Norm.

A.2 Service and support

Technical support

You can reach the technical support team for all A&D projects at

- Telephone: +49 (0) 180 5050 222
- Fax: +49 (0) 180 5050 223

Internet

- Visit our site on the Internet at:
  http://www.siemens.com/automation/service&support

- You can send a support query to:
  http://www.siemens.de/automation/support-request

- You can find the latest general information about our identification systems on the Internet at:
  http://www.siemens.de/simatic-sensors

- The online catalog and the online ordering system is available at:
  http://mall.automation.siemens.com/

A.3 Contact partners

If you have any further questions on the use of our products, please contact one of our representatives at your local Siemens office.

The addresses are found on the following pages:

- On the Internet at: http://www.siemens.com/automation/partner
- In catalog CA 01
- In Catalog FS 10 specially for factory automation sensors

A.4 Training

Training center

We offer appropriate courses to get you started. Please contact your regional Training Center, or the central Training Center in D-90327 Nuremberg.

Telephone: +49 (911) 895-3200

http://www.sitrain.com

Index

A

Accessories of the RF660R reader, 8-1
Antenna configuration, 4-2
Approvals, A-1

C

Cable
  Shielding, 4-29
Certificates, A-1
Classes, 7-2
Configuration, 5-10
  Antennas, 4-2
Contact partners, A-5
Coupling paths, 4-26

D

Design of the RF660R reader, 5-3
Dimensions
  RF660R reader, 5-17

E

Electromagnetic compatibility
  Coupling paths, 4-26
Electromagnetic interference, 4-23
Electromagnetic waves
  UHF range, 4-13
EMC Directives, A-3
EMC Guidelines
  Avoiding interference, 4-27
  Basic rules, 4-20
  Cable shielding, 4-29
  Definition, 4-20
  Equipotential bonding, 4-28
  Overview, 4-19
  Propagation of electromagnetic interference, 4-23
Equipotential bonding, 4-28

G

Gate configuration
  Application areas, 4-3
  Arrangement of antenna, 4-3
Generations, 7-2

I

Identification system
  Performance Features, 3-3
  UHF range, 3-1
Influence of
  Interference, 4-13
  Liquids, 4-15
  Metals, 4-14
  Non-metallic substances, 4-15
  reflections, 4-13
Interfaces, 5-10
  Digital, 5-6
  Serial, 5-5
Interference, 4-13
Interference sources
  Electromagnetic, 4-24

M

Main applications
  RF600, 3-2
Minimum distances
  For antennas, 4-7, 6-4
Mounting types of the RF660R reader, 5-10

P

Performance Features
  RF600, 3-3
Portal configuration
  Application example, 4-2
Power supply, 5-8

R

Reading range
  Dependency of the, 4-10
reflections, 4-13
Regulations applicable to UHF frequency bands
  Europe, 4-16
  USA, 4-18
RF600
  Main applications, 3-2
  Performance Features, 3-3
  System requirements, 3-3
RF660A antenna
  Design, 6-1
  Mounting types, 6-6
  Ordering data, 6-3
  Radiating/receiving characteristic, 6-2
  Technical specifications, 6-10
RF660R reader
  Accessories, 8-1
  Configuration, 5-10
  Design, 5-3
  Dimensions, 5-17
  Examples of mounting types, 5-10
  FCC information, 5-18
  Interfaces, 5-5, 5-6, 5-10
  Power supply, 5-8
  Status displays, 5-4
  Technical specifications, 5-14
  Transmission protocols, 5-12

S

Safety Information, 2-1
Service, A-4
Shielding, 4-29
Status LEDS of the RF660R reader, 5-4
Support, A-4
System overview
  SIMATIC RF600, 3-1
System requirements
  RF600, 3-3

T

Technical specifications
  RF660A antenna, 6-10
  RF660R reader, 5-14
Training center, A-5
Transmission protocols, 5-12
Transponder
  Classes, 7-2
  Generations, 7-2
  how it works, 7-1
  Improving detection, 4-13

W

Wide-range power supply unit
  Safety Information, 8-4
  Technical specifications, 8-6