RFID SYSTEMS

SIMATIC RF600

System Manual · 06/2010

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RFID systems SIMATIC RF600

System Manual

06/2010
J31069-D0171-U001-A10-7618

Legal information

Warning notice system

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 product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

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.

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Introduction 1

1.1 Preface

Purpose of this document

This system manual contains the information needed to plan and configure the RF600 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.

Scope of this documentation

This documentation is valid for all supplied versions of the SIMATIC RF600 system and describes the state of delivery as of **June 2010**.

Conventions

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

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

Registered trademarks

SIMATIC ® is a registered trademark of the Siemens AG.

History

Edition	Comment
11/2005	First edition
03/2006	2. revised edition
04/2006	3. revised and extended edition Details in the technical descriptions were revised.
06/2006	4. revised and extended edition
07/2008	5. revised and extended edition
11/2008	6. revised and extended edition: new RF620R and RF630R readers
07/2009	7. 7th revised and extended edition: FCC approval RF620R/RF630R

Edition	Comment
10/2009	8th. revised and expanded edition for multitag mode
12/2009	9. revised and extended edition
06/2010	10. revised and extended 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.
RF600 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.
Transponder/tags	Description of transponders which can be used for SIMATIC RF600.
Integration into networks	Integration of the RF600 reader to higher-level systems, control.
System diagnostics	Description of the flash codes and error codes of the reader.
Accessories	Connecting cable, wide-range power supply unit, technical data, ordering lists, dimension drawings
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 VDE/DIN, 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 where you purchased your device to find out which system expansion devices may safely be installed.

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

2.2 Safety instructions for third-party antennas as well as for modifications to the RF600 system

Always observe the following general safety instructions before selecting a component from a different vendor:

The manufacturer accepts no responsibility for functional suitability or legal implications for the installation of third-party components.

NOTICE
Loss of radio equipment approvals Alterations to the SIMATIC RF600 devices themselves are not permitted. Failure to observe this requirement shall constitute a revocation of the CE, FCC, UL, CSA radio equipment approvals and the manufacturer's warranty.

Modifications to the SIMATIC RF600 system

CAUTION
Damage to the system If you install unsuitable or unapproved extensions, you may damage the system or violate the safety requirements and regulations for radio frequency interference suppression. Contact your technical support team or where you purchased your device to find out which system extensions may safely be installed.

CAUTION
Loss of warranty If you cause defects on the SIMATIC RF600 system by improperly installing or exchanging system expansions, the warranty becomes void.

NOTICE
Loss of validity for type tests and certificates SIMATIC RFID products comply with the salient safety specifications to VDE/DIN, IEC, EN, UL and CSA. When using RFID components which do not belong to the RF600 range of products, the validity of all type tests as well as all certificates relevant to the RF600 are canceled: CE, FCC, UL, CSA.

Note

User responsibility for modified product

As a user of the modified product, you accept responsibility for use of the complete RFID product comprising both SIMATIC RF600 components and third-party RFID components. This particularly applies to modification or replacement of:

- Antennas
- Antenna cables
- readers
- Power supply units with connection cables

2.3 Safety distance to transmitter antenna

2.3.1 Safety distance between transmitter antenna and personnel

For antenna configurations where it is possible to be briefly or constantly within the transmission range of the antennas, as in loading ramps, for example, minimum distances must be maintained.

Limits

The ICRP (International Commission of Radiological Protection) has worked out limit values for human exposure to HF fields that are also recommended by the ICNIRP (International Commission of Non Ionizing Radiological Protection). In German legislation on emissions (since 1997), the following limit values apply. These can vary according to frequency:

Frequency f [MHz]	Electrical field strength E [V/m]	Magnetic field strength H [A/m]
10 - 400	27,5	0,073
400 - 2.000	$1.375 \times f^{1/2}$	$0.0037 \times f^{1/2}$
2.000 - 300.000	61	0,16

The limit values for the 900 MHz reader antenna alternating field are thus:

Electrical field strength: E = 41.25 V/m

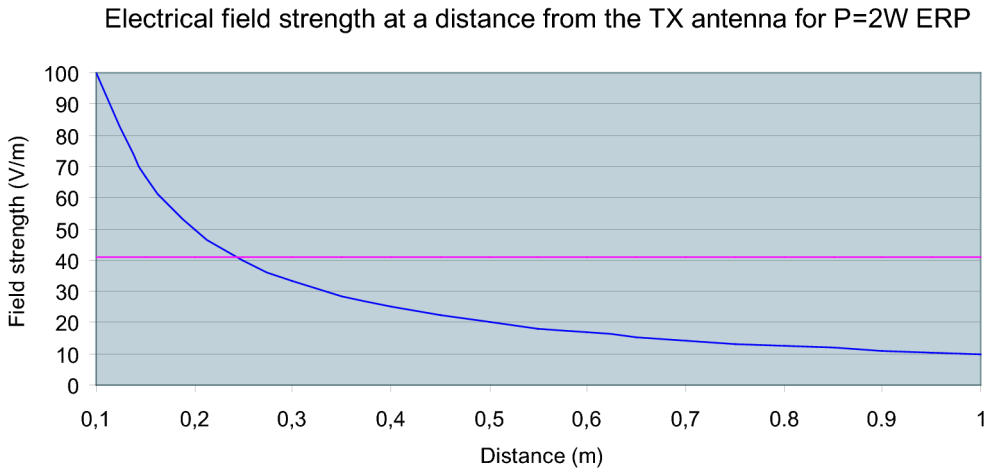
Magnetic field strength: H = 0.111 A/m

HF power density: E x H = 4.57 W/m^2

2.3.2 Minimum distance to antenna in accordance with ETSI

Minimum distance to antenna in accordance with ETSI (EU, EFTA, Turkey)

At a transmission frequency of 900 MHz, the wavelength of the electromagnetic wave λ is approximately 0.34 m. For distances less than 1 λ in the near field, the electrical field strength diminishes exponentially to the power three over distance, and for distances greater than 1 λ, it diminishes exponentially to the power two over distance.



The horizontal line at 41.25V/m marks the "safety limit value".

For the maximum permisisble transmission power in accordance with ETSI (2W ERP), the "safety distance" d = 0.24 m. This means that personnel should not remain closer than 24cm to the transmitter antenna for extended periods (more than several hours without interruption). Remaining within the vicinity of the antenna for a brief period, even for repeated periods (at a distance < 0.24 m), is harmless according to current knowledge.

Distance to transmitter antenna [m]	Feld strength [V/m]	% of limit value
1	10	24
5	2	5

If the transmitter power is set lower than the highest permissible value (2 watts ERP), the "safety distance" reduces correspondingly.

The values for this are as follows:

Radiated power ERP [W]	Safety distance to transmitter antenna [m]
2,0	0,24
1,0	0,17
0,5	0,12

Note

Reduced maximum radiated power with RF620R/RF630R readers

The SIMATIC RF620R (ETSI) reader has a maximum radiated power of 0.5 W ERP. The maximum safety distance is therefore 0.12 m.

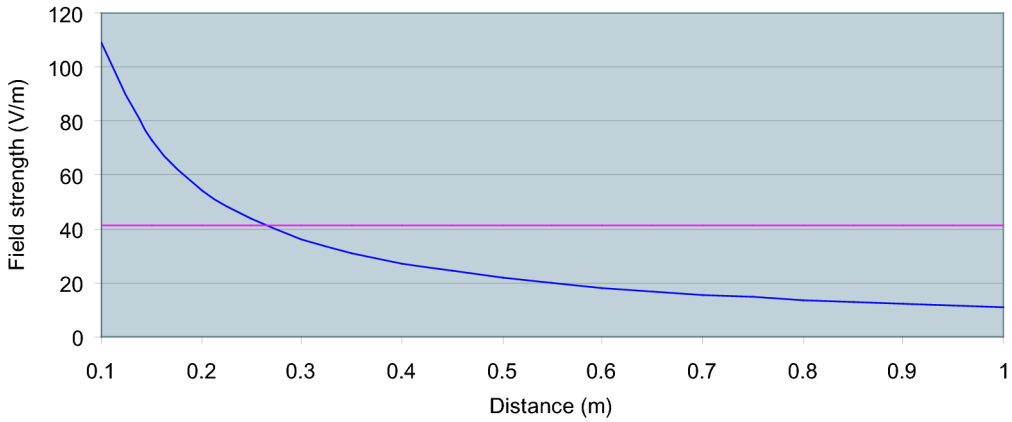
The SIMATIC RF630R (ETSI) reader has a maximum transmitter power of 0.5 W. The radiated power therefore depends on the antenna cable and the type of antenna used, but must not exceed the 2 W ERP.

2.3.3 Minimum distance to antenna in accordance with FCC (USA)

Minimum distance to antenna in accordance with FCC (USA)

For the maximum permisisble transmission power in accordance with FCC (4W EIRP), the "safety distance" d = 0.26 m. This means that personnel should not remain closer than 26cm to the transmitter antenna for extended periods (more than several hours without interruption). Remaining within the vicinity of the antenna for brief period, even repeated periods (at a distance < 0.26 m) is harmless to health according to current knowledge.

Electrical field strength at a distance from the TX antenna for P=4W EIRP



The horizontal line at 41.25 V/m marks the "safety limit value".

Distance to transmitter antenna [m]	Feld strength [V/m]	% of limit value
1	10,9	26
5	2,2	5,3

If the transmitter power is set lower than the highest permissible value (4 watts ERP), the "safety distance" reduces correspondingly.

The values for this are as follows:

Radiated power ERP [W]	Safety distance to transmitter antenna [m]
4,0	0,26
2,0	0,185
0,8	0.1xx
0,5	0,13

Note

Reduced maximum radiated power with RF620R/RF630R readers

The SIMATIC RF620R (FCC) reader has a maximum radiated power of 0.795 W EIRP. The maximum safety distance is therefore 0.1xx m.

The SIMATIC RF630R (ETSI) reader has a maximum transmitter power of 0.5 W. The radiated power therefore depends on the antenna cable and the type of antenna used, but must not exceed the 4 W EIRP.

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 RF670R reader and RF660R reader (write/read devices), 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 at the control level in order, for example, to generate the receiving department transaction for the ERP (Enterprise Resource Planning) system at the business administration control level. At the same time, the delivery can be automatically checked for correctness and completeness prior to storage by means of the electronic delivery list.

The general automation and IT structure of a company is shown in the following figure. This comprises several different levels that are described in detail below.

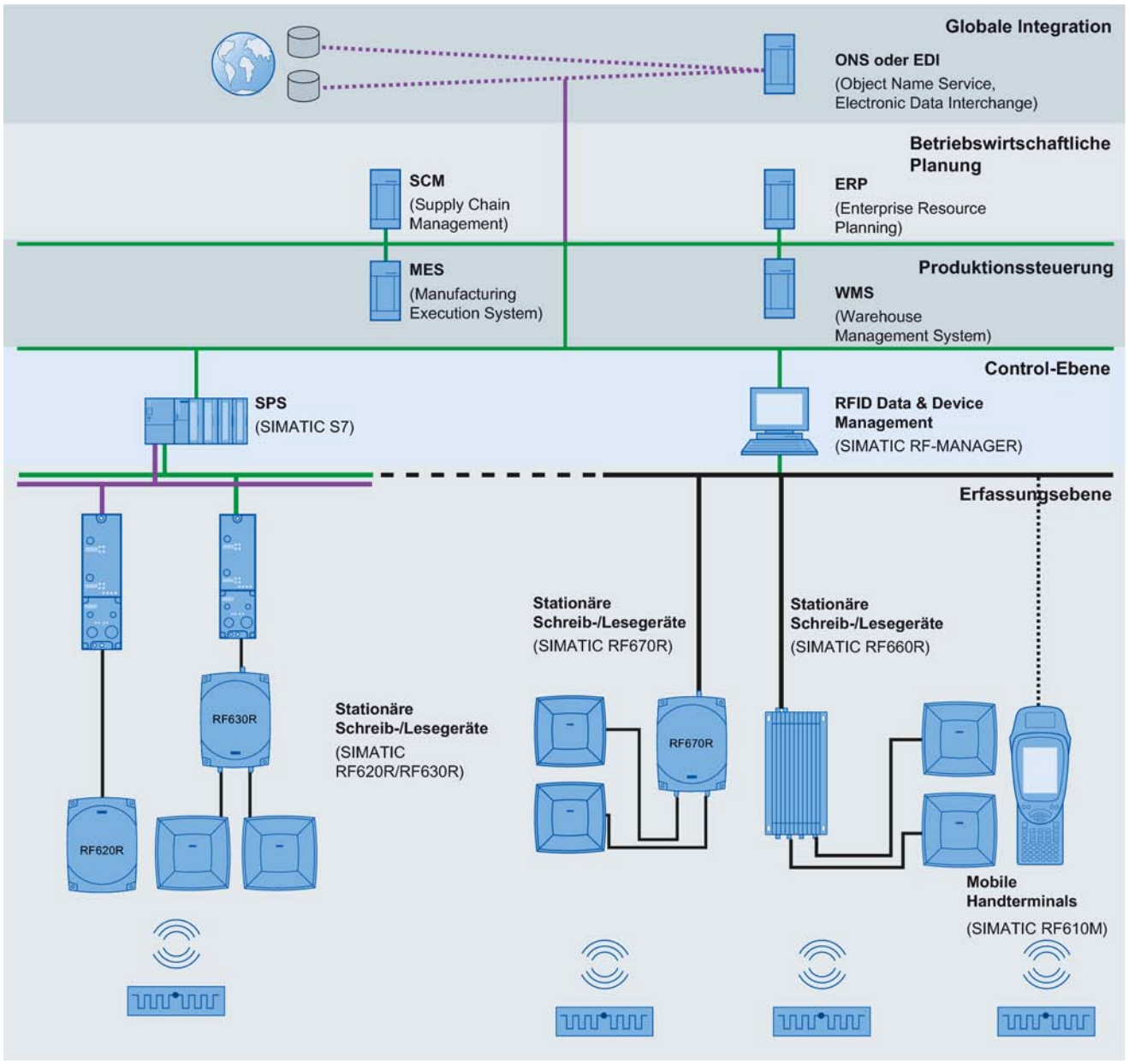


Figure 3-1 System overview of SIMATIC RF600

- **Acquisition level**
  This level contains the RFID readers that read the appropriate tag data and transfer them to the next highest level.
- **Control level**
  At the control level , the RFID data are collected, preprocessed and presented to the production control and business administration control levels for further processing.

- **Production control**
  The Manufacturing Execution System (MES) closes the gap between the data that arise in the automation environment (control level) and the logistical and commercial processes of the company (business administration control). MES solutions are used, for example, for defining and performing production processes.
- **Business administration control**
  This level covers planning and control of the equipment used. For this purpose, Enterprise Resource Planning (ERP) systems and Supply Chain Management (SCM) systems are used with modules for cost accounting, financial bookkeeping and personnel management.
- **Global integration**
  Product information can be exchanged here at an inter-company level. This can be performed over the Internet with the help of special services.

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, transponder or tag - is attached to every item, package or pallet, and contains all important information. The data medium receives the power it requires via an antenna which is also used for data transmission.

3.1.2 System components (hardware/software)

RF600 products	Description
	Due to its compact format and high degree of protection, the RF670R reader is ideally suited to applications in production logistics and distribution. The integrated data processing makes it easier to use in complex scenarios and reduces the IT integration costs. Integration is performed using an XML protocol, TCP/IP and Ethernet.
	Equipped with a rugged casing to the high IP 65 degree of protection and suitable for use over a wide range of temperatures, the SIMATIC RF660R reader is also a match for the demands of harsh industrial conditions in, for example, warehouses or on loading ramps.

RF600 products	Description
	The RF620R reader creates with its connection to a SIMATIC controller optimum preconditions for production-related application scenarios and/or production-related logistics applications by RFID. It has an integrated circular polarized antenna. .
	The RF630R reader creates with its connection to a SIMATIC controller optimum preconditions for production-related application scenarios and/or production-related logistics applications by RFID. It has 2 connections for external antennas.
	SIMATIC RF610M expands the RF600 RF identification system with a powerful mobile reader for applications in the areas of logistics, production and service. In addition, it is an indispensable aid for startup and testing.
	Also the RF660A antennas are equipped for the harsh conditions in production and logistics environments due to their high IP67 degree of protection. Up to 4 antennas can be connected to the RF670R and RF660R readers depending on the application and up to two can be connected to the RF630R reader.
	The SIMATIC RF620A is an antenna of compact, industry-standard design. It is suitable for UHF transponders with normal (far field) antenna characteristics.

RF600 products	Description
	The RF600 tag family offers the right solution for every application: The RF640T tool tag for industrial requirements is highly resistant to oils and can be directly mounted on metal. The RF620T container tag for industrial requirements is rugged and highly resistant to detergents. The RF630L Smart Labels made of plastic or paper can be used in many different applications: The application areas range from simple identification such as electronic barcode replacement/ supplementation, through warehouse and distribution logistics, right up to product identification.
	SIMATIC RF-MANAGER manages the connected RFID readers, collects the supplied data and reduces them as required by the higher-level enterprise systems (e.g. MES/ERP). The SIMATIC RF-MANAGER is used for configuring, commissioning and operating RFID systems. It allows you to collect RFID data, to process it and to filter it. This data can be exchanged with an S7 PLC by means of variables or transferred to a higher-level management system. The RF-MANAGER supports you with quick and easy creation of RFID solutions as well as the administration of RFID systems and their hardware components. The application also offers extensive help with the preprocessing of RFID data.

3.1.3 Features

The RF600 identification system has the following performance features:

RFID system RF600	
Type	Contactless RFID (Radio Frequency IDentification) system in the UHF band

RF670R reader			
Transmission frequency	865-868 MHz (ETSI: EU; EFTA, Turkey) 902-928 MHz (FCC: USA) 920.125 - 924.875 MHz (FCC: CHINA)		
Writing/reading range	EU, EFTA, Turkey: < X m @@@ USA: < X m China: < X m		
Standards	EPCglobal Class 1, Gen 2		
Compatible data carriers	Tags / Smart Labels	Designation	Standards supported
	Smart Labels	RF630L	EPCglobal Class 1, Gen 2
	ISO card	RF610T	EPCglobal Class 1, Gen 2
	Container tag	RF620T	EPCglobal Class 1, Gen 2
	Powertrain tag	RF630T	EPCglobal Class 1, Gen 2
	Tool tag	RF640T (Gen 2)	EPCglobal Class 1, Gen 2
	Heat-resistant tag	RF680T	EPCglobal Class 1, Gen 2

RF660R reader			
Transmission frequency	865-868 MHz (ETSI: EU; EFTA, Turkey) 869.5 MHz (ETSI SRD: EU, EFTA, Turkey)[1)] 902-928 MHz (FCC: USA) 920.125 - 924.875 MHz (FCC: CHINA)		
Writing/reading range	EU, EFTA, Turkey: < 3.5 m USA: < 4 m China: < 4 m		
Standards	EPCglobal Class 1, Gen 1 EPCglobal Class 1, Gen 2 ISO 18000-6B		
Compatible data carriers	Tags / Smart Labels	Designation	Standards supported
	Smart Labels	RF620L RF630L	ISO 18000-6B, EPCglobal Class 1, Gen 2
	ISO card	RF610T	EPCglobal Class 1, Gen 2
	Container tag	RF620T	EPCglobal Class 1, Gen 2
	Powertrain tag	RF630T	EPCglobal Class 1, Gen 2
	Tool tag	RF640T	ISO 18000-6B
	Tool tag	RF640T (Gen 2)	EPCglobal Class 1, Gen 2
	Heat-resistant tag	RF680T	EPCglobal Class 1, Gen 2

1) ETSI SRD not supported by Firmware V1.3 upwards

RF620R reader			
Transmission frequency	865-868 MHz (EU, EFTA, Turkey) 902-928 MHz (USA) 920.125 - 924.875 MHz (CHINA)		
Writing/reading range	EU, EFTA, Turkey: 0.1 - 2 m USA: 0.1 - 2 m CHINA: 0.1 - 2 m		
Standards	EPCglobal Class 1, Gen 2		
Compatible data carriers	Tags / Smart Labels	Designation	Standards supported
	Smart Labels	RF630L	EPCglobal Class 1, Gen 2
	ISO card	RF610T	EPCglobal Class 1, Gen 2
	Container tag	RF620T	EPCglobal Class 1, Gen 2
	Powertrain tag	RF630T	EPCglobal Class 1, Gen 2
	Tool tag	RF640T (Gen 2)	EPCglobal Class 1, Gen 2
	Heat-resistant tag	RF680T	EPCglobal Class 1, Gen 2

RF630R reader	
Transmission frequency	865-868 MHz (EU, EFTA, Turkey) 902-928 MHz (USA) 920.125 - 924.875 MHz (CHINA)
Writing/reading range	EU, EFTA, Turkey: 0.1 - 2 m USA: 0.1 - 2 m CHINA: 0.1 - 2 m

RF630R reader			
Standards	EPCglobal Class 1, Gen 2		
Compatible data carriers	**Tags / Smart Labels**	**Designation**	**Standards supported**
	Smart Labels	RF630L	EPCglobal Class 1, Gen 2
	ISO card	RF610T	EPCglobal Class 1, Gen 2
	Container tag	RF620T	EPCglobal Class 1, Gen 2
	Powertrain tag	RF630T	EPCglobal Class 1, Gen 2
	Tool tag	RF640T (Gen 2)	EPCglobal Class 1, Gen 2
	Heat-resistant tag	RF680T	EPCglobal Class 1, Gen 2

RF610M mobile handheld terminal			
Transmission frequency	869.5 MHz (Europe SRD) 912.5-917.4 MHz (USA)		
Writing/reading range	Europe < 0.75 m USA < 1 m		
Standards	EPCglobal Class 1, Gen 2 ISO 18000-6B		
Compatible data carriers	**Tags / Smart Labels**	**Designation**	**Standards supported**
	Smart Labels	RF620L	ISO 18000-6B,
	ISO card	RF630L	EPCglobal Class 1, Gen 2
	Container tag	RF610T	EPCglobal Class 1, Gen 2
	Powertrain tag	RF620T	EPCglobal Class 1, Gen 2
	Tool tag	RF630T	EPCglobal Class 1, Gen 2
	Tool tag	RF640T	ISO 18000-6B
	Heat-resistant tag	RF640T (Gen 2)	EPCglobal Class 1, Gen 2
		RF680T	EPCglobal Class 1, Gen 2

Data carrier/tags			
Version	**Tags / Smart Labels**	**Designation**	**Standards supported**
	Smart Labels	RF620L	ISO 18000-6B,
	ISO card	RF630L	EPCglobal Class 1, Gen 2
	Container tag	RF610T	EPCglobal Class 1, Gen 2
	Powertrain tag	RF620T	EPCglobal Class 1, Gen 2
	Tool tag	RF630T	EPCglobal Class 1, Gen 2
	Tool tag	RF640T	ISO 18000-6B
	Heat-resistant tag	RF640T (Gen 2)	EPCglobal Class 1, Gen 2
		RF680T	EPCglobal Class 1, Gen 2
Standards	EPCglobal Class 1, Gen 1 EPCglobal Class 1, Gen 2 ISO 18000-6B		

Software	
RF-MANAGER 2008	PC software for • System-wide configuration of readers – RF670R – RF660R – RF630R – RF620R – RF610M • Management and configuration of the connected readers • Preprocessing and evaluation of the RFID data • Interfacing to the higher-level enterprise system • Connection to SIMATIC S7 controller System requirements: Windows XP / SP2 and higher
RF-MANAGER Basic 2010	PC software for parameterizing the RF670R reader System requirement: Windows XP, SP2 and higher
RF660R configuration software	PC software for parameterizing the RF660R reader System requirements: Windows XP / SP1 or SP2

RF600 system planning

4

4.1 Overview

You should observe the following criteria for implementation planning:

- Possible system configurations
- Antenna configurations
- Environmental conditions for transponders
- The response of electromagnetic waves in the UHF band
- Regulations applicable to frequency bands
- EMC Directives

4.2 Possible system configurations

The SIMATIC RF600 system is characterized by a high level of standardization of its components. This means that the system follows the TIA principle throughout: Totally Integrated Automation. It provides maximum transparency at all levels with its reduced interface overhead. This ensures optimum interaction between all system components.

The RF600 system with its flexible components offers many possibilities for system configuration. This chapter shows you how you can use the RF600 components on the basis of various example scenarios.

4.2.1 Scenario for incoming goods

This example scenario shows the incoming goods bay of a warehouse. Pallets of goods are delivered through the incoming goods portal of a warehouse. Each pallet is equipped with a

tag. The tags contain user data that provide information about the sender and receiver of the goods. These data are read out and routed on.

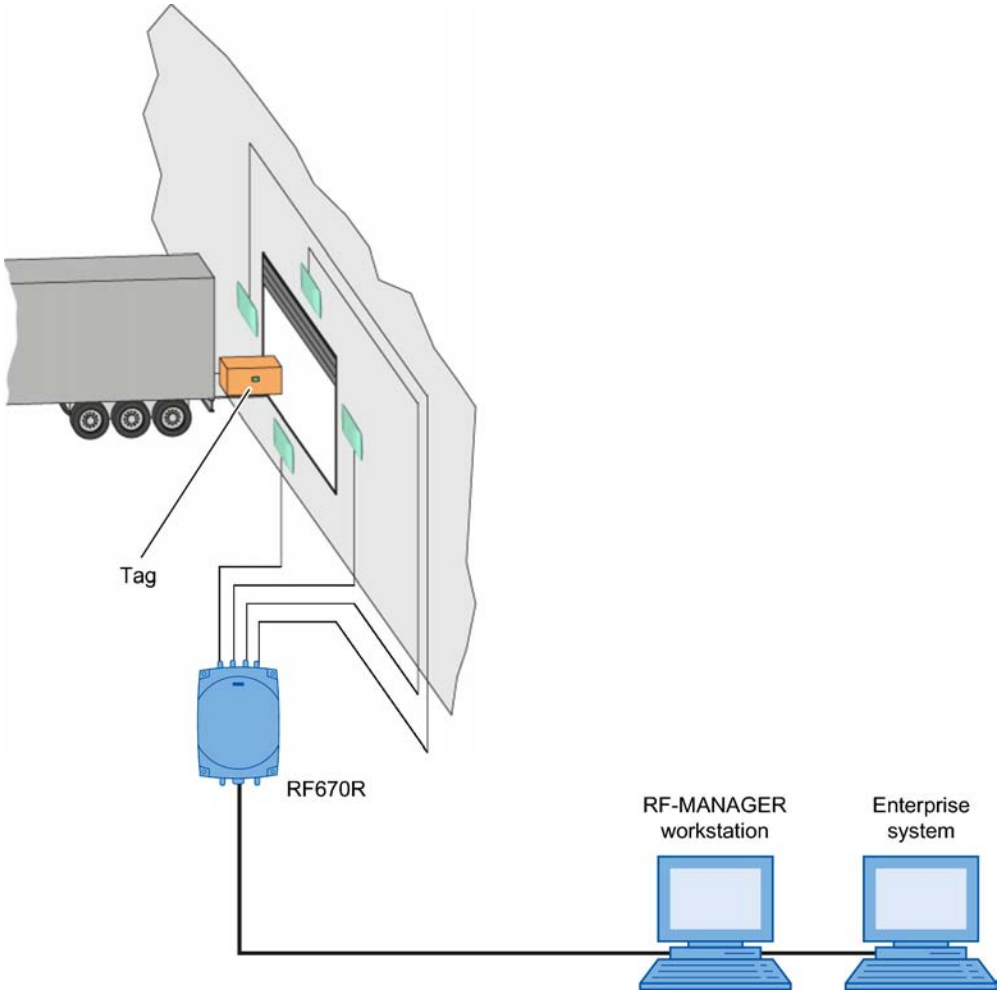


Figure 4-1 Incoming goods bay

Features of the scenario

In this example, the maximum number of 4 antennas of the SIMATIC°RF660A type are connected to the SIMATIC°RF670R reader. The four antennas are aligned with one read point and therefore form a portal that is to be monitored. The reading ranges depend on the size of the portal as well as the density of readers.

The tags in this scenario are Smart Labels of type SIMATIC°RF630L. They are usually attached to a non-metallic base such as wooden crates or cartons, in which the goods are packed. The tags can be mounted in almost any position on the packaging or pallet.

The tags are read with the "Bulk reading" procedure in the incoming goods bay, i.e. a large number of items and many tags can be acquired at once. High read rates can be achieved in this manner.

The SIMATIC RF670R reader is connected to an RF-MANAGER workstation that is connected, in turn, to an enterprise system through an ALE interface. The tag data can be managed by means of the enterprise system.

Summary of the features

Note

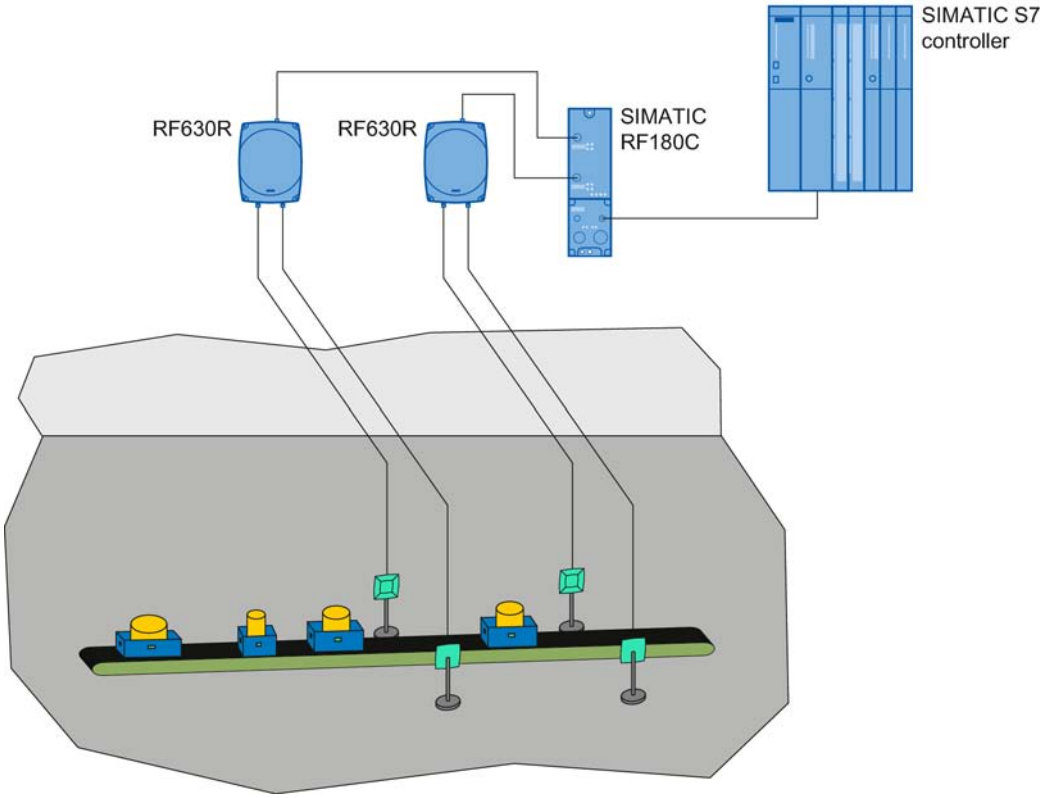
Note that the following features show sample values for the scenario. The specific data for your application may deviate from these values.

Feature	
Single-tag	No
Multi-tag	Yes
Read velocity	2 m/s
Tag orientation	Not defined
Material characteristics	Non-metal
Reading ranges	Approx. 3.5°m
Reader density	High
Interference	High

4.2.2 Scenario for material handling control

This scenario shows a possible solution for monitoring and controlling the infeed of material to a production line. The objective is to provide the right material at the right time. This can be

particularly useful in plants with frequently changing manufacturing scenarios for ensuring that incorrect infeed and downtimes are minimized.



Features of the scenario

The conveyor moves different transport containers past the readers in an arbitrary alignment. The RFID tag is, however, always applied to the transport containers with the same alignment. The tags in this scenario are transponders of type SIMATIC RF620T.

The conveyor has a maximum width of 80 cm in this example. The transport velocity is up to 2 m/s. With this arrangement only a single RFID tag has to be detected each time (single-tag).

In this scenario a SIMATIC RF630R is used as the reader. Optimum reading reliability is ensured by two external SIMATIC RF660A antennas in a portal arrangement. Where the distances to, or between, the materials containers are extremely short the SIMATIC RF620A is an excellent alternative. The SIMATIC°RF630R reader reads the information from the tags on the transport containers and transfers it via a communication module to the SIMATIC S7 controller which controls the process in accordance with the tag information.

Summary of the features

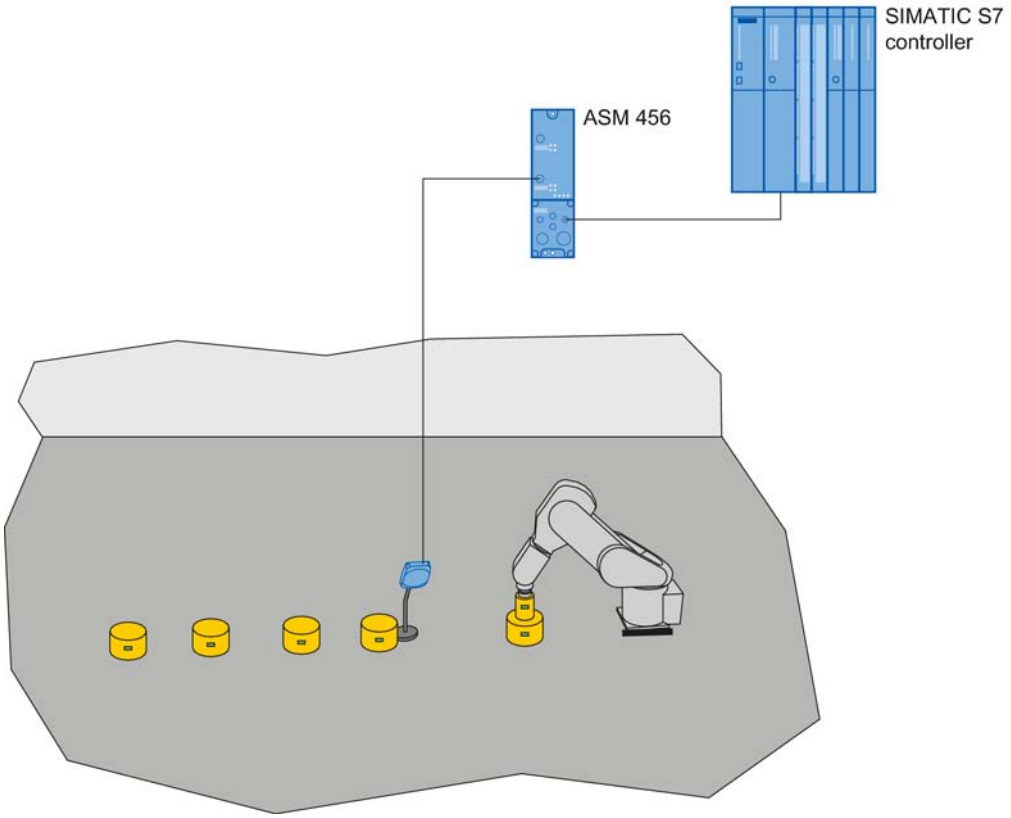
Note

Note that the following features show sample values for the scenario. The specific data for your application may deviate from these values.

Feature	
Single-tag	Yes
Multi-tag	No
Read velocity	Max. 2 m/s
Orientation of the RFID tag	Not defined
Carrier material of the tag	Metal or non-metal
Reading range	Approx. 1 m
Reader density	High
Interference	High

4.2.3 Scenario for workpiece identification

A typical characteristic of modern manufacturing scenarios is their multitude of variations. The individual data and production steps are stored in the tag of a toolholder or product. These data are read by the machining stations during a production process and, if necessary, tagged with status information. This can be used to dynamically identify which production step is the next in the series. This has the advantage that the production line can work automatically without the need to access higher system components. The use of RFID therefore increases the availability of the plant.



Features of the scenario

RFID tags are attached to workpiece holders. Their spatial orientation is always identical. With this arrangement, only a single tag has to be detected each time (single-tag). The tags in this scenario are transponders of type SIMATIC RF640T.

The SIMATIC RF620R reader reads the information from the tags with its integrated antenna and transfers it to the SIMATIC S7 controller via a communication module. Depending on the stored tag information, the SIMATIC-S7 performs different control tasks, for example, automatically providing a suitable tool for an industrial robot at the correct time.

Summary of the features

Note

Note that the following features show sample values for the scenario. The specific data for your application may deviate from these values.

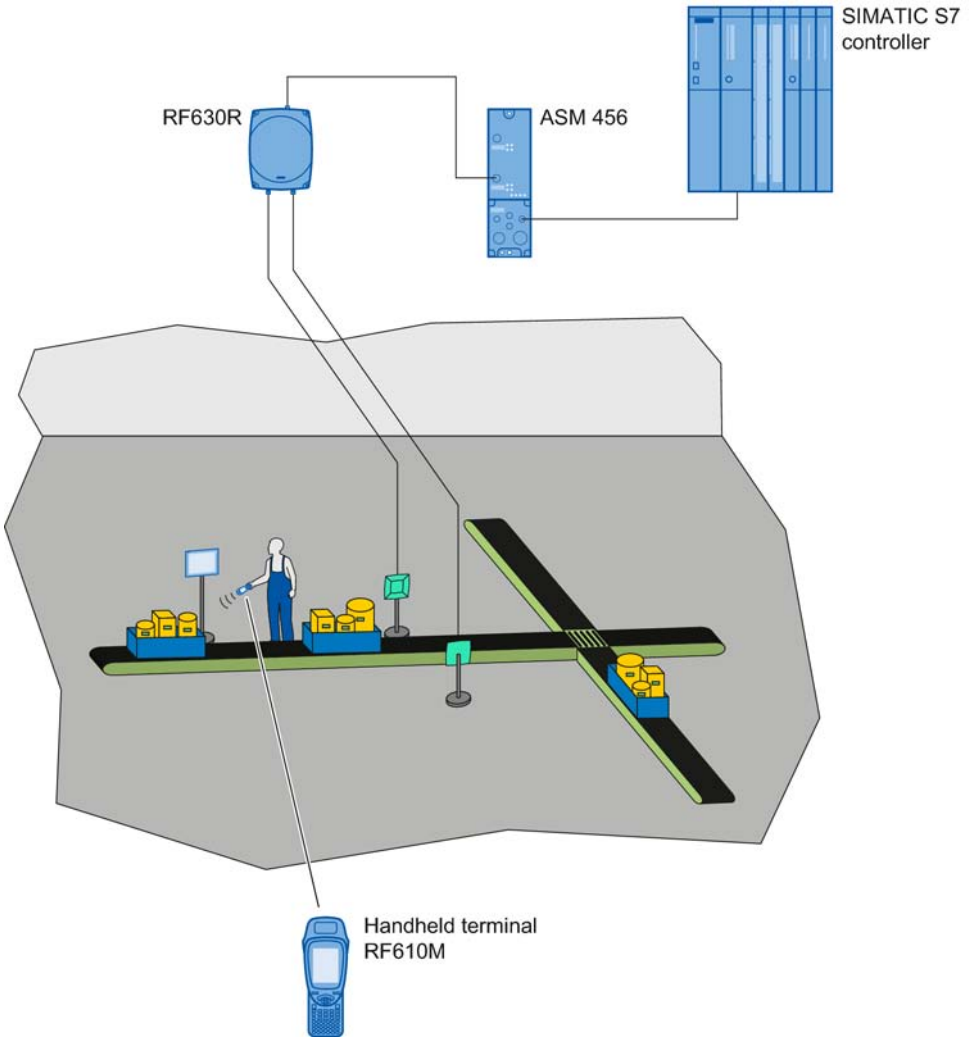
Features	
Single-tag	Yes
Multi-tag	No
Reading velocity	Not applicable
Orientation of the RFID tag	Same alignment for all the tags
Carrier material of the tag	Metal
Reading distance	Approx. 1 m
Reader density	High
Interference	High

4.2.4 Scenario for Intra logistics

Intra logistics comprises all logistical procedures that are required on a production site as well as within the overall company. The main task of Intra logistics is to control the subsequent processes:

- Transporting goods from the incoming goods bay into the warehouse
- Management of stock
- Conveyance of goods from the warehouse for production

- Order picking
- Packing



Features of the scenario

In this example scenario. items must be distributed to the correct storage location in a transport container via a separating filter. The RFID tags of type SIMATIC RF630L are directly attached to the item. The maximum transport velocity of the conveyor is 2 m/s.

In this scenario, bulk acquisition is necessary because several objects must be detected at the same time.

The SIMATIC RF630R reader uses two external antennas in a portal arrangement to read the information from the tags on the passing items and transfers it to the SIMATIC S7 controller via a communication module. The SIMATIC S7 controls the separating filter of the conveyor system depending on the tag information.

If only one simple evaluation of the tag ID is required, and the data will not undergo further processing, the SIMATIC RF670R offers this function without interfacing to the controller.

The SIMATIC RF610M mobile handheld terminal is used in this example for additional analysis and visualization of the item data directly on-site. The mobile handheld terminal can transfer the data to SIMATIC RF-MANAGER over the WLAN, and this then controls the separating filter via the SIMATIC S7 controller.

Summary of the features

Note

Note that the following features show sample values for the scenario. The specific data for your application may deviate from these values.

Features	
Single-tag	Yes
Multi-tag	No
Reading velocity	Max. 2 m/s
Orientation of the RFID tag	Same alignment for all the tags
Carrier material of the tag	Metal
Reading range	Approx. 1 m
Reader density	High
Interference	High

4.2.5 Scenario for outgoing goods

This example scenario shows the outgoing goods area of a warehouse with two loading gates. Pallets are dispatched through the outgoing goods portals - each pallet is marked with a tag. These tags also contain user data that provide information about the sender and receiver of the goods. The data read by the readers are checked to ensure that the pallets are waiting at

the correct outgoing goods portal. Depending on the read results of the reader, the outgoing portal opens, or it remains closed.

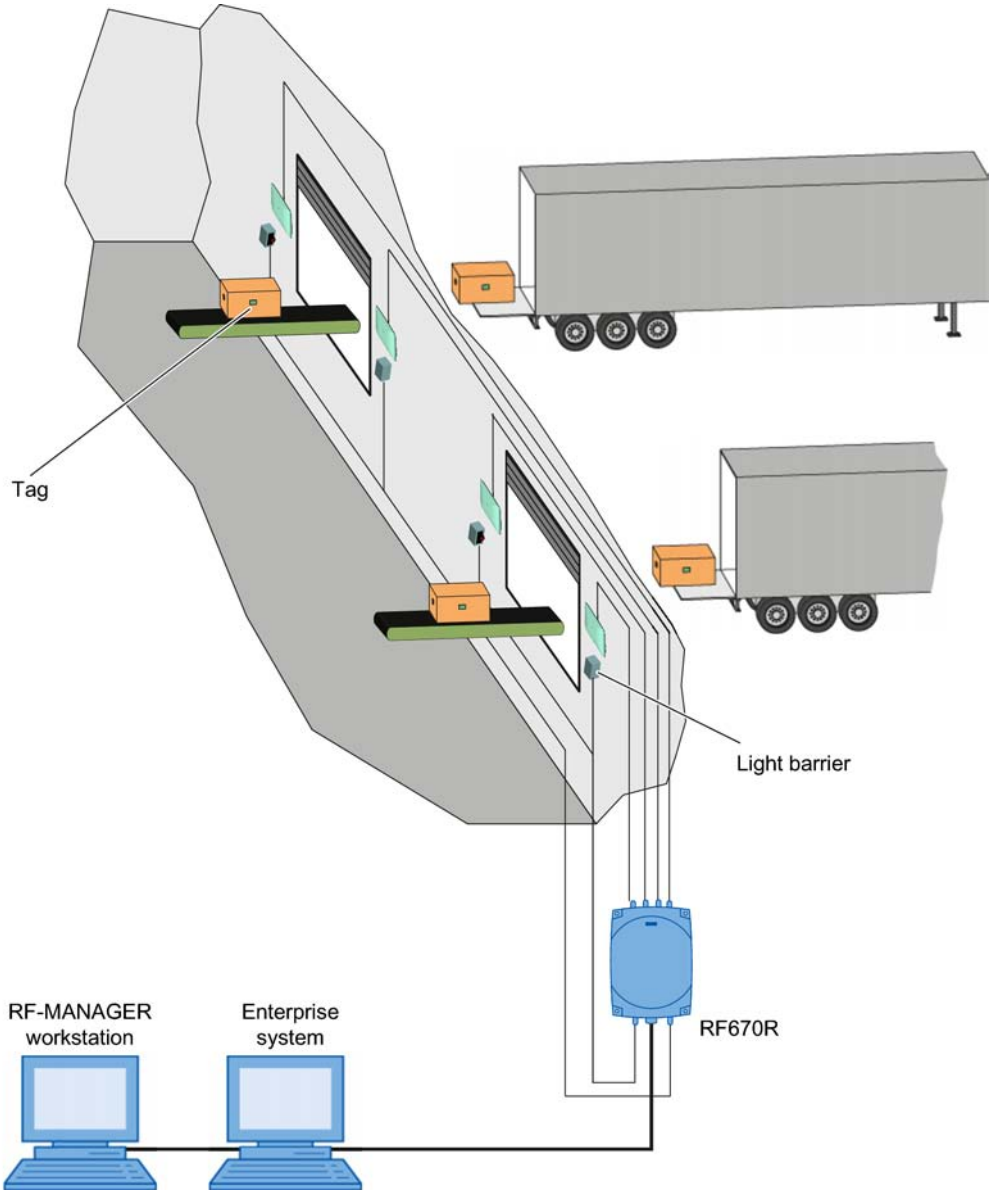


Figure 4-2 Outgoing goods

In this example, the maximum number of 4 antennas of the SIMATIC°RF660A type are connected to the SIMATIC°RF670R reader. The four antennas form two different read points and therefore monitor two loading gates. The reading ranges depend on the size of the portal as well as the density of readers.

The tags in this scenario are Smart Labels of type SIMATIC°RF630L. They are usually attached to a non-metallic base such as wooden crates or cartons, in which the goods are packed. The tags can be mounted in almost any position on the packaging or pallet.

The tags are read with the "bulk reading" procedure at the outgoing goods gates, i.e. a large number of items and many tags can be acquired at once. High read rates can be achieved in this manner.

The SIMATIC RF670R reader is connected to an RF-MANAGER workstation that is connected, in turn, to an enterprise system through an ALE interface. The tag data can be managed by means of the enterprise system.

Summary of the features

Note

Note that the following features show sample values for the scenario. The specific data for your application may deviate from these values.

Feature	
Single-tag	No
Multi-tag	Yes
Read velocity	2 m/s
Tag orientation	Not defined
Material characteristics	Non-metal
Reading ranges	Approx. 3.5°m
Reader density	High
Interference	High

4.3 Antenna configurations

Note

Validity of antenna configuration

The following specifications for the antenna configuration only apply to the RF660A antenna. See Section Guidelines for selecting RFID UHF antennas (Page 181) for specifications for the configuration of third-party antennas.

4.3.1 Antenna configuration example

The following diagram shows an application example for an antenna configuration of the RF670R. The antennas 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 three antennas. Up to four antennas can be used depending on the local conditions.

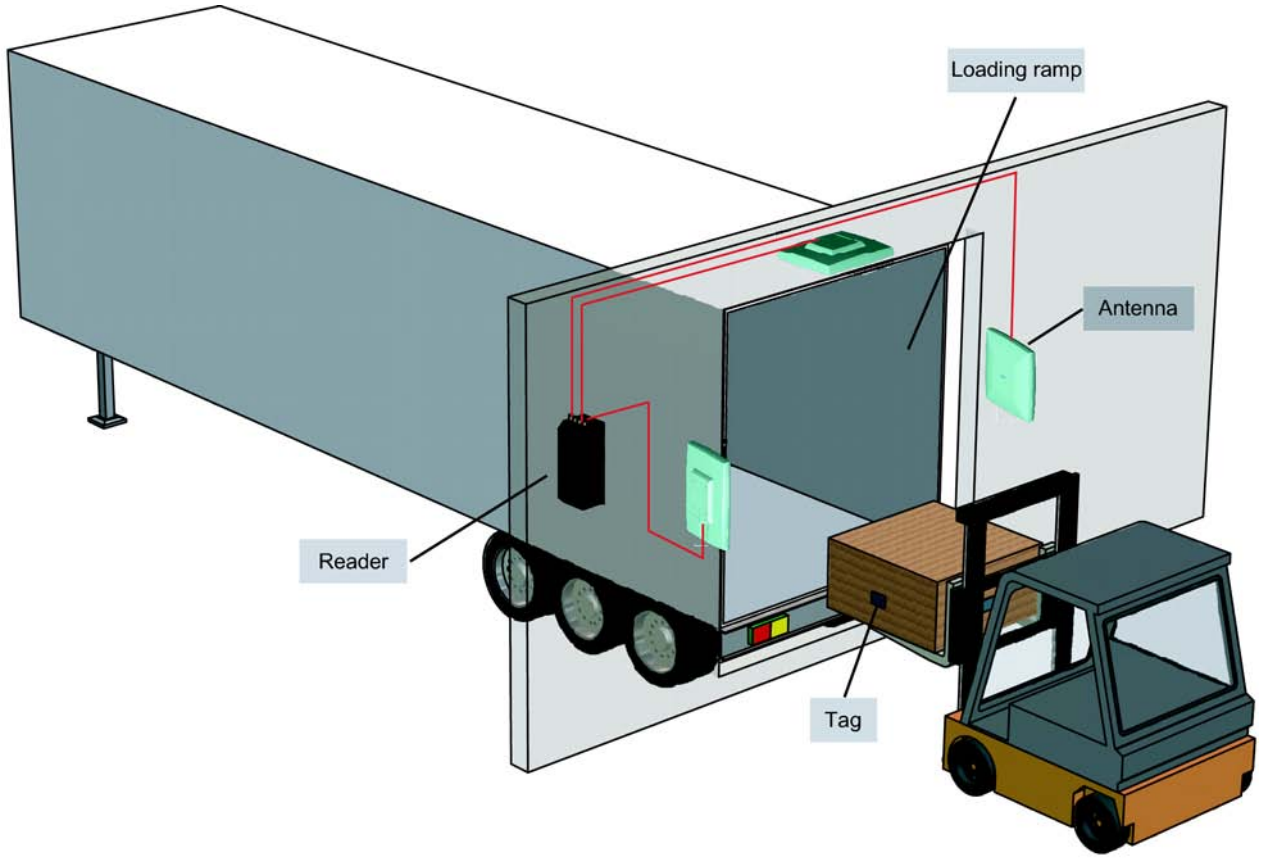
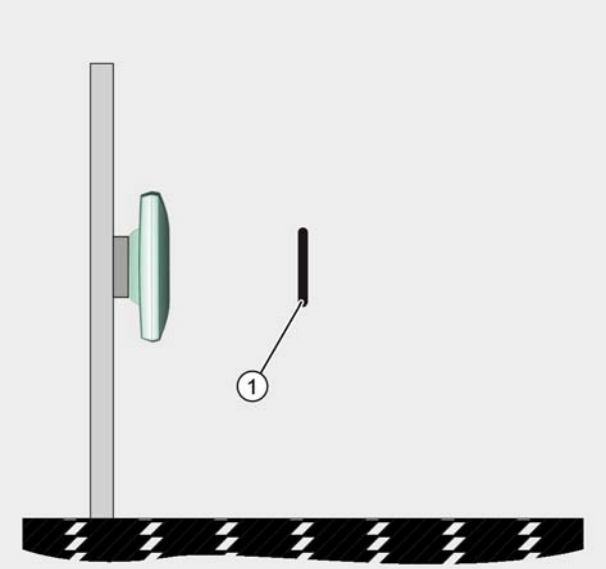


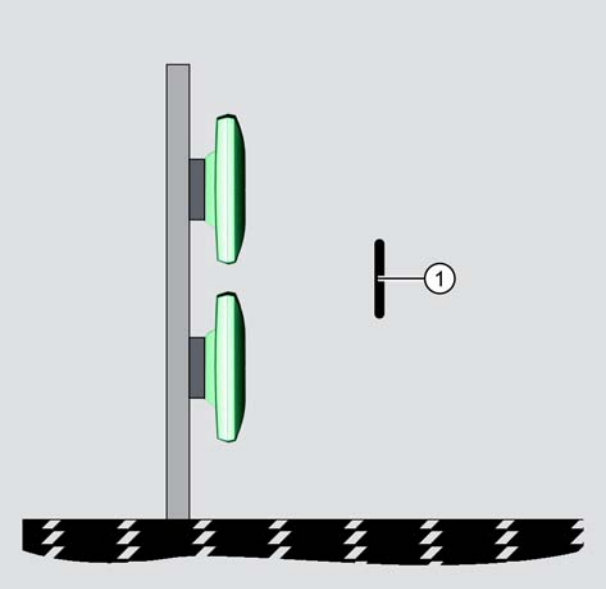
Figure 4-3 Example of an antenna configuration with three antennas. @@ Grafik wird auf RF670R geändert

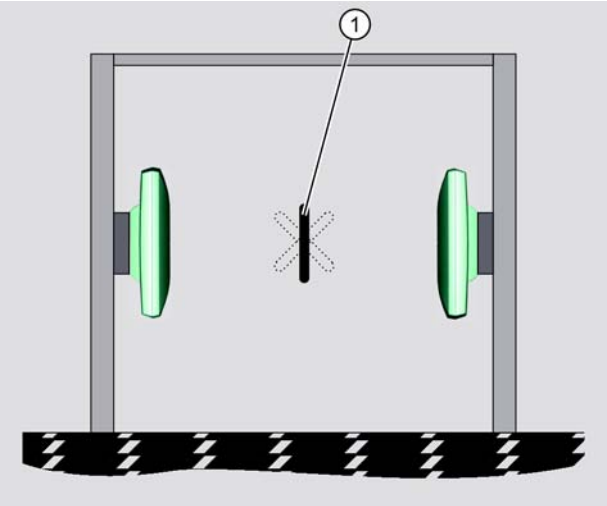
4.3.2 Possibilities and application areas for antenna configurations

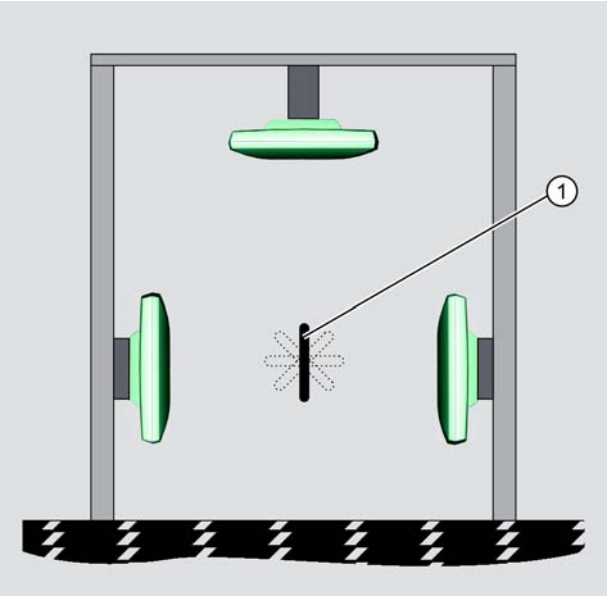
Some basic antenna configurations and possible fields of application are shown below. Please note for the possible configurations, that up to four external antennas can be connected to the RF670R and RF660R readers and up to two external antennas can be connected to the

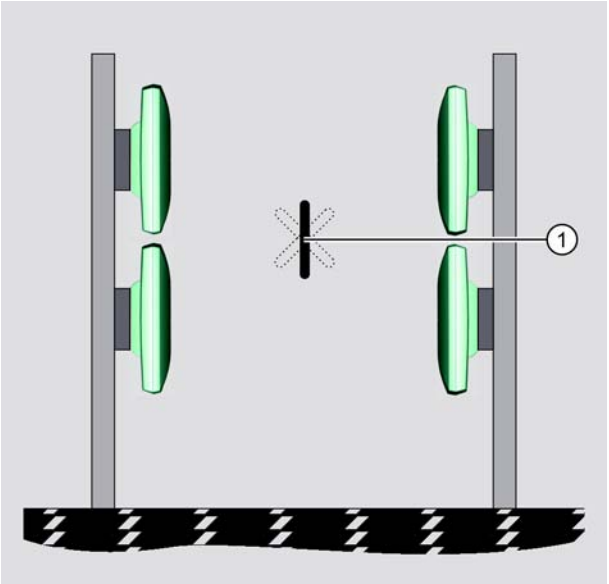
RF630R reader. No external antennas can be connected to the RF620R reader. It has an integrated antenna.

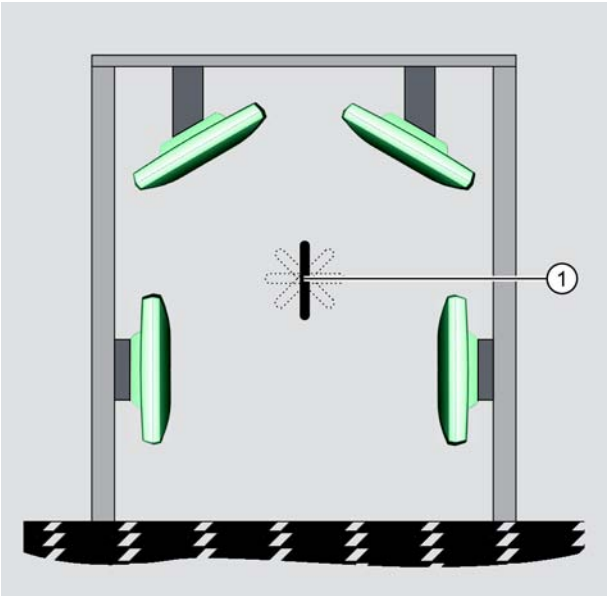
Antenna configuration 1:	Description/ application areas
	This arrangement of antennas is appropriate when the tags to be read are only located on one side of the goods to be acquired, for example, if a conveyor with passing goods has to be monitored during production and it is precisely defined on which side the tags to be read are attached. ① Tag This antenna configuration is possible with the following readers: • RF670R with one antenna • RF630R with one antenna • RF620R

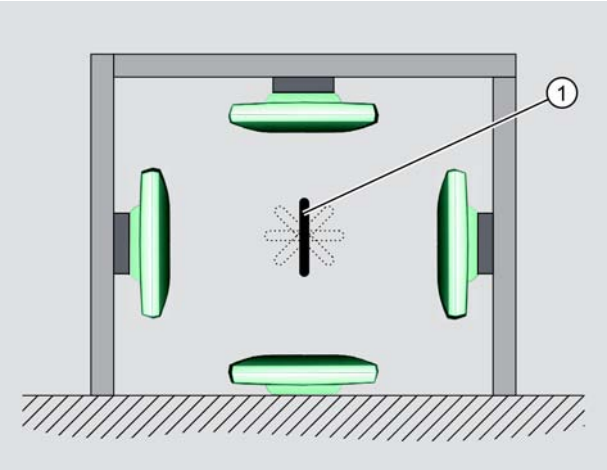
Antenna configuration 2:	Description/ application areas
	This arrangement of antennas is appropriate when the tags to be read are only located on one side of the items to be identified, e.g. when pallets are to be identified on which the tags to be read must be on a prespecified side. ① Tag This antenna configuration is possible with the following readers: • RF670R with two antennas • RF660R with two antennas • RF630R with two antennas

Antenna configuration 3:	Description/ application areas
	Preferred for the identification of goods at 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 This antenna configuration is possible with the following readers: • RF670R with two antennas • RF660R with two antennas • RF630R with two antennas

Antenna configuration 4:	Description/ application areas
	Preferred for the identification of goods at loading portals: Similar to configuration 2, but with additional reading reliability when the tag is at an angle to the vertical. ① Tag This antenna configuration is possible with the following readers: • RF670R with three antennas • RF660R with three antennas

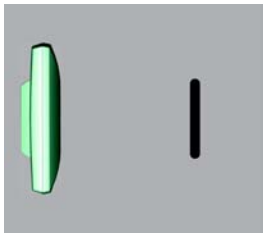
Antenna configuration 5:	Description/ application areas
	Preferred for the identification of goods at loading portals: The tag is located in the field of radiation of all four antennas, so the tag position can vary more than in configuration 2 for reliable tag identification. ① Tag This antenna configuration is possible with the following readers: • RF670R with four antennas • RF660R with four antennas

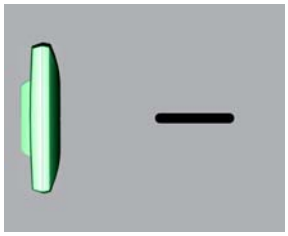
Antenna configuration 6:	Description/ application areas
	Preferred for the identification of goods at loading portals: Similar to configuration 4, but the reliability of tag identification is improved as a result of the four antennas at separate locations, so the tag position is not critical. ① Tag This antenna configuration is possible with the following readers: • RF670R with four antennas • RF660R with four antennas

Antenna configuration 7:	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 This antenna configuration is possible with the following readers: • RF670R with four antennas • RF660R with four antennas

4.3.3 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.

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

4.3.4 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.

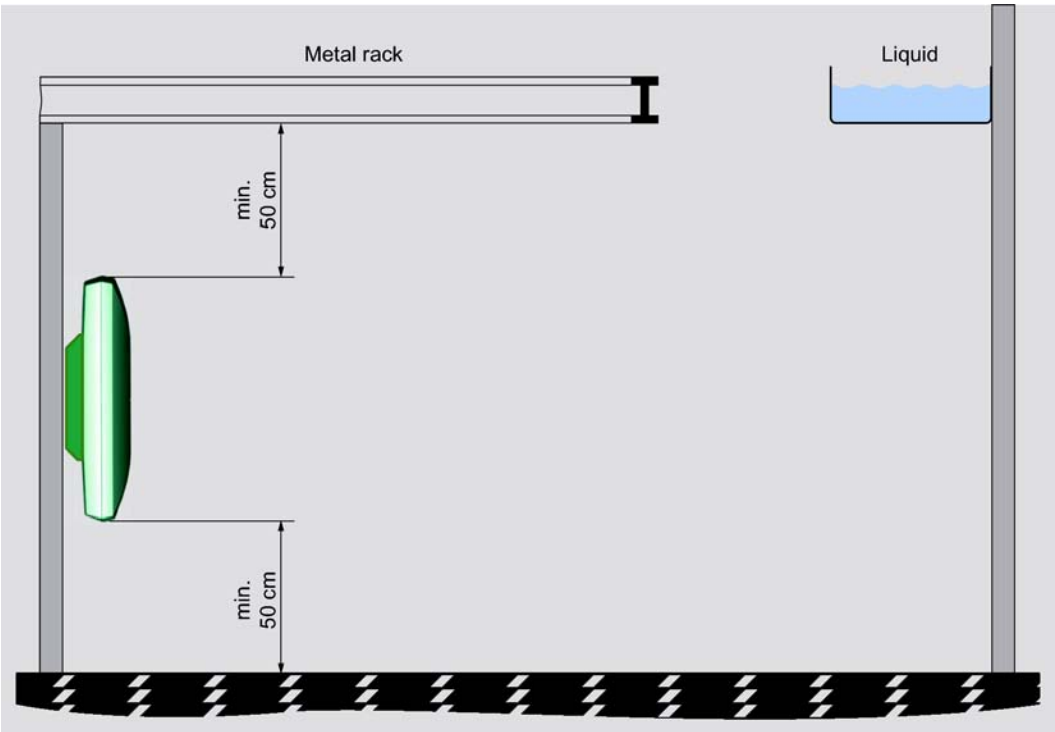


Figure 4-4 Minimum distance to the environment

The distance between two antennas mounted alongside each other or one above the other should be at least 20 cm, but a distance of more than 50 cm is better.

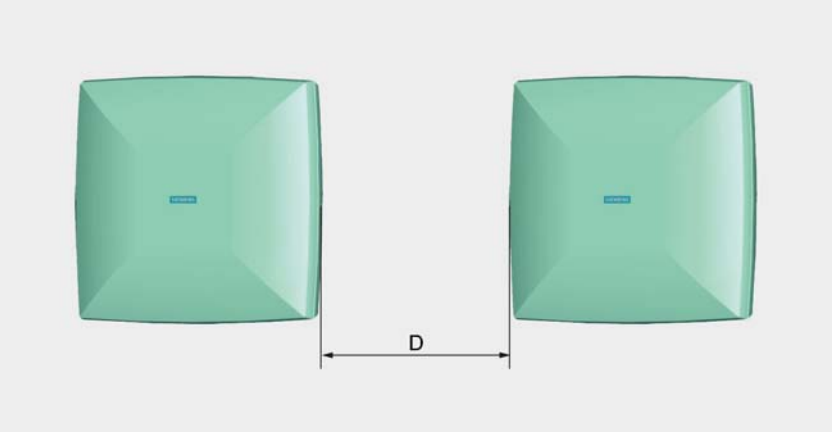


Figure 4-5 Antennas mounted adjacently horizontally or vertically

Readers	Minimum spacing D
RF670R with RF660A	20-50 cm
RF660R with RF660A	20-50 cm
RF630R with RF660A	20-50 cm
RF620R	3 m

The minimum distance between antennas mounted alongside each other or one above the other depends on the transmit power of the reader and the sensing range of the tags.

For a portal configuration, the maximum distance between two antennas that are connected to the same reader is 8 m.

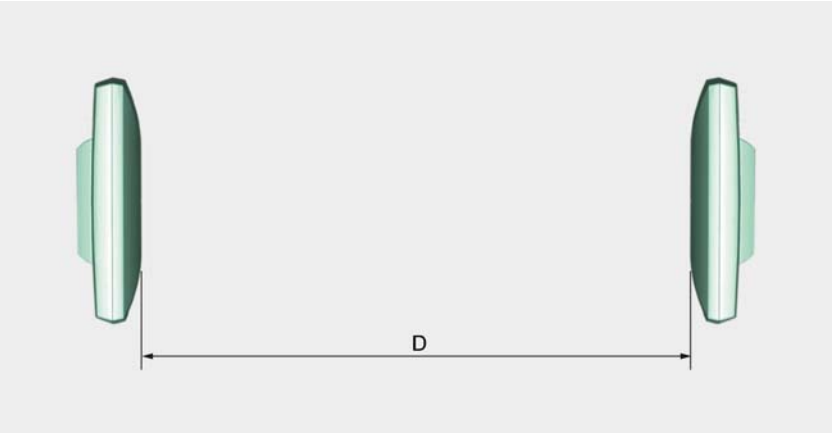


Figure 4-6 Portal configuration, maximum distance

Readers	Maximum distance D
RF670R with RF660A	8 m *
RF660R with RF660A	8 m*
RF630R with RF660A	4 m

*) A portal spacing of up to 10 m is possible. The probability of a read must be checked.

The specified distances are recommended minimum or maximum values for configuration.

4.3.5 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 then occur particularly when they transmit on the same channel (on the same frequency).

To prevent this, readers used in Europe and China must operate on different channels with "Frequency hopping" activated. "Frequency hopping" is permanently set in the USA.

4.3.6 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.
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 (e.g., in rooms with reflecting surfaces, machinery, or concrete walls), the reading range can be significantly higher than in a low-reflection environment.

You will find detailed information about the reading range of the individual readers in the "Technical specifications" in the sections for the various readers.

4.3.7 Operation of several readers within restricted space

4.3.7.1 Dense Reader Mode

A special operating mode for Gen 2 tags enables several RF600 readers to be operated without interference in close proximity to each other. This applies to all RF600 readers: RF670R, RF660R, RF630R and RF620R.

Dense Reader Mode (DRM)

In this mode, tag readability is increased through the application of interference-reducing measures.

DRM is only defined for Gen 2 and does not function with other tag types.

Operating principle

Dense Reader Mode allows physically adjacent readers to use the same frequency when Gen 2 tags are being used.

In accordance with EPC Global as well as ETSI EN 302 208 V1.2.1, the four transmit channels are used for transmission with the RF670R, with the RF660R in Firmware Version V1.3 and higher, and with the RF620R/RF630R (see Section Regulations for UHF frequency bands in Europe (ETSI EN 302 208 V1.2.1) (Page 54)) and the tag response appears on the associated neighboring channels. As a result of the large difference in level between the transmitter channels and the tag response channels, this technology provides great advantages for frequency reuse. However, a prerequisite is that a certain minimum distance, and thus minimum decoupling, is observed between the antennas of adjacent readers.

In accordance with EPC Global as well as ETSI EN 302 208 V1.1.1, only the even channels are used for transmitting in this mode (communications path Reader -> Tag) with the RF660R in Firmware Version V1.2 and below; the tag response is on the odd channels as a result of the frequency offset.

Antenna alignment and distances

The minimum distance required between antennas that use the same frequency and that are connected to different readers depends on the maximum radiated power set (RF670R with

RF660A = 2000 mW ERP; RF660R with RF660A = 2 W ERP; RF620R/RF630R = 500 mW ERP) and the antenna alignment.

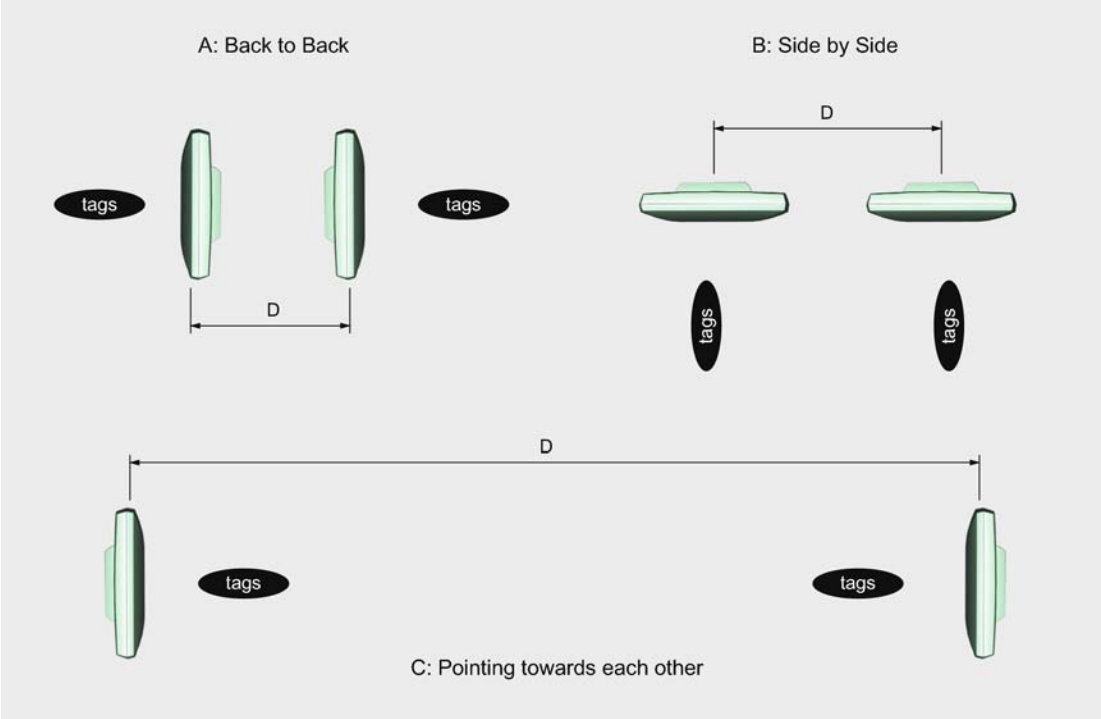


Figure 4-7 Antenna distances for different readers and identical frequencies

Antenna configuration	Antenna alignment	Minimum distance required = D RF670R with RF660A	Minimum distance required = D RF660R with RF660A	Minimum distance required = D RF620R	Minimum distance required = D RF630R with RF660A
A	With backs to each other	< 0.5 m	1 m	2 m	4.5 m
B	Arranged laterally	< 1 m	2 m	1.2 m	1.5 m
C	Antennas point toward each other	< 6 m	5 m	54 m	30 m

4.3.7.2 Optimizing tag reading accuracy

A further improvement in the tag reading accuracy in an environment with a high density of readers can be achieved by orienting the antennas toward the respective tag field, i.e. by rotating them horizontally and vertically.

In addition, the transmitter power of the readers can be reduced down to the minimum at which the tags are still just detected accurately.

This greatly reduces the probability of interference.

4.3.7.3 Optimization of robustness of tag data accesses for readers that are operated simultaneously

Parameter data access reliability

If several readers are to be operated simultaneously in an environment, then the following settings affect the reliability of the reader's access to transponder data:

- Electromagnetic environment (see Chapter The response of electromagnetic waves in the UHF band (Page 51))
- Type of transponder (see chapter Transponder/tags (Page 205))
- Number of transponders to be detected by an antenna at a time
- Type of antenna (see Chapter Antennas (Page 153), Chapter Guidelines for selecting RFID UHF antennas (Page 181), and Chapter Planning application (Page 84))
- Transponders' distance from and orientation toward antennas (see Chapter Transponder/ tags (Page 205))
- Distances and orientation of antennas of different readers to each other
- Radiated power of antennas

The robustness of tag data accesses is improved for readers whenever distances to adjacent readers are increased, radiated power is reduced, and a channel plan (for ETSI readers) is implemented. Adjacent readers are parameterized in the channel plan such that they cannot use the same channels.

A channel plan can be created for ETSI readers; for FCC readers, it is assumed that the probability of two readers accidentally using the same channel is very low.

SIMATIC RF620R reader

The RF620R has an integrated, circular polarized antenna. This means that the type of antenna cannot be freely selected.

Note

Rotation of the reader through 90° around the z axis

Since the horizontal electrical opening angle of the RF620R antenna is greater than the vertical electrical opening angle, the effects on adjacent readers can be reduced by rotating the reader through 90° around the z axis (see coordinate diagram in Chapters Antenna diagram for RF620R (ETSI) (Page 85) and Antenna diagram for RF620R (FCC) (Page 88)).

SIMATIC RF670R, RF630R or RF660R reader with SIMATIC RF660A antenna

The electrical opening angles (vertical and horizontal) of the RF660A antenna are identical. Therefore, the robustness of the readers' access to transponder data cannot be optimized further by rotating them around the antenna axis.

Application example for RF620R/RF630R

The following example explains measures for enhancing the data access security from the RF620R reader to transponders:

- The antennas are placed next to each other and are aligned in parallel (see arrangement B in Chapter Dense Reader Mode (Page 46)).
- Radiated power is limited to 27 dBm (ERP) or 500 mW (ERP).
- The RF620R readers have been rotated through 90° around the z axis.

In addition, the following characteristics are to be fulfilled:

- Length of data to be read/written on the transponder: 99,99%
- Length of data to be read/written on the transponder: 512 bits (64 bytes)
- Transponder type RF630L (6GT2810-2AB03)

The table below provides an overview of the minimum distances to be observed depending on the radiated power and maximum possible number of transponders for the RF620R/ RF630R readers if the above-named requirements must be fulfilled:

Mode	Max. number of tags	Radiated power dBm (ERP)/ mW (ERP)	Min. distance [m] between - two RF620R readers - two RF660A antennas operated with RF630R readers - one RF620R and one RF660A antenna operated with a RF630R reader
Single tag mode: Read	1	27 dBm (ERP)/ 500 mW (ERP)	3
Single tag mode: Write	1	27 dBm (ERP)/ 500 mW (ERP)	3
Multitag mode: Read	40	27 dBm (ERP)/ 500 mW (ERP)	6
Multitag mode: Write	10	27 dBm (ERP)/ 500 mW (ERP)	6

See also

RF660A antenna (Page 175)

4.3.7.4 Frequency hopping

This technique should prevent mutual interference between readers. The reader changes its transmission channel in a random or programmed sequence (FHSS).

Procedure for FCC

The 50 available channels mean that the probability is low that two readers will be operating on the same frequency (see Section Regulations for UHF frequency bands in the USA (Page 60)). In China, one reader operates on at least 2 channels, e.g. 16 channels of 2 W (see Section Regulations for UHF frequency bands in China (Page 58)).

Procedure for ETSI

Frequency hopping is optional here. According to ETSI EN 203 208 V1.2.1, frequency hopping is however recommended to ensure that the reader does not have to pause for 100 ms after 4 seconds.

4.3.7.5 Listen before talk

With this technique which is only applicable to ETSI, the reader checks whether the relevant channel is assigned before transmission to prevent collisions. The reader will only transmit when this channel is free. The reader can transmit for up to 4 seconds on this channel and must then either pause for at least 100 milliseconds or jump immediately to an unassigned channel where it can transmit for another 4 seconds.

With the new ETSI EN 302 208 standard V1.2.1 this technique must be not be used (see Chapter Regulations for UHF frequency bands in Europe (ETSI EN 302 208 V1.1.2) (Page 57) and Chapter Regulations for UHF frequency bands in Europe (ETSI EN 302 208 V1.2.1) (Page 54)).

4.4 Environmental conditions for transponders/tags

4.4.1 Basic rules

The transponder/tag 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 operates better when the distance is greater (between 5 and 20 cm).

- Tag assembly on non-conductive material (plastic, wood) has a tendency to be less critical than assembly even on poorly conductive material.
- The best results are achieved on the materials specified by the tag manufacturer.
- You can obtain more detailed information from the tag manufacturer.

4.5 The response of electromagnetic waves in the UHF band

4.5.1 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 transmitter 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 gaps in reader coverage.

4.5.2 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.
- Do not place metallic or conducting 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. For further details on the special case of attaching transponders to electrically conducting materials, see Section SIMATIC RF620T (Page 235) and SectionSIMATIC RF640T (Page 271) .

In the case of transponders that are not designed for mounting on metallic materials, the minimum permissible distance from metal is 5 cm. The larger the distance between the transponder and the metallic surface, the better the function of the transponder.

4.5.3 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.

4.5.4 Influence of external components

The R&TTE guideline and the relevant standards govern the electromagnetic compatibility requirements. This also concerns the external components of the RF600 system. Even though the requirements for electromagnetic compatibility have been specified, various components will still interfere with each other.

The performance of the RF600 system is highly dependent on the electromagnetic environment of the antennas.

Reflections and interference

On the one hand, antenna fields will be weakened by absorbing materials and reflected by conducting materials. When electromagnetic fields are reflected, the antenna field and reflecting fields overlap (interference).

External components in the same frequency band

On the other hand, external components can transmit on the same frequency band as the reader. Or the external components can transmit in different frequency bands with side bands that overlap with the frequency band of the reader. This results in a reduction of the "signal-to-noise" ratio which reduces the performance of an RF600 system.

If a DECT station that is transmitting in the 2 GHz band, for example, is located in the receiving range of an antenna of the RF600 system, the performance of the write and read accesses to the transponder will be affected.

4.6 Regulations applicable to frequency bands

The following section describes the regulations for frequency bands which apply in different regions with reference to RFID. It presents the definition of the applicable standard, the precise channel assignments as well as the applicable technique.

4.6.1 Regulations for UHF frequency bands in Europe

4.6.1.1 Regulations for UHF frequency bands in Europe (ETSI EN 302 208 V1.2.1)

This revision of the standards EN 302 208 also supports RFID systems with many readers that are operating simultaneously. Within the frequency spectrum, 4 exclusive RFID channels have been defined. The procedure "Listen Before Talk" must no longer be used.

Regulations for frequency bands according to EN 302 208 V1.2.1

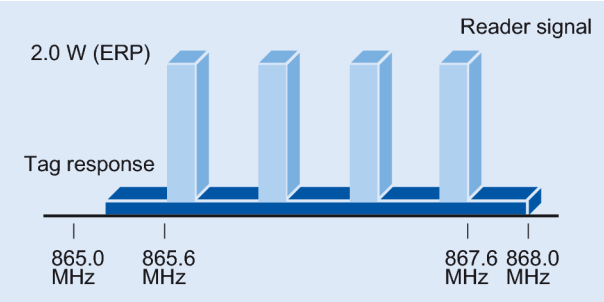
ETSI (European Telecommunications Standards Institute)

Specifications of European standard EN 302 208:

- UHF band: 865…868 MHz
- Radiant power: max. 2 W (ERP)
- Channel bandwidth: 200 KHz, channel spacing 600 kHz
- Number of channels: 4
  - 865,7
  - 866,3
  - 866,9
  - 867,5

Channel assignment

- The UHF band from 865 to 868 MHz with 4 RFID channels occupies:



Validity

Note that readers may be operated with this setting since November 4, 2008 (publication of the standard in the Official Journal of the European Union).

Note
Availability

Please note that this profile is available for the following readers and firmware versions:

- RF620R/RF630R, firmware V1.0 or higher
- RF660R, firmware V1.3 or higher
- RF670R, firmware V1.0 or higher

4.6.1.2 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 band, assigned	869.4– 869.65 MHz
Frequency used	869.50 MHz
Transmit power	Max. 0.5 W ERP
Duty cycle (frequency assignment period)	10% (6 minutes per hour)

Note
Availability

Please note that this profile is available for the following readers and firmware versions:

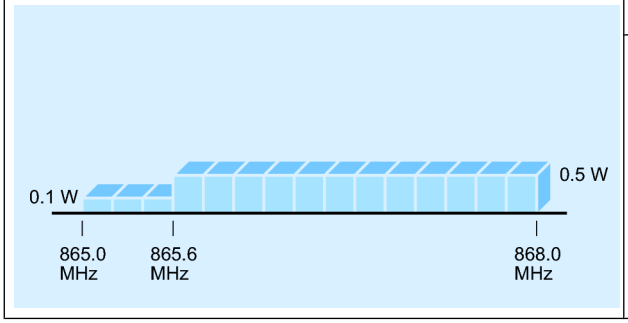
- RF610M
- RF660R up to firmware V1.2

4.6.1.3 Partial abrogation of the regulations for France

A decision from the European Commission of May 16, 2007 refers to a temporary, partial abrogation of the regulations for frequency bands in accordance with EN 302 208 that will only apply until 2010. According to this, the sub frequency band 865.5 MHz – 867.6 MHz will be limited to a maximum transmitted power of 0.5 W ERP when the RF600 system is operated within certain zones in France. These zones are defined in the annex to the decision of the commission and can be referred to in the appendix (Page 353).

Channel assignment according to ETSI EN 302 208 V1.1.1

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

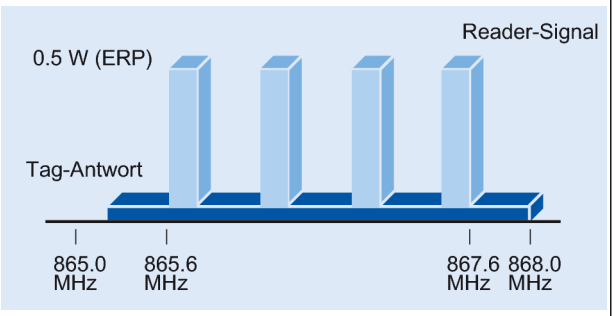
Sub bands	Frequency band	Power
	865.0 to 865.5 MHz	0.1 W ERP
	865.6 to 868.0 MHz	0.5 W ERP

Validity

Note that readers with this setting may only be sold until December 31, 2009. Readers sold with this setting before December 31, 2009 may continue to be used after that date.

Channel assignment according to ETSI EN 302 208 V1.2.1

The UHF band now only contains four permanently assigned frequencies on which the reader can transmit as per the 4-channel plan (see Chapter Regulations for UHF frequency bands in Europe (ETSI EN 302 208 V1.2.1) (Page 54)).

Sub bands	Frequency band	Power
	865,7 866,3 866,9 867,5	0.5 W ERP

Validity

Note that readers may be operated with this setting since November 4, 2008 (publication of the standard in the Official Journal of the European Union).

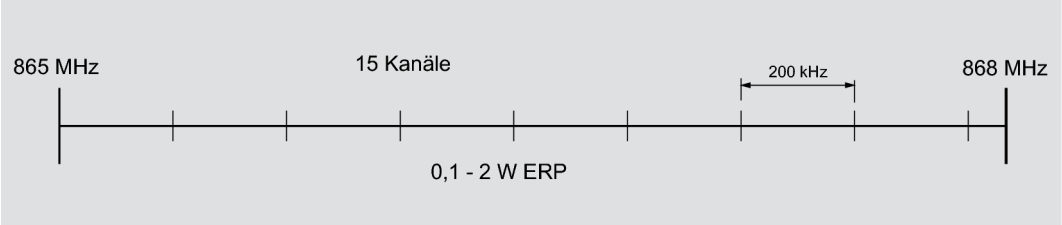
4.6.1.4 Regulations for UHF frequency bands in Europe (ETSI EN 302 208 V1.1.2)

Regulations for frequency bands according to EN 302 208 V1.1.1

ETSI (European Telecommunications Standards Institute)

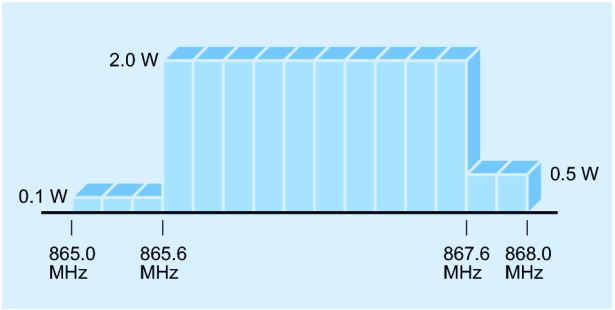
Specifications of European standard EN 302 208 V1.1.1:

- UHF band: 865…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 band	Power
	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

Validity

Note that readers with this setting may only be sold until December 31, 2009. Readers sold with this setting before December 31, 2009 may continue to be used after that date.

Note

Availability

Please note that this profile is available for the following readers and firmware versions:

- RF620R/RF630R, firmware V1.0 or lower
- RF660R up to firmware V1.2

Listen Before Talk

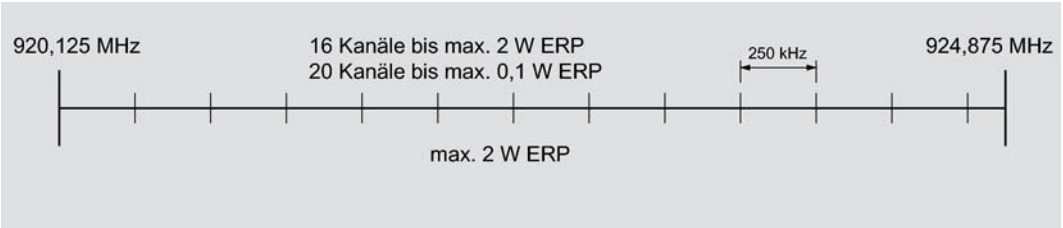
With this technique, the reader checks whether the relevant channel is assigned before transmission to prevent collisions. The reader will only transmit when this channel is free. The reader can transmit for up to 4 seconds on this channel and must then either pause for at least 100 milliseconds or jump immediately to an unassigned channel where it can transmit for another 4 seconds.

4.6.2 Regulations for UHF frequency bands in China

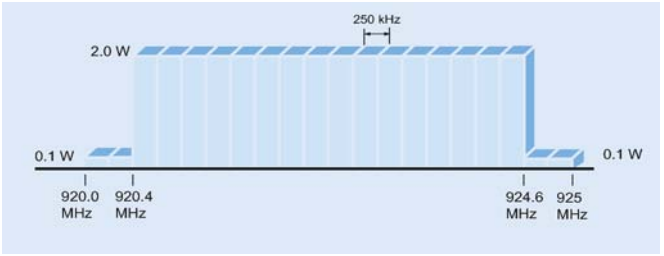
Regulations for UHF frequency bands in China

FCC (Federal Communications Commission)

- UHF band: 920.125 to 924.875 MHz in 250 kHz channel blocks.
- Radiant power: max. 2 W (ERP)
- Number of channels: 16 to max. 2 W (ERP), 20 to max. 0.1 W (ERP)
- Frequency hopping



Channel assignment

Sub bands	Frequency band	Power
	920.125 to 920.375 MHz	0.1 W ERP
	920.625 to 924.375 MHz	2.0 W ERP
	924.625 to 924.875 MHz	0.1 W ERP

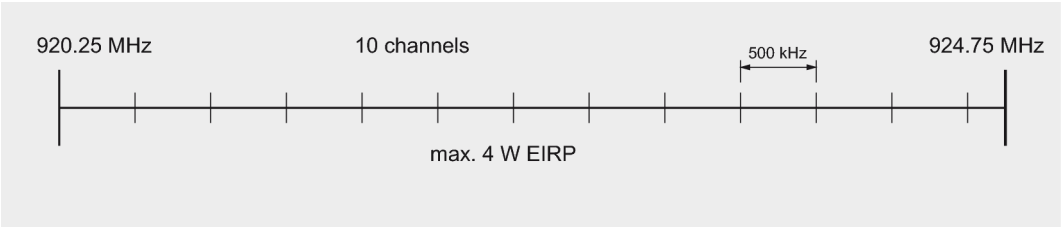
Frequency hopping

This technique should prevent mutual interference between readers. The reader changes its transmission channel in a random or programmed sequence (FHSS). With 16 available channels that can be used simultaneously at up to 2000 mW (ERP) and with 20 channels that can be used simultaneously at up to 100 mW, the probability of two readers operating on the same frequency is reduced.

4.6.3 Regulations for UHF frequency bands in Thailand

FCC (Federal Communications Commission)

- UHF band: 920.25 to 924.75 MHz
- Radiant power: max. 4 W (EIRP)
- Number of channels: 10
- Frequency hopping, dwell time 2 seconds per channel



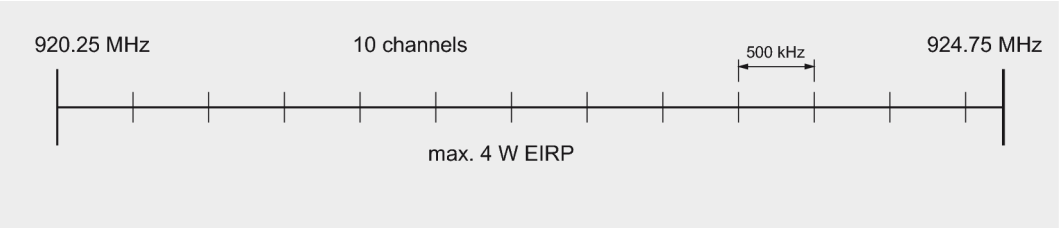
Frequency hopping

This technique should prevent mutual interference between readers. The reader changes its transmission channel in a random or programmed sequence (FHSS). 10 available channels mean that the probability is low that two readers will be operating on the same frequency.

4.6.4 Regulations for UHF frequency bands in the 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). The 50 available channels mean that the probability is low that two readers will be operating on the same frequency.

4.7 Operation of RF600 readers according to EN 302208 V1.2.1 and EN 302208 V1.1.1

4.7.1 Validity of the standards

NOTICE
Validity of EN 302208 V1.1.1 and EN 302208 V1.2.1 As of 1 January 2010, RF660R readers that are commissioned within the EU, EFTA or Turkey may use firmware V1.3 only. Exception: Defective RF660R readers which are repaired or replaced can still be used with older firmware versions.

Note

RF660R readers with firmware version V1.3 no longer support the ETSI radio profile according to EN 302208 V1.1.1.

Note

If an RF660R reader with firmware version V1.3 is to replace a reader commissioned before 1 January 2010, the new reader can also use a firmware version older than V1.3. The downgrade is described in the "RF660R Configuration Software" configuration manual.

Note

If possible, upgrade all older RF660R readers to the new firmware V1.3.

4.7.2 Disturbances when operating readers according to ETSI EN V1.1.1 and V1.2.1 in mixed mode

If RF600 readers in the ETSI band (EU, EFTA & Turkey) are operated according to EN 302 208 V1.1.1 (firmware V1.2) and at the same time to EN 302 208 V1.2.1 (Firmware V1.3) in close proximity to each other (up to 20 m), these readers might interfere with each other.

Reasons for interference

The following reasons may cause the interference:

- Only four transmission channels (865.7; 866.3; 866.9; 867.5 MHz) are now available according to the latest ETSI standard.
- Deactivation of Listen Before Talking (LBT)
- When operating readers in mixed mode according to the old ETSI standard (EN 302 208 V1.1.1) and the new ETSI standard (EN 302 208 V1.2.1), the transmission and receive channels may interfere with each other. Tag reading might thus be blocked. (See Chapter Possible causes of error (Page 67))

RF620R and RF630R

The RF620R (ETSI) and RF630R (ETSI) readers support both ETSI standards EN 302 208 V1.1.1 and V1.2.1 (max. 4 channels without LBT). As of January 2010, these readers must be operated using the 4-channel plan and without LBT.

RF660R

RF660R readers V1.2 or earlier firmware versions exclusively use a radio profile according to EN 302 208 V 1.1.1 (max. 15 channels with LBT).

RF660R readers V1.3 or later firmware versions exclusively use a radio profile according to EN 302 208 V1.2.1(max. 4 channels without LBT).

4.7.3 Preventing interference in mixed operation

If the RF660R readers use the air interface standards EPC Global Class 1 Gen 1, EPC Global Class 1 Gen 2 (no dense mode) or ISO 18000-6B, the the receive channel is identical to the respective transmission channel of a reader.

Permitted channel assignment according to ETSI EN 302 208 V1.1.1

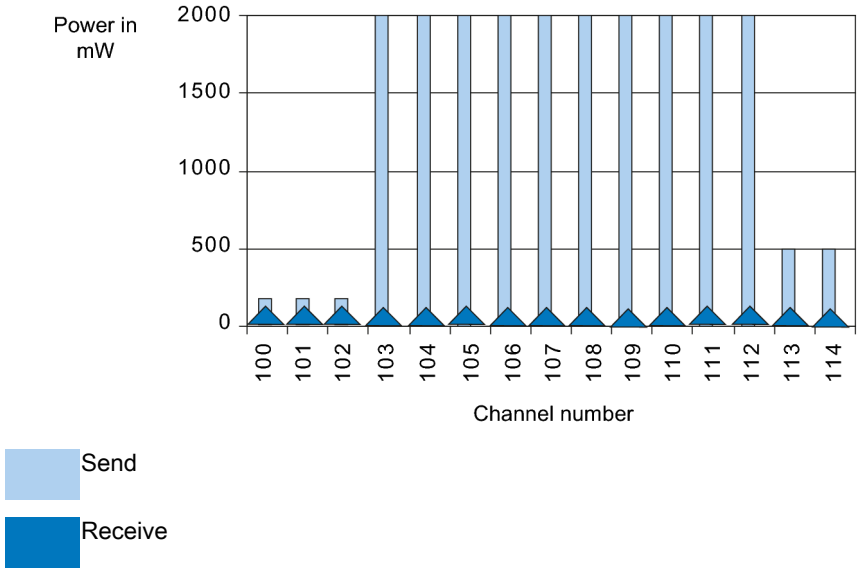
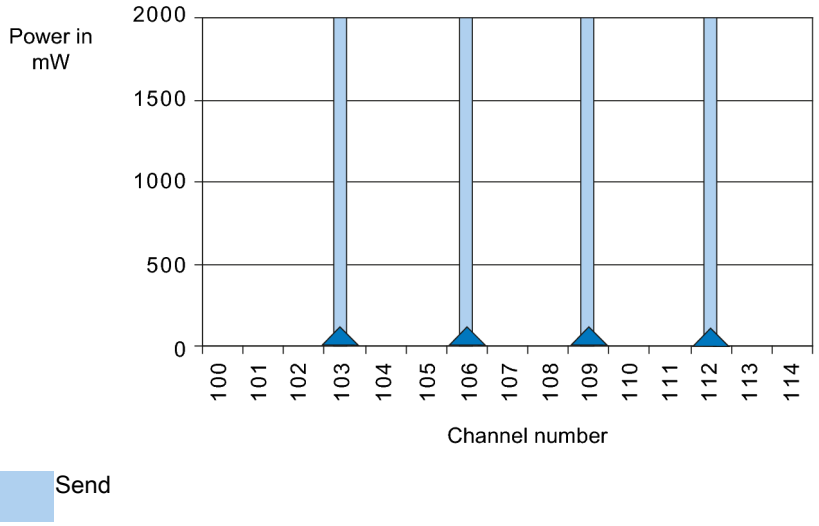


Figure 4-8 Channel assignment ETSI EN 302 208 V1.1.1

Permitted channel assignment according to ETSI EN 302 208 V1.2.1



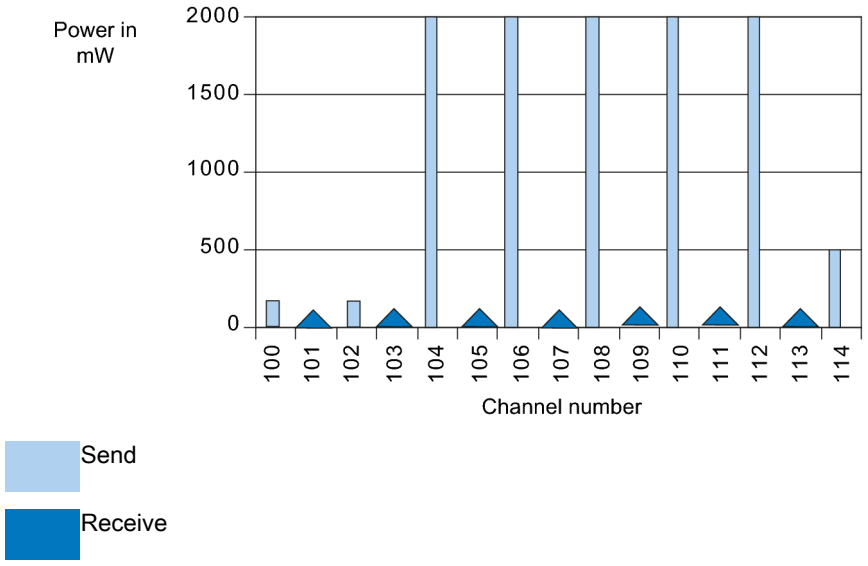
Receive

Figure 4-9 Channel assignment ETSI EN 302 208 V1.2.1

4.7.3.1 Mixed operation - dense mode

If the RF660R readers use the air interface standard EPC Global Class 1 Gen 2 (dense mode), the receive channel is shifted by a "link frequency" compared to the respective transmission channel of the reader (e.g. with profile 23 for RF660R, a link frequency of 160 kHz is used). Thus the performance distribution of the tag responses in dense mode is within the channels that are right next to a transmission channel.

Permitted channel assignment ETSI EN 302 208 V1.1.1 dense mode



Send

Receive

Figure 4-10 Channel assignment ETSI EN 302 208 V1.1.1 dense mode

Permitted channel assignment ETSI EN V1.2.1 dense mode

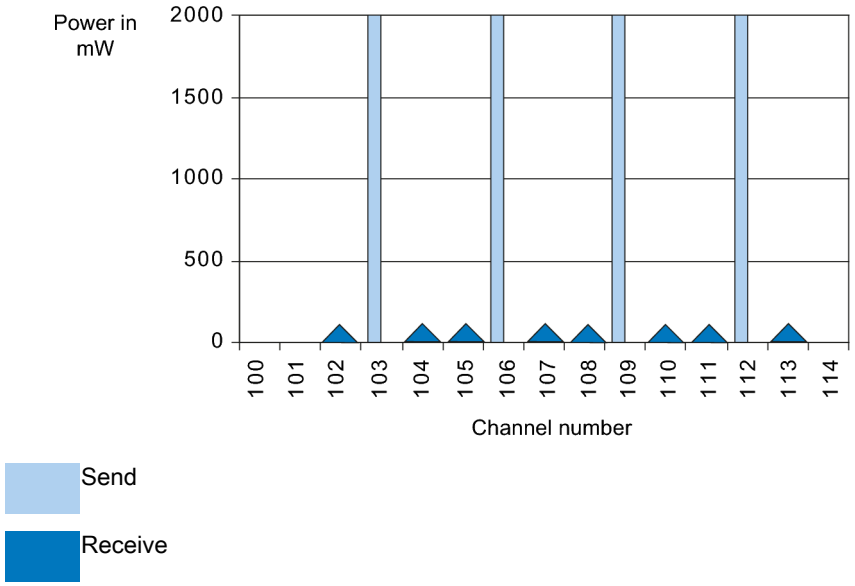


Figure 4-11 Channel assignment ETSI EN 302 208 V1.2.1 dense mode

4.7.3.2 Preventing interference in mixed operation

You ensure problem-free operation by a strict separation in the assignment of transmission and receive channels of the RF600 readers according to EN 302 208 V1.1.1 and EN 302 208 V1.2.1. This means that neither the transmission channels nor the receive channels of the readers operated according EN 302 208 V1.1.1 must overlap with the transmission or receive channels of the readers operated according to EN 302 208 V1.2.1.

Procedure

1. In the channel plan, only mark the transmission channels as assigned channels of a reader for all readers that are not to operated in dense mode (EPC Global Class 1 Gen 1, EPC Global Class 1 Gen 2 (no dense mode)) or ISO 18000-6B).
2. For all readers that are to operate in dense mode (EPC Global Class 1 Gen 1, EPC Global Class 1 Gen 2 (dense mode)), mark the transmission channels and the channels right next to them (receive channels) as assigned channels of a reader.
3. For this purpose, first mark all transmission channels and any adjacent receive channels in dense mode operation of the R660R readers for V1.3 or later versions in the channel plan. In mixed operation, the RF660R reader operated according to EN 302 208 V1.1.1 can use more channels than an RF660R reader operated according to EN 302 208 V1.2.1.
4. Then mark all transmission channels and any adjacent receive channels in dense mode operation of the R660R readers for V1.2 or earlier versions in the channel plan.

Example of planning a channel plan

Below you will find a concrete example of a channel plan with which you prevent interference:

- New readers operating according to EN 302 208 V1.2.1 must use channels with a channel number below 107. Dense mode can be activated or deactivated.
- Readers according to the old standard EN 302 208 V1.1.1 can use channels with a channel number between 109 and 114. If dense mode is activate, only even-numbered channels can be used.

Such a setting prevents that readers interfere with each other. At which channel number the separation will be depends on the ratio of readers according to the old standard and new standard. This limit can be shifted as required.

4.7.3.3 Example 1: Recommended channel assignment mixed operation

This case refers to mixed operation of several readers according to EN 302 208 V1.1.1 with standard profile and several readers according to EN 302 208 V1.2.1 in dense mode.

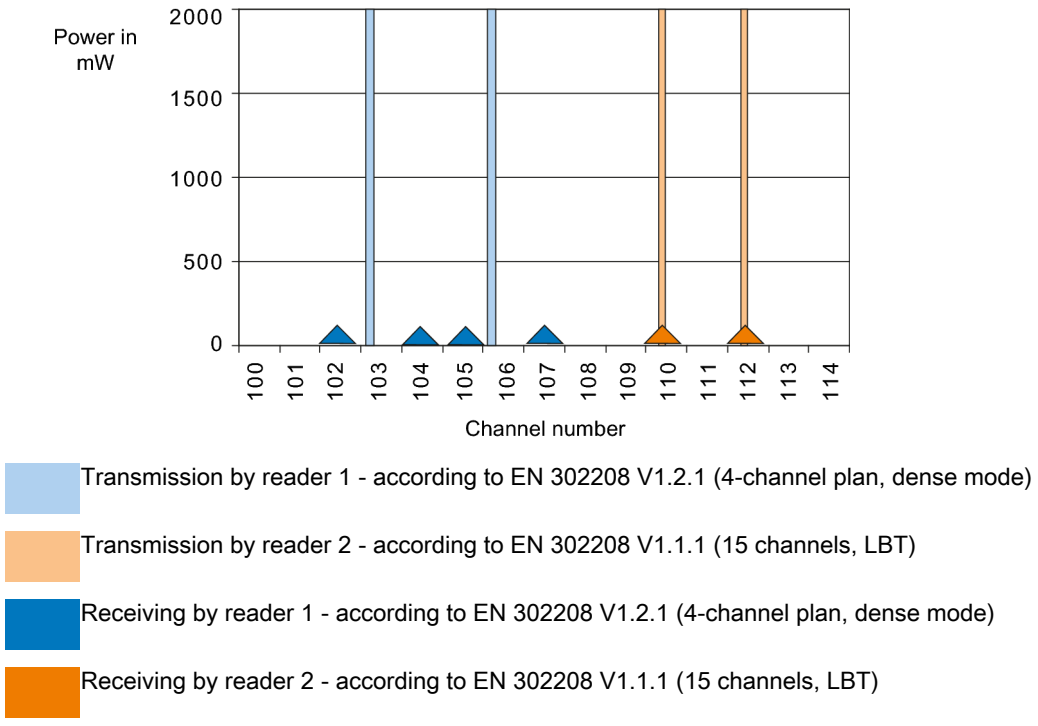


Figure 4-12 Recommended channel assignment mixed operation

Note

If possible, all older RF660R readers should be upgraded to the new firmware V1.3.

If only a few readers operate according to EN 302 208 V1.1.1, the following channel distribution is also possible:

- 3 channels for readers according to EN 302 208 V1.2.1
- 2 channels for readers according to EN 302 208 V1.1.1

4.7.3.4 Example 2: Recommended channel assignment mixed operation

This case refers to mixed operation of several readers according to EN 302 208 V1.1.1 in dense mode and several readers according to EN 302 208 V1.2.1 in dense mode.

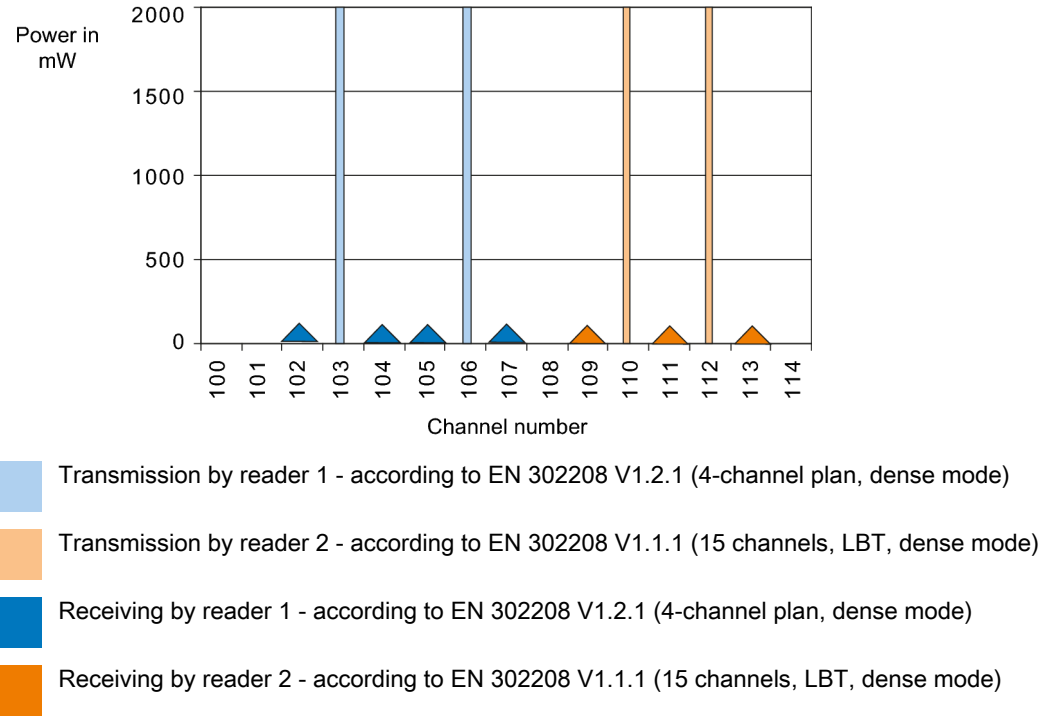


Figure 4-13 Recommended channel assignment mixed operation dense mode

Note

Readers that operate according to the standard ETSI EN 302 208 V1.1.1 can also use the top two channels of the channel plan if low performance suffices.

Transmission capability for RF620R/RF630R

The basic setting of the RF620R and RF630R is the 4-channel plan without LBT and dense mode.

Therefore the following applies:
If you operate the RF620R or RF630R in mixed mode with RF660R EN 302 208 V1.1.1, the same settings apply as for mixed operation of RF660R according to EN 302 208 V1.2.1 in dense mode and RF660R according to EN 302 208 V1.1.1.

4.7.4 Possible causes of error

If the channels are not separated in mixed operation, the following can occur:

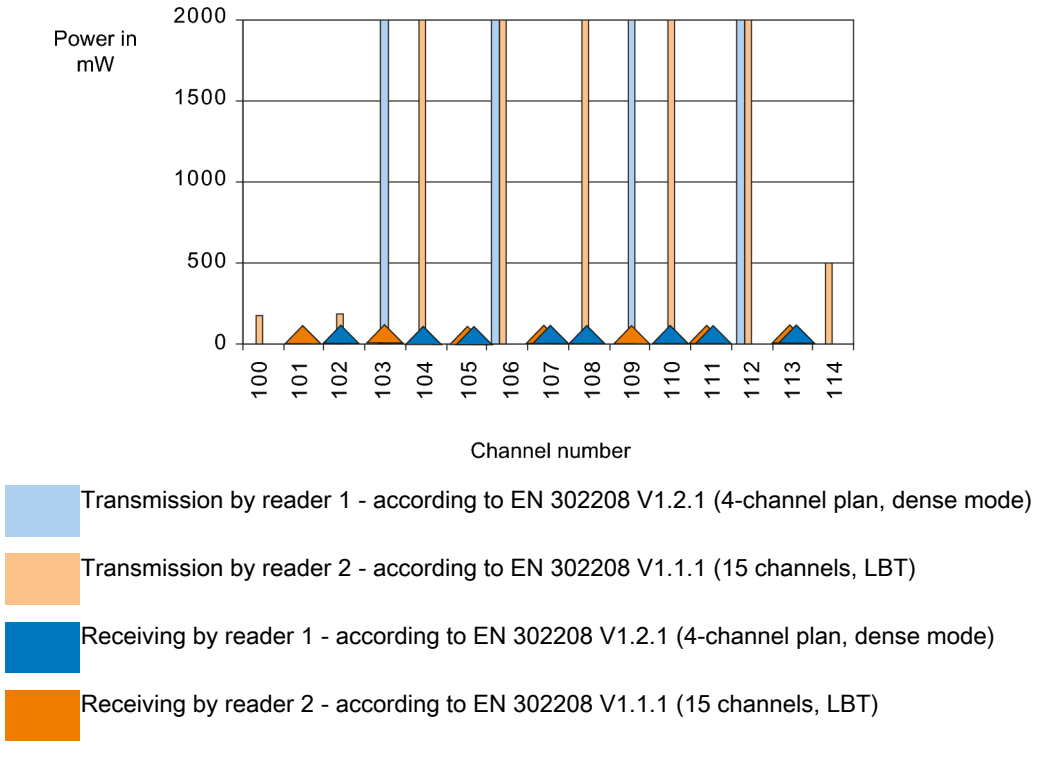


Figure 4-14 Interference with adjacent readers in mixed operation

Transmission from readers 2 partially interfere with receiving by readers 1. Since readers 1 do not have to adhere to LBT, they will block the transmission by readers 2 on these respective channels. Furthermore, transmission from readers 1 blocks receiving by readers 2.

Other disturbances and causes

The following overview shows possible interference and its causes which can occur if the channels are not separated in mixed mode.

Firmware version V1.2 always refers to firmware version V1.2 or previous firmware versions.

Firmware version V1.3 always refers to firmware version V1.3 or later firmware versions.

RF660R ≥V 1.3 or RF600 [1]	**RF660R ≤V1.2**			
	ISO 18000-6B	**EPC Class 1 Gen 1**	**EPC Class 1 Gen 2 dense mode**	**EPC Class 1 Gen 2 no dense mode**
ISO 18000-6B	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same channel	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same channel	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same transmission channel. If RF660R V1.3 transmits on a receive channel of RF660R V1.2, then the tag response cannot be decoded by RF660R V1.2.	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same channel
EPC Class 1 Gen 1	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same channel	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same channel	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same transmission channel. If RF660R V1.3 transmits on a receive channel of RF660R V1.2, then the tag response cannot be decoded by RF660R V1.2.	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same channel

RF660R ≥V 1.3 or RF600 [1]	RF660R ≤V1.2			
	ISO 18000-6B	EPC Class 1 Gen 1	EPC Class 1 Gen 2 dense mode	EPC Class 1 Gen 2 no dense mode
EPC Class 1 Gen 2 dense mode	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same transmission channel. If RF660R V1.2 transmits on a receive channel of RF660R V1.3, then the tag response cannot be decoded by RF660R V1.3.	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same transmission channel. If RF660R V1.2 transmits on a receive channel of RF660R V1.3, then the tag response cannot be decoded by RF660R V1.3.	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same transmission channel. If RF660R V1.2 transmits on a receive channel of RF660R V1.3, then the tag response cannot be decoded by RF660R V1.3. If RF660R V1.3 transmits on a receive channel of RF660R V1.2, then the tag response cannot be decoded by RF660R V1.2.	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same transmission channel. If RF660R V1.2 transmits on a receive channel of RF660R V1.3, then the tag response cannot be decoded by RF660R V1.3.
EPC Class 1 Gen 2 no dense mode	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same channel	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same channel	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same transmission channel. If RF660R V1.3 transmits on a receive channel of RF660R V1.2, then the tag response cannot be decoded by RF660R V1.2.	RF660R V1.3 uses no LBT and could interfere with RF660R V1.2 if they use the same channel.

[1] RF600 readers, except RF660R: RF670R, RF630R and RF620R

4.8 Guidelines for electromagnetic compatibility (EMC)

4.8.1 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 rectify defects in this area in the event of interference.

NOTICE
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.

4.8.2 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 external 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 plant operator must comply with the locally applicable laws and regulations. They are not covered in this document.

4.8.3 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 against electromagnetic fields generated by inductances.
- 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 power cables, signal cables and HF 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.

- Routing HF cables:
  avoid parallel routing of HF cables.
- Do not route cables through the antenna field.

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.

4.8.4 Propagation of electromagnetic interference

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

- Interference source
- Coupling path
- Interference sink

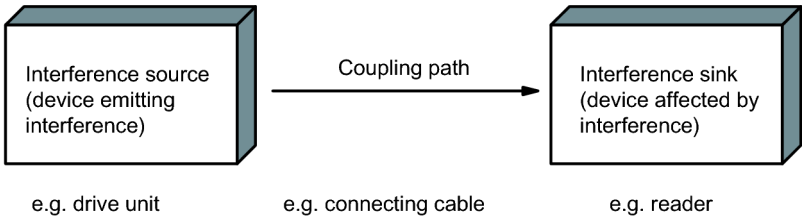


Figure 4-15 Propagation of interference

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	• Position the antennas further apart. • Erect suitable damping materials between the antennas. • Reduce the power of the readers. Please follow the instructions in the section *Installation guidelines/ reducing the effects of metal*

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:

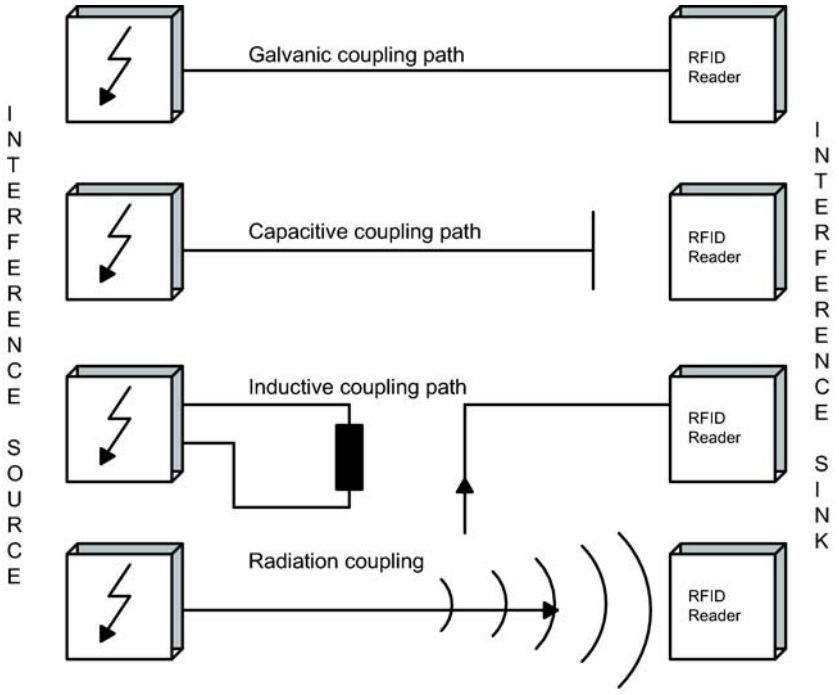


Figure 4-16 Ways in which interference can be coupled in

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

4.8.5 Prevention of interference sources

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

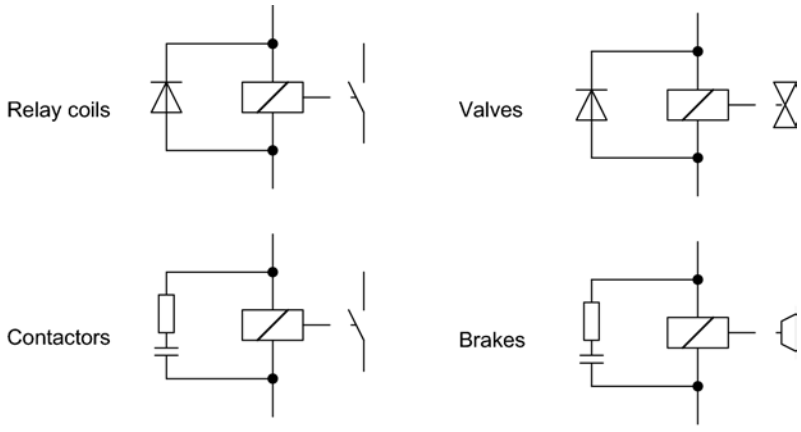


Figure 4-17 Suppression of inductance

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.

4.8.6 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 (EBS), the power components and non-power components must be combined.
- The equipotential bonding conductors of the separate modules must lead directly to the equipotential bonding strip.

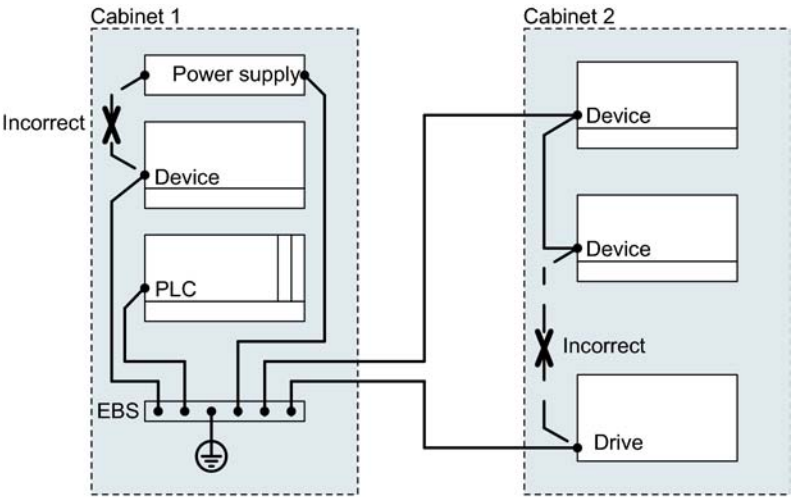


Figure 4-18 Equipotential bonding (EBS = Equipotential bonding strip)

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 shock voltages in the event of equipment faults whereas equipotential bonding prevents the occurrence of differences in potential.

4.8.7 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

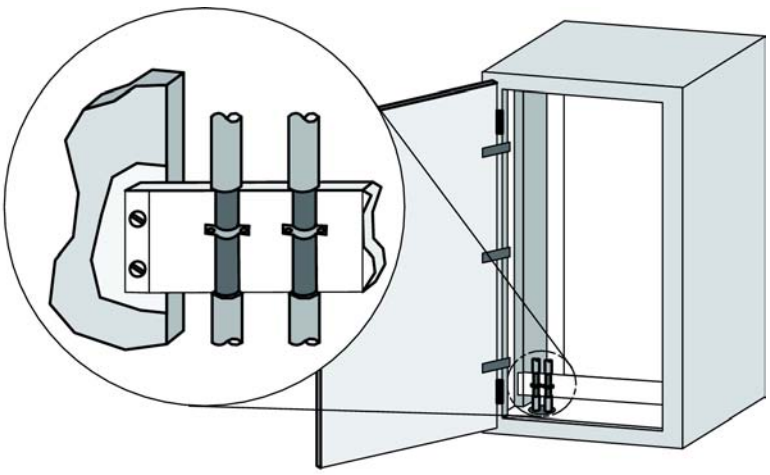


Figure 4-19 Cable shielding

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.

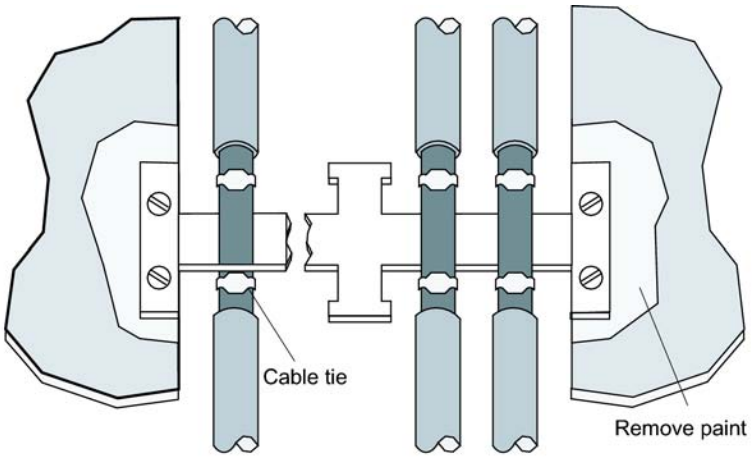


Figure 4-20 Connection of shielding bus

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.

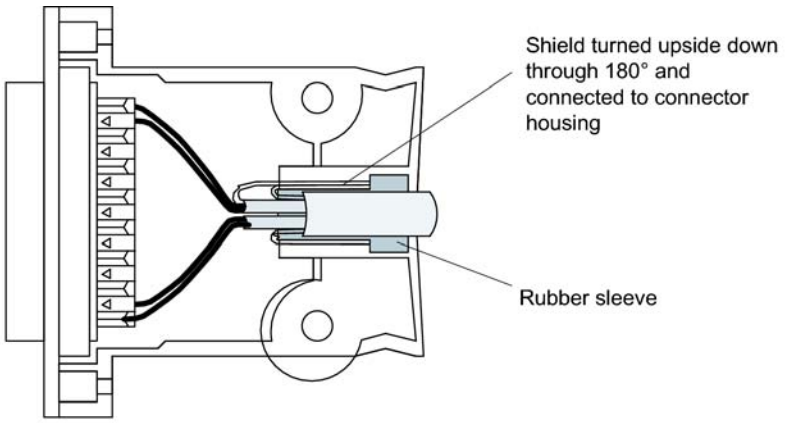


Figure 4-21 Interruption of shielded cables

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.

Readers

5

The following table shows the most important features of the stationary RF600 readers at a glance:

Features		SIMATIC RF670R	SIMATIC RF660R	SIMATIC RF630R	SIMATIC RF620R
Air interface / standards supported		EPCglobal Class 1 Gen 2	EPCglobal Class 1, Gen 1, EPCglobal Class 1, Gen 2, ISO 18000-6B	EPCglobal Class 1, Gen 2	EPCglobal Class 1, Gen 2
ETSI variant		Available	Available	Available	Available
FCC variant		Available	Available	Available	Available
CHINA variant		In preparation	Available		
LEDs		1	3	1	1
Interfaces					
	Number of external antennas via RTNC	1 through 4	2 through 4	1 through 2	- Integrated antenna
	Ethernet	1x RJ45 connection according to IEC PAS 61076-3-117	1x RJ45 connection according to IEEE 802.3 and ISO 8802-3	-	-
	RS232	-	1x connector (5-pin M12). Bit rate: 115200 bps	-	-
	RS422	-	-	1 x plug (8-pin M12)	1 x plug (8-pin M12)
	Digital inputs	4 (12-pin M12) log. "0": 0…7 V log "1": 15…24 V	3 (8-pin M12) log. "0": 0…7 V log. "1": 15 to 24 V	-	-
	Digital outputs (short-circuit proof)	4 (12-pin M12) 24 V; 0.5 A each	3 (8-pin M12) 24 V; 0.5 A each	-	-
	Power supply	24 V DC (4-pin M12) 20 to 30 V (2.2 A) external	24 V DC (4-pin M12) 20 to 30 V (2.2 A) external	Via ASM	Via ASM
Max. radiated power EU, EFTA, Turkey in ERP		-	-	-	0.5 W ERP
Max. radiated power USA/China in EIRP		-	-	-	0.795 W EIRP
Max. transmit power EU, EFTA, Turkey / China		XXX@@	0.1 to 2 W	0.5 W	-

Features	SIMATIC RF670R	SIMATIC RF660R	SIMATIC RF630R	SIMATIC RF620R
Max. transmit power USA	XXX @@@	0.24 to 2.4 W	0.5 W	-
Max. transmission rate of the communication interface	XXX @@@	921 kbps (max. TCP/IP data rate)	115.2 kbps	115.2 kbps
Max. data rate reader-to-tag	XXX @@@	80 kbps	40 kbps	40 kbps
Max. data rate tag-to-reader	XXX @@@	160 kbps	160 kbps	160 kbps

5.1 RF620R reader

5.1.1 Description

The SIMATIC RF620R is an active stationary reader in the UHF frequency range with an integrated circular polarized antenna.

The SIMATIC RF620R is connected to a SIMATIC S7 controller via an ASM interface module. The degree of protection corresponds to IP 65.

Item	Description
(1)	LED status indicator
(2)	RS 422 interface (8-pin M12 socket)

Highlights

- The tags are read in accordance with the requirements of the EPCglobal Class 1, Gen 2 and ISO/IEC 18000-6C standards
- Supports low-cost SmartLabels as well as reusable, rugged data media
- High reading speed: Depending on the function block (multitag mode), many tags can be detected simultaneously (bulk reading), rapidly moving tags are reliably acquired.
- The RF620R (ETSI) "6GT2811-5BA00-0AA0" is suitable for the frequency band 865 to 868 MHz UHF (EU, EFTA, Turkey). The reader supports the ETSI EN 302 208 V1.1.1 standard as well as the new ETSI EN 302 208 V1.2.1 standard (4-channel plan).
- The RF620R (FCC) "6GT2811-5BA00-1AA0" is suitable for the frequency ranges 920.25 to 924.75 MHz (Thailand) and 902 to 928 MHz (North America).
- The RF620R (CHINA) "6GT2811-5BA00-2AA0" is suitable for the frequency band 920.125 to 924.875 MHz (China)
- IP65 degree of protection for reader
- Can be used for a high temperature range
- Dense Reader Mode (DRM) for environments in which many readers are operated in close proximity to each other
- TIA system interface:
  - RS 422

5.1.1.1 Ordering data

Ordering data RF620R

Product	Order No.
RF620R (ETSI) reader basic unit for EU, EFTA, Turkey	6GT2811-5BA00-0AA0
RF620R (FCC) reader basic unit for North America	6GT2811-5BA00-1AA0
RF620R (CHINA) reader basic unit for China	6GT2811-5BA00-2AA0

Ordering data (accessories)

Product	Order No.
Connecting cable	
• RS°422, M12 plug, 8-pin socket: 2 m	• 6GT2891-0FH20
• RS°422, M12 plug, 8-pin socket: 5 m	• 6GT2891-0FH50
• RS°422, M12 plug, 8-pin socket: 10 m	• 6GT2891-0FN10
• RS°422, M12 plug, 8-pin socket: 20 m	• 6GT2891-0FN20
• RS°422, M12 plug, 8-pin socket: 50 m	• 6GT2891-0FN50
Antenna mounting kit	6GT2890-0AA00
CD-ROM Software & Documentation	6GT2080-2AA10

5.1.1.2 Status display

The device is equipped with a three colored LED. The LED can be lit in green, red or yellow. The meaning of the indication changes in accordance with the color and state (on, off, flashing) of the LED:

Green LED	Red LED	Yellow LED	Meaning
Off	Off	Off	The device is starting up.
Flashing	Off	Off	The device is ready. The antenna is switched off.
On	Off	Off	The device is ready. The antenna is switched on.
Off	Off	On	"With presence": At least one tag is in the field. "Without presence": Communication with a tag is active.
Off	Flashing	Off	Reader is not active, a serious error has occurred. In addition, this LED also indicates the fault status through the number of flashing pulses. Reboot (operating voltage Off → On is necessary). The LED flashes once for the 'INACTIVE' status, rebooting is **not** necessary in this case.

For more detailed information on the flash codes of the reader see Chapter Error messages and flash codes for RF620R/RF630R (Page 338)

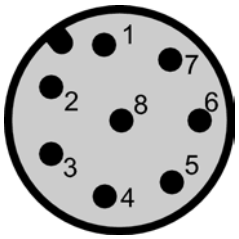
Note

LED not lit yellow?

If the LED does not light up yellow even though a tag is located within the field, common causes are:

- Incorrect configuration in the init_run command, or init_run command was not executed (see "Configuration Manual RF620R/RF630R")
- Antenna is switched off
- A tag is used, that is not compatible with the reader protocol (EPC Global Class 1 Gen 2).
- Tag is defective
- Reader or antenna has a defect
- Tag is not in the field of radiation of the transmit antenna

5.1.1.3 Pin assignment of the RS422 interface

Pin	Pin Device end 8-pin M12	Assignment
	1	+ 24 V
	2	- Transmit
	3	0 V
	4	+ Transmit
	5	+ Receive
	6	- Receive
	7	Free
	8	Earth (shield)

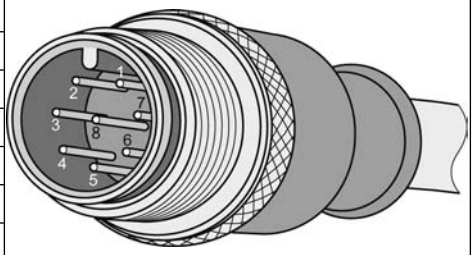
The knurled bolt of the M12 plug is not connected to the shield (on the reader side).

Note

You must therefore not use any SIMATIC connecting cables that use the angled M12 plug.

5.1.1.4 Pin assignment of the connecting cable

Table 5-1 RS 422 - on reader side

M12 pin	Core color	Pin assignment	View of M12 connector
1	white	24 VDC	
2	brown	TX neg	
3	green	GND	
4	yellow	TX pos	
5	Gray	RX pos	
6	pink	RX neg	
7	blue	Not assigned	
8	red	Earth (shield)	

Comment

This cable has an 8-pin M12 connector at one end and the other cable end is 'open'. There are 8 color-coded single cores there for connecting to external devices. There are different cable lengths in the product range (3 m to 50 m). Long cables can be reduced if necessary.

Note

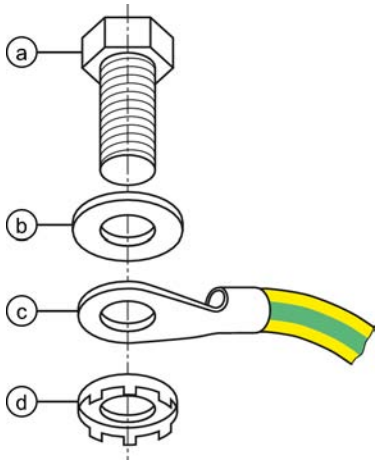
For long cables: Adapt supply voltage and data rate accordingly

Note that with long cables in particular, the supply voltage of 24 V DC must always be applied. Note also that the data rate on the serial interface must, if necessary, be reduced. (See "Configuration Manual RF620R/RF630R")

5.1.1.5 Grounding connection

The RF620R/RF630R can be electrically connected to the ground potential through a contact washer. The tightening torque must be increased in this case to ensure that electrical contact is made (2.7 Nm).

Ground connection



(a)	Hexagon-head screw
(b)	Plain washer
(c)	Cable lugs
(d)	Contact washer: Use contact washers according to the Siemens standard SN 70093-6-FSt-flNnnc-480h for ground connection, Siemens item No.: H70093-A60-Z3

5.1.2 Planning application

5.1.2.1 Minimum mounting clearances of two readers

The RF620R has a circular polarized antenna. At 500 mW ERP radiated power, due to the opening angle of the antennas, their fields can overlap considerably. It is no longer possible to clarify in which antenna field access to the data of a tag is performed.

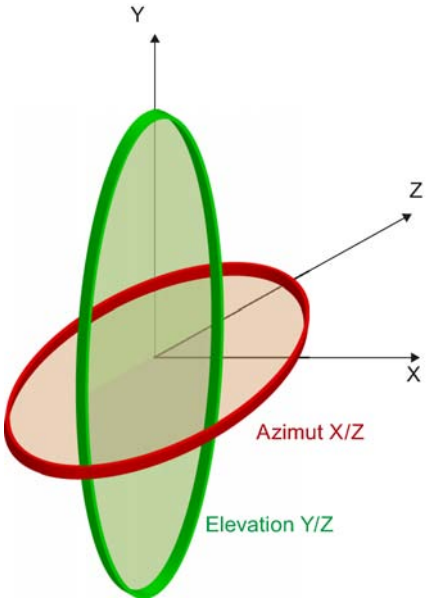
In order to avoid this, always keep a minimum distance of 3 m between two readers with the maximum radiated power of 500 mW ERP.

Dense Reader Mode (DRM)

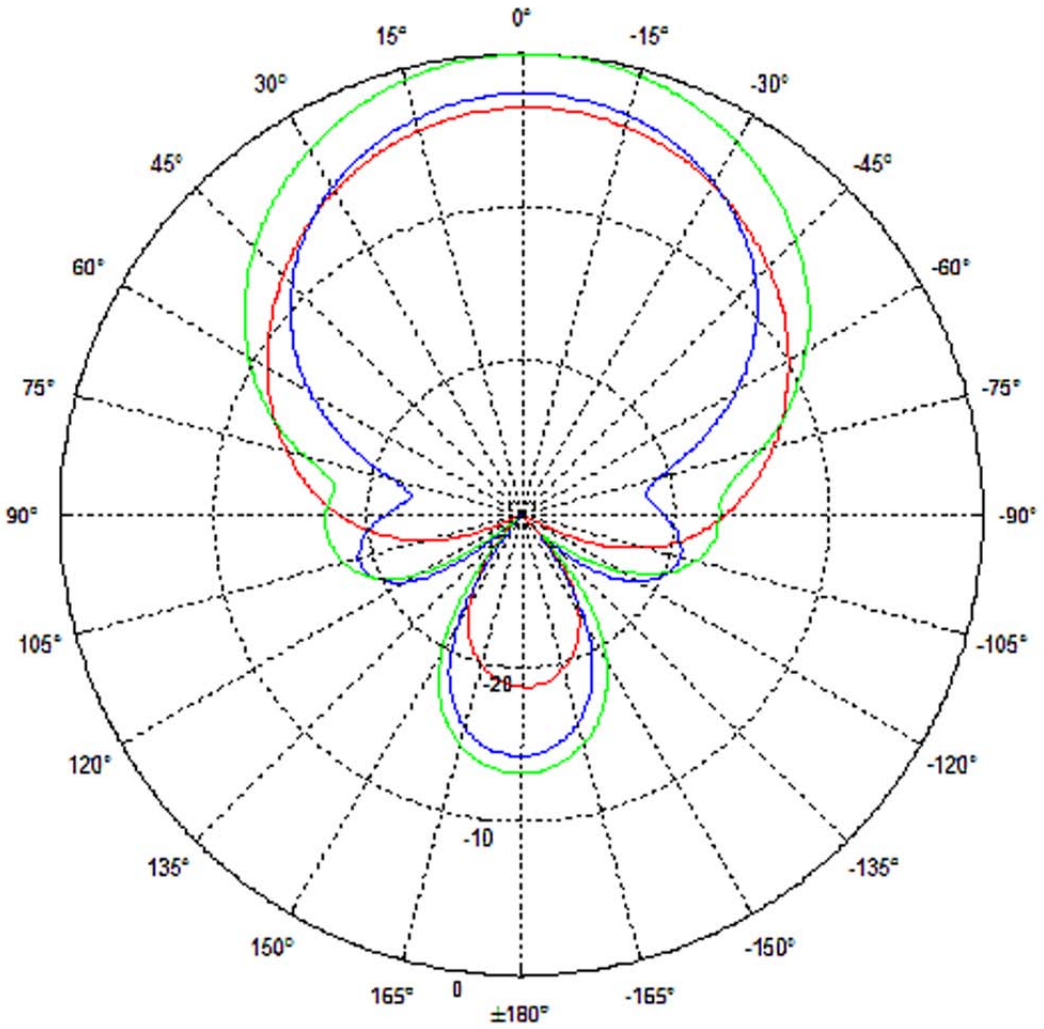
The readers can also interfere with each other (secondary fields), if the channels (Reader TX, Transponder TX) overlap. In order to prevent a transponder channel overlapping with a reader channel, we recommend that the Dense Reader Mode (DRM) is used.

5.1.2.2 Antenna diagram for RF620R (ETSI)

The following radiation diagrams show the directional radiation pattern of the internal antenna of the RF620R (ETSI) reader. For the spatial presentation of the directional radiation pattern, the vertical plane in space (Azimuth section) as well as the horizontal plane (elevation section) must be considered. This results in a spatial image of the directional radiation pattern of the antenna with its main and auxiliary fields.



Radiation diagram (Azimuth section)



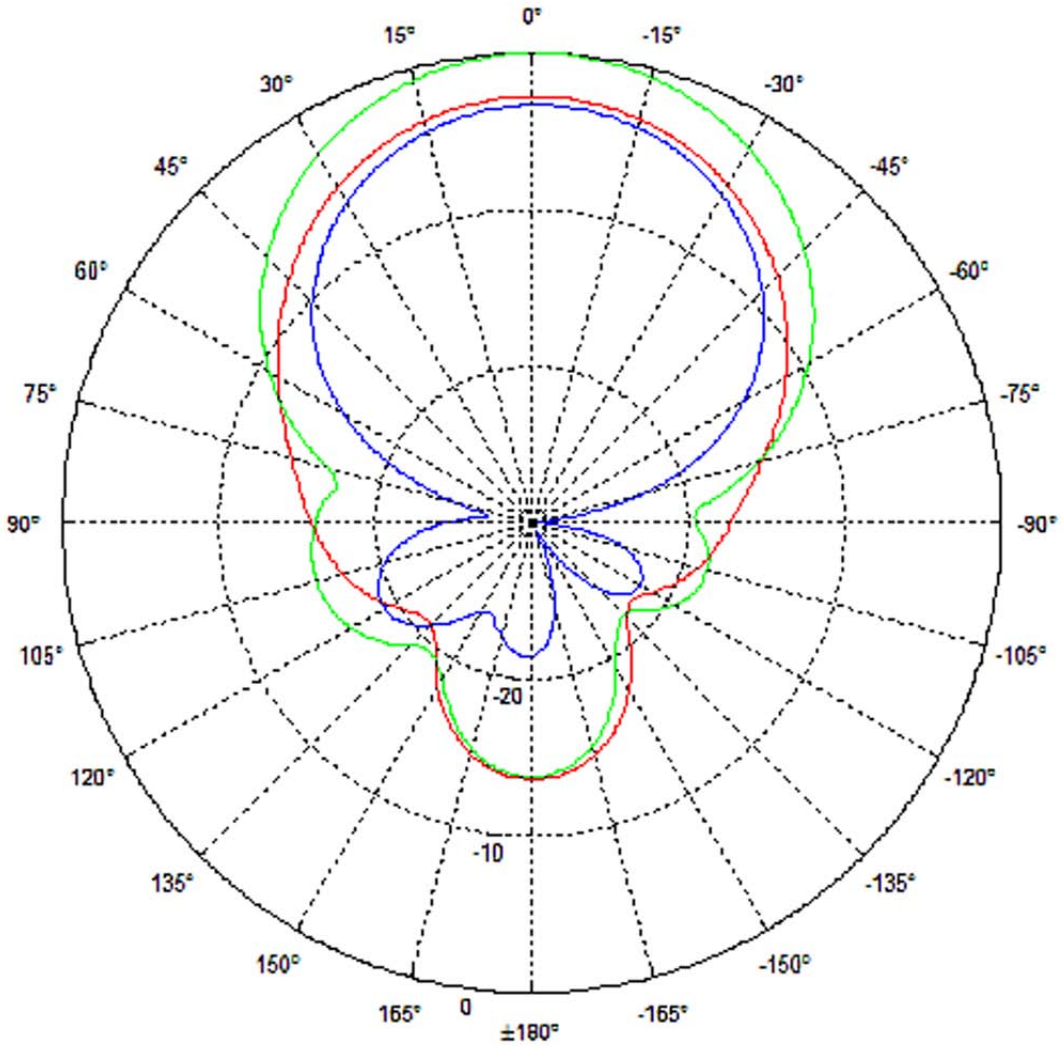
Vertical component of the polarization direction of the antenna

Horizontal component of the polarization direction of the antenna

Right circular component of the polarization direction of the antenna

Figure 5-1 Azimuth section

Radiation diagram (elevation section)



Vertical component of the polarization direction of the antenna

Horizontal component of the polarization direction of the antenna

Right circular component of the polarization direction of the antenna

Figure 5-2 Elevation section

Overview of the antenna parameters

Table 5-2 Maximum linear electrical opening angle at 865 MHz:

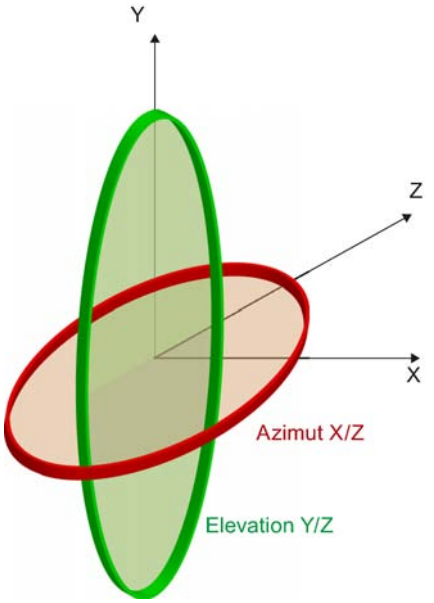
Azimuth section	77.7°
Elevation section	66.1°

Typical antenna gain in the frequency range 865 to 868 MHz	7.3 dBic
Antenna axis ratio	0.7 dB

See also Chapter Guidelines for selecting RFID UHF antennas (Page 181)

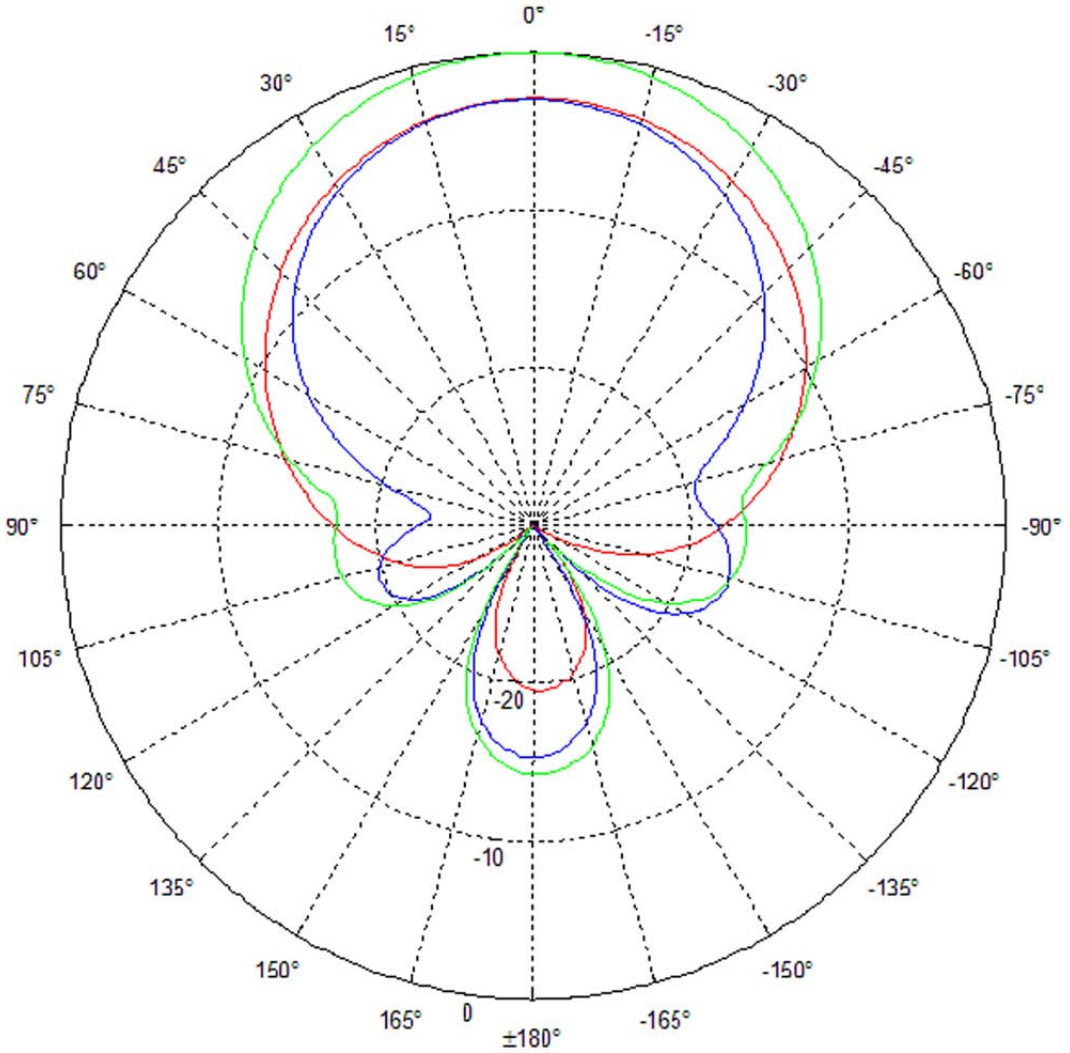
5.1.2.3 Antenna diagram for RF620R (FCC)

The following radiation diagrams show the directional radiation pattern of the internal antenna of the RF620R (FCC) reader. For the spatial presentation of the directional radiation pattern, the vertical plane in space (Azimuth section) as well as the horizontal plane (elevation section) must be considered. This results in a spatial image of the directional radiation pattern of the antenna with its main and auxiliary fields.



Azimuth	XZ plane
Elevation	YZ plane

Radiation diagram (Azimuth section)



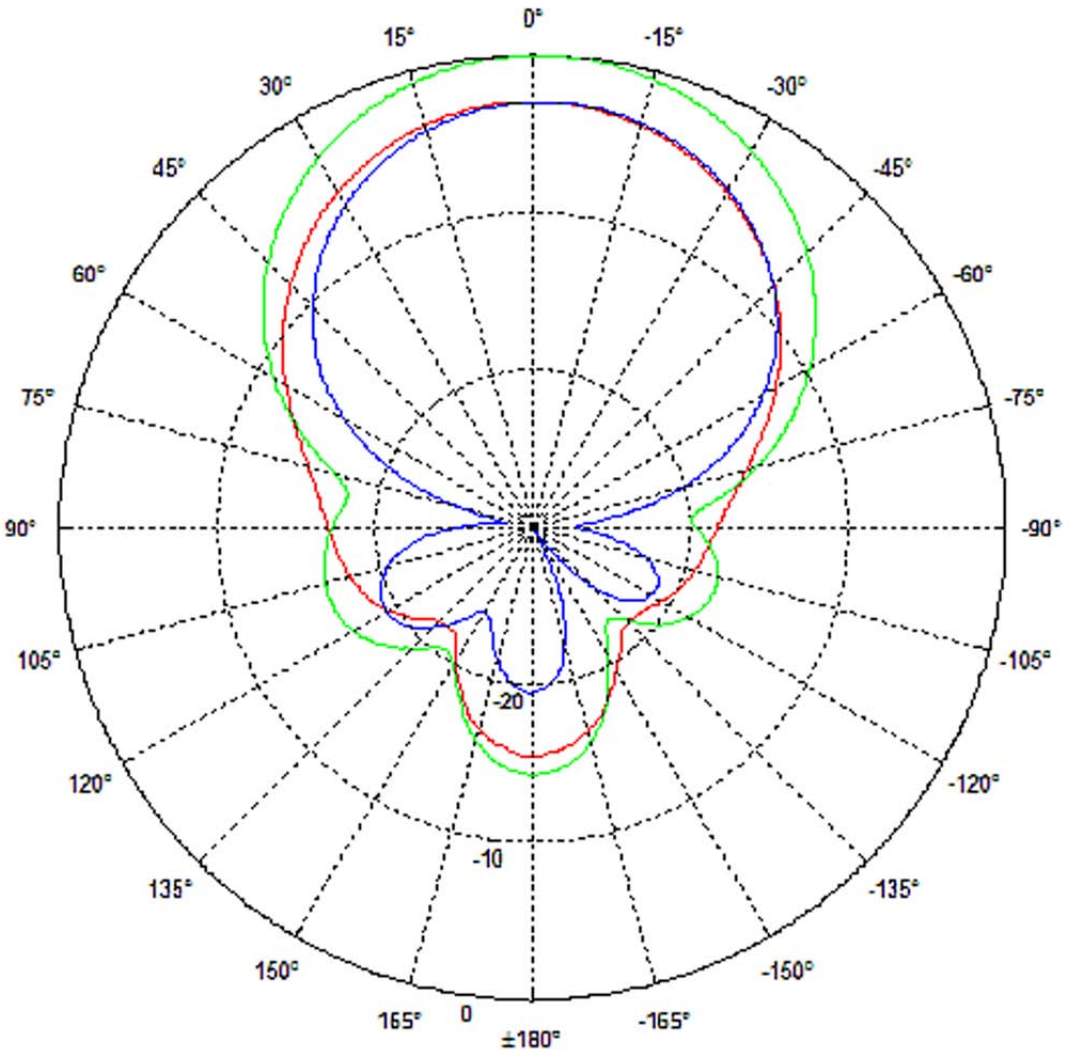
Vertical component of the polarization direction of the antenna

Horizontal component of the polarization direction of the antenna

Right circular component of the polarization direction of the antenna

Figure 5-3 Azimuth section

Radiation diagram (elevation section)



Vertical component of the polarization direction of the antenna

Horizontal component of the polarization direction of the antenna

Right circular component of the polarization direction of the antenna

Figure 5-4 Elevation section

Overview of the antenna parameters

Table 5-3 Maximum linear electrical opening angle at 865 MHz:

Azimuth section	75.4 °
Elevation section	69.1 °

Typical antenna gain in the frequency range 865 to 868 MHz	7.3 dBic ± 0.5 dB
Antenna axis ratio	<1 dB

See also Chapter Guidelines for selecting RFID UHF antennas (Page 181).

5.1.2.4 Interpretation of directional radiation patterns

The following overview table will help you with the interpretation of directional radiation patterns.

The table shows which dBi values correspond to which read/write ranges (in %): You can read the radiated power depending on the reference angle from the directional radiation patterns, and thus obtain information on the read/write range with this reference angle with regard to a transponder.

The dBr values correspond to the difference between the maximum dBi value and a second dBi value.

Deviation from maximum antenna gain [dBr]	Read/write range [%]
0	100
-3	70
-6	50
-9	35
-12	25
-15	18
-18	13

Example

As one can see from the section Antenna diagram for RF620R (ETSI) (Page 85), the maximum antenna gain is 0 dB. In the Azimuth diagram, the antenna gain falls by 3°dB at approximately ± 39°. Therefore the dBr value is -3. The antenna range is only 50% of the maximum range at ± 39° from the Z axis within the horizontal plane.

5.1.2.5 Antenna/read point configurations

The RF620R reader has an internal circular polarized antenna. You can cover one read point with this antenna. When several RF620R readers are used, the readers are addressed via the SIMATIC level.

5.1.3 Installing/Mounting

Requirement

WARNING

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

NOTICE

Disregarding FCC RF exposure requirements

Ensure that the following conditions are met before the device is mounted to meet the FCC RF exposure requirements:

- The RF620R reader must be installed so that a minimum distance from people of 20 cm is always observed.
- The reader may not be installed or operated in the immediate vicinity of another reader or antenna.

See also chapter FCC information (Page 98) RF620R or chapter FCC information (Page 112) RF630R.

5.1.3.1 Mounting/Installing FCC

CAUTION

Emitted radiation

The transmitter complies with the requirements of Health Canada and the FCC limit values for subjecting persons to HF radiation, provided that a minimum spacing of 26 cm exists between antenna and person. When the antennas are installed, you must therefore ensure that a minimum spacing of 26 cm is maintained between personnel and antennas.

Mounting/installing the device

You can mount the reader in two different ways:

- Via a standardized VESA 100 mounting system using the Antenna Mounting Kit (see Chapter Mounting with antenna mounting kit (Page 203)). Tighten the M4 screws on the rear of the reader using a maximum torque of ≤ 1.3 Nm.
- Directly onto a flat surface.

The positions of the fixing holes for the device are shown in the section Dimension drawings (Page 97).

5.1.4 Configuration/integration

The RS422 system interface is provided for integrating the device into system environments/ networks. The system interface transfers data to SIMATIC controllers or PCs with the appropriate interface.

Apart from transmitting communication data from the reader to the controller and vice versa, the RS422 interface also supplies power to the reader (24 V DC).

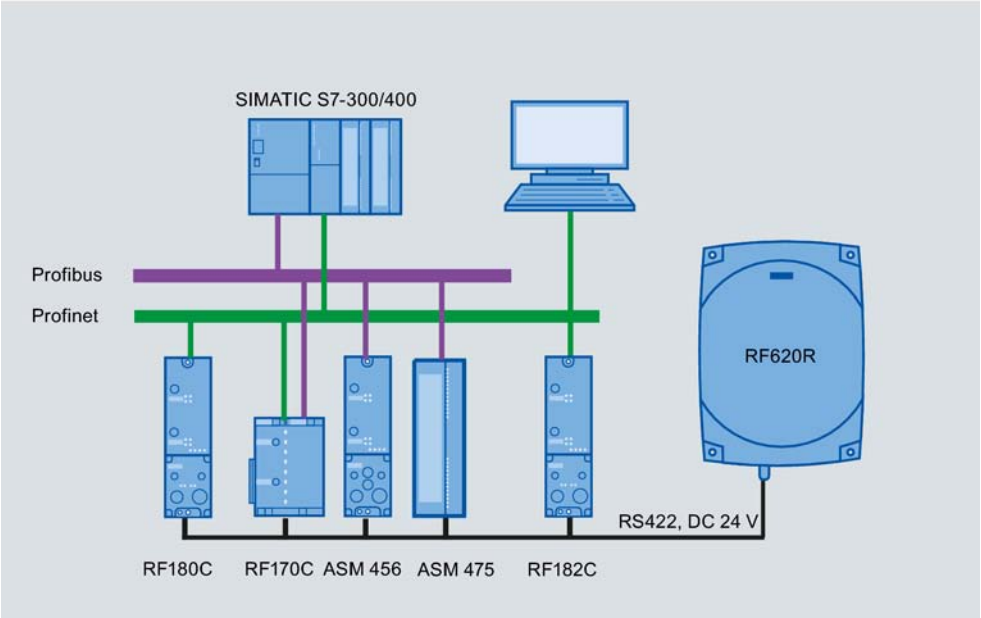


Figure 5-5 Overview of configuration of the RF620R reader

The RF620R reader can alternatively be connected to a SIMATIC controller via the ASM 456, ASM 475, RF170C and RF180C interface modules/communication modules.

The RF620R reader can alternatively also be connected directly to the PC via the RF182 communication module.

For further details on the interface modules used, see Chapter .

Further information about commissioning the readers can be found in the configuration manual "RF620R/RF630R" in the "Commissioning" section.

5.1.4.1 Transmission protocols

RS 422 communication

	3964R protocol
Transmission rates	19.2 kbps 57.6 kbps 115.2 kbps
Start bits	1
Data bits	8
Parity	Odd
Stop bits	1

5.1.5 Technical data

5.1.5.1 Mechanical data

Mechanical data		
Weight		1850 g
Dimensions (L x W x H) in mm		252 X 193 x 52 mm, without connections
Material for housing top section		ABS (GF 20), silicone-free
Material for housing bottom section		Aluminum, silicone-free
Color of housing top section		Pastel turquoise
Color of housing bottom section		Silver
Status displays on the device		1 LED Colors: Red, yellow, green
Interfaces		
	RS422	1 x plug (8-pin M12)
	Software	SIMATIC S7

Technical and electrical characteristics			
Supply voltage • Permitted range		21.6 to 30 V DC [1]	
Supply voltage		Current consumption (in standby mode, no transmit power)	Power consumption (in standby mode, no transmit power)
	20 V input voltage on the reader, typical	135 mA	2.7 W
	24 V input voltage on the reader, typical	115 mA	2.76 W
	30 V input voltage on the reader, typical	95 mA	2.85 W
Supply voltage		Current consumption (at 500 mW ERP)	Power requirement (at 500 mW ERP)

	20 V input voltage on the reader, typical	470 mA	9.4 W
	24 V input voltage on the reader, typical	395 mA	9.48 W
	30 V input voltage on the reader, typical	320 mA	9.6 W
Ramp-up time, typical		7 s	

1) All supply and signal voltages must be safety extra low voltage (SELV/PELV according to EN 60950)

24 V DC power supply: safe (electrical) isolation of extra-low voltage (SELV / PELV acc. to EN 60950)

Mechanical environmental conditions	
Shock resistant to EN 60068-2-27 Vibration EN 60068-2-6	50 g[1] 20 g[1]
Climatic Conditions	
Ambient temperature during operation	-25 °C to +55 °C (a 10-minute warm-up time must be observed at an operating temperature below -20 °C)
Ambient temperature for transport and storage	-40 °C to +85 °C

1) The values for shock and vibration are maximum values and must not be applied continuously.

EMV & approvals/conformity for RF620R (ETSI)	
Electromagnetic compatibility	ETSI EN 301 489-1 / -3
	ETSI EN 302 208
Approvals/Conformity	• Radio to R&TTE- guidelines EN 300 330, EN 301 489 • CE • ETSI EN 302-208 V1.1.1 • ETSI EN 302-208 V1.2.1 • Reader degree of protection acc. to EN 60529 (IP65)

EMC & approvals for FCC variant	
Electromagnetic compatibility	FCC Part 15
Approvals	• FCC, cULus • IEC60950, including US and Canadian variants of it • FCC CFR47 Part 15.247 • RoHS-compliant according to EU Directive 2002/95/EC • Industrial Canada, RSS-210, Issue 7, June 2007

5.1.5.2 Technical data according to EPC and ISO

Technical data	
Frequency accuracy	max.± 10 ppm
Channel spacing	EU: 200 kHz US: 500 kHz China: 250 kHz

Technical data	
Modulation methods	ASK: DSB modulation & PR-ASK modulation Encoding, Manchester or Pulse Interval (PIE)
Effective radiant power with integrated antenna (the radiant power depends on the antennas and cables used, see Guidelines for selecting RFID UHF antennas (Page 181))	≤ 0.5 W ERP ≤ 0.795 W EIRP
Transmitter power (the radiant power depends on the antennas and cables used, see Guidelines for selecting RFID UHF antennas (Page 181))	≤ 0.5 W

ETSI frequencies	
Frequency range EU, EFTA, Turkey according to ETSI EN 302 208 V1.1.1 (commissioning until December 31, 2009)	865 to 868 MHz (10 subchannels LBT at 2 W ERP, 12 subchannels at 0.5 W ERP, 15 subchannels LBT at 0.1 W ERP)
Frequency range EU, EFTA, Turkey according to ETSI EN 302 208 V1.2.1 (valid since November 4, 2008, publication in the Official Journal of the European Union)	• 865.7 MHz • 866.3 MHz • 866.9 MHz • 867.5 MHz (4 channels LBT optional at max. 2 W ERP)

Reading range for EU, EFTA, Turkey / China	
Readers mounted on the same side	Max. 2 m (recommended maximum value for configuration; depending on the transponder)

FCC frequencies	
North American frequency band	902 ... 928 MHz (50 channels, frequency hopping)
Frequency band for China	920.125 to 924.875 MHz (16 subchannels at 2 W ERP, 20 subchannels at 0.1 W ERP)

Read distance for USA	
Readers mounted on the same side	max. 2 m (recommended maximum value for configuration)

5.1.5.3 Maximum number of readable tags

The maximum number of readable tags depends on the following parameters:

- Size of the antenna field
- Readability of the tags

For a transmit power of 500 mW ERP, the following is read when the tag RF620T is used:

- Max. 40 tags in the antenna field (tags perpendicular to antenna and 1 m in front)
- Max. 18tags per second

5.1.6 Dimension drawings

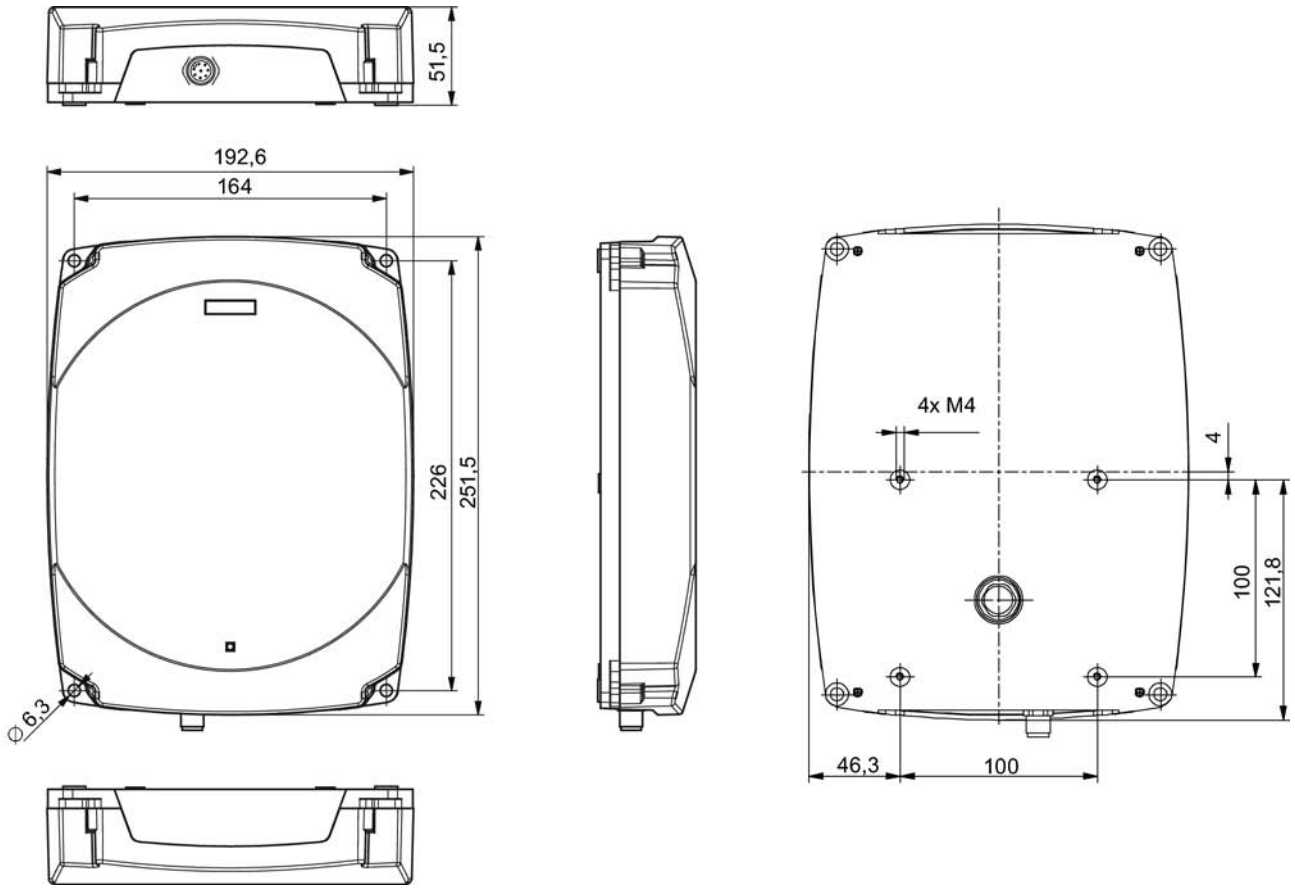


Figure 5-6 Dimension drawing for RF620R

All dimensions in mm

5.1.7 Certificates and approvals

Table 5-4 6GT2811-5BA00-0AA0

Certificate	Description
CE	Compatible with R&TTE directive

5.1.7.1 FCC, IC-FCB approval and UL certification

Table 5-5 6GT2811-5BA00-1AA0

Standard	
Federal Communications Commission	FCC CFR 47, Part 15 sections 15.247 Radio Frequency Interference Statement This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. FCC ID: NXW-RF620R
Industry Canada Radio Standards Specifications	RSS-210 Issue 7, June 2007 ,Sections 2.2, A8 IC: 267X-RF620R
C US	This product is UL-certified for the USA and Canada. It meets the following safety standard(s): UL 60950-1 - Information Technology Equipment Safety - Part 1: General Requirements CSA C22.2 No. 60950 -1 - Safety of Information Technology Equipment UL Report E 205089

5.1.7.2 FCC information

Siemens SIMATIC RF620R (FCC): 6GT2811-5BA00-1AA0

FCC ID: NXW-RF620R

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.

Note

This equipment has been tested and found to comply with the limits for a Class B 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.

FCC Notice

To comply with FCC part 15 rules in the United States, the system must be professionally installed to ensure compliance with the Part 15 certification.

It is the responsibility of the operator and professional installer to ensure that only certified systems are deployed in the United States. The use of the system in any other combination (such as co-located antennas transmitting the same information) is expressly forbidden.

FCC Exposure Information

To comply with FCC RF exposure compliance requirements, the RF620R Reader (antenna and transmitter) must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

5.2 RF630R reader

5.2.1 Description

The SIMATIC RF630R is an active stationary reader in the UHF frequency range without an integrated antenna. Up to two external UHF RFID antennas can be connected via TNC reverse connections.

The maximum HF power output is 0.5 W on the reader output. The SIMATIC RF630R is connected to a SIMATIC S7 controller via an ASM interface module. The degree of protection is IP65.

	Item	Description
	(1)	TNCreverse interface for connection of antenna 1 (ANT 1)
	(2)	TNCreverse interface for connection of antenna 2 (ANT 2)
	(2)	LED status indicator
	(3)	RS 422 interface (8-pin M12 connector)

Highlights

- The tags are read in accordance with the requirements of the EPCglobal Class 1, Gen 2 and ISO/IEC 18000-6C standards
- Supports low-cost SmartLabels as well as reusable, rugged data media
- High reading speed: Depending on the function block (multitag mode), many tags can be detected simultaneously (bulk reading), rapidly moving tags are reliably acquired.
- The RF630R (ETSI) "6GT2811-4AA00-0AA0" is suitable for the frequency band 865 to 868 MHz UHF (EU, EFTA, Turkey). The reader supports the ETSI EN 302 208 V1.1.1 standard as well as the new ETSI EN 302 208 V1.2.1 standard (4-channel plan).
- The RF630R (FCC) "6GT2811-4AA00-1AA0" is suitable for the frequency bands 920.25 to 924.75 MHz (Thailand) and 902 to 928 MHz (North America).
- The RF630R (CHINA) "6GT2811-4AA00-2AA0" is suitable for the frequency band 920.125 to 924.875 MHz (China)
- Up to 2 external antennas can be connected and configured in operating mode
- IP65 degree of protection for reader
- Can be used for a high temperature range
- Dense Reader Mode (DRM) for environments in which many readers are operated in close proximity to each other
- TIA system interface:
  - RS 422

5.2.1.1 Ordering data

Ordering data for RF630R

Product	Order No.
RF630R (ETSI) reader basic unit for EU, EFTA, Turkey	6GT2811-4AA00-0AA0
RF630R (FCC) reader basic unit for the USA	6GT2811-4AA00-1AA0

Ordering data for antennas and antenna cables

Product	Order No.
Antennas • RF620A antenna for EU, EFTA, Turkey (868 MHz) • RF620A antenna for China and USA (915 MHz) • RF660A antenna for EU, EFTA, Turkey (868 MHz) • RF660A antenna for China and USA (915 MHz)	 • 6GT2812-1EA00 • 6GT2812-1EA01 • 6GT2812-0AA00 • 6GT2812-0AA01
Antenna cable • 3 m (cable attenuation: 1.0 dB) • 10 m (cable attenuation: 2,0 dB) • 10 m (cable attenuation: 4.0 dB) • 20 m (cable attenuation: 4.0 dB)	 • 6GT2815-0BH30 • 6GT2815-1BN10 • 6GT2815-0BN10 • 6GT2815-0BN20

Ordering data (accessories)

Product	Order No.
Connecting cable • RS°422, M12 plug, 8-pin socket: 2 m • RS°422, M12 plug, 8-pin socket: 5 m • RS°422, M12 plug, 8-pin socket: 10 m • RS°422, M12 plug, 8-pin socket: 20 m • RS°422, M12 plug, 8-pin socket: 50 m	 • 6GT2891-0FH20 • 6GT2891-0FH50 • 6GT2891-0FN10 • 6GT2891-0FN20 • 6GT2891-0FN50
CD-ROM Software & Documentation	6GT2080-2AA10

5.2.1.2 Status display

The device is equipped with a three colored LED. The LED can be lit in green, red or yellow. The meaning of the indication changes in accordance with the color and state (on, off, flashing) of the LED:

Green LED	Red LED	Yellow LED	Meaning
Off	Off	Off	The device is starting up.
Flashing	Off	Off	The device is ready. The antenna is switched off.
On	Off	Off	The device is ready. The antenna is switched on.
Off	Off	On	"With presence": At least one tag is in the field. "Without presence": Communication with a tag is active.
Off	Flashing	Off	Reader is not active, a serious error has occurred. In addition, this LED also indicates the fault status through the number of flashing pulses. Reboot (operating voltage Off → On is necessary). The LED flashes once for the 'INACTIVE' status, rebooting is **not** necessary in this case.

For more detailed information on the flash codes of the reader see Chapter Error messages and flash codes for RF620R/RF630R (Page 338)

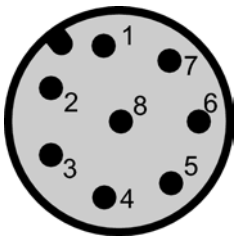
Note

LED not lit yellow?

If the LED does not light up yellow even though a tag is located within the field, common causes are:

- Incorrect configuration in the init_run command, or init_run command was not executed (see "Configuration Manual RF620R/RF630R")
- Antenna is switched off
- A tag is used, that is not compatible with the reader protocol (EPC Global Class 1 Gen 2).
- Tag is defective
- Reader or antenna has a defect
- Tag is not in the field of radiation of the transmit antenna

5.2.1.3 Pin assignment of the RS422 interface

Pin	Pin Device end 8-pin M12	Assignment
	1	+ 24 V
	2	- Transmit
	3	0 V
	4	+ Transmit
	5	+ Receive
	6	- Receive
	7	Free
	8	Earth (shield)

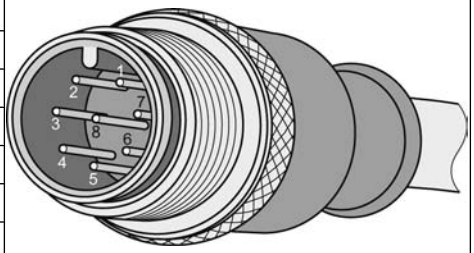
The knurled bolt of the M12 plug is not connected to the shield (on the reader side).

Note

You must therefore not use any SIMATIC connecting cables that use the angled M12 plug.

5.2.1.4 Pin assignment of the connecting cable

Table 5-5 RS 422 - on reader side

M12 pin	Core color	Pin assignment	View of M12 connector
1	white	24 VDC	
2	brown	TX neg	
3	green	GND	
4	yellow	TX pos	
5	Gray	RX pos	
6	pink	RX neg	
7	blue	Not assigned	
8	red	Earth (shield)	

Comment

This cable has an 8-pin M12 connector at one end and the other cable end is 'open'. There are 8 color-coded single cores there for connecting to external devices. There are different cable lengths in the product range (3 m to 50 m). Long cables can be reduced if necessary.

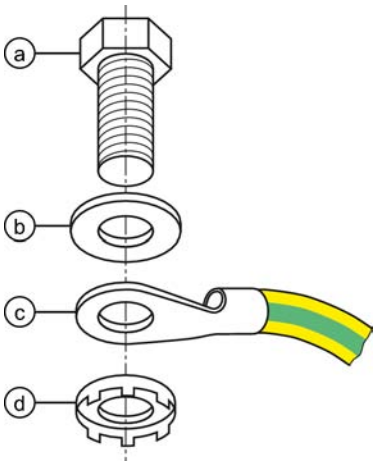
Note

For long cables: Adapt supply voltage and data rate accordingly

Note that with long cables in particular, the supply voltage of 24 V DC must always be applied. Note also that the data rate on the serial interface must, if necessary, be reduced. (See "Configuration Manual RF620R/RF630R")

5.2.1.5 Grounding connection

The RF620R/RF630R can be electrically connected to the ground potential through a contact washer. The tightening torque must be increased in this case to ensure that electrical contact is made (2.7 Nm).

Ground connection		
	(a)	Hexagon-head screw
	(b)	Plain washer
	(c)	Cable lugs
	(d)	Contact washer: Use contact washers according to the Siemens standard SN 70093-6-FSt-flNnnc-480h for ground connection, Siemens item No.: H70093-A60-Z3

5.2.2 Planning application

5.2.2.1 Minimum mounting clearances of two antennas of different readers

At 500 mW ERP radiated power, due to the opening angle of the antennas, their fields can overlap considerably. It is no longer possible to clarify in which antenna field access to the data of a tag is performed.

In order to avoid this, always keep a minimum distance of 3 m between two antennas of different RF630R readers with the maximum radiated power of 500 mW ERP.

Dense Reader Mode (DRM)

The readers can also interfere with each other (secondary fields), if the channels (Reader TX, Transponder TX) overlap. In order to prevent a transponder channel overlapping with a reader channel, we recommend that the Dense Reader Mode (DRM) is used.

5.2.2.2 Antenna/read point configurations

You can connect up to two external antennas to the RF630R reader. The standard setting is that two antennas are connected when the reader is started.

You have 3 possibilities for aligning the antennas and covering the read point.

One RF630R reader with two antennas and two read points

If you connect two external antennas to the device and align them in different directions, you can read tags at two different read points. With this technique, a particular antenna must be switched off application-dependently to be able to establish which tags have been read from which antenna. The reader also provides a mode for this purpose in which the antennas can be switched on and off cyclically (both antennas must be connected). Note the minimum distances between the antennas for the antenna configuration (see Chapter Specified minimum and maximum spacing of antennas (Page 44) .

One RF630R reader with two antennas and one read point

If you connect two external antennas to the device and align them in the same direction (portal configuration), you can read tags at one read point. With this method, the reader automatically switches between the two antennas while the tags are being read. Note the minimum distances between the antennas for the antenna configuration (see Chapter Specified minimum and maximum spacing of antennas (Page 44) .

One RF630R reader with one antenna and one read point

If you connect an external antenna to the device, you can read tags at one read point.

5.2.3 Installing/Mounting

5.2.3.1 Mounting/Installation

Requirement

⚠ WARNING

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

⚠ CAUTION

Emitted radiation

The transmitter complies with the requirements of Health Canada and the FCC limit values for subjecting persons to HF radiation, provided that a minimum spacing of 26 cm exists between antenna and person. When the antennas are installed, you must therefore ensure that a minimum spacing of 26 cm is maintained between personnel and antennas.

Mounting/installing the device

You can mount the reader directly onto a flat surface.

The positions of the fixing holes for the device are shown in the section Dimension drawings (Page 111).

5.2.4 Configuration/integration

The RS422 system interface is provided for integrating the device into system environments/ networks. The system interface transfers data to SIMATIC controllers or PCs with the appropriate interface.

Apart from transmitting communication data from the reader to the controller and vice versa, the RS422 interface also supplies power to the reader (24 V DC).

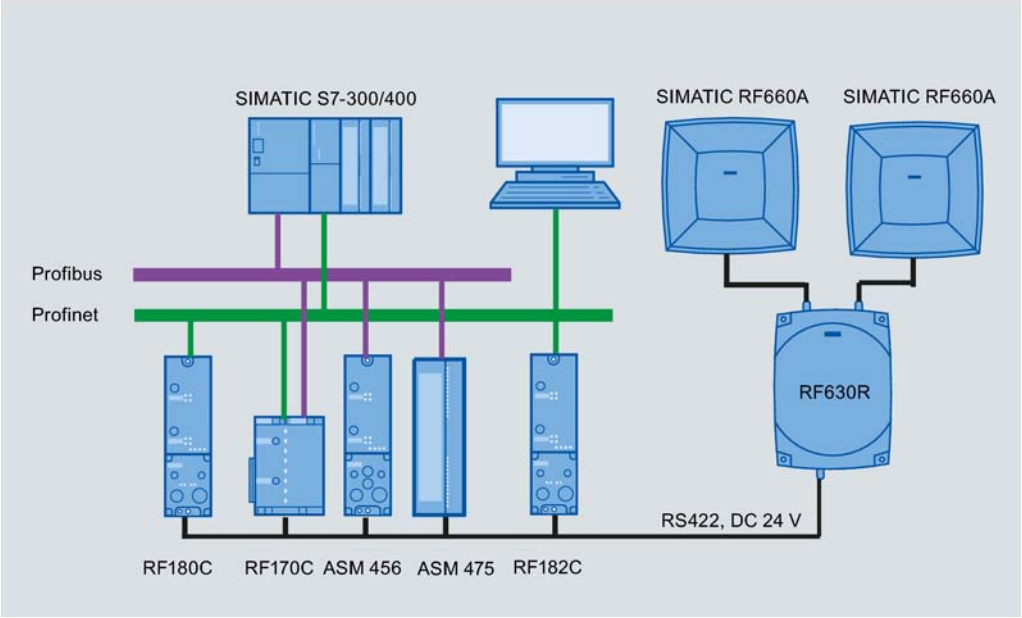


Figure 5-7 Overview of configuration of the RF630R reader

The RF620R reader can alternatively be connected to a SIMATIC controller via the ASM 456, ASM 475, RF170C and RF180C interface modules/communication modules.

The RF620R reader can alternatively also be connected directly to the PC via the RF182 communication module.

For further details on the interface modules used, see Chapter .

Further information about commissioning the readers can be found in the Configuration Manual "RF620R/RF630R" in the "Commissioning" section.

5.2.4.1 Transmission protocols

RS 422 communication

	3964R protocol
Transmission rates	19.2 kbps 57.6 kbps 115.2 kbps
Start bits	1
Data bits	8
Parity	Odd
Stop bits	1

5.2.5 Technical data

5.2.5.1 Mechanical data

Mechanical data		
Weight		1640 g
Dimensions (L x W x H) in mm		252 x 193 x 52 mm, without connections
Material for housing top section		ABS (GF 20)
Material for housing bottom section		Aluminum
Color of housing top section		Anthracite
Color of housing bottom section		Silver
Status displays on the device		1 LED Colors: Red, yellow, green
Interfaces		
	Antenna connections	2x RTNC plug
	RS422	1 x plug (8-pin M12)
	Software	SIMATIC S7

Thermal and electrical properties			
Power supply • Permitted range		21.6 to 30 V DC [1]	
Power supply		Current consumption (in standby mode, no transmit power)	Current consumption (in standby mode, no transmit power)
	20 V input voltage on the reader, typical	135 mA	2.7 W
	24 V input voltage on the reader, typical	115 mA	2.76 W
	30 V input voltage on the reader, typical	95 mA	2.85 W

Power supply		Current consumption (at 500 mW ERP)	Power requirement (at 500 mW ERP)
	20 V input voltage on the reader, typical	470 mA	9.4 W
	24 V input voltage on the reader, typical	395 mA	9.48 W
	30 V input voltage on the reader, typical	320 mA	9.6 W
Rampup time		7 s	

1) All supply and signal voltages must be safety extra low voltage (SELV/PELV according to EN 60950)

24 V DC power supply: safe (electrical) isolation of extra-low voltage (SELV / PELV acc. to EN 60950)

Mechanical environmental conditions	
Shock resistant to EN 60068-2-27 Vibration EN 60068-2-6	50 g[1] 20 g[1]
Climatic Conditions	
Ambient temperature in operation	-25 °C to +55 °C (a 10-minute warm-up time must be observed at an operating temperature below -20 °C)
Ambient temperature for transport and storage	-40 °C to +85 °C

1) The values for shock and vibration are maximum values and must not be applied continuously.

EMC & approvals/conformity for ETSI variant	
Electromagnetic compatibility	ETSI EN 301 489-1 / -3
	ETSI EN 302 208
Approvals/Conformity	• Radio to R&TTE guidelines EN 300 330, EN 301 489 • CE • ETSI EN 302-208 V1.1.1 • ETSI EN 302-208 V1.2.1 • Reader degree of protection acc. to EN 60529 (IP65)

EMC & approvals for FCC variant	
Electromagnetic compatibility	FCC Part 15
Approvals	• FCC, cULus • IEC60950, including US and Canadian variants of it • FCC CFR47 Part 15.247 • RoHS-compliant according to EU Directive 2002/95/EC • Industrial Canada, RSS-210, Issue 7, June 2007

5.2.5.2 Technical data according to EPC and ISO

Technical data	
Frequency accuracy	max.± 10 ppm
Channel spacing	EU, EFTA, Turkey: 200 kHz US: 500 kHz China: 250 kHz
Modulation methods	ASK: DSB modulation & PR-ASK modulation Encoding, Manchester or Pulse Interval (PIE)
Effective transmitter power (the radiant power depends on the antennas and cables used, see Guidelines for selecting RFID UHF antennas (Page 181))	≤ 0.5 W ERP

ETSI frequencies	
Frequency range EU, EFTA, Turkey according to ETSI EN 302 208 V1.1.1 (commissioning until December 31, 2009)	865 to 868 MHz (10 subchannels LBT at 2 W ERP, 12 subchannels at 0.5 W ERP, 15 subchannels LBT at 0.1 W ERP)
Frequency bands for EU, EFTA, Turkey: according to ETSI EN 302 208 V1.2.1 (valid since November 4, 2008, publication in the Official Journal of the European Union)	• 865.7 MHz • 866.3 MHz • 866.9 MHz • 867.5 MHz (4 channels LBT optional at max. 2 W ERP)

Reading range for EU, EFTA, Turkey	
Antennas mounted on opposing sides (portal configuration)	3.5 m max. (recommended maximum value for configuration)
Antennas mounted on the same side	Max. 2 m (recommended maximum value for configuration; depending on the transponder)

FCC frequencies	
North American frequency band	902 ... 928 MHz (50 channels, frequency hopping)

Reading range for USA	
Antennas mounted on opposing sides (portal configuration)	3.5 m max. (recommended maximum value for configuration)
Readers mounted on the same side	2 m max. (recommended maximum value for configuration)

FCC frequencies	
Frequency band for China	920.125…924.875 MHz (16 subchannels at 2 W ERP, 20 subchannels at 0.1 W ERP

Reading range for China	
Antennas mounted on opposing sides (portal configuration)	3.5 m max. (recommended maximum value for configuration)
Readers mounted on the same side	2 m max. (recommended maximum value for configuration)

5.2.5.3 Maximum number of readable tags

The maximum number of readable tags depends on the following parameters:

- Size of the antenna field
- Readability of the tags

For a transmit power of 500 mW ERP, the following is read when the tag RF620T is used:

- Max. 40 tags in the antenna field (tags perpendicular to antenna at 1 m distance). If 2 antennas are used, up to 80 tags can be recognized.
- Max. 18 tags per second

Note for 2-antenna operation

- If 2 antennas are connected to the SIMATIC RF630R, the antennas must be controlled using the SET-ANT command.
- If 2 antennas are configured as a gate, both antennas should be simultaneously switched on with the SET-ANT command. The reader multiplexes both antennas internally. The multiplexing time is 100°ms (internal read time per antenna).

5.2.6 Dimension drawings

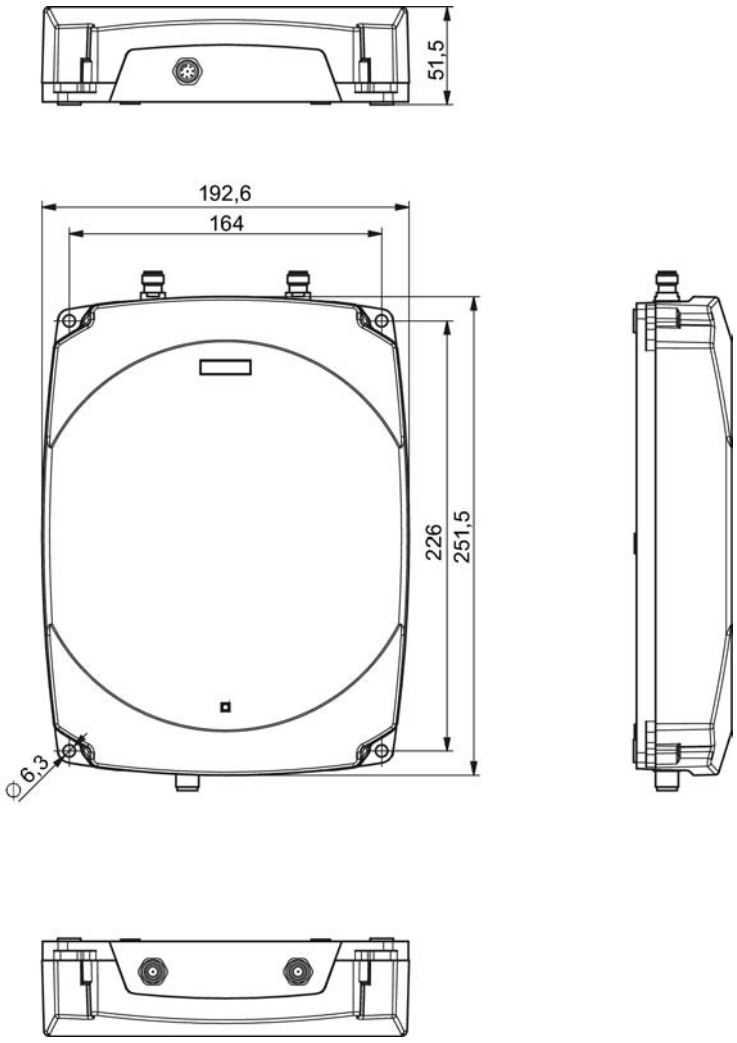


Figure 5-8 Dimension drawing for RF630R

All dimensions in mm

5.2.7 Certificates and approvals

Table 5-6 6GT2811-4AA00-0AA0

Certificate	Description
CE	Compatible with R&TTE directive

Table 5-7 6GT2811-4AA00-2AA0

Standard	Description
	China radio approval

Table 5-7 6GT2811-4AA00-1AA0

Standard	
FC Federal Communications Commission	FCC CFR 47, Part 15 sections 15.247 Radio Frequency Interference Statement This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. FCC ID: NXW-RF630R
Industry Canada Radio Standards Specifications	RSS-210 Issue 7, June 2007, Sections 2.2, A8 IC: 267X-RF630
C UL US	This product is UL-certified for the USA and Canada. It meets the following safety standard(s): UL 60950-1 - Information Technology Equipment Safety - Part 1: General Requirements CSA C22.2 No. 60950 -1 - Safety of Information Technology Equipment UL Report E 205089

5.2.7.1 FCC information

Siemens SIMATIC RF630R (FCC): 6GT2811-4AA00-1AA0

FCC ID: NXW-RF630R

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.

Note

This equipment has been tested and found to comply with the limits for a Class B 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.

FCC Notice To comply with FCC part 15 rules in the United States, the system must be professionally installed to ensure compliance with the Part 15 certification.

It is the responsibility of the operator and professional installer to ensure that only certified systems are deployed in the United States. The use of the system in any other combination (such as co-located antennas transmitting the same information) is expressly forbidden.

FCC Exposure Information To comply with FCC RF exposure compliance requirements, the antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

5.2.7.2 IC-FCB information

Siemens SIMATIC RF630R (FCC): 6GT2811-4AA00-1AA0

IC: 267X-RF630

Industry Canada Notice To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This device has been designed to operate with the SIMATIC RF620A antenna 902-928 as well as the SIMATIC RF660A antenna 902-928 listed below, and having a maximum gain of 5,5 dBi.

Other antennas or antennas having a gain greater than 5,5 dBi are strictly prohibited for use with this device.

The required antenna impedance is 50 Ohms.

5.3 RF670R reader

5.3.1 Description

5.3.1.1 Overview

The SIMATIC RF670R is an active stationary reader in the UHF frequency range without an integrated antenna. Up to four external UHF RFID antennas can be connected via TNC reverse connections.

The maximum HF power output is 1000°W on the reader output. A radiant power of up to 2000 mW ERP is achieved when the appropriate antennas and antenna cables are used. The interfaces (Ethernet, M12 power supply, M12 digital I/O interface) are located along the narrow lower edge. These interfaces can be used to connect the reader to the power supply and the PC for parameterization.

The degree of protection is IP65.

	Item	Description
	(1)	TNC reverse interfaces for connecting up to four antennas
	(2)	LED status indicator
	(3)	24 V°DC power supply
	(4)	Ethernet interface (TCP/IP)
	(5)	Digital I/O interface

Highlights

- The tags are read in accordance with the requirements of the EPC Global Class 1 Gen 2 or ISO/IEC 18000-6C 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.

- The RF670R (ETSI) "6GT2811-0AB00-0AA0" is suitable for the frequency band 865 to 868°MHz UHF (EU, EFTA, Turkey). The reader supports the current standard ETSI EN 302 208 V1.2.1 (4-channel plan).
- The RF670R (FCC) "6GT2811-0AB00-1AA0" is suitable for the frequency band 902 to 928°MHz (North America).
- The RF670R (CHINA) "6GT2811-0AB00-2AA0" is suitable for the frequency band 920.125 to 924.875°MHz.
- Up to four external antennas can be connected
- Antennas can be used separately for up to four independent reading points; several antennas can be combined to form one reading point
- IP65 degree of protection
- Can be used for a high temperature range
- Antenna switching for high tag reader probability
- Dense Reader Mode (DRM) for environments in which many readers are operated in close proximity to each other.
- System integration over Ethernet (TCP/IP)
- Digital I/Os: Industry-compatible with high output power levels
- Configurable switching of the digital outputs with reader-internal logic
- Data processing in the reader (filtering, smoothing, etc.)
- Additional information for each acquired RFID transponder (RSSI values, time stamp)

5.3.1.2 Ordering data

Ordering data for RF670R

Product	Order No.
RF670R (ETSI) reader basic unit for EU, EFTA, Turkey	6GT2811-0AB00-0AA0
RF670R (FCC) reader basic unit for the USA	6GT2811-0AB00-1AA0
RF670R (CHINA) reader basic unit for China	6GT2811-0AB00-2AA0

Ordering data for antennas and antenna cables

Product	Order No.
RF660A antenna for EU, EFTA, Turkey (868 MHz)	6GT2812-0AA00
RF620A antenna for EU, EFTA, Turkey (868 MHz)	6GT2812-1EA00
RF660A antennas for the USA and China (915°MHz)	6GT2812-0AA01

Product	Order No.
RF620A antenna for FCC (915 MHz)	6GT2812-1EA01
Antenna cable • 3 m (cable attenuation: 1.0 dB) • 10 m (cable attenuation: 4.0 dB) • 10 m (cable attenuation: 2,0 dB) • 20 m (cable attenuation: 4.0 dB)	 • 6GT2815-0BH30 • 6GT2815-0BN10 • 6GT2815-1BN10 • 6GT2815-0BN20

Ordering data (accessories)

Product	Order No.
Antenna mounting kit	6GT2890-0AA00
Connecting cable and connectors • Digital I/O, open cable ends, 5 m • Ethernet: 10 m (cross cable) • Ethernet connector on reader according to IEC PAS 61076-3-117IE RJ45 Plug PRO (IP67) • Ethernet connector, Standard IE FastConnect RJ45 Plug 180 (IP20) • Ethernet cable sold by the meter, green	 • 6GT2891-0CH50 • 6GT2891-1HN10 • 6GK1901-1BB10-6AA0 • 6GK1901-1BB10-2AB0 • 6XV1840-2AH10
Wide-range power supply unit for SIMATIC RF systems • With EU plug • With UK plug • With US plug	 • 6GT2898-0AA00 • 6GT2898-0AA10 • 6GT2898-0AA20
24 V connecting cable 5 m between reader and power supply (for RF670R only, pin assignment is PNO compatible)	6GT2891-0NH50
Set of protective caps Contains 3 protective caps for antenna output and one protective cap for digital I/O (required for IP65 degree of protection when some connections are unoccupied)	6GT2898-4AA00
Software and documentation • RFID CD-ROM Software & Documentation • RF-MANAGER 2008, incl. SP3 - 1 reader • RF-MANAGER 2008, incl. SP3 - 5 reader • RF-MANAGER 2008, incl. SP3 - 20 reader • RF-MANAGER 2008, incl. SP3 - 50 reader • RF-MANAGER 2008 SP3 as download	 • 6GT2080-2AA10 • 6GT2080-3CA00-?AA5 • 6GT2080-3CA00-?AA5 • 6GT2080-3CA00-?AA5 • 6GT2080-3CA00-?AA5 • Internet

5.3.1.3 Status display

The device is equipped with a three colored LED. The LED can be lit in green, red or yellow. The meaning of the indication changes in accordance with the color and state (on, off, flashing) of the LED:

Green LED	Red LED	Yellow LED	Meaning
Off	Off	Off	The device is not connected to a power supply.
Off	Off	On briefly	Status shortly after application of voltage and until start-up begins.
Flashing	Off	Off	The device is starting up. The connection is being established. In normal operation, no communication with the reader has taken place.
On	Off	Off	The device is ready. The connection is established.
Off	Off	Flashing	"With presence": More than one tag is in the field.
Off	Off	On	"With presence": At least one tag is in the field.
Off	Flashing	Off	Error states with flash codes (see Chapter Error messages and flash codes for RF670R (Page 337))

Note

LED not lit yellow?

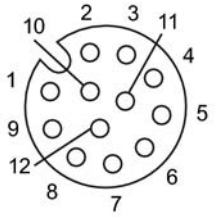
If the LED does not light up yellow even though a tag is located within the field, common causes are:

- Antenna is switched off
- A tag is used, that is not compatible with the reader protocol (EPC Global Class 1 Gen 2).
- Tag is defective
- Reader or antenna has a defect
- Tag is not in the field of radiation of the transmit antenna

For more detailed information on the flash codes of the reader see Chapter Error messages and flash codes for RF670R (Page 337)

5.3.1.4 Pin assignment of the digital I/O interface

View of socket (reader end)

M12 socket (reader end)	Pin	Pin assignment
	1	GND (output for supply of digital inputs/outputs [not electrically isolated])
	2	VCC (output for supply of digital inputs/outputs [not electrically isolated])
	3	DO Common / Outport Common
	4	DO 0 / Outport 00
	5	DO 1 / Outport 01
	6	DO 2 / Outport 02
	7	DO 3 / Outport 03
	8	DI 0 / Inport 00
	9	DI Common / Inport Common
	10	DI 1 / Inport 01
	11	DI 2 / Inport 02
	12	DI 3 / Inport 03

Wiring diagram M12 connector (cable end)

You must assemble your reader cable with a matching connector that fits the interface shown above. Adhere to the following wiring diagram:

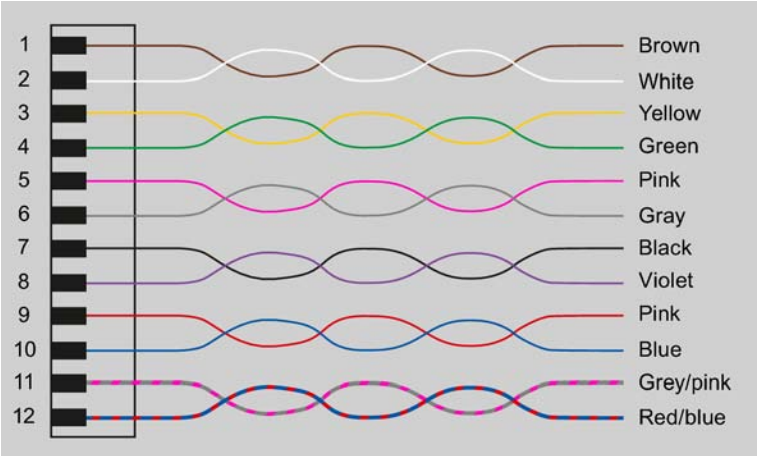


Figure 5-9 M12 connector wiring diagram

5.3.1.5 Connection scheme for the digital I/O interface

Connection possibilities

You can connect the RF670R reader in different ways. In general, the outputs and inputs should be connected as follows:

Output Outport (0), (1), (2), (3)

- Each output is rated for 0.5 A current and is electronically protected.
- Four digital outputs can be operated simultaneously with up to 0.5 A each (up to 1.5 A in total).
- The outputs are optically isolated through optocouplers.

Input Inport (0), (1), (2), (3)

- The inputs are optically isolated through optocouplers.
- The 24 V voltage for the digital inputs (e.g. switches, proximity switches) must be supplied over a separate cable if electrical isolation is required.
- Level Low 0 ... 3 V; High 3,6 ... 24 V
- Sampling rate < 20 ms

The following diagrams illustrate various connection possibilities.

Voltage infeed through internal source (no electrical isolation)

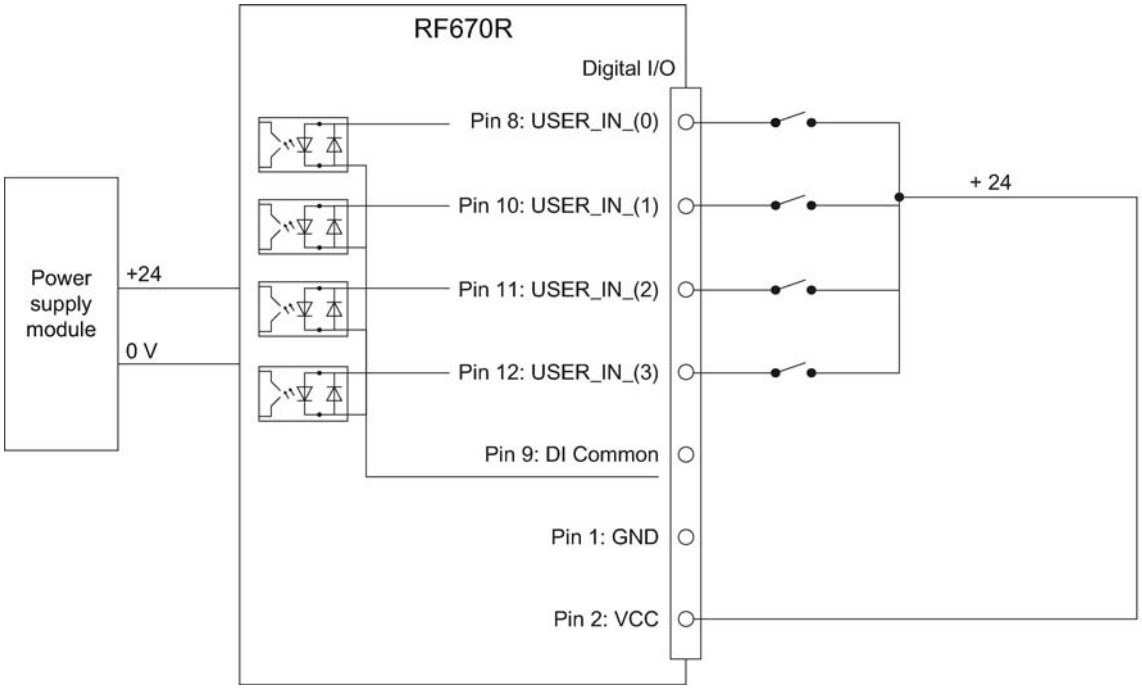


Figure 5-10 Example circuit 1: Digital inputs

Alternative connection possibilities:

- Pin 2 (VCC) to Pin 9 DI Common
- Pin 1 GND to busbar inputs

Voltage infeed through external source

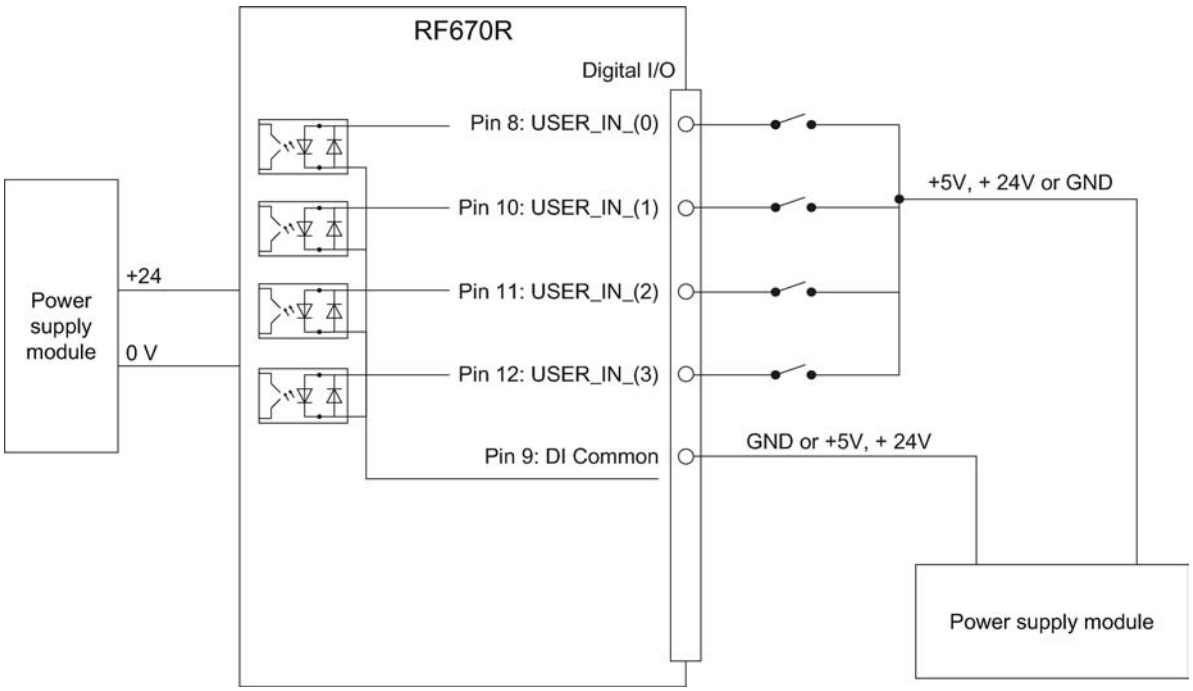


Figure 5-11 Example circuit 2: Digital inputs

Voltage infeed through external source with various voltages

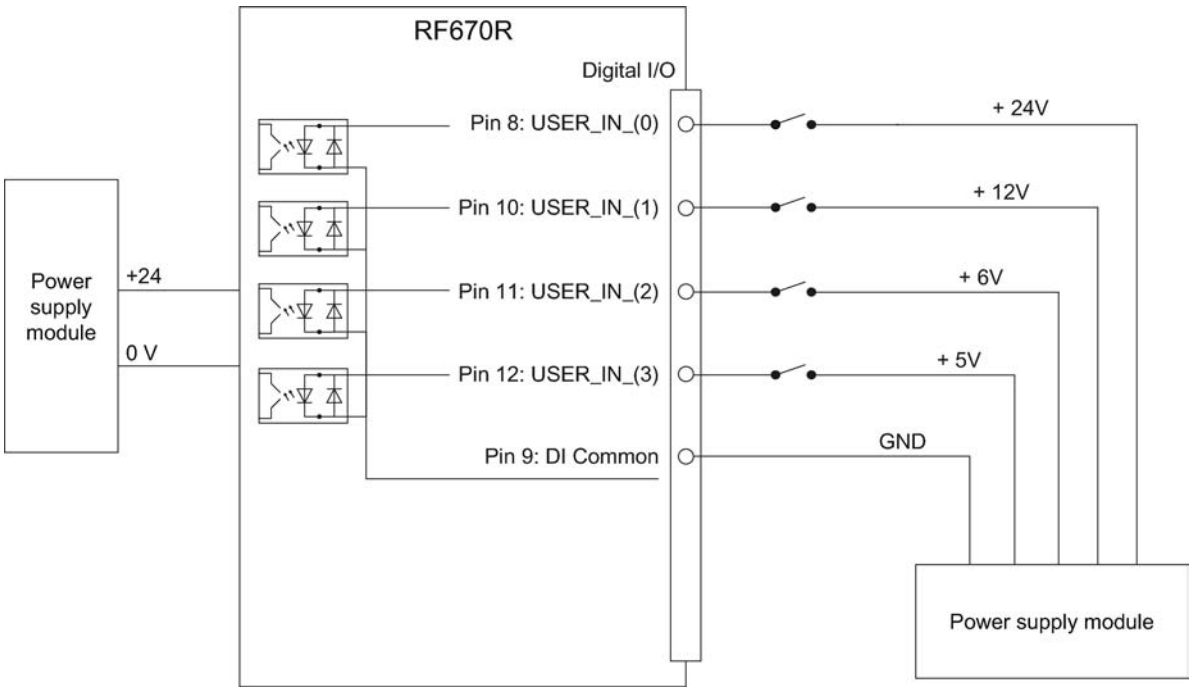


Figure 5-12 Example circuit 3: Digital inputs

Voltage infeed through internal source

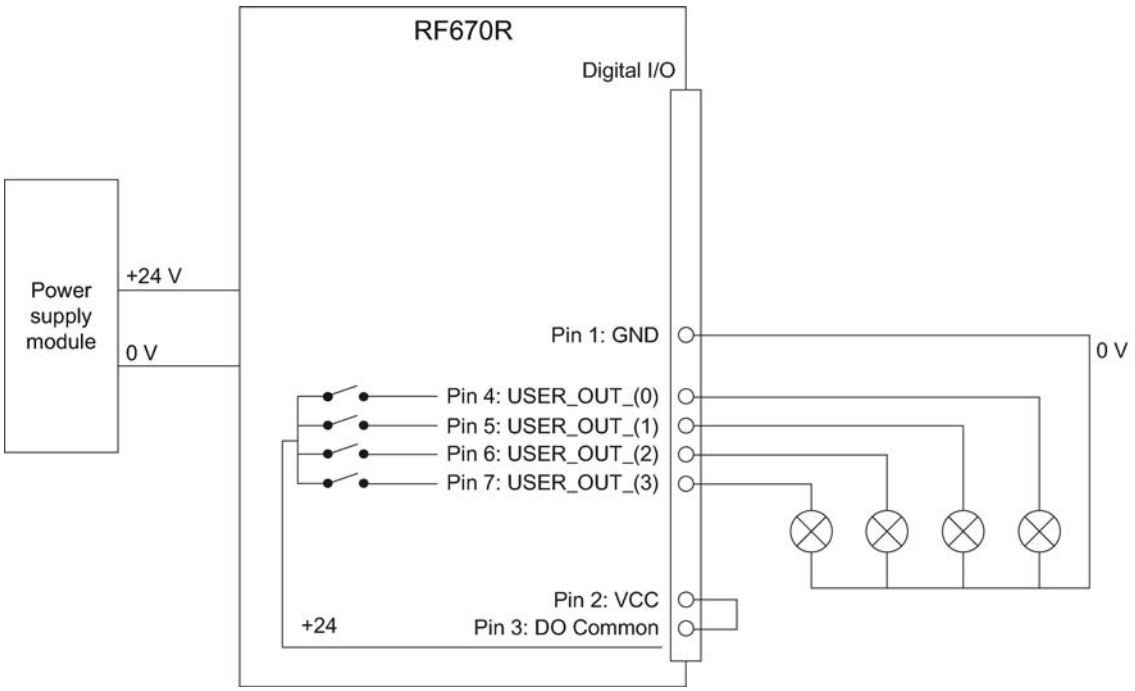


Figure 5-13 Example circuit 4: Digital outputs

Alternative connection possibilities:

- Pin 1 GND to Pin 3 DO Common
- Pin 2 (VCC) to busbar outputs

Voltage infeed through external source

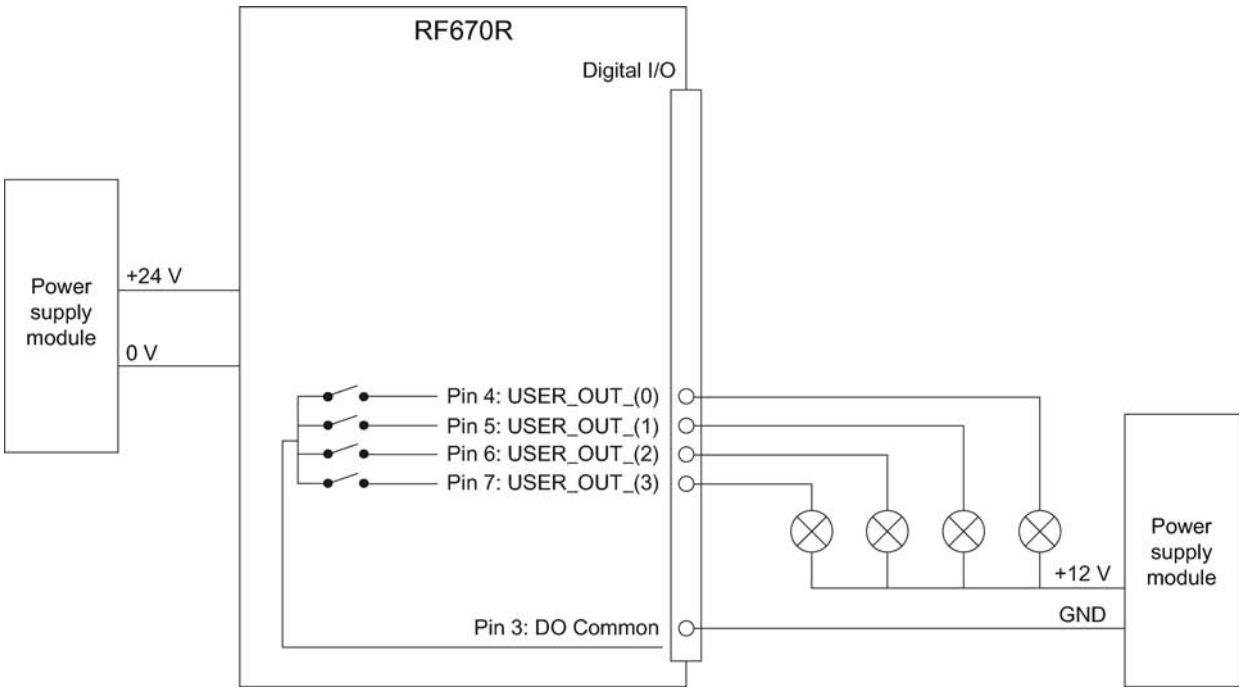


Figure 5-14 Example circuit 5: Digital outputs

Voltage infeed through an external source is shown here for 12°V by way of example. Other voltages are also permissible.

Voltage infeed through external source with various voltages

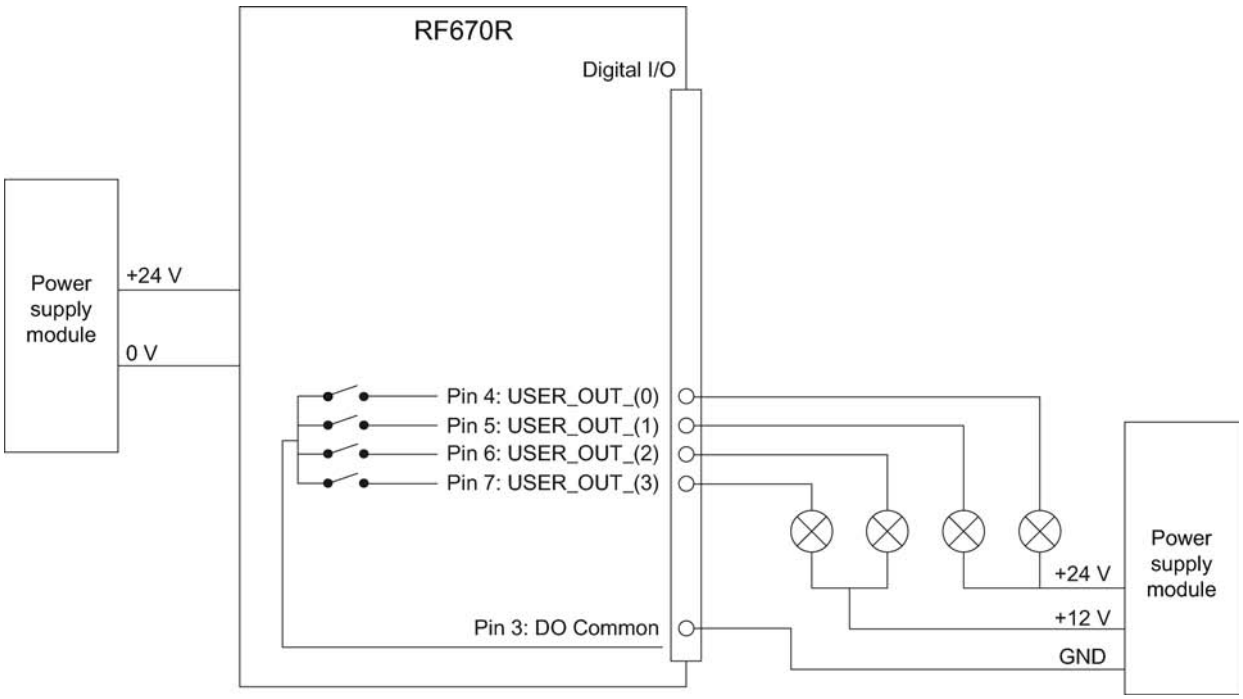
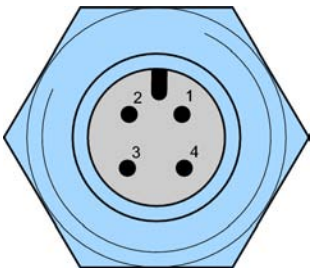


Figure 5-15 Example circuit 6: Digital outputs

5.3.1.6 Pin assignment for power supply

Pin assignment of the power connections

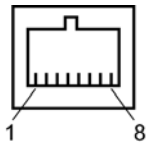
Power connector (on reader side)	Pin	Pin assignment
	1 2 3 4	24 V°DC Not connected Ground (0 V) Not connected

The power connector of the RF670R is PNO compatible, i.e.° normal PROFINET IO connectors will fit this interface.

Note

Please note that the pin assignment for the power connection differs between the RF670R and the RF660R!

5.3.1.7 Pin assignment for Industrial Ethernet interface

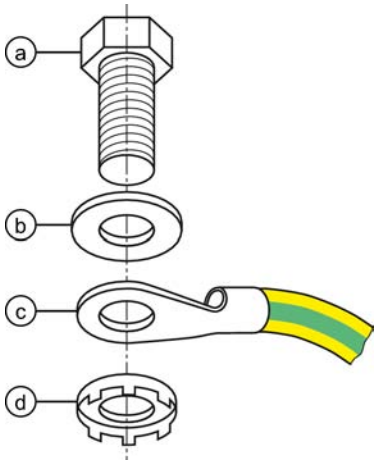
Industrial Ethernet (on reader side)	Pin	Pin assignment
	1	Transmit Data (+)
	2	Transmit Data (-)
	3	Receive Data (+)
	4	Terminated
	5	Terminated
	6	Receive Data (-)
	7	Terminated
	8	Terminated

NOTICE

We recommend that only original Siemens Ethernet crossover cables are used (10 m cable: Order No. 6GT2891-1HN10) or the Siemens connector (see Section Ordering data (Page 115)) for connecting to the Ethernet socket of the reader. If plug-in connectors from other manufacturers are used, it may be difficult or even impossible to remove the plug from the reader

5.3.1.8 Grounding connection

The RF670R can be electrically connected to the ground potential through a contact washer. The tightening torque must be increased in this case to ensure that electrical contact is made (2.7 Nm).

Ground connection		
	(a)	Hexagon-head screw
	(b)	Plain washer
	(c)	Cable lugs
	(d)	Contact washer: Use contact washers according to the Siemens standard SN 70093-6-FSt-flNnnc-480h for ground connection, Siemens item No.: H70093-A60-Z3

5.3.2 Planning the use

5.3.2.1 Firmware and software compatibility

Firmware and software compatibility

NOTICE
Incompatibility between RF670R and RF660R Config Tool Please note that the RF670R reader cannot be configured using the Config Tool of the RF660R.

With RF-MANAGER 2008 Service Pack 3 and higher existing projects can be easily adapted to the RF670R reader by resetting the reader type.

The XML protocol of the RF670R is not compatible with the XML protocol of the RF660R.

The functions that are currently known to be incompatible with RF660R are as follows:

- No radio profile ETSI_SRD or ETSI with LBT
- No transponder with EPC CLASS1 GEN1 and ISO 18000-6B
- No serial interfacing

5.3.2.2 Antenna/read point configurations

You can connect up to four external antennas to the RF670R reader. The standard setting is that four antennas are connected when the reader is started.

With RF-MANAGER Basic 2010 or RF-MANAGER 2008 with SP 3 and higher you can set up various different configurations of antennas and/or reading points as required. It is possible to find solutions to many different tasks through the number of data sources and subsequent assignment of the antennas.

Examples of possible antenna/reading point configurations

- Four data sources each with one antenna for four different reading points.
- Two data sources each with two antennas for small portals.
- One data source with 4 antennas for large portals.

You will find further information in the online Help for the products.

See also

Specified minimum and maximum spacing of antennas (Page 44)

5.3.3 Installing / mounting

Requirement

WARNING

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

CAUTION

Emitted radiation

The transmitter complies with the requirements of Health Canada and the FCC limit values for subjecting persons to HF radiation, provided that a minimum spacing of 26 cm exists between antenna and person. When the antennas are installed, you must therefore ensure that a minimum spacing of 26 cm is maintained between personnel and antennas.

Mounting/installing the device

You can mount the reader in two different ways:

- Via a standardized VESA 100 mounting system using the Antenna Mounting Kit (see Chapter). Tighten the M4 screws on the rear of the reader using a maximum torque of ≤ 1.3 Nm.
- Directly onto a flat surface.

The positions of the fixing holes for the device are shown in the section Dimension drawings (Page 131).

5.3.4 Configuration/integration

5.3.4.1 Configuration

An Ethernet interface is available for integrating the device into system environments/networks. Over the Ethernet interface and with direct connection to the PC, the RF670R can be configured in two different ways:

- Using RF-MANAGER Basic 2010
- Using RF-MANAGER 2008 Service Pack 3 and higher

The communication interface transfers the data over the RF-MANAGER interface to the IT, ERP and SCM systems as well as to SIMATIC controllers. Alternatively the data is transferred to user applications by means of XML commands.

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

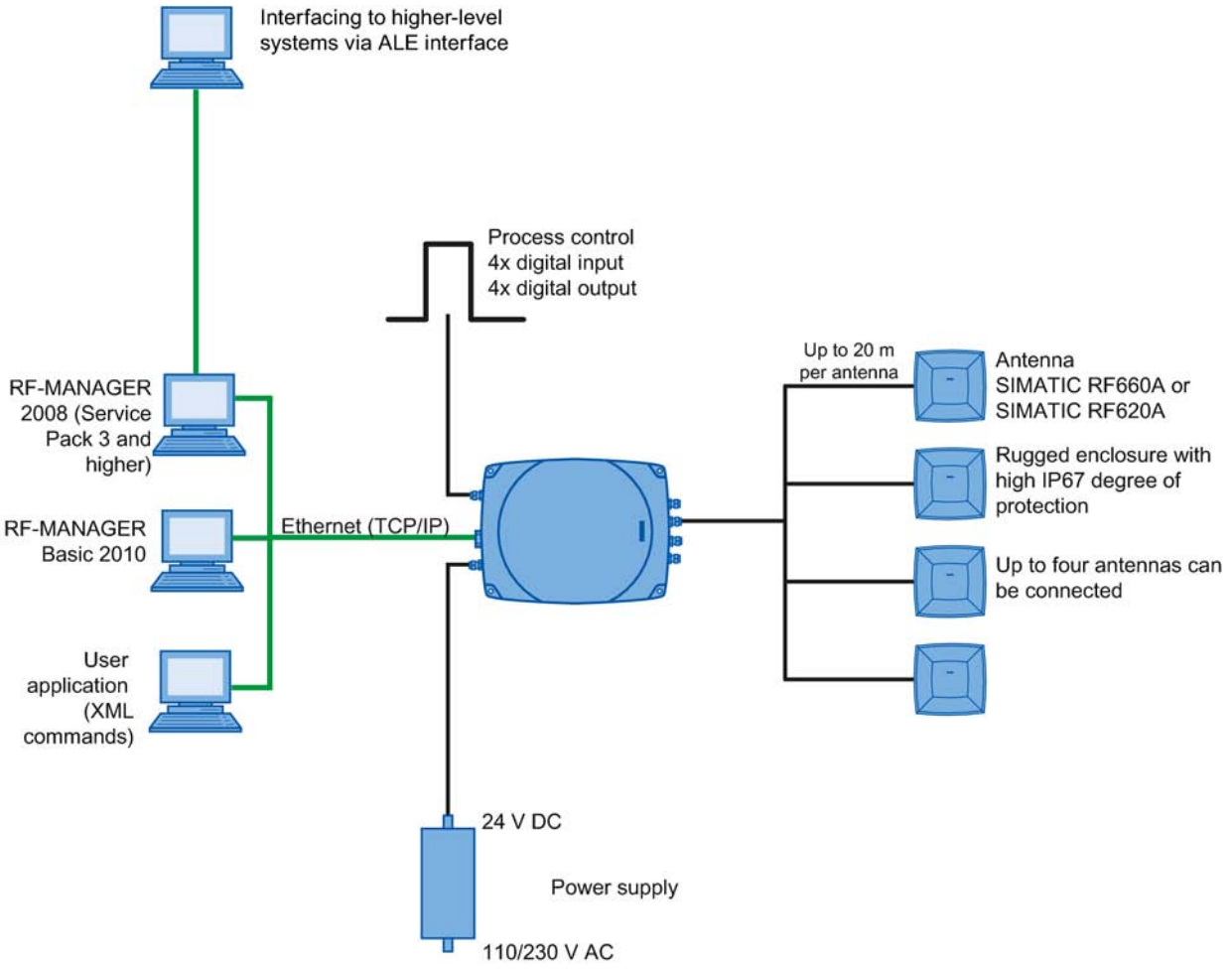


Figure 5-16 Overview of configuration of the RF670R reader

5.3.5 Technical data

5.3.5.1 Mechanical data

Mechanical data	
Weight	1800 g
Dimensions (L x W x H) in mm	252 x 193 x 52 mm, without connections
Material for housing top section	ABS (GF 20)
Material for housing bottom section	Aluminum
Color of housing top section	Anthracite
Color of housing bottom section	Silver
Status displays on the device	1 LED Colors: Red, yellow, green
Interfaces	

	Antenna connections	4x RTNC connector
	Power supply	1 x plug (4-pin M12)
	Digital I/O interface	1 x socket (12-pin M12)
	Digital inputs	4
	Digital outputs	4 (500 mA each; max. 1500 mA in total)
	Ethernet	RJ45 TCP/IP (Push-Pull) 10/100 Mbit/s

Thermal and electrical properties			
Power supply • Permitted range		20 V DC... 30 V°DC [1]	
Power supply		Current consumption (in standby mode, no transmit power)	Power requirement (in standby mode, no transmit power)
	20 V input voltage on the reader, typical	140 mA	2.8 W
	24 V input voltage on the reader, typical	120 mA	2.88 W
	30 V input voltage on the reader, typical	100 mA	3.0 W
Power supply		Current consumption (at 1000 mW ERP)	Power requirement (at 1000 mW ERP)
	20 V input voltage on the reader, typical	530 mA	10.6 W
	24 V input voltage on the reader, typical	450 mA	10.8 W
	30 V input voltage on the reader, typical	370 mA	11.1 W
Rampup time		19 s	

1) All supply and signal voltages must be safety extra low voltage (SELV/PELV according to EN 60950)

24 V DC power supply: safe (electrical) isolation of extra-low voltage (SELV / PELV acc. to EN 60950)

Mechanical environmental conditions	
Shock resistant to EN 60068-2-27 Vibration EN 60068-2-6	50 g[1] 20 g[1]
Climatic Conditions	
Ambient temperature in operation	-25 °C to +55 °C (a 10-minute warm-up time must be observed at an operating temperature below -20 °C)
Ambient temperature for transport and storage	-40 °C to +85 °C

1) The values for shock and vibration are maximum values and must not be applied continuously.

EMC & approvals/conformity for ETSI variant	
Electromagnetic compatibility	ETSI EN 301 489-1 / -3
Approvals/Conformity	• Radio to R&TTE guideline EN 301 489 • CE • ETSI EN 302-208 V1.2.1 • Reader degree of protection acc. to EN 60529 (IP65) • RoHS-compliant according to EU Directive 2002/95/EC • EN302208 -1 & -2 • Human exposure

EMC & approvals for FCC and CHINA variant	
Electromagnetic compatibility	FCC Part 15
Approvals	• FCC, cULus • IEC60950, including US and Canadian variants of it • Reader degree of protection acc. to EN 60529 (IP65) • FCC CFR47 Part 15.247 • RoHS-compliant according to EU Directive 2002/95/EC • Industrial Canada, RSS-210, Issue 7, June 2007 • Radio approval for China (mainland)

5.3.5.2 Technical data according to EPC and ISO

Technical data	
Frequency accuracy	max.± 10 ppm
Channel spacing	EU, EFTA, Turkey: 200 kHz US: 500 kHz China: 250 kHz
Modulation methods	ASK: DSB modulation & PR-ASK modulation Encoding, Manchester or Pulse Interval (PIE)
Effective radiant power (the radiant power depends on the antennas and cables used, see Guidelines for selecting RFID UHF antennas (Page 181))	≤ 2 W ERP

ETSI frequencies	
Frequency bands for EU, EFTA, Turkey: according to ETSI EN 302 208 V1.2.1 (valid since November 4, 2008, publication in the Official Journal of the European Union)	• 865.7 MHz • 866.3 MHz • 866.9 MHz • 867.5 MHz (4 channels at max. 2 W ERP)

Reading range for EU, EFTA, Turkey	
Antennas mounted on opposing sides (portal configuration)	max. X m @@@
Antennas mounted on the same side	max. X m (dependent on transponder) @@@

FCC frequencies	
North American frequency band	902 ... 928 MHz (50 channels, frequency hopping)
Frequency band for China	920.125…924.875 MHz (16 subchannels at 2 W ERP, 20 subchannels at 0.1 W ERP

Reading range for USA / China	
Antennas mounted on opposing sides (portal configuration)	max. X m @@@
Readers mounted on the same side	max. X m @@@

5.3.6 Dimension drawings

5.3.6.1 Dimension drawings

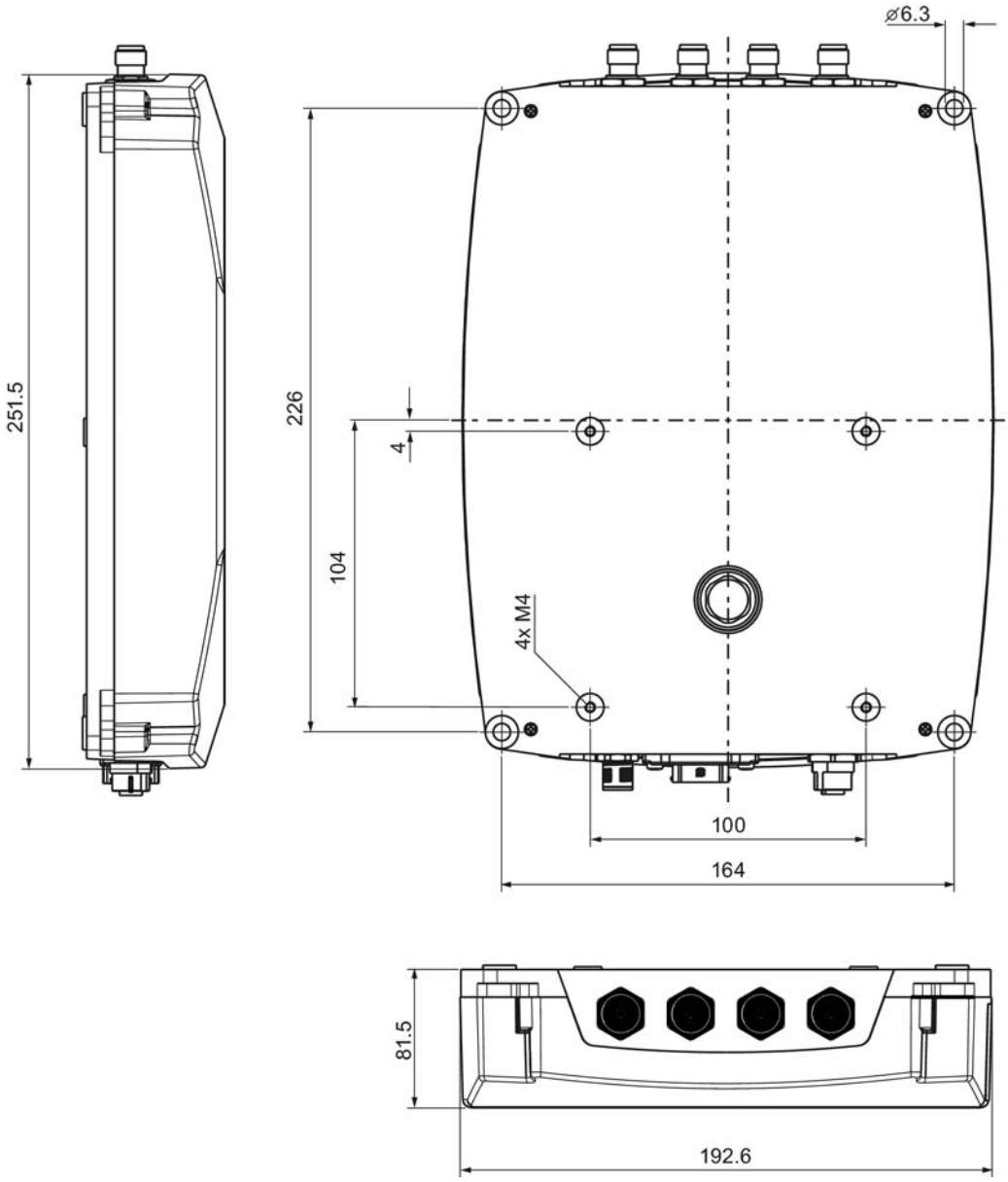


Figure 5-17 Dimension drawing for RF670R

5.3.7 Certificates and approvals

5.3.7.1 CE mark

Table 5-7 6GT2811-0AB00-0AA0

Certificate	Description
CE	Compatible with R&TTE directive

5.3.7.2 FCC, IC-FCB approval and UL certification

RF670R

Table 5-8 FCC ID: NXW-RF670; IC: 267X-RF670

Standard	
FC Federal Communications Commission	FCC Title 47, Part 15.sections 15.247 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.
Industry Canada Radio Standards Specifications	RSS-210 Issue 6, Sections 2.2, A8
c UL us	This product is UL-certified for the USA and Canada. It meets the following safety standard(s): UL 60950-1 - Information Technology Equipment Safety - Part 1: General Requirements CSA C22.2 No. 60950 -1 - Safety of Information Technology Equipment UL Report E 205089

5.3.7.3 FCC information

Siemens SIMATIC RF670R (FCC): 6GT2811-0AB00-1AA0

FCC ID: NXW-RF670

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.

Note

This equipment has been tested and found to comply with the limits for a Class B 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.

FCC Notice To comply with FCC part 15 rules in the United States, the system must be professionally installed to ensure compliance with the Part 15 certification.

It is the responsibility of the operator and professional installer to ensure that only certified systems are deployed in the United States. The use of the system in any other combination (such as co-located antennas transmitting the same information) is expressly forbidden.

FCC Exposure Information To comply with FCC RF exposure compliance requirements, the antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

5.3.7.4 IC-FCB information

Siemens SIMATIC RF670R : 6GT2811-0AB00-1AA0

IC: 267X-RF670

Industry Canada Notice To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This device has been designed to operate with the SIMATIC RF620A antenna 902-928 as well as the SIMATIC RF660A antenna 902-928 listed below, and having a maximum gain of 5,5 dBi.

Other antennas or antennas having a gain greater than 5,5 dBi are strictly prohibited for use with this device.

The required antenna impedance is 50 Ohms.

5.4 RF660R reader

5.4.1 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 environments such as production plants, conveyor systems, warehouses, or direct at the loading gate.

Figure 5-18 RF660R reader

Highlights

- The tags are read in accordance with the requirements of the EPCglobal Class 1, Gen 1 and Gen 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 920.125 to 924.875 MHz band in China as well as the 902 to 928 MHz UHF band in North America
- Up to 4 antennas can be connected and configured in operating mode
- Reader degree of protection IP65, antenna degree of protection IP67
- Can be used for a high temperature range
- Antenna switching for high tag reader probability
- Dense Interrogator Environment mode, (DIE mode) for environments in which many readers are operated in close proximity to each other
- Flexible system integration:
  - Serial (RS 232)
  - Ethernet (TCP/IP)

5.4.1.1 Ordering data

Ordering data for RF660R

Product	Order No.
RF660R reader basic unit for ETSI and FCC	6GT2811-0AA00

Ordering data for antennas and antenna cables

Product	Order No.
Antennas	
• RF620A for ETSI (868 MHz)	• 6GT2812-1EA00
• RF620A for FCC (915 MHz)	• 6GT2812-1EA01
• RF660A for ETSI (868 MHz)	• 6GT2812-0AA00
• RF660A for FCC (915 MHz)	• 6GT2812-0AA01
Antenna cable	
• 3°m (cable attenuation: 1.0 dB)	• 6GT2815-0BH30
• 10 m (cable attenuation: 4.0 dB)	• 6GT2815-0BN10
• 10°m (cable attenuation: 2.0 dB)	• 6GT2815-1BN10
• 20 m (cable attenuation: 4.0 dB)	• 6GT2815-0BN20

Ordering data (accessories)

Product	Order No.
Connecting cable	
• RS 232, 9-pin sub D female connector: 5 m	• 6GT2891-0GH50
• RS 232, 9-pin sub D female connector: 10 m	• 6GT2891-0GN10
• Digital I/O, M12 socket: 2 m	• 6GT2891-0FH20
• Digital I/O, M12 socket: 5 m	• 6GT2891-0FH50
• Digital I/O, M12 socket: 10 m	• 6GT2891-0FN10
• Digital I/O, M12 socket: 20 m	• 6GT2891-0FN20
• Digital I/O, M12 socket: 50 m	• 6GT2891-0FN50
• Ethernet: 10 m (only for RF660R)	• 6GT2891-0HN10
• Ethernet: 20 m (only for RF660R)	• 6GT2891-0HN20
Wide-range power supply unit for SIMATIC RF systems • With EU plug • With UK plug • With US plug	• 6GT2898-0AA00 • 6GT2898-0AA10 • 6GT2898-0AA20
24 V connecting cable	
• 5 m between reader and power pack	• 6GT2491-1HH50
CD-ROM Software and Documentation	• 6GT2080-2AA10

NOTICE

Loss of validity for type tests and certificates

Note that when the 3°m antenna cable (6GT2815-0BH30) or the 10 m antenna cable (6GT2815-1BN10) is used, the certifications for operating the reader outside of the validity range of ETSI (EU, EFTA, Turkey) become void.

NOTICE
Excessive radiated power Please note that when the above-mentioned antenna cable is used, unless indicated otherwise for specific antennas, the cable attenuation must be set in the RF660R to the values specified for cable attenuation. Otherwise, in the case of high antenna gain (e.g.°SIMATIC RF660A) the result would be a radiated power that exceeds the permitted range.

5.4.1.2 Design of the RF660R reader

Item	Description
(1)	Status LED
(2)	Industrial Ethernet (RJ45 socket)
(3)	RS 422 interface (not assigned)
(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 plug)

5.4.1.3 Status displays

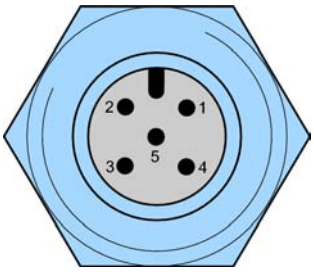
Status displays	LEDs	Color	Description
	Power on	Green	Power supply ON
	Tag Detect	Yellow	LED lit, as soon as at least one tag with a correct tag ID is within the field.
	System error	Red	Reader is not active, a more or less major fault has occurred In addition, this LED also indicates the fault status through the number of flashing pulses. Reboot (operating voltage Off → On is necessary). The LED flashes once for the 'INACTIVE' status, rebooting is **not** necessary in this case.

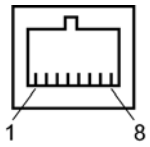
Note

If "Tag Detect" is not lit even though a tag is located within the field, common reasons include:

- Tag protocol has been set incorrectly (can be set with Configuration Software)
- Tag is defective
- Reader or antenna has a defect
- Tag is not in the field of radiation of the transmit antenna

5.4.1.4 Pin assignment of the serial interfaces

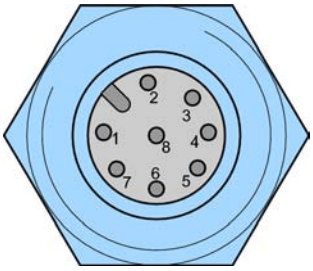
RS 232 connector (on reader side)	Pin	Pin assignment
	1 2 3 4 5	RS232_TX N.C. N.C. RS232_RX GND

Industrial Ethernet (on reader side)	Pin	Pin assignment
	1 2 3 4 5 6 7 8	Transmit Data (+) Transmit Data (-) Receive Data (+) Terminated Terminated Receive Data (-) Terminated Terminated

NOTICE
We recommend that only original Siemens Ethernet connectors are used (10 m cable: Order No. 6GT2891-0HN10; 20 m cable: Order No. 6GT2891-0HN20) for connecting to the Ethernet socket of the reader. If plug-in connectors from other manufacturers are used, it may be difficult or even impossible to remove the plug from the reader

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

Pin assignment

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

Connections

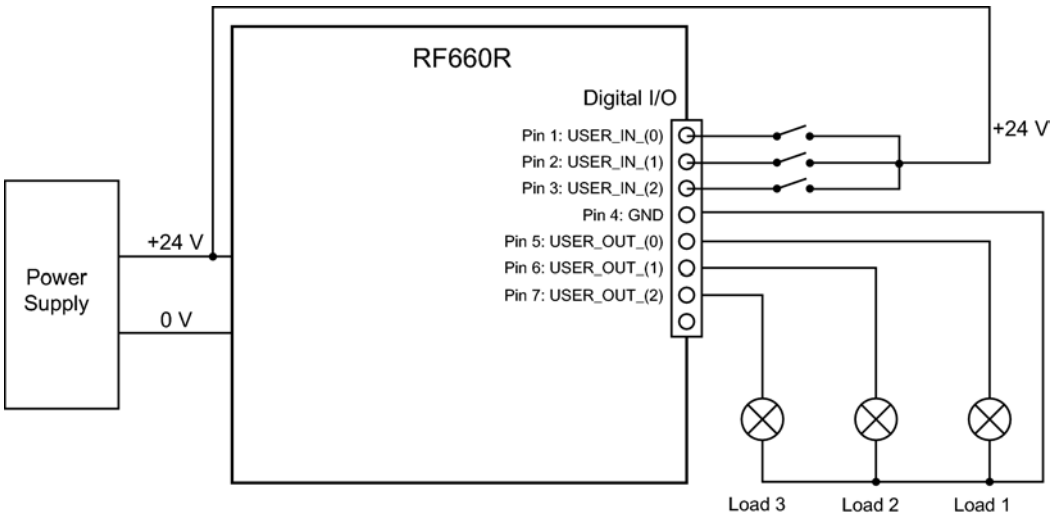


Figure 5-19 Connections for digital I/O

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

- These are high-side switches that connect V_{cc} (+24 V) to the output ('active high').
- Each output is rated for 0.5 A current and is electronically protected.
- The 0 V rail is Pin 4 (GND).
- Three digital outputs can be operated simultaneously with up to 0.5 A each.
- The outputs are optically isolated through optocouplers.

Input USER_IN (0), (1), (2)

- The inputs are optically isolated through optocouplers.
- The 24 V voltage for the digital inputs (e.g. switches, proximity switches) must be supplied over a separate cable.
- The 24 V voltage for the digital inputs can alternatively be supplied from a digital output (USER-OUT). In the user program, however, the digital output must be permanently connected to "1" in this case.

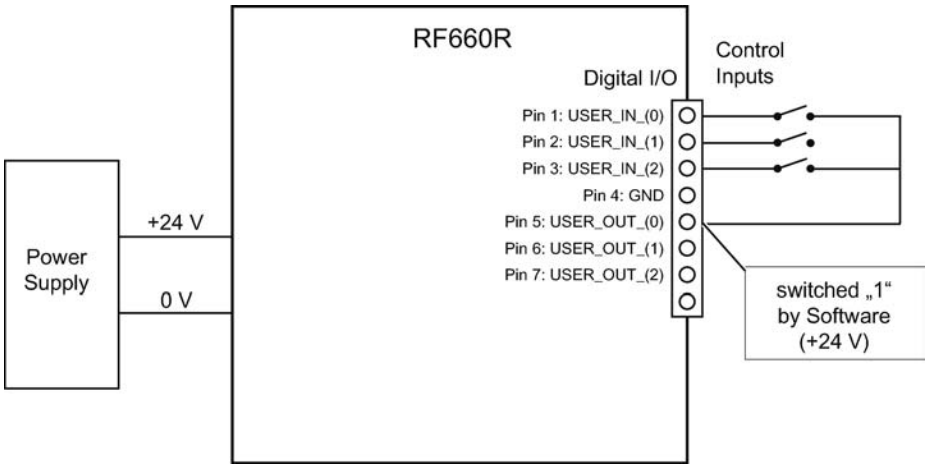


Figure 5-20 RF660R connection diagram

NOTICE
It may be necessary to restart the reader
The length of trigger pulses must be longer than 30 ms.

5.4.1.6 Pin assignment of the connecting cable

Table 5-9 RS 232

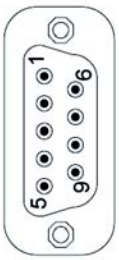
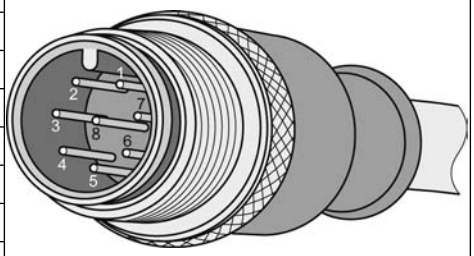
Signal	M12Pin	SUB-D pin	Image
TX (reader)	1	2	
-	2	-	
-	3	-	
RX (reader)	4	3	
GND	5	5	

Table 5-10 Digital I/O, for cable with open cable ends

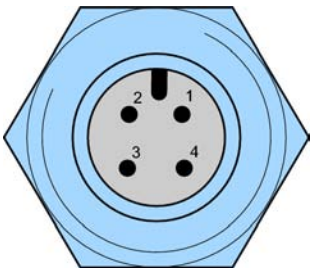
M12 pin	Core color	Pin assignment	View of M12 connector
1	white	Input USER_IN (0)	
2	brown	Input USER_IN (1)	
3	green	Input USER_IN (2)	
4	yellow	GND	
5	Gray	Output USER_OUT (0)	
6	pink	Output USER_OUT (1)	
7	blue	Output USER_OUT (2)	
8	red	Housing	
Shield	Shield		

Comment

This cable has an 8-pin M12 connector at one end and the other cable end is 'open'. There are 8 color-coded single cores there for connecting to external devices. Cable length = 5m. The cable length can be reduced, if needed.

5.4.1.7 Power supply

Pin assignment of the power connections

Power connector (on reader side)	Pin	Pin assignment
	1 2 3 4	Ground (0 V) +24 V +24 V Ground (0 V)

5.4.1.8 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.

Earthing connection	
	The ground terminal (M4 threads) on the device (large surface, large-area contact) has to be connected with the ground 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 mm^2.

5.4.2 Planning application

Firmware and software compatibility

CAUTION
Damage to the reader
The SIMATIC RF660R reader with firmware version V1.2 must only be configured and operated with the relevant SIMATIC RF660R Configuration Software V1.2.
The SIMATIC RF660R reader with firmware version V1.3 must only be configured and operated with the relevant SIMATIC RF660R Configuration Software V1.2 (limited functionality) or V1.3.
No other combination of firmware and configuration software is permissible. The configuration software V1.3 recognizes if it has been connected to a SIMATIC RF660R reader with firmware version V1.3 or version 1.2.
Therefore always refer to the chapter "Firmware/Configuration Software Compatibility" of the Configuration Manual before you make any changes to the firmware version or the version of the SIMATIC RF660R Configuration Software.

Compatibility RF-MANAGER versions/reader firmware versions

Below you will find an overview of the compatibility of RF-MANAGER versions and RF660R reader firmware versions.

In RF-MANAGER°2008°Service Pack°2 and higher, you can select the matching ETSI standard (ETSI standard EN 302 208 V1.1.1 or EN 302 208 V1.2.1) for your reader RF660R depending on the firmware version.

For detailed information, please refer to the RF-MANAGER documentation. This documentation can be downloaded via the portal Service & Support (Page 354).

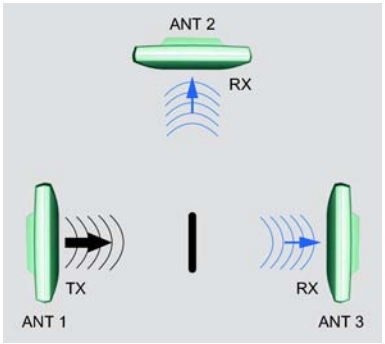
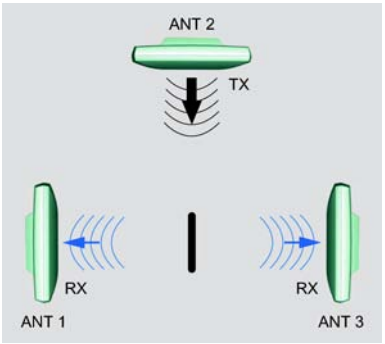
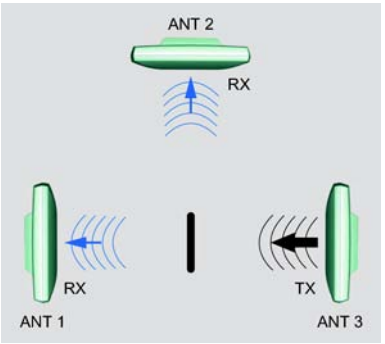
	Older RF-MANAGER versions	RF-MANAGER 2008 SP2 and higher	
Reader firmware version	GR_XML_2.0	GR_XML_2.0	GR_XML_3.0
V1.1	X	X	-
V1.2	Restricted functionality	Restricted functionality	-
V1.3	X [1)]	-	X

1) No commands may be used that are no longer permitted in firmware V1.3.

5.4.2.1 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 RF660R reader:

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

Cycle 1	Cycle 2	Cycle 3
		
Antenna 1 transmits Antennas 2 and 3 receive	Antenna 2 transmits Antennas 1 and 3 receive	Antenna 3 transmits Antennas 1 and 2 receive

5.4.3 Installation /Mounting

Requirement

⚠ WARNING

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

⚠ CAUTION

Emitted radiation

The transmitter complies with the requirements of Health Canada and the FCC limit values for subjecting persons to HF radiation, provided that a minimum spacing of 26 cm exists between antenna and person. When the antennas are installed, you must therefore ensure that a minimum spacing of 26 cm is maintained between personnel and antennas.

Mounting/installing the device

The positions of the fixing holes for the device are shown in the section Dimension drawings (Page 149).

Examples of mounting types		
Material	**Hole diameter**	**Mounting**
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	Gravity toggle: 4 mm diameter, 50 mm length
Metal (min. 2 mm thick)	5 mm diameter	M4 metal screws: 4 mm diameter, 15 mm length

5.4.4 Configuration/integration

5.4.4.1 Configuration

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

- Ethernet 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 write/read device via three digital inputs and outputs with 24 V each.

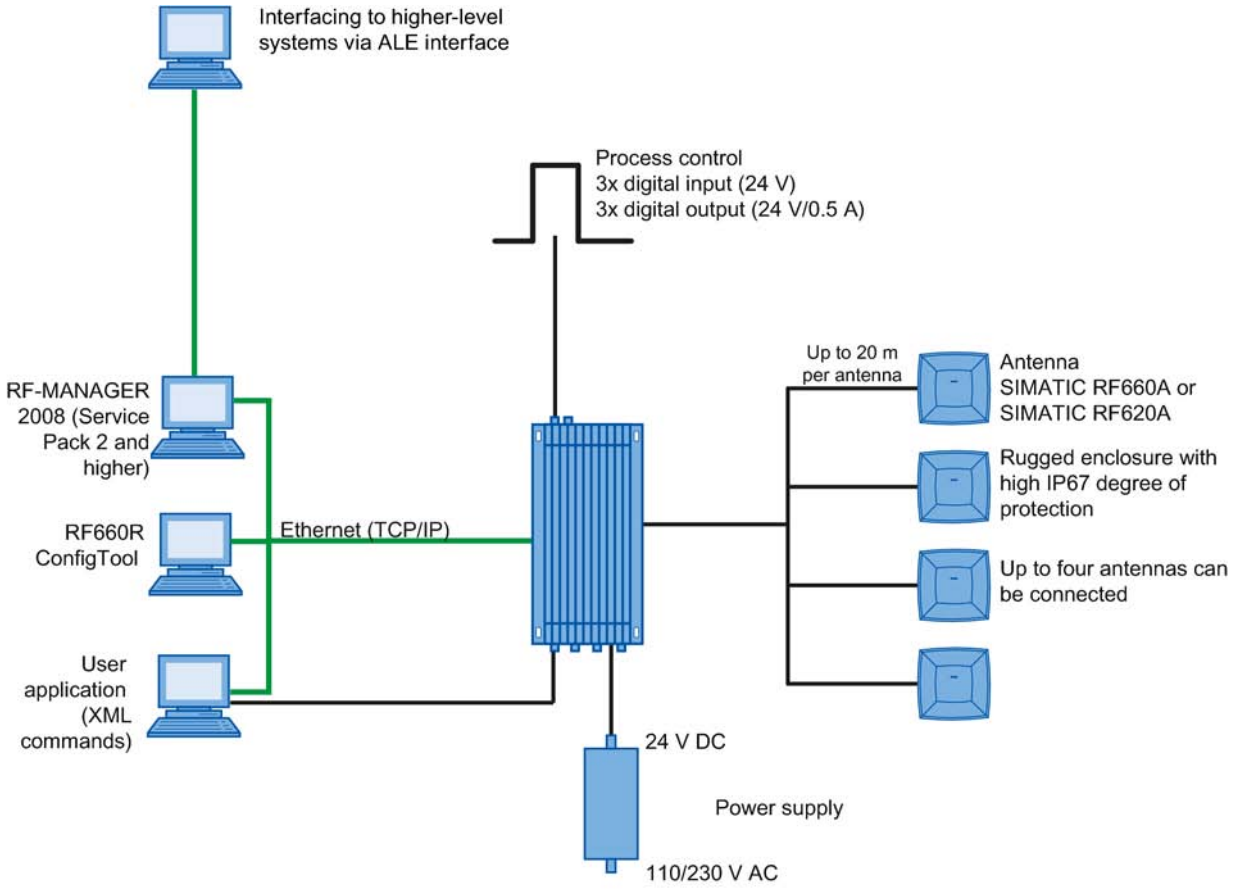


Figure 5-21 Configuration overview of the RF660R reader

Note

Maximum cable length for the RS232 interface

For secure and error-free data transmission, a data transfer rate of 115.2 kbit/s applies: maximum cable length 10 m.

5.4.4.2 Transmission protocols

RS232 communication

	XML protocol
Transmission rates	115200 bps
Start bits	1
Data bits	8
Parity	None
Flow control	Xon/Xoff
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.

5.4.5 Technical specifications

5.4.5.1 Mechanical data

Mechanical specification of RF660R		
Weight	3.7 kg	
Dimensions (L x W x H) in mm	320 x 145 x 100 without connections	
Material	Aluminum	
Color	Anthracite	
Power consumption, typical	24 V • At 2 W transmit power • No digital outputs active	800 mA

Mechanical environmental conditions	
Shock	ETSI EN 300 019-2-3 V2.1.2 IEC 60068-2-27
Total shock response spectrum	Type 3.3
Vibration	ETSI EN 300 019-2-3 V2.1.2 IEC 60068-2-64
Climatic Conditions	
Ambient temperature during operation	-25 °C to +55 °C
Ambient temperature for transport and storage	-40 °C to +85 °C

Electromagnetic compatibility	ETSI EN 301 489-1 / -3
	ETSI EN 302 208 V1.2.1
	FCC Part 15

Status displays on the device	
Power On	Green LED
Tag Detect	Yellow LED
System error	Red LED
Interfaces	
Antenna connections	4x RTNC connector
Maximum number of antenna channels operating independently of each other	2 (with 2 x 2 antennas, tags can be read by a reader at 2 independent locations)
Ethernet 10BaseT or 100BaseTx	1x RJ45 connection according to IEEE 802.3 and ISO 8802-3
RS422	Currently unassigned
RS232	1x connector (5-pin M12). Bit rate: 115200 bps
Digital inputs	3 (8-pin M12) log. "0": 0…7 V log. "1": 15…24 V
Digital outputs (short-circuit proof)	3 (8-pin M12) 24 V; 0.5 A each
Power supply	24 V DC (4-pin M12) 20 to 30 V (2.2 A)

Approvals/Conformity	• Radio to R&TTE- guidelines EN 300 330, EN 301 489 • CE, EMC, FCC, IC, cULus • IEC60950, including US and Canadian variants of it • FCC CFR47 Part 15.247 • Industrial Canada, RSS-210, Issue 6, Sept. 2005 • ETSI EN 302-208 V1.2.1 • Reader degree of protection acc. to EN 60529 (IP65)

5.4.5.2 Technical data according to EPC and ISO

Frequencies	
European frequency band	865 … 868 MHz (4 channels 865.7 MHz; 866.3 MHz; 866.9 MHz; 867.5 MHz without LBT with up to 2 W ERP)
North American frequency band	902 ... 928 MHz (50 channels, frequency hopping)
Frequency band for China	920.125 to 924.875 MHz (16 subchannels at 2 W ERP, 20 subchannels at 0.1 W ERP)
Frequency accuracy	max.± 10 ppm

Channel spacing	EU: 200 kHz US: 500 kHz China: 250 kHz
Modulation methods	ASK: DSB modulation & PR-ASK modulation Encoding, Manchester or Pulse Interval (PIE)

Effective radiated power and reading range with RF620A

Effective radiant power	**Europe / China**	**USA**
Range	0.1 to 2 W ERP	0.4 to 4 W EIRP = 0.24 to 2.4 W ERP
Reading range	**Europe / China**	**USA**
Antennas mounted on opposing sides (portal configuration)	max. 1 m (recommended maximum value for configuration)	max. 1 m (recommended maximum value for configuration)
Antennas mounted on the same side	max. 1 m (recommended maximum value for configuration)	max. 1 m (recommended maximum value for configuration)

Note

Reading ranges are highly dependent on the transponder type and mounting surface

The reading ranges recommended above are applicable to the RF630L (6GT2810-2AB00, -2AB01, -2AB02) on card with a 3 m antenna cable (1 dB cable attenuation) and with the reader set to the maximum power. The RF620A antenna is mounted on a metal surface.

Effective radiated power and reading range with RF660A

Effective radiant power	**Europe / China**	**USA**
Range	0.1 to 2 W ERP	0.4 to 4 W EIRP = 0.24 to 2.4 W ERP
Reading range	**Europe / China**	**USA**
Antennas mounted on opposing sides (portal configuration)	max. 10 m (recommended maximum value for configuration)	max. 10 m (recommended maximum value for configuration)
Antennas mounted on the same side	max. 10 m (recommended maximum value for configuration)	max. 10 m (recommended maximum value for configuration)

5.4.6 Dimension drawings

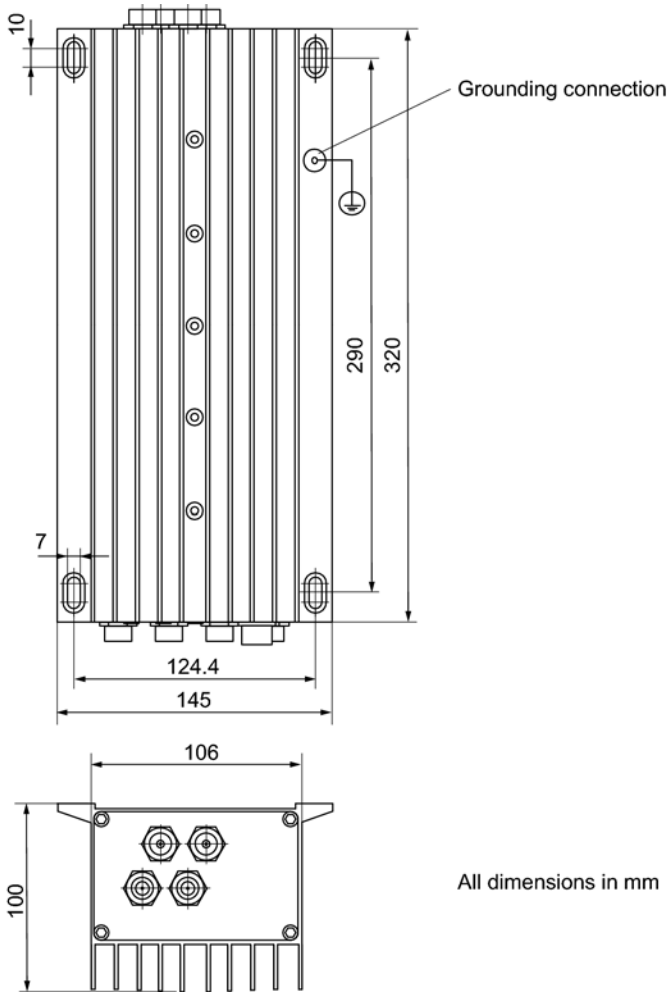


Figure 5-22 Dimension drawing of the reader

5.4.7 Certificates and approvals

5.4.7.1 CE mark

Table 5-11 6GT2811-0AA00

Certificate	Description
CE	Compatible with R&TTE directive

Table 5-12 FCC IDs: NXW-RF660; IC 267X-RF660

Standards	Description
FC Federal Communications Commission	FCC Title 47, Part 15.sections 15.247 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. FCC IDs: NXW-RF660
Industry Canada Radio Standards Specifications	RSS-210 Issue 6, Sections 2.2, A8 IC: 267X-RF660
C UL US	This product is UL-certified for the USA and Canada. It meets the following safety standard(s): UL 60950-1 - Information Technology Equipment Safety - Part 1: General Requirements CSA C22.2 No. 60950 -1 - Safety of Information Technology Equipment UL Report E 205089

5.4.7.2 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.

Note

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.

FCC Notice

To comply with FCC part 15 rules in the United States, the system must be professionally installed to ensure compliance with the Part 15 certification.

It is the responsibility of the operator and professional installer to ensure that only certified systems are deployed in the United States. The use of the system in any other combination (such as co-located antennas transmitting the same information) is expressly forbidden.

FCC Exposure Information

To comply with FCC RF exposure compliance requirements, the antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

5.4.7.3 IC-FCB information

Siemens SIMATIC RF660R: 6GT2811-0AA01

IC: 267X-RF660

Industry Canada Notice To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This device has been designed to operate with the SIMATIC RF620A antenna 902-928 as well as the SIMATIC RF660A antenna 902-928 listed below, and having a maximum gain of 5,5 dBi.

Other antennas or antennas having a gain greater than 5,5 dBi are strictly prohibited for use with this device.

The required antenna impedance is 50 Ohms.

Antennas

6

6.1 Overview

The following table shows the most important features of the RF600 antennas at a glance:

Features		RF620A antenna 865-868	RF620A antenna 902-928	RF660A antenna 865-868	RF660A antenna 902-928
Material		PA 12, silicon-free			
Frequency band		865-868 MHz	902-928 MHz	865-868 MHz	902-928 MHz
Impedance		50 Ohm nominal			
Antenna gain		-10…-5 dBi		5-7 dBil	> 6 dBic
VSWR (standing wave ratio)		2:1 max.			
Polarization		Linear		RH circular	
Radiating/receiving angle		Depending on the mounting surface		55°- 60°	60° - 75°
Connector		RTNC coupling		RTNC	
Degree of protection		IP67			
Permissible ambient temperature		-25° C to +75° C			
Number of connectable antennas per reader					
	RF630R	1 or 2 antennas			
	RF670R	1, 2, 3 or 4 antennas			
	RF660R	2, 3, or 4 antennas			

6.2 RF620A antenna

6.2.1 Description

SIMATIC RF620A	Features	
	Field of application	The SIMATIC RF620A is an antenna of compact, industry-standard design. It is suitable for UHF transponders with normal (far field) antenna characteristics, e.g. SIMATIC RF630L, SIMATIC RF620T.
	Antenna field	Designed for transponders that are uniformly aligned whilst directed past the antenna. See Chapter Alignment of transponders to the antenna (Page 158)
	Writing/reading range	Approx. 0.5 m depending on the transponder (see Chapter Read/write ranges (Page 169))
	Connecting cable	30 cm movable connecting cable and RTNC coupling (an antenna cable, e.g. 6GT2815-0BH30 is required for connection to the reader)
	Readers that can be connected	• RF670R (1 to 4 antennas) • RF630R (1 or 2 antennas) • RF660R (at least 2 antennas)
	Polarization	Linear
	Degree of protection	IP67

Frequency bands

The antenna is available for two different frequency bands that have been specified for the regions of Europe, and China, USA respectively.

- The antenna for Europe operates in the frequency band of 865 to 868 MHz.
- The antenna for China and the USA operates in the frequency band of 902 to 928 MHz.

Function

The SIMATIC RF620A is used for transmitting and receiving RFID signals in the UHF frequency band. The antennas are connected to the SIMATIC RF600 readers via antenna cables that are available in different lengths.

6.2.2 Ordering data

Table 6-1 Ordering data RF620A

Product	Order No.
SIMATIC RF620A (ETSI)	6GT2812-1EA00
SIMATIC RF620A (FCC)	6GT2812-1EA01

Accessories

Table 6-2 Ordering data (accessories)

Product		Order No.
Connecting cable between reader and antenna	3 m (cable loss 1.0 dB)	6GT2815-0BH30
	10 m (cable loss 2.0 dB)	6GT2815-1BN10
	10 m (cable loss 4.0 dB)	6GT2815-0BN10
	20 m (cable loss 4.0 dB)	6GT2815-0BN20

6.2.3 Installation and assembly

6.2.3.1 RF620A mounting types

Two holes for M5 screws are provided for mounting the antenna. This is therefore suitable for:

- Mounting on metallic and non-metallic backgrounds

Note

To achieve optimum wave propagation, the antenna should not be surrounded by conducting objects. The area between antenna and transponder should also allow wave propagation without interference.

6.2.4 Connecting an antenna to the reader

6.2.4.1 Overview

The SIMATIC RF620A antenna must be connected to the reader using an antenna cable.

Requirement

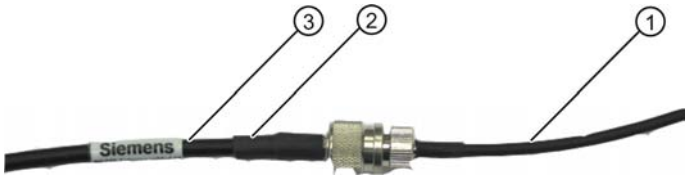
Note

Use of Siemens antenna cable

To ensure optimum functioning of the antenna, it is recommended that a Siemens antenna cable is used in accordance with the list of accessories.

Strain relief

The antenna cable is provided with strain relief as shown in the following diagram:



① RF620A connecting cable
② RF600 antenna cable
③ Strain relief (should take place at this position)

Figure 6-1 Strain relief

Bending radii of the cables

Cable designation	Order No.	Length [m]	Cable loss [dB]	Bending radius [mm]
RF620A connecting cable				15
Antenna cable	6GT2815-0BH30	3	1	51
Antenna cable	6GT2815-1BN10	10	2	77
Antenna cable	6GT2815-0BN10	10	4	51
Antenna cable	6GT2815-0BN20	20	4	77

6.2.4.2 Connecting RF620A to RF670R

Preassembled standard cables (Page 155) in lengths of 3 m, 10 m and 20 m are available for the connection.

The read range is limited by the cable loss. The maximum range can be achieved with the 6GT2815-0BH30 cable (length 3 m) since this has the lowest cable loss.

Connection of one, two or three antennas

When one, two or three antennas are used, we recommend that the remaining antenna connection on the RF670R reader be sealed using the supplied protective cap.

Connection of four antennas

When using two antennas on the RF670R, there are no limitations to the positioning.

6.2.4.3 Connecting RF620A to RF630R

Preassembled standard cables (Page 155) in lengths of 3 m, 10 m and 20 m are available for the connection.

The read range is limited by the cable loss. The maximum range can be achieved with the 6GT2815-0BH30 cable (length 3 m) since this has the lowest cable loss.

Connection of one antenna

When one antenna is used, we recommend that the remaining antenna connection on the RF630R reader be sealed using the supplied protective cap.

Connection of two antennas

When using two antennas on the RF630R, there are no limitations to the positioning.

6.2.4.4 Connecting RF620A to RF660R

Preassembled standard cables (Page 155) in lengths of 3 m, 10 m and 20 m are available for the connection.

The read range is limited by the cable loss. The maximum range can be achieved with the 6GT2815-0BH30 cable (length 3 m) since this has the lowest cable loss.

At least two antennas must be connected in order to guarantee correct functioning.

Connection of two antennas

When two antennas are used, we recommend that the antennas be connected to the reader as follows:

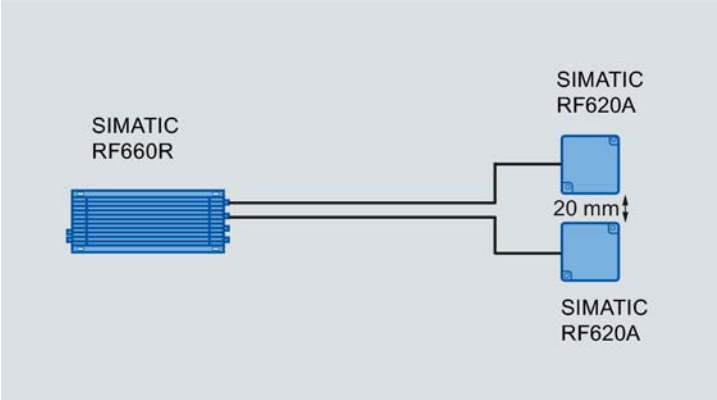


Figure 6-2 Configuration with RF660R

The RF620A antennas must always be arranged in pairs with the RF660R since one antenna is needed for transmitting signals to the transponder whereas the other antenna receives the signals from the transponder.

Note

Operation of the RF660R with more than two RF620A antennas does not offer optimum performance!

More than two antennas should not be connected due to the functional design of the reader. The optimum read rates cannot be achieved if you connect more than two RF620A antennas.

6.2.5 Alignment of transponders to the antenna

Polarization axis

Since the RF620A antenna has linear polarization, it is necessary to consider the alignment of the transponders with regard to the polarization axis of the antenna.

The polarization axes of antenna and transponder must always be parallel. The symbol on the antenna indicates the polarization axis.

Figure 6-3 Polarization axis

Alignment

The following diagram shows the optimum alignment of the RF600 transponders to the RF620A antenna.

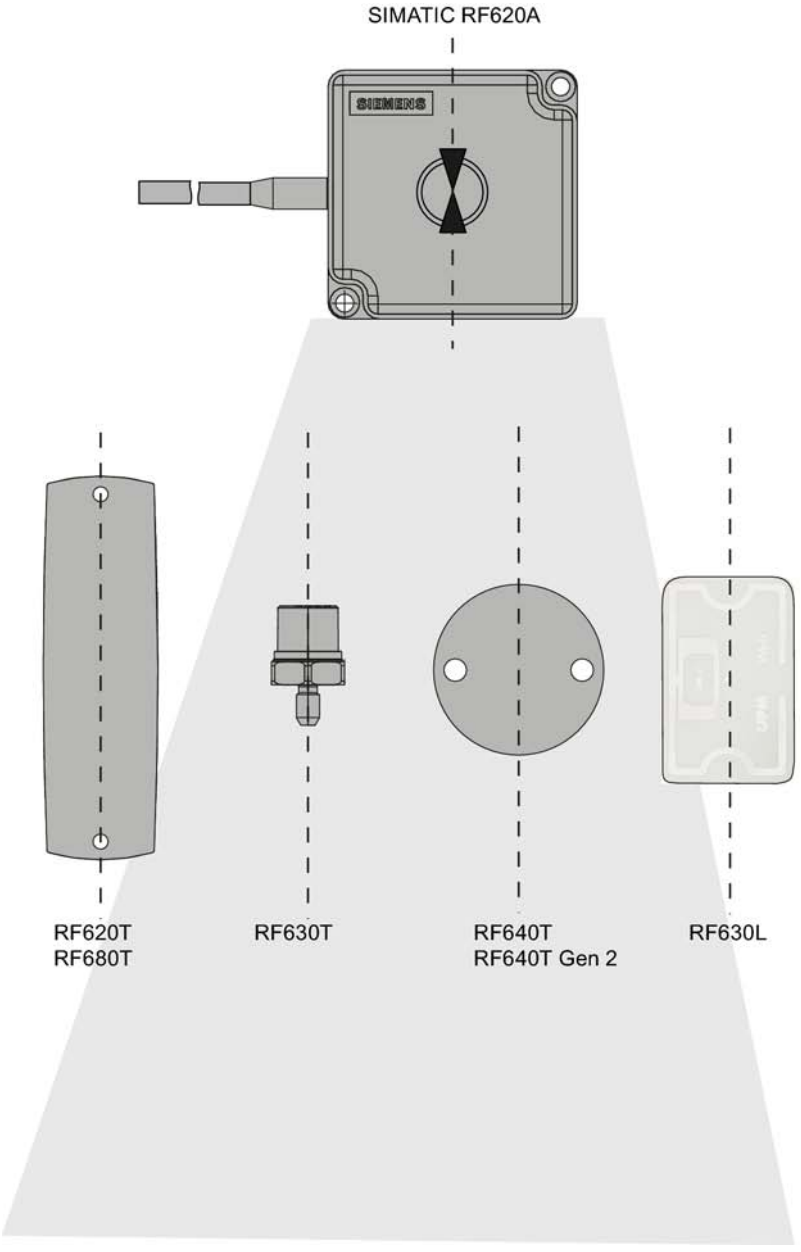


Figure 6-4 Antenna/transponder alignment

Angle deviation diagram for alignment

The following diagram shows the dependence of the following factors.

- Alignment angle of transponder to antenna
- Maximum range of antenna

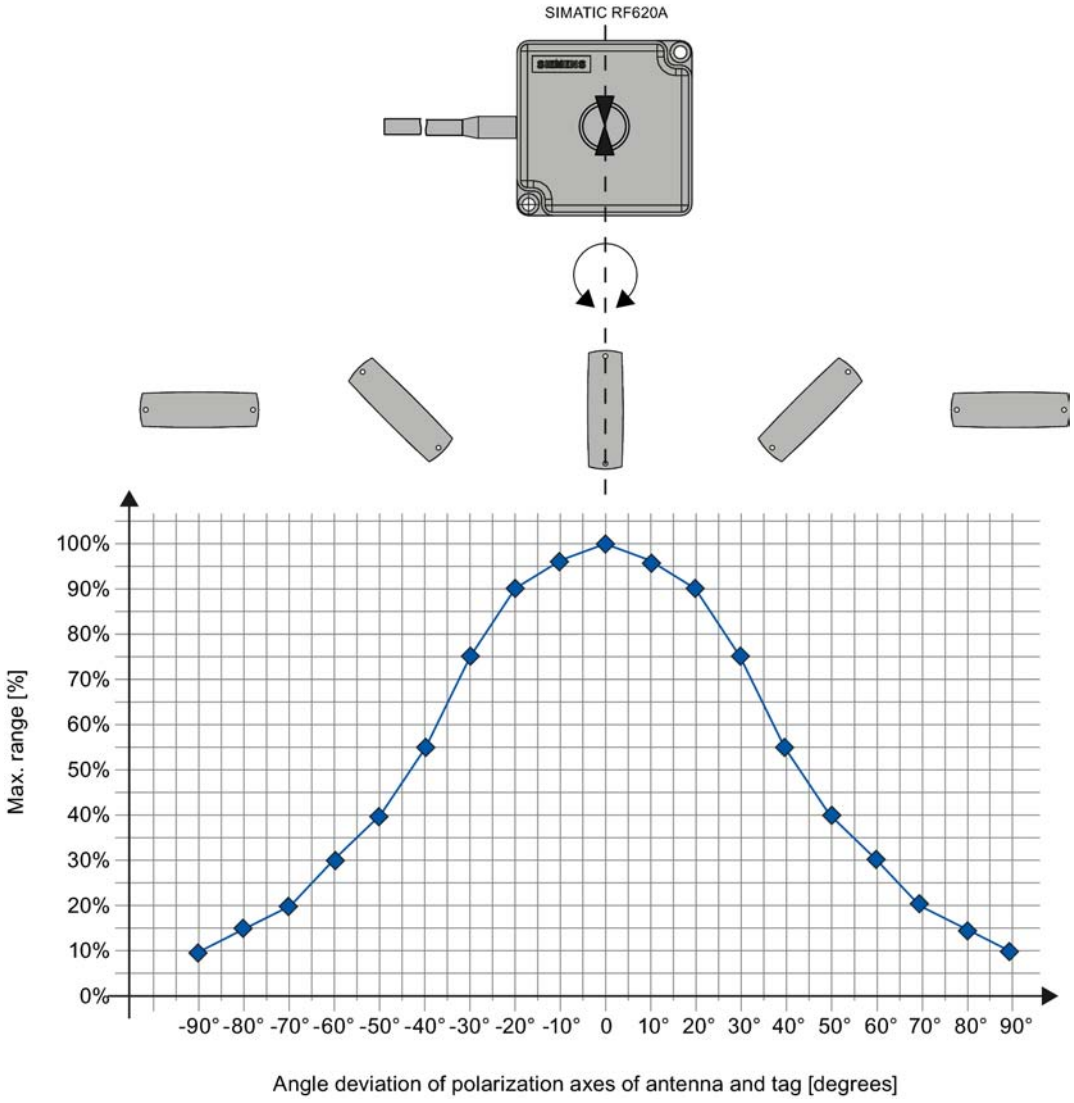


Figure 6-5 Angle deviation diagram for alignment

6.2.6 Parameterization of RF620A for RF660R

The procedure for parameterizing the RF620A antenna for the RF660R reader is described below. This is a special case which is not applicable to the other readers of the RF600 family.

ETSI antenna

The actual antenna gain for parameterization cannot be directly set.

The maximum range with the SIMATIC RF620A antenna can be achieved with the default values of 7 dBi antenna gain and 4 dB cable loss. With these settings the RF600 system complies with the applicable directives and standards.

Antenna cable	Order No.	Actual cable loss	Set cable loss
3 m	6GT2815-0BH30	1 dB	4 dB
10 m	6GT2815-1BN10	2 dB	4 dB
10 m	6GT2815-0BN10	4 dB	4 dB
20 m	6GT2815-0BN20	4 dB	4 dB

NOTICE
The actual cable loss and the set cable loss differ
The maximum range can only be achieved with a 3 m cable with 1 dB loss and setting 4 dB.

FCC antenna and parameterization

Make sure that the values for the actual cable loss are set correctly.

The maximum range with the SIMATIC RF620A antenna can only be achieved with the following settings. With these settings the RF600 system complies with the applicable directives and standards.

Antenna cable	Order No.	Actual cable loss	Set cable loss
3 m	6GT2815-0BH30	1 dB	1 dB
10 m	6GT2815-1BN10	2 dB	2 dB
10 m	6GT2815-0BN10	4 dB	4 dB
20 m	6GT2815-0BN20	4 dB	4 dB

6.2.7 Antenna patterns

6.2.7.1 Antenna pattern ETSI

Directional radiation pattern Europe (ETSI)

The directional radiation pattern is shown for nominal alignment and a center frequency of 866.3 MHz. The nominal antenna alignment is given when the antenna elevation is provided as shown in the following figure.

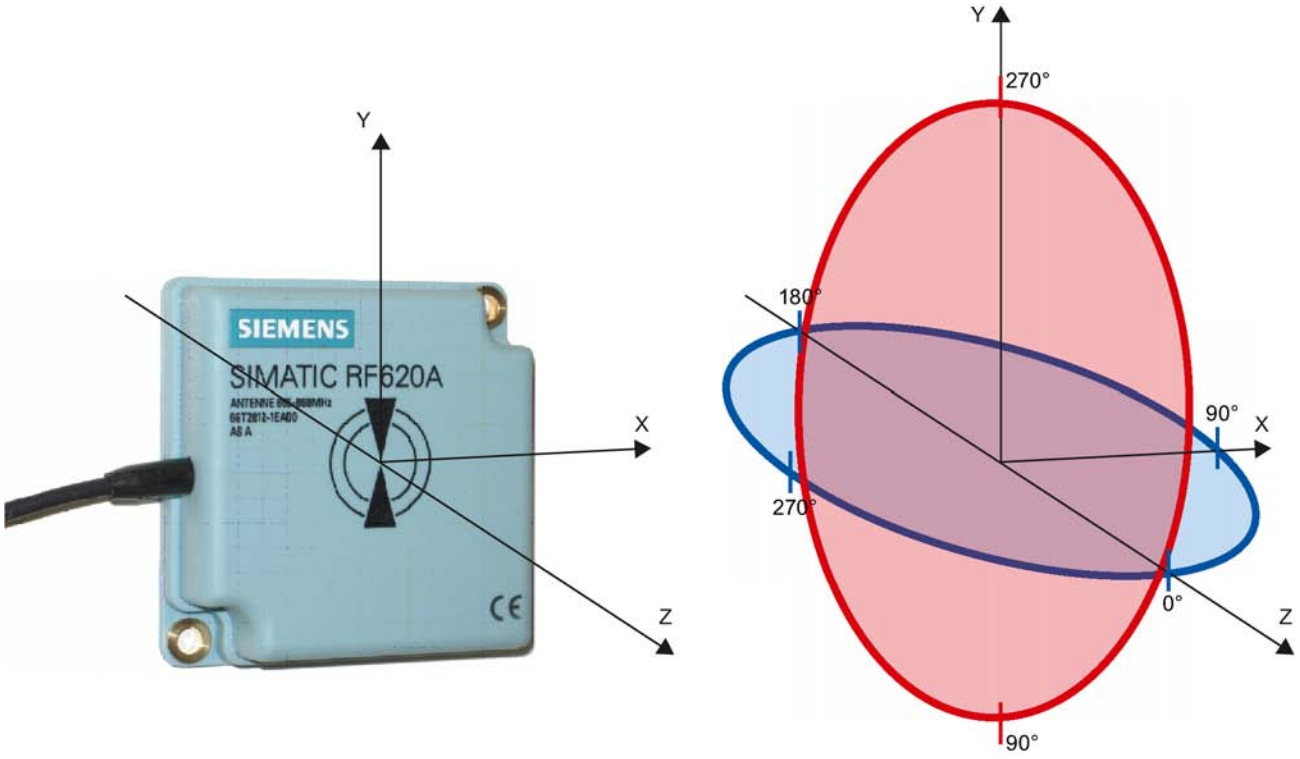


Figure 6-6 Reference system

The half-power beamwidth of the antenna is defined by the angle between the two -3 dB points. Which range (in %) corresponds to the dB values in the patterns can be obtained from this table (Page 168).

Note that the measurements presented graphically below were carried out in a low-reflection environment. Deviations can therefore occur in a normally reflecting environment.

Directional radiation pattern ETSI on metallic mounting surface (15 cm x 15 cm)

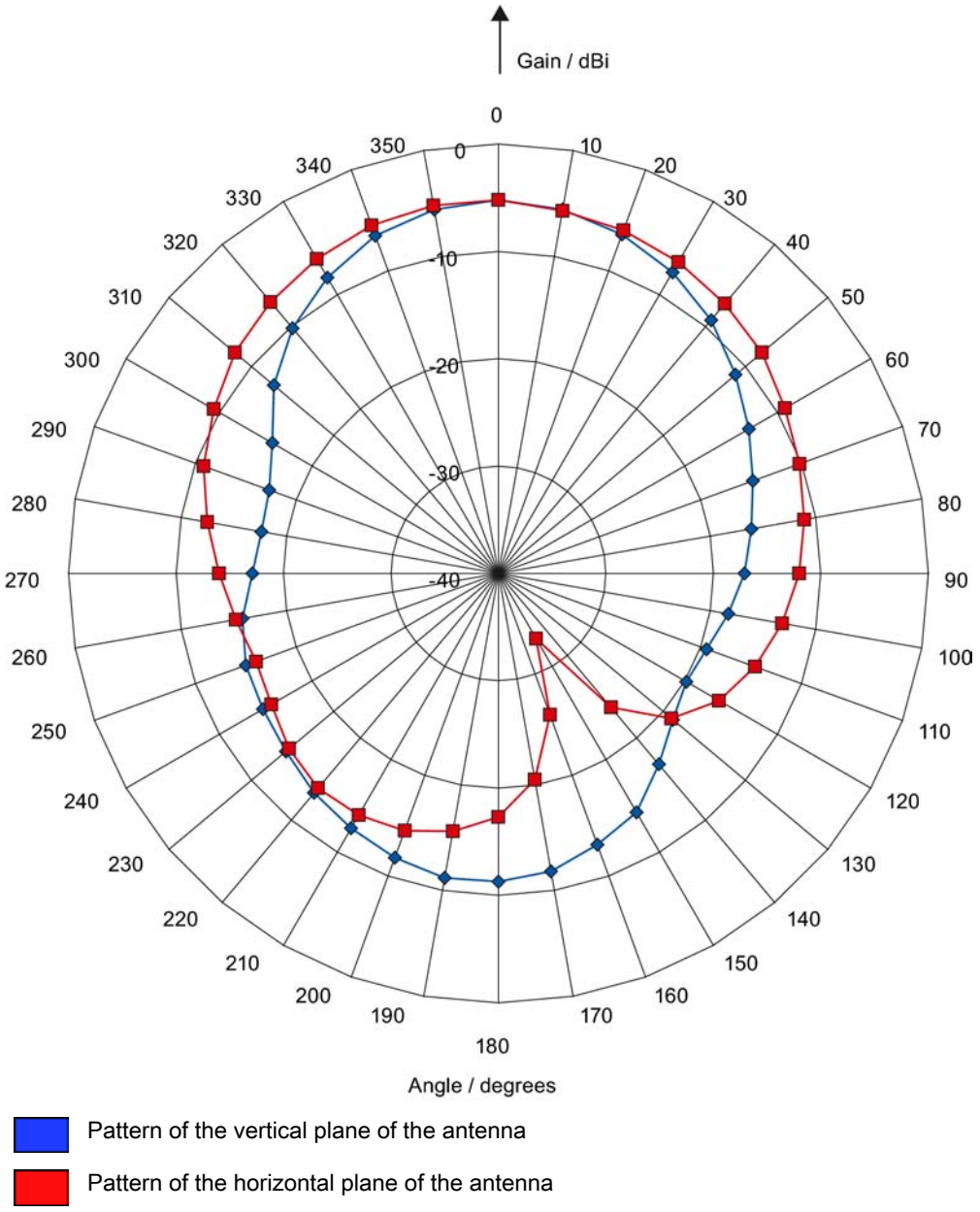


Figure 6-7 Directional radiation pattern RF620A ETSI on metallic mounting surface

Directional radiation pattern ETSI on non-metallic mounting surface

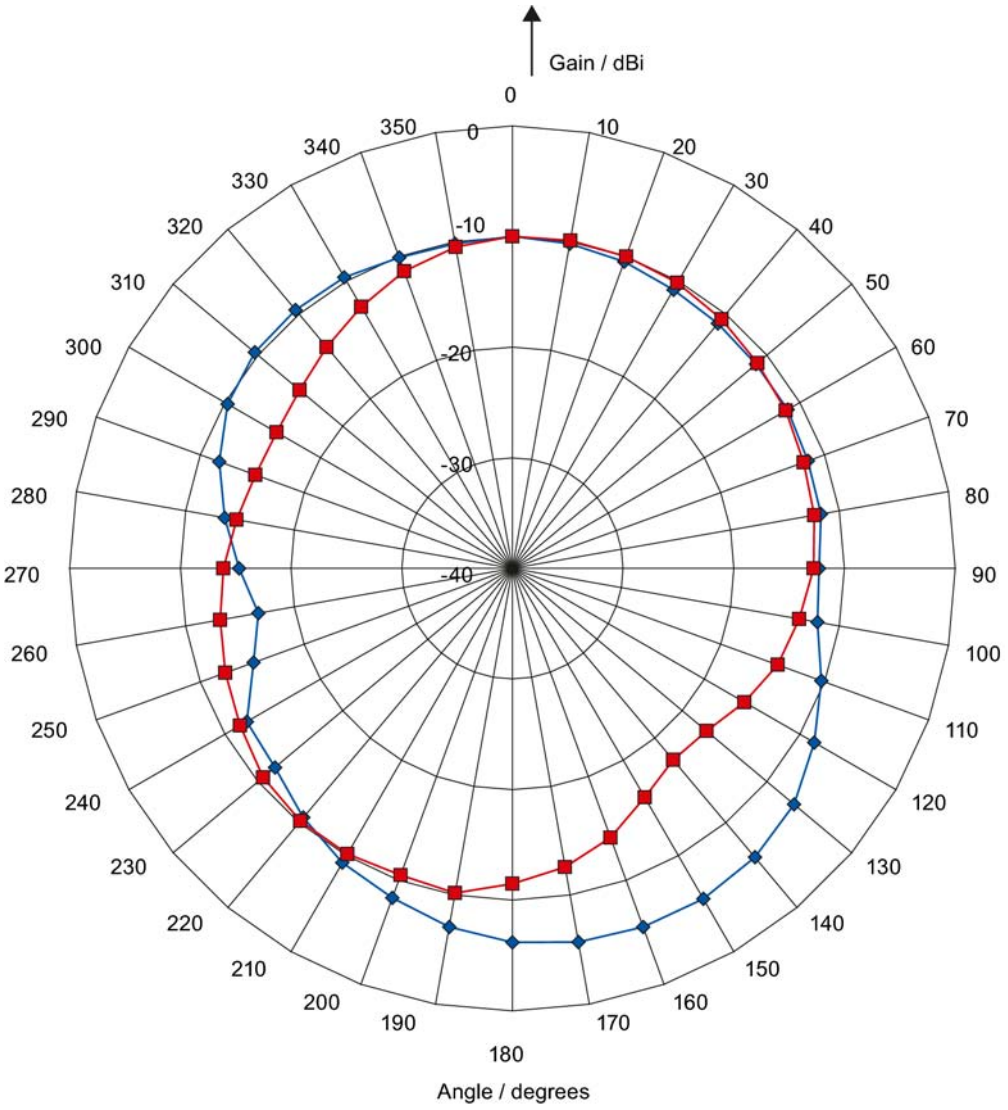


Figure 6-8 Directional radiation pattern RF620A ETSI on non-metallic mounting surface

6.2.7.2 Antenna pattern FCC

Directional radiation pattern USA (FCC)

The directional radiation pattern is shown for nominal alignment and a center frequency of 915 MHz.

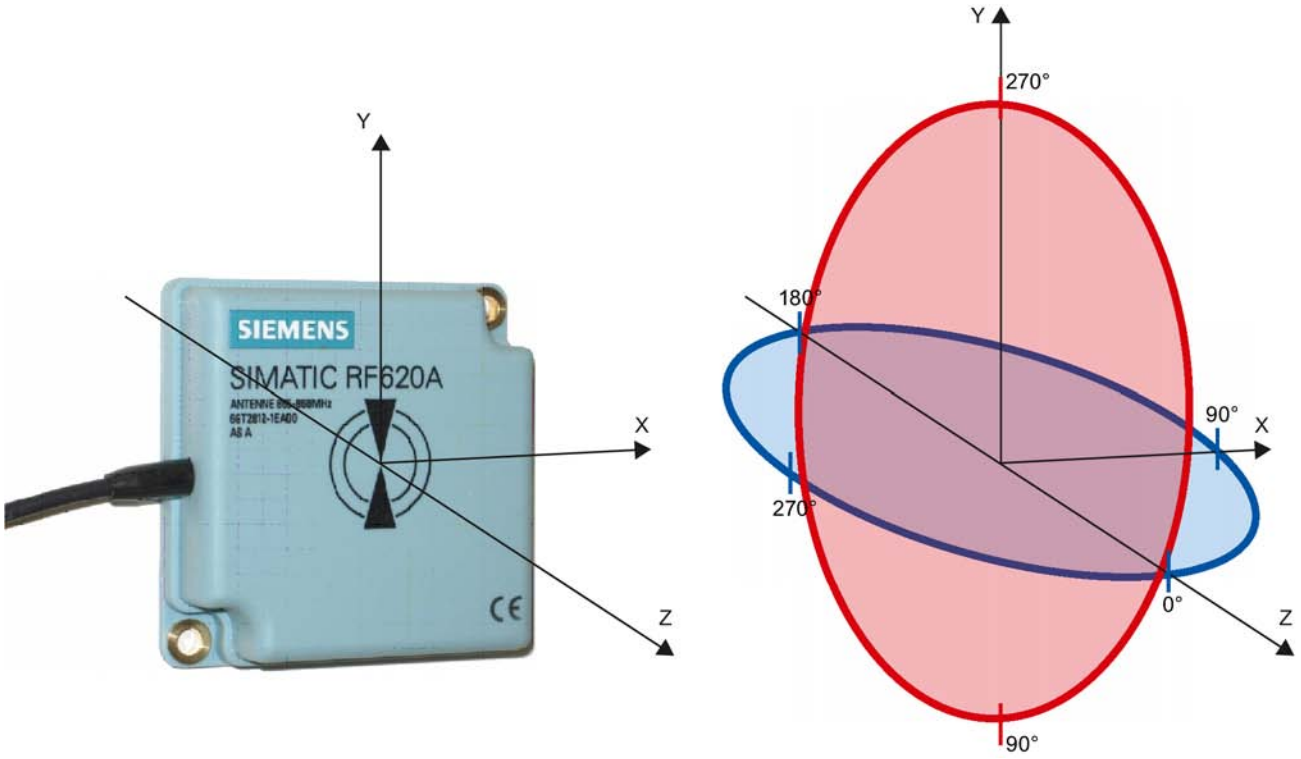


Figure 6-9 Reference system

The half-power beamwidth of the antenna is defined by the angle between the two -3 dB points (corresponding to half the power referred to the maximum power). Which range (in %) corresponds to the dB values in the patterns can be obtained from this table (Page 168).

Note that the measurements presented graphically below were carried out in a low-reflection environment. Low deviations can therefore occur in a normally reflecting environment.

Directional radiation pattern of the RF620A (FCC) on metallic mounting surface (15 cm x 15 cm)

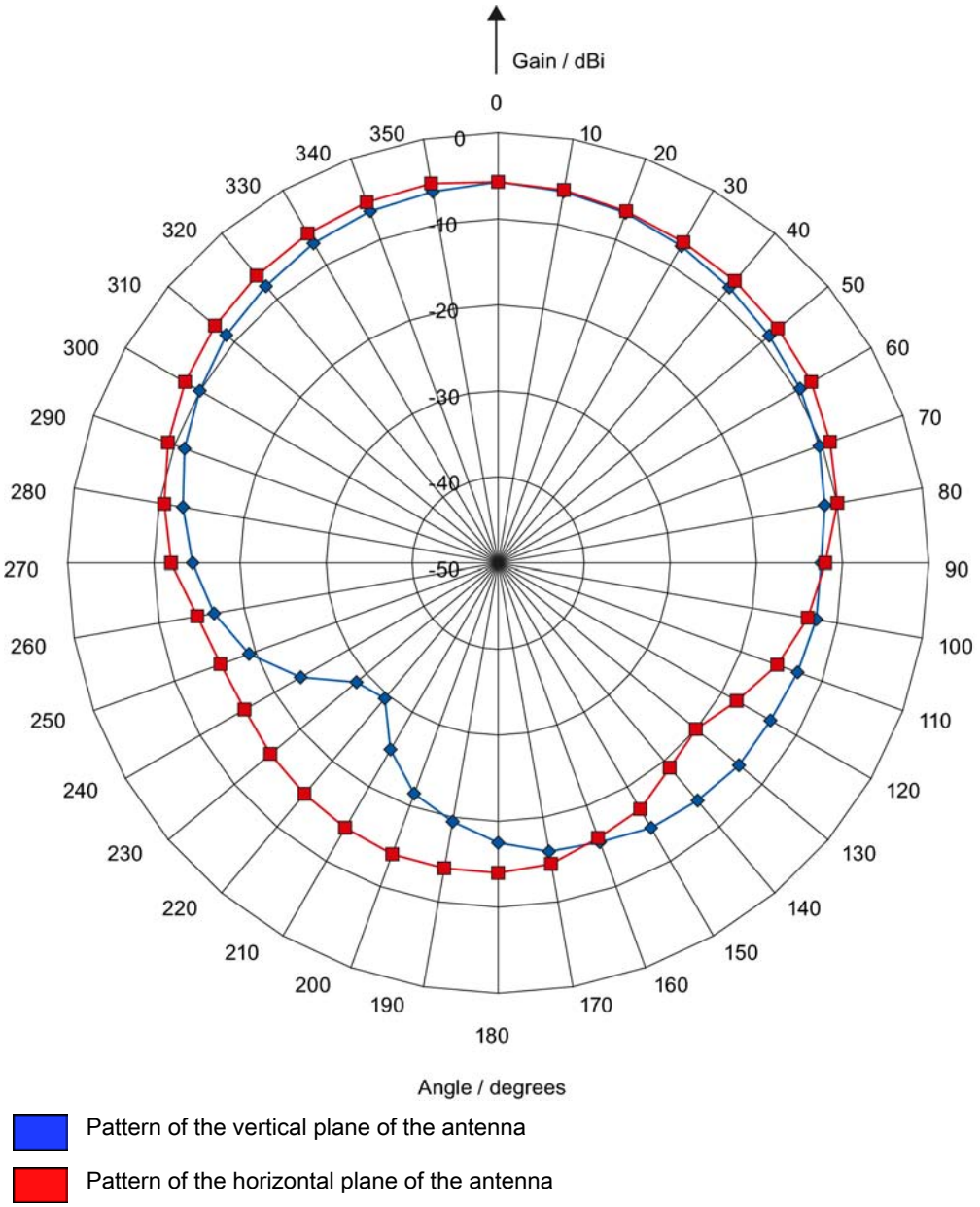


Figure 6-10 Directional radiation pattern of the RF620A (FCC) on metallic mounting surface

Directional radiation pattern of the RF620A (FCC) on non-metallic mounting surface

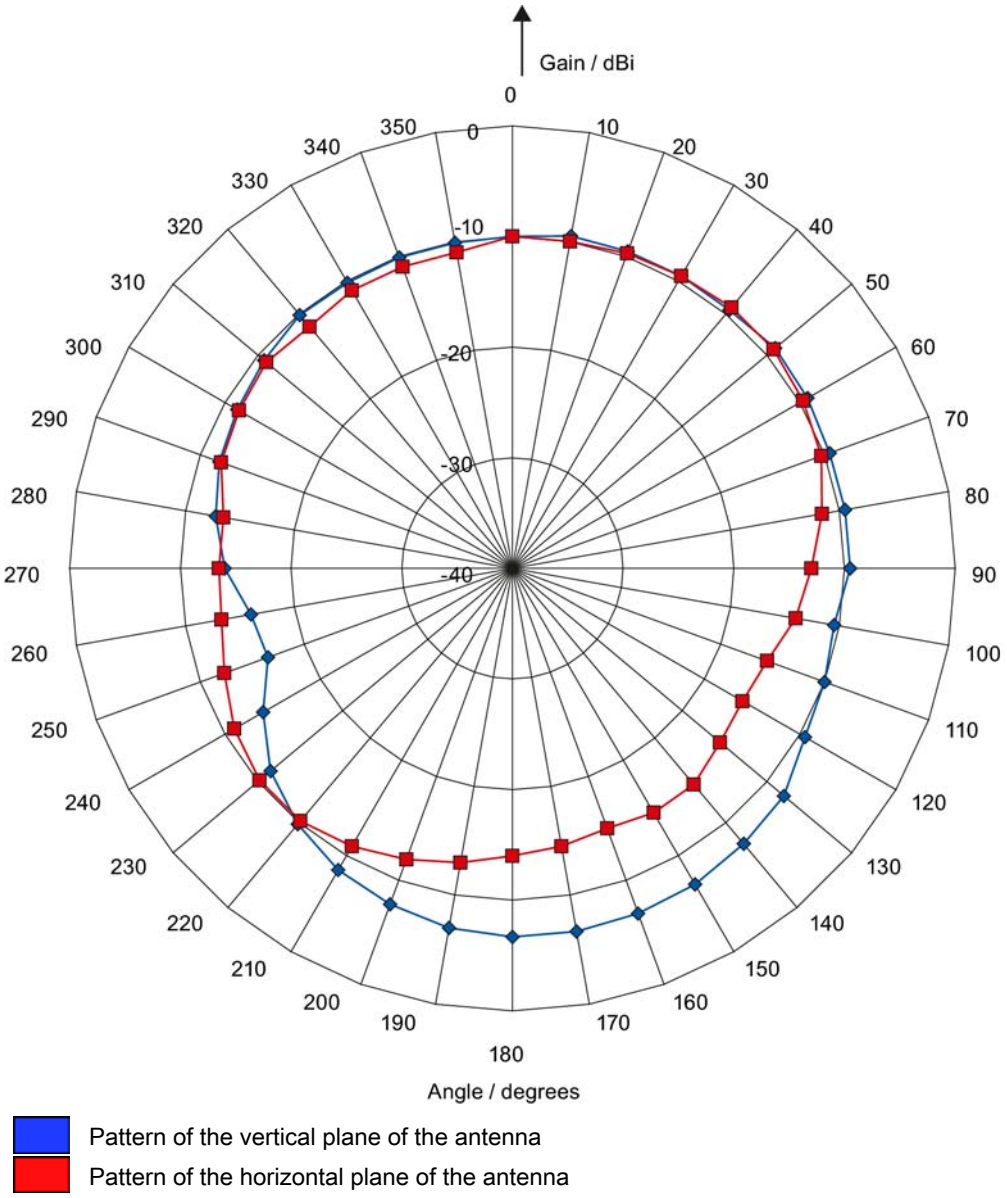


Figure 6-11 Directional radiation pattern of the RF620A (FCC) on non-metallic mounting surface

6.2.7.3 Interpretation of directional radiation patterns

The following overview table will help you with the interpretation of directional radiation patterns.

The table shows which dBi values correspond to which read/write ranges (in %): You can read the radiated power depending on the reference angle from the directional radiation patterns,

and thus obtain information on the read/write range with this reference angle with regard to a transponder.

The dBr values correspond to the difference between the maximum dBi value and a second dBi value.

Deviation from maximum antenna gain [dBr]	Read/write range [%]
0	100
-3	70
-6	50
-9	35
-12	25
-15	18
-18	13

Example

As one can see from the Antenna pattern ETSI (Page 163), the maximum antenna gain is -5 dBi. In the vertical plane, the antenna gain has dropped to approx. -11 dBi at +40° and 320°. Therefore the dBr value is -6. The antenna range is only 50% of the maximum range at ± 40° from the Z axis within the vertical plane (see values shown in blue in the directional radiation pattern: characteristic of the vertical plane of the antenna (Page 163) and the associated representation of the reference system (Page 163)).

6.2.8 Read/write ranges

The following tables show the typical read/write ranges of RF600 readers which are connected to the RF620A antenna via the 3 m antenna cable (1 dB loss) and various types of tags.

Note

Please note that tolerances of ±20% are admissible due to production and temperature conditions.

When using other antenna cables, the ranges listed here are reduced as a result of the higher antenna cable losses in the following manner:

Cable designation	Order No.	Length [m]	Cable loss [dB]	Read/write range [%]
Antenna cable	6GT2815-0BH30	3	1	100
Antenna cable	6GT2815-1BN10	10	2	90
Antenna cable	6GT2815-0BN10	10	4	70
Antenna cable	6GT2815-0BN20	20	4	70

The measuring tolerances in the following tables are ±3 cm.

Read distances RF630R

Table 6-3 Read distances RF630R

Transponder	Connection to RF630R			
	RF620A ETSI on metal [cm]	RF620A ETSI on non-metal [cm]	RF620A FCC on metal [cm]	RF620A FCC on non-metal [cm]
RF630L (6GT2810-2AB00, -2AB01, -2AB02)	90 [1]	70 [1]	60 [1]	50 [1]
RF630L (6GT2810-2AB03)	55	50	55	45
RF680L	55	50	55	45
RF610T	55	50	55	45
RF620T	55	45	70	60
RF630T	25 [2]	20 [2]	35 [2]	25 [2]
RF640T Gen 2	55 [2]	45 [2]	40 [2]	35 [2]
RF680T	60	50	90	70

[1] Transponder mounted on cardboard

[2] Transponder mounted on metal

Write distances RF630R

Table 6-4 Write distances RF630R

Transponder	Connection to RF630R			
	RF620A ETSI on metal [cm]	RF620A ETSI on non-metal [cm]	RF620A FCC on metal [cm]	RF620A FCC on non-metal [cm]
RF630L (6GT2810-2AB00, -2AB01, -2AB02)	45 [1]	40 [1]	35 [1]	30 [1]
RF630L (6GT2810-2AB03)	35	30	20	25
RF680L	35	30	20	25
RF610T	35	30	20	25
RF620T	30	30	40	35
RF630T	15 [2]	5 [2]	15 [2]	10 [2]
RF640T Gen 2	35 [2]	20 [2]	20 [2]	15 [2]
RF680T	40	30	40	35

[1] Transponder mounted on cardboard

[2] Transponder mounted on metal

Reading ranges for RF670R @@@ insert values

Table 6-5 Reading ranges for RF670R

Transponder	Connection to RF670R			
	RF620A ETSI on metal [cm]	RF620A ETSI on non-metal [cm]	RF620A FCC on metal [cm]	RF620A on non-metal [cm]
RF630L (6GT2810-2AB00, -2AB01, -2AB02)				
RF630L (6GT2810-2AB03)				
RF680L				
RF610T				
RF620T				
RF630T				
RF640T				
RF640T Gen 2				
RF680T				

1) Transponder mounted on cardboard

2) Transponder mounted on metal

Writing ranges for RF670R @@@ insert values

Table 6-6 Writing ranges for RF670R

Transponder	Connection to RF670R			
	RF620A ETSI on metal	RF620A ETSI on non-metal	RF620A FCC on metal	RF620A on non-metal
RF630L (6GT2810-2AB00, -2AB01, -2AB02)				
RF630L (6GT2810-2AB03)				
RF680L				
RF610T				
RF620T				
RF630T				
RF640T				
RF640T Gen 2				
RF680T				

1) Transponder mounted on cardboard

2) Transponder mounted on metal

Read distances RF660R

Table 6-7 Read distances RF660R

Transponder	Connection to RF660R			
	RF620A ETSI on metal [cm]	RF620A ETSI on non-metal [cm]	RF620A FCC on metal [cm]	RF620A on non-metal [cm]
RF630L (6GT2810-2AB00, -2AB01, -2AB02)	135 [1]	120 [1]	100 [1]	90 [1]
RF630L (6GT2810-2AB03)	85	70	75	65
RF680L	85	70	75	65
RF610T	85	70	75	65
RF620T	85	85	95	95
RF630T	40 [2]	35 [2]	50 [2]	35 [2]
RF640T	40 [2]	35 [2]	40 [2]	30 [2]
RF640T Gen 2	90 [2]	70 [2]	70 [2]	50 [2]
RF680T	90	90	135	95

[1] Transponder mounted on cardboard

[2] Transponder mounted on metal

Write distances RF660R

Table 6-8 Write distances RF660R

Transponder	Connection to RF660R			
	RF620A ETSI on metal	RF620A ETSI on non-metal	RF620A FCC on metal	RF620A on non-metal
RF630L (6GT2810-2AB00, -2AB01, -2AB02)	110 [1]	90 [1]	55 [1]	50 [1]
RF630L (6GT2810-2AB03)	75	70	60	55
RF680L	75	70	60	55
RF610T	75	70	60	55
RF620T	60	55	60	45
RF630T	30 [2]	25 [2]	35 [2]	25 [2]
RF640T	35 [2]	30 [2]	25 [2]	25 [2]
RF640T Gen 2	70 [2]	60 [2]	50 [2]	40 [2]
RF680T	80	75	100	80

[1] Transponder mounted on cardboard

[2] Transponder mounted on metal

6.2.9 Technical data

Table 6-9 General technical data RF620A

Feature	SIMATIC RF620A ETSI	SIMATIC RF620A FCC
Dimensions in mm (L x W x H)	75 x 75 x 20	
Color	Pastel turquoise	
Material	PA 12 (polyamide 12)	
	Silicone-free	
Frequency band	865 to 868 MHz	902 to 928 MHz
Plug connection	30 cm coaxial cable with RTNC coupling (for connection of antenna cable)	
Max. radiated power	< 500 mW ERP	No limitation (since antenna gain ≪ 6 dBi)
Max. power	2 W	1 W
Impedance	50 Ohm	
Antenna gain	-10 dBi ... -5 dBi	
	Depends on background, see Chapter Directional radiation pattern ETSI (Page 163)	Depends on background, see Chapter Directional radiation pattern FCC (Page 166)
VSWR (standing wave ratio)	Max. 2:1	
Polarization	Linear	
Beam angle for sending/ receiving • When mounted on a metal surface of 15 cm x 15 cm [1)]	• Horizontal plane: 100° • Vertical plane: 75° See Chapter Antenna pattern ETSI (Page 163)	• Horizontal plane: 130° • Vertical plane: 105° See Chapter Directional Characteristic for FCC (Page 166).
Shock resistant to EN 60068-2-27	50 g	
Vibration resistant to EN 60068-2-6	20 g	
Attachment of the antenna	2 x M5 screws	
Tightening torque (at room temperature)	≤ 2 Nm	
Ambient temperature		
• Operation	• -20 °C to +70 °C	
• Transport and storage	• -40 °C to +85 °C	
Degree of protection according to EN 60529	IP67	
Weight, approx.	90 g	

[1)] The values differ for different dimensions/materials of the mounting surface.

6.2.10 Dimension drawing

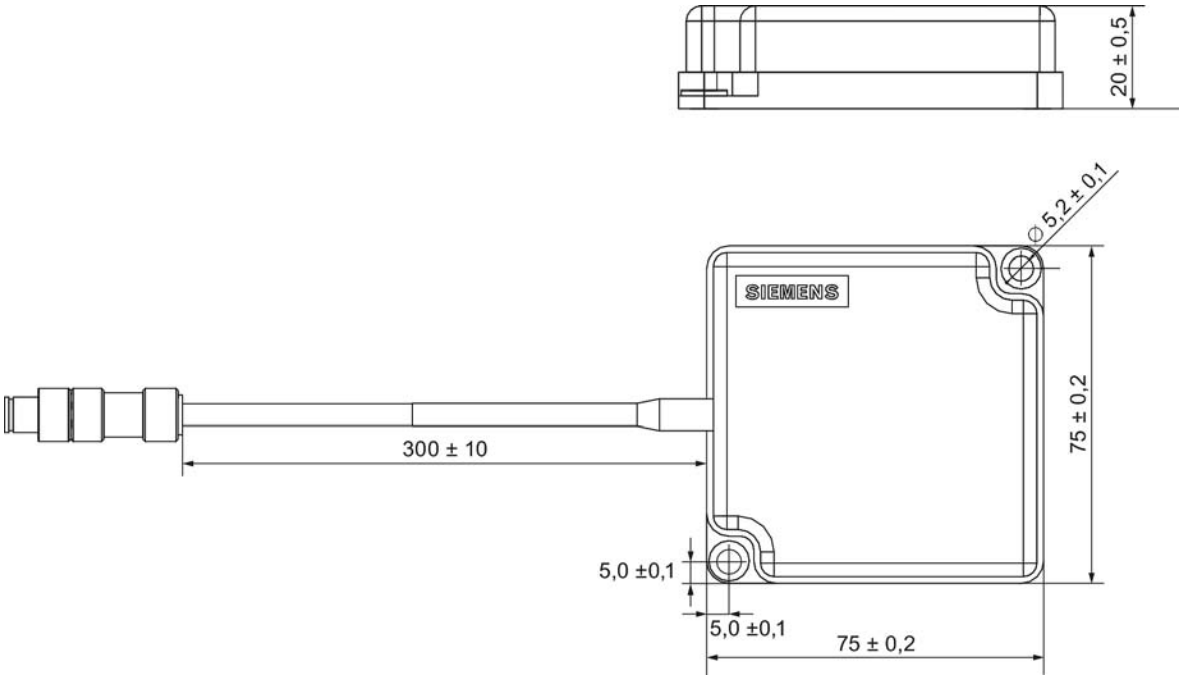


Figure 6-12 Dimension drawing RF620A

All dimensions in mm

6.2.11 Approvals & certificates

6.2.11.1 CE mark

Table 6-10 6GT2812-1EA00

Certificate	Designation
CE	Conformity in accordance with R&TTE directive in association with the readers and accessories used

6.2.11.2 FCC approvals

Table 6-11 6GT2812-1EA01

Standard	
FC Federal Communications Commission	FCC CFR 47, Part 15 sections 15.247 Radio Frequency Interference Statement This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. The FCC approval is granted in association with the FCC approval of the following RF600 readers: • FCC ID: NXW-RF630R • FCC ID: NXW-RF660
Industry Canada Radio Standards Specifications	RSS-210 Issue 7, June 2007, Sections 2.2, A8 The approval for Industry Canada is granted in association with the Industry Canada approval of the following RF600 readers: • IC: 267X-RF630 • IC: 267X-RF660
c UL us	This product is UL-certified for the USA and Canada. It meets the following safety standard(s): UL 60950-1 - Information Technology Equipment Safety - Part 1: General Requirements CSA C22.2 No. 60950 -1 - Safety of Information Technology Equipment UL Report E 205089

6.3 RF660A antenna

6.3.1 RF660A description

The RF660A is a stationary antenna, specially designed for RF600 systems.

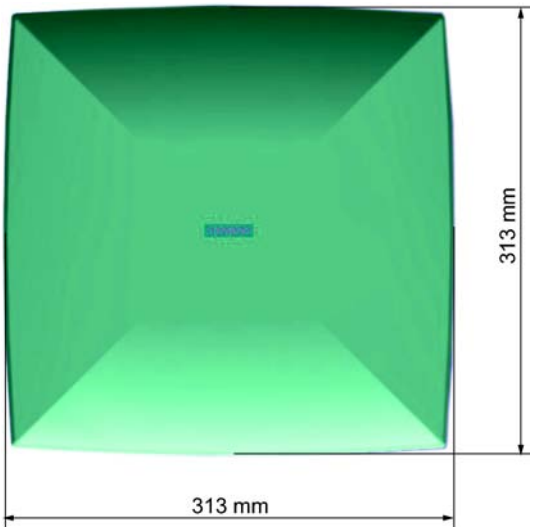
The antenna is available in two different frequency bands that have been specified for the regions of Europe, China and USA respectively.

Frequency band

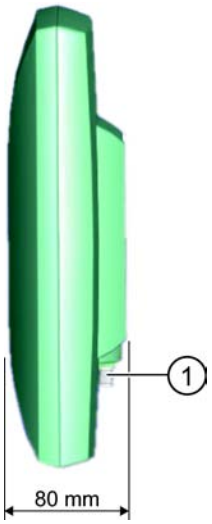
- The antenna for Europe operates in the frequency band of 865 to 868 MHz.
- The antenna for China and the USA operates in the frequency band of 902 to 928 MHz.

Design of the RF660A

The antenna is installed in a rectangular plastic housing.



Front view



Side view

① RTNC connection

Ordering data

Description	Machine-Readable Product Code
RF660A antenna for Europe incl. mounting plate (865-868)	6GT2812-0AA00
RF660A antenna for China and the USA incl. mounting plate (902-928)	6GT2812-0AA01

Ordering data (accessories)

Description		Machine-Readable Product Code
Antenna mounting kit		6GT2890-0AA00
Connecting cable between reader and antenna	3 m (1 dB cable attenuation)	6GT2815-0BH30
	10 m (2 dB cable attenuation)	6GT2815-1BN10
	10 m (4 dB cable attenuation)	6GT2815-0AN10
	20 m (4 dB cable attenuation)	6GT2815-0AN20

6.3.2 Antenna pattern

Spatial directional radiation pattern

The following schematic diagram shows the main and auxiliary fields of the RF660A antenna in free space in the absence of reflecting/absorbing materials. Please note that the diagram is not to scale.

The recommended working range lies within the main field that is shown in green.

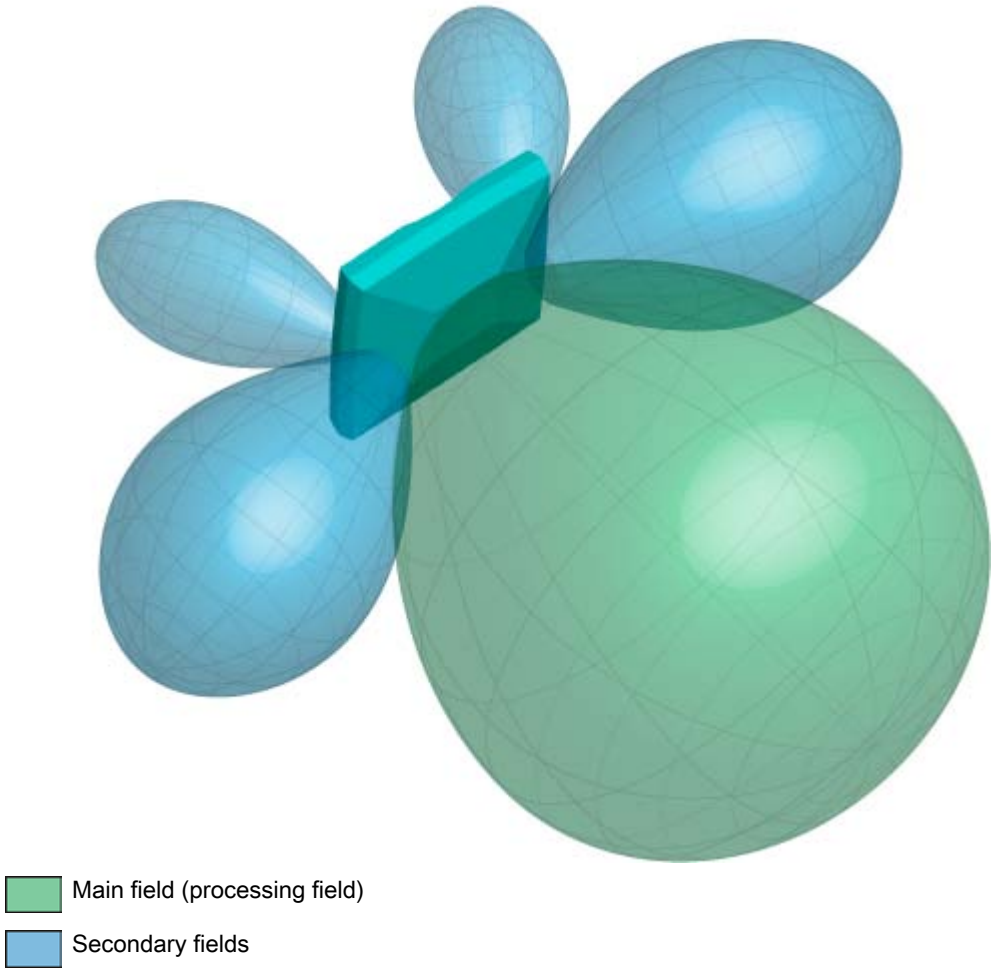


Figure 6-13 Main and auxiliary fields of the RF660A antenna

Radiation diagram (horizontal)

Europe (ETSI)

The radiation diagram is shown for horizontal alignment and for a center frequency of 865 MHz. Horizontal antenna alignment is provided when the TNC connection on the antenna points vertically up or down.

The radiating/receiving angle of the antenna is defined by the angle between the two -3 dB points (corresponding to half the power referred to the maximum performance at a 0° angle).

The optimum radiating/receiving angle is therefore approximately ±30 degrees.

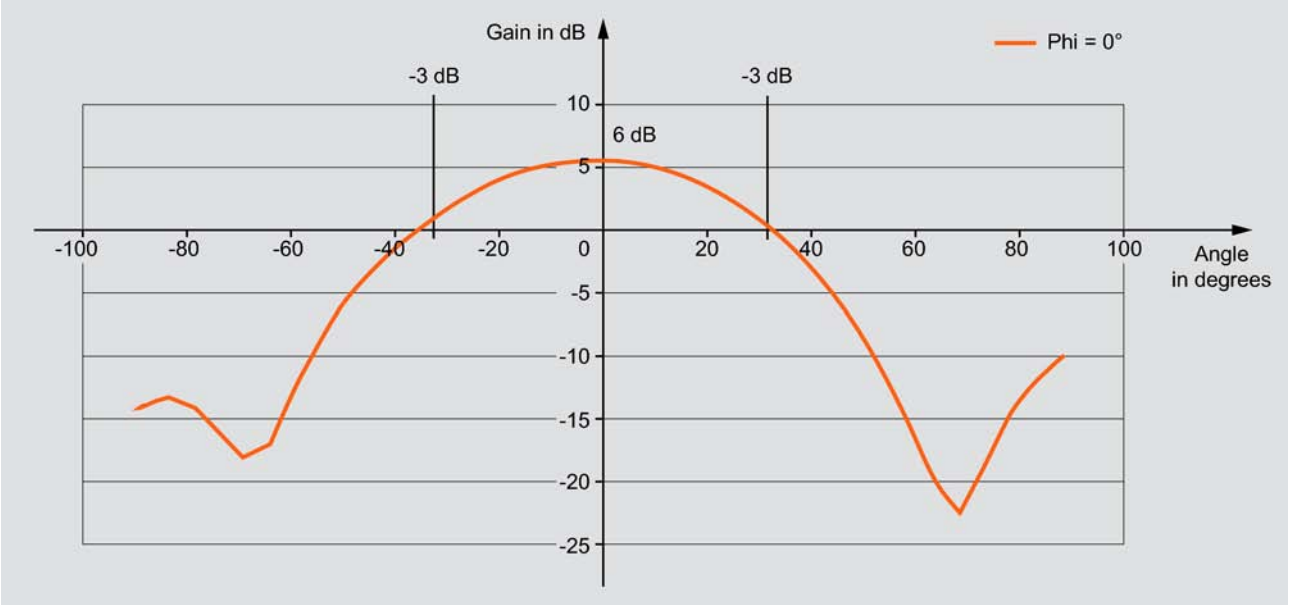


Figure 6-14 Directional radiation pattern of the antenna (at 865 MHz, horizontal alignment)

USA (FCC)

The radiation diagram is shown for horizontal alignment and for a center frequency of 915 MHz.

The radiating/receiving angle of the antenna is defined by the angle between the two -3 dB points (corresponding to half the power referred to the maximum performance at a 0° angle).

The optimum radiating/receiving angle is therefore approximately ±35 degrees.

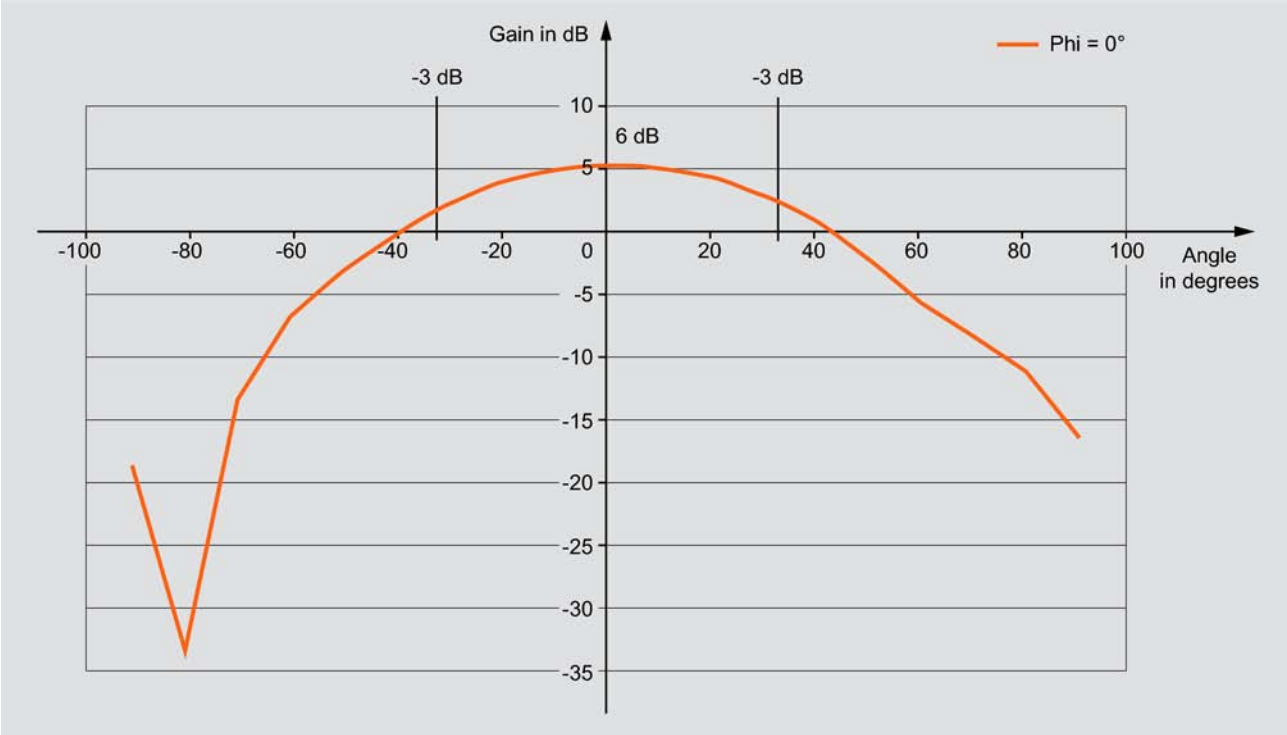


Figure 6-15 Directional radiation pattern of the antenna (at 915 MHz, horizontal alignment)

6.3.3 Interpretation of directional radiation patterns

The following overview table will help you with the interpretation of directional radiation patterns.

The table shows which dBi values correspond to which read/write ranges (in %): You can read the radiated power depending on the reference angle from the directional radiation patterns, and thus obtain information on the read/write range with this reference angle with regard to a transponder.

The dBr values correspond to the difference between the maximum dBi value and a second dBi value.

Deviation from maximum antenna gain [dBr]	Read/write range [%]
0	100
-3	70
-6	50
-9	35
-12	25
-15	18
-18	13

Example

As one can see from the section Antenna pattern (Page 177), the maximum antenna gain is 6 dBi. In the vertical plane, the antenna gain has dropped to approx. 3 dBi at +30°. Therefore the dBr value is -3. The antenna range is only 50% of the maximum range at ± 30° from the Z axis within the vertical plane.

6.3.4 Installation and assembly

The RF660A antenna can be fixed to any firm support.

More information on the types of antenna fixing can be found in section Mounting types (Page 200).

6.3.5 Connecting an antenna to a reader

NOTICE
Use of Siemens antenna cable To ensure optimum functioning of the antenna, it is urgently recommended that a Siemens antenna cable is used in accordance with the list of accessories.

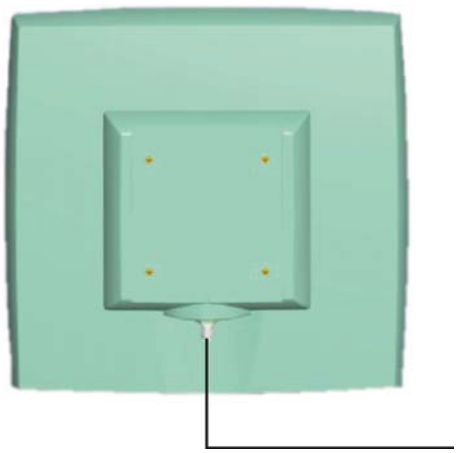


Figure 6-16 Rear of antenna with RTNC connection

Connecting RF660A to RF670R/RF660R

Preassembled standard cables in lengths of 3 m, 10 m and 20 m are available for connection.

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

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

Connecting RF660A to RF630R

Preassembled standard cables in lengths of 3 m, 10 m and 20 m are available for connection.

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

When one antenna is used, it is recommended that the remaining antenna connection is sealed using the supplied protective cap.

6.3.6 Technical specifications

	RF660A antenna 865-868	RF660A antenna 902-928
Material	Silicone-free	Silicone-free
Frequency band	865-868 MHz	902-928 MHz
Impedance	50 Ohm nominal	50 Ohm nominal
Antenna gain	5-7 dBil	> 6 dBic
VSWR (standing wave ratio)	2:1 max.	2:1 max.
Polarization	RH circular	RH circular
Radiating/receiving angle	55°- 60°	60° - 75°
Connector	RTNC	RTNC
Degree of protection	IP67	IP67
Permissible ambient temperature	-25° C to +75° C	-25° C to +75° C

6.4 Guidelines for selecting RFID UHF antennas

6.4.1 Note safety information

⚠ WARNING

Before planning how to use third-party components, as the operator of a system that comprises both RF600 components and third-party components, you must comply with the safety information in Section Safety instructions for third-party antennas as well as for modifications to the RF600 system (Page 16).

6.4.2 Preconditions for selecting RFID UHF antennas

Target group

This chapter has been prepared for configuration engineers who thoroughly understand and wish to carry out the selection and installation of an external antenna or an external cable for the SIMATIC RF600 system. The various antenna and cable parameters are explained, and information is provided on the criteria you must particularly observe. Otherwise this chapter is equally suitable for theoretical and practice-oriented users.

Purpose of this chapter

This chapter enables you to select the appropriate external antenna or cable with consideration of all important criteria and to carry out the corresponding settings in the configuration software of the SIMATIC RF600 system. Correct and safe integration into the SIMATIC RF600 system is only possible following adaptation of all required parameters.

History

Edition	Comment
12/2007	First edition

6.4.3 General application planning

6.4.3.1 Overview of the total SIMATIC RF600 system and its influencing factors

The following graphic shows the design of the total SIMATIC RF600 system and the factors which have an influence on the total system.

You must be aware of these influencing factors and also consider them if you wish to integrate third-party components such as antennas or cables into the system. These influencing factors are described in more detail in Sections Antennas (Page 185) and Antenna cables (Page 196).

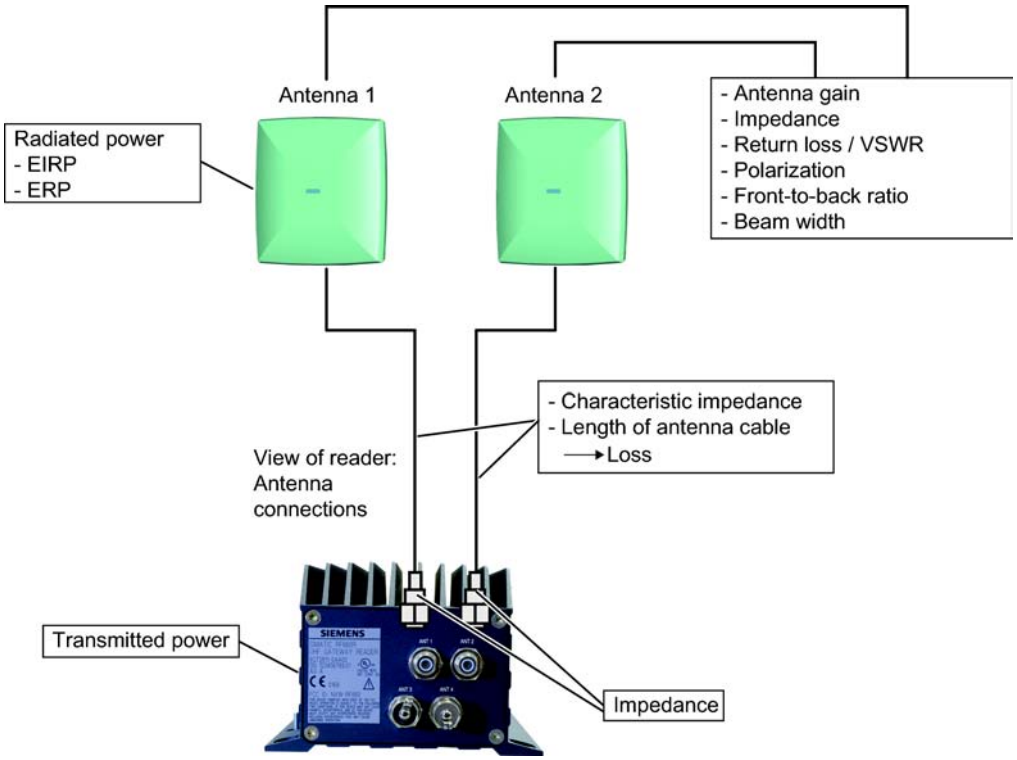


Figure 6-17 Overview of total system and influencing factors

When operating the RF600 system, additional influencing factors must also be observed such as minimum spacing between antennas in the room. You will find this information in the System Manual "SIMATIC RF600".

6.4.3.2 Environmental conditions

CAUTION
Damage to the device In line with the application, you must take into consideration the mechanical loads (shock and vibration) as well as environmental demands such as temperature, moisture, UV radiation. The device could be damaged if these factors are not considered.

6.4.3.3 General procedure

Depending on whether you wish to use a third-party antenna or antenna cable - or both - in combination with the SIMATIC RF660R reader, these instructions will help you to select the components and to set the important parameters in the SIMATIC RF660R configuration software.

There are two different application cases:

- Selection of third-party components:
  you wish to select appropriate third-party components for the SIMATIC RF600 system and to subsequently configure the reader for these components.
- Configuration of existing third-party components:
  you already have third-party components (antenna, antenna cable or both) and wish to appropriately configure the reader for these components.

Procedure for selecting third-party components

Always proceed in the following order during your considerations and the practical implementation:

1. Consider which third-party components you wish to use in the SIMATIC RF600 system.
2. Depending on the third-party component required, refer either to Section Antennas (Page 185) or Section Antenna cables (Page 196) for the important criteria for selection of your components. The selection criteria/parameters are sorted in descending relevance.
3. Use the specified equations to calculate your missing parameters, and check whether the required values are reached (e.g. antenna gain) and that important secondary values (e.g. cable loss) are not exceeded or undershot.
4. Configure the reader with the parameters of your third-party components. You can usually carry this out in the SIMATIC RF660R configuration software. The exact procedure is described in Section .
5. For advanced users or in exceptional cases, e.g. input of an antenna gain <4.0 dBi), it is recommendable to carry out the configuration directly using XML commands. For further information, refer to Section .

Procedure for configuration of existing third-party components

If you already have third-party components which you wish to integrate into the SIMATIC RF600 system, proceed as follows:

1. Depending on the third-party component, refer either to Section "Antennas" or Section "Antenna cables" for the important criteria of your components. The parameters are sorted in descending relevance.
2. Compare the limits with the data of your antenna or cable vendor.
3. Subsequently proceed exactly as described above in "Procedure for selecting third-party components" from Paragraph 3. onwards.

6.4.4 Antennas

6.4.4.1 Types of antenna and properties

Basically all types of directional antennas can be considered as third-party antennas for integration into the SIMATIC RF600 system. Directional antennas have a preferred direction in which more energy is radiated than in other directions.

6.4.4.2 Antenna parameters

Overview

The properties of an antenna are determined by a large number of parameters. You must be aware of these properties in order to make the correct selection for your appropriate UHF antenna. The most important parameters are described below. These important parameters are described in detail in the following sections. The following parameters describe both the send and receive functions of the antenna (reciprocity). The antenna is a passive antenna. A two-way relationship exists.

- Radiated power
- Antenna gain
- Impedance
- Return loss / VSWR
- Power rating
- Polarization
- Front-to-back ratio
- Beam width

Radiated power

In order to comply with national directives with regard to the radiated power (which differ depending on the location or country of use), the RF660R reader together with the antenna cable(s) and antenna(s) must be exactly parameterized or configured.

This means that the product of the transmitted power P_0 of the reader and the antenna gain G must always have the correct ratio with regard to the radiated power "EIRP" depending on the location of use or the permissible frequency band.

Calculation of the radiated power is briefly described below.

Calculation of the radiated power

The radiated power is the total power radiated by the antenna in the room. The isotropic radiator serves as the physical computing model which uniformly radiates the power into the room (spherically).

EIRP

Directional antennas combine the radiation, and therefore have a higher power density in the main beam direction compared to an isotropic radiator. To enable antennas of different design or Directional characteristic to be compared with one another, the equivalent isotropic radiated power (EIRP) has been introduced which represents the effective power which must be applied to an isotropic radiator in order to deliver the same power density in the main beam direction of the antenna.

EIRP is the product of the transmitted power P_0 and the antenna gain G:

$EIRP = P_0 * G$

ERP

Also common is specification of the equivalent radiated power referred to the half-wave dipole "ERP" (effective radiated power):

$$ERP = P_0 * G_d = P_0 * \frac{G}{1,64}$$

Logarithmic and standardized data

Approximate calculations are easier to carry out as additions than as products, therefore the logarithms are taken for the above equations and the power data standardized to 1 mW and specified in decibels (dBm or dBi).

$$\frac{EIRP}{dBm} = \frac{P_0}{dBm} + \frac{G}{dBi}$$

Calculation of the radiated power with consideration of the cable loss a_k

If the transmitted power is not applied directly but via a cable with loss a_K, this loss should be compensated such that the same radiated power is obtained.

$$\frac{EIRP}{dBm} = \frac{P_0}{dBm} + \frac{G}{dBi} - \frac{a_k}{dB} \text{ if } \quad a_k > 0$$

If the loss is not appropriately compensated, the radiated power is too small.

General preliminary information on the unit "dB"

Requirements

This section provides you with information on the unit "decibel". This knowledge is a requirement for optimum understanding of the following section. You can ignore this section if you already have the appropriate knowledge.

Definition

When specifying decibels, the ratios between powers or voltages are not defined directly but as logarithms. The decibel is therefore not a true unit but rather the information that the specified numerical value is the decimal logarithm of a ratio of two power or energy variables P1 and P2 of the same type.

This ratio is defined by the following equation:

$$a = 10 * \log_{10}\left(\frac{P_1}{P_2}\right) dB$$

Example:

If P1 = 200 W and P2 = 100 mW, how large is the ratio a in dB?

$$a = 10 * \log_{10}\left(\frac{P_1}{P_2}\right) dB =$$

$$= 10 * \log_{10}(2000) dB =$$

$$= 33{,}01 \text{ dB}$$

Use with other units

As with other units, there are also different versions of the unit for decibel depending on the reference variable. With this reference, the logarithmic power ratio becomes an absolute variable. The following table lists the most important combinations in this context with other units:

Versions of decibel	Description
0 dBm	Power level with the reference variable 1 mW.
dBi	Power level with the reference variable on the isotropic spherical radiator (see also Section Antenna gain (Page 187)).

Antenna gain

Definition

The antenna gain specifies the degree to which the antenna outputs or receives its power in the preferred angle segment.

With this theoretical variable, a comparison is always made with an isotropic spherical radiator, a loss-free antenna which does not exist in reality. It describes how much power has to be added to the isotropic spherical radiator so that it outputs the same radiated power in the preferred direction like the antenna to be considered. The unit for the antenna gain is therefore specified in dBi (dB isotropic).

The antenna gain is defined for the receive case as the ratio between the power received in the main beam direction and the received power of the isotropic spherical radiator.

Specifications

You must know the antenna gain in the corresponding frequency band or range. You can obtain the value of the antenna gain from the technical specifications of your antenna vendor.

- With a cable loss of 4 dB, a gain $\geq$ 6 dBi(L) is required since otherwise the maximum radiated power will not be achieved.
- In the case of antennas used in the FCC area of approval, a gain of at least 6 dBi(L) is required since otherwise the permissible radiated power of 4 W EIRP will not be reached.
- If the gain is > 6 dBi(L)*, the difference is compensated in accordance with the directives by reducing the transmitted power.

* (L) is the reference to the linear polarization.

Dependencies

- Frequency dependency:
  if a frequency dependency exists in the frequency band used, you must apply the highest value in each case for the antenna gain. With the cable loss, on the other hand, you must select the smallest value in each case it frequency dependency exists.
  This procedure means that the permissible radiated power will not be exceeded in the extreme case.
- Dependency on the plane
  If the data for the antenna gain are different in the horizontal and vertical planes, you must use the higher value in each case.

Impedance

Definition

Impedance is understood as the frequency-dependent resistance. The impedances of the antenna, reader and antenna cables should always be the same. Differences in the impedance result in mismatching which in turn means that part of the applied signal is reflected again and that the antenna is not fed with the optimum power.

Specifications

- Only antennas can be used whose connection has a characteristic impedance of Z = 50 Ohm.
- The mechanical design of the coaxial antenna connection is of secondary importance; N, TNC and SMA plug connectors are usual.

Return loss / VSWR

Definition

Since the impedance at the antenna connection is frequency-dependent, mismatching automatically occurs with broadband use. This mismatching can be reflected by two parameters:

- The voltage standing wave ratio VSWR
- The return loss

Voltage standing wave ratio VSWR

The power sent by the transmitter cannot flow unhindered to the antenna and be radiated as a result of the mismatching described by the VSWR. Part of the power is reflected at the antenna and returns to the transmitter. The powers in the forward and reverse directions produce a standing wave which has a voltage maximum and a voltage minimum. The ratio between these two values is the VSWR (voltage standing wave ratio).

Return loss

The return loss parameter is based on the reflection factor which describes the voltage ratio between the forward and reverse waves.

Specifications

So that the smallest possible transmitted and received powers are reflected by the antenna under ideal conditions, you should observe the following data for the VSWR and the return loss $|S_{11}|$/ dB in the respective frequency band (865-870 MHz or 902-928 MHz):

- VSWR < 1.24:1 or
- $|S_{11}|$/ dB $\geq$ 20 dB

Power rating

Definition

The power rating is understood as the maximum power defined by the vendor with which the device may be operated.

Specifications

Third-party antennas must be dimensioned for an effective power applied to the antenna connection of at least 4 Watt.

Polarization

Definition

The polarization parameter describes how the electromagnetic wave is radiated by the antenna. A distinction is made between linear and circular polarization. With linear polarization, a further distinction is made between vertical and horizontal polarization.

Specifications

UHF transponders usually have a receive characteristic similar to that of a dipole antenna which is linearly polarized. Horizontal or vertical polarization is then present depending on the transponder mounting.

Selection of circular polarized antenna

If the orientation of the transponder is unknown, or if an alternating orientation can be expected, the transmit and receive antennas must have circular polarization.

When selecting a circular antenna, the polarization purity must be observed in addition to the polarization direction. A differentiation is made between left-hand and right-hand circular polarization (LHCP and RHCP). The two types cannot be combined in the same system. On the other hand, selection of the polarization direction is insignificant if the antenna system of a transponder is linearly polarized. With actual antennas, elliptical polarization is encountered rather than the ideal circular polarization. A measure of this is the ratio between the large and small main axes of the ellipse, the axial ratio (AR), which is frequently specified as a logarithm.

Axial ratio	AR
Ideal	0 dB
Real	2-3 dB

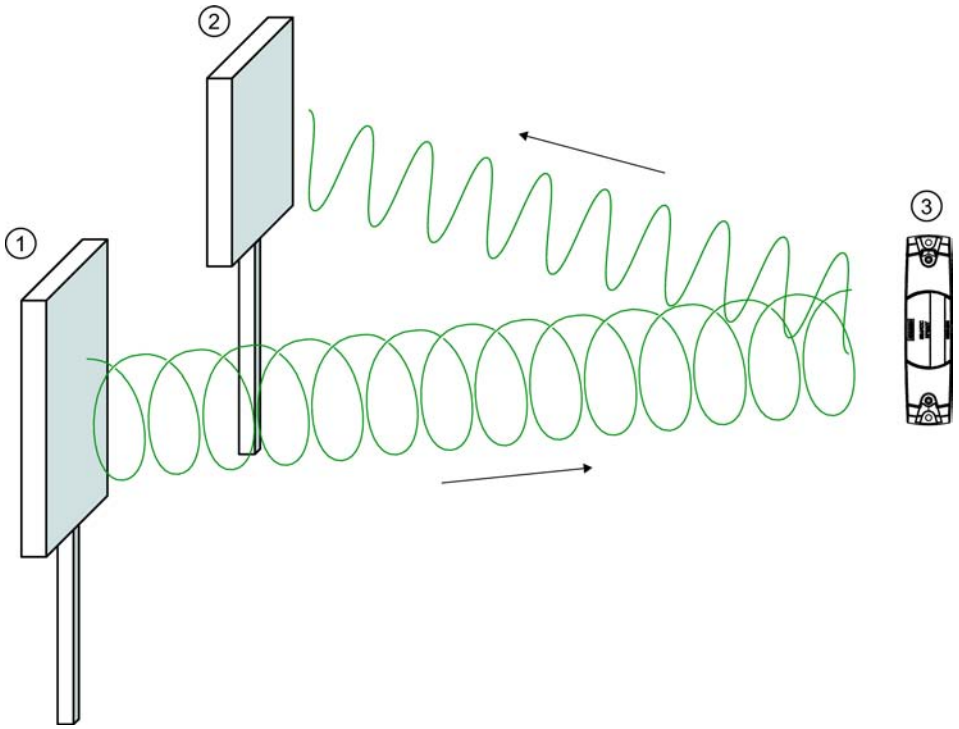
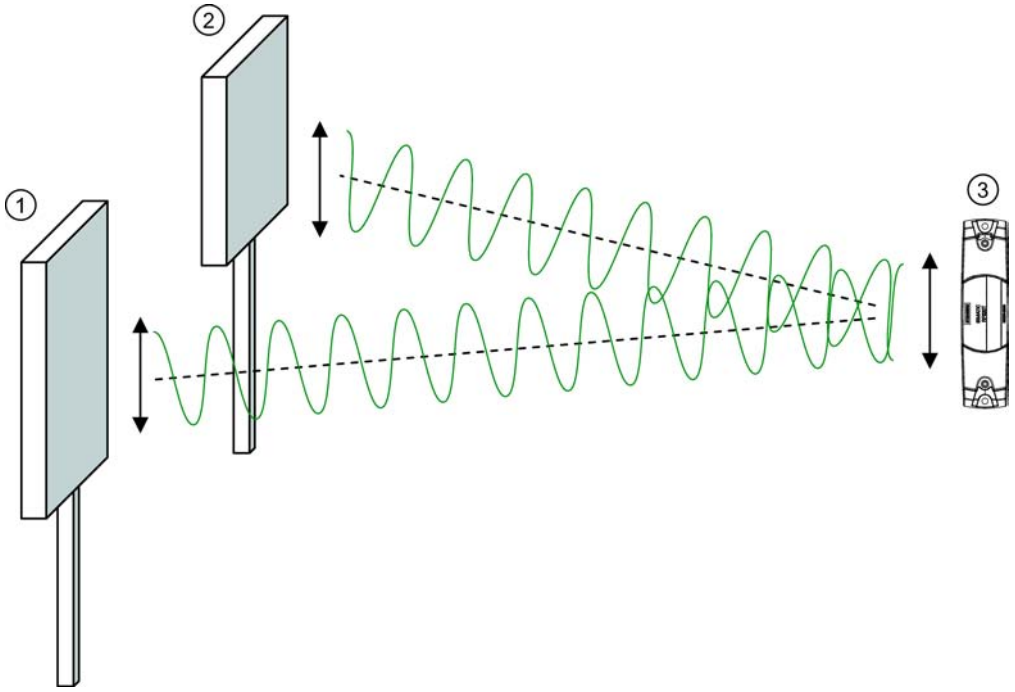


Figure 6-18 Circular polarization of antenna system and transponder

Selection of linear polarized antenna

When using linear polarized antennas, you must always make sure that the transmitter antenna, receiver antenna and transponder have identical polarizations (vertical or horizontal).

As a result of the principle used, no special requirements need be observed to suppress the orthogonal components (cross-polarization).



① Transmitter antenna, vertical polarization
② Receiver antenna, vertical polarization
③ Transponder dipole

Figure 6-19 Homogenous vertical polarization of antenna system and transponder

Front-to-back ratio

Definition

As a result of their design, directional antennas not only transmit electromagnetic waves in the main beam direction but also in other directions, particularly in the reverse direction. The largest possible suppression of these spurious lobes is expected in order to reduce faults and to keep the influence on other radio fields low. This attenuation of spurious lobes in the opposite direction to the main beam is called the front-to-back ratio.

Specifications

Requirement: The front-to-back ratio must be ≥ 10 dB. This requirement also applies to spurious lobes illustrated by the following graphics in Section Half-value width (Page 193).

Half-value width

Definition

A further description of the directional characteristic is the beam width. The beam width is the beam angle at which half the power (-3 dB) is radiated referred to the maximum power. The antenna gain is directly related to the beam width. The higher the antenna gain, the smaller the beam angle.

Coupling in ETSI

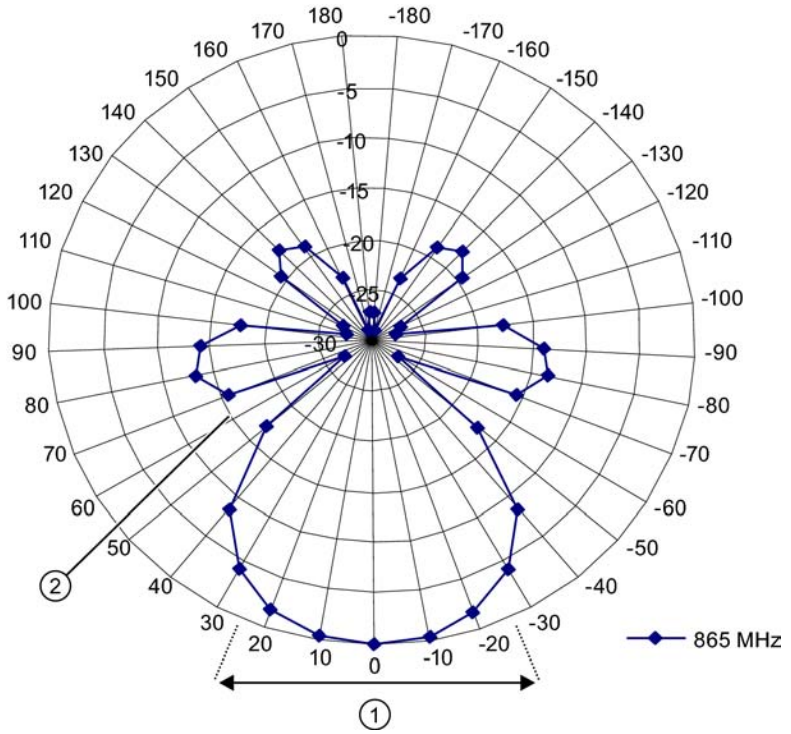
In ETSI EN 302 208 (release version V1.2.1 2008-06), the radiated power is coupled to the beam width, i.e.

- Radiated power 500-2000 mW ERP: beam width ≤ 70 degrees

The beam width requirement applies to both the horizontal and vertical planes. The FCC directives do not envisage coupling with the beam width.

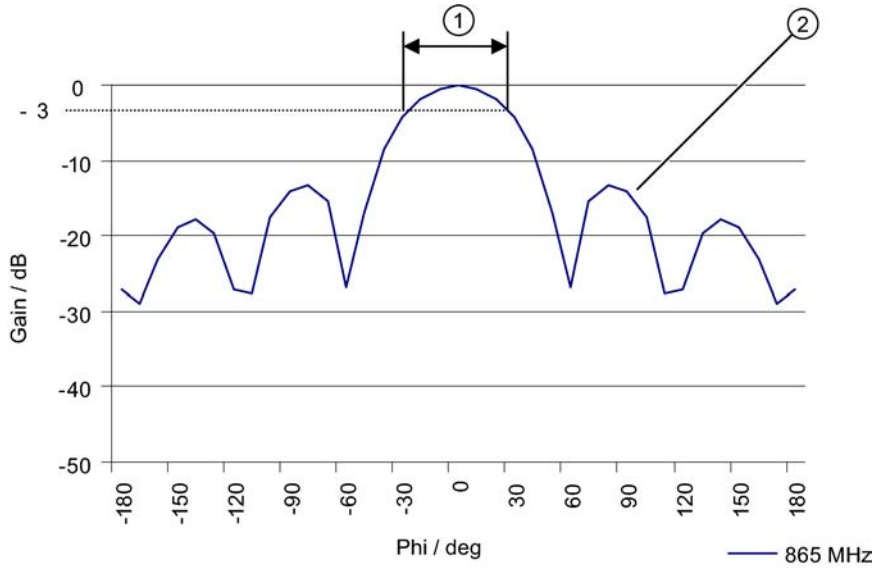
The following graphics show examples of the directional radiation pattern of an antenna in polar and linear representations for which both the horizontal and vertical planes must be considered.

Directional radiation pattern in polar representation



①	Beam width
②	Spurious lobe

Directional radiation pattern in linear representation



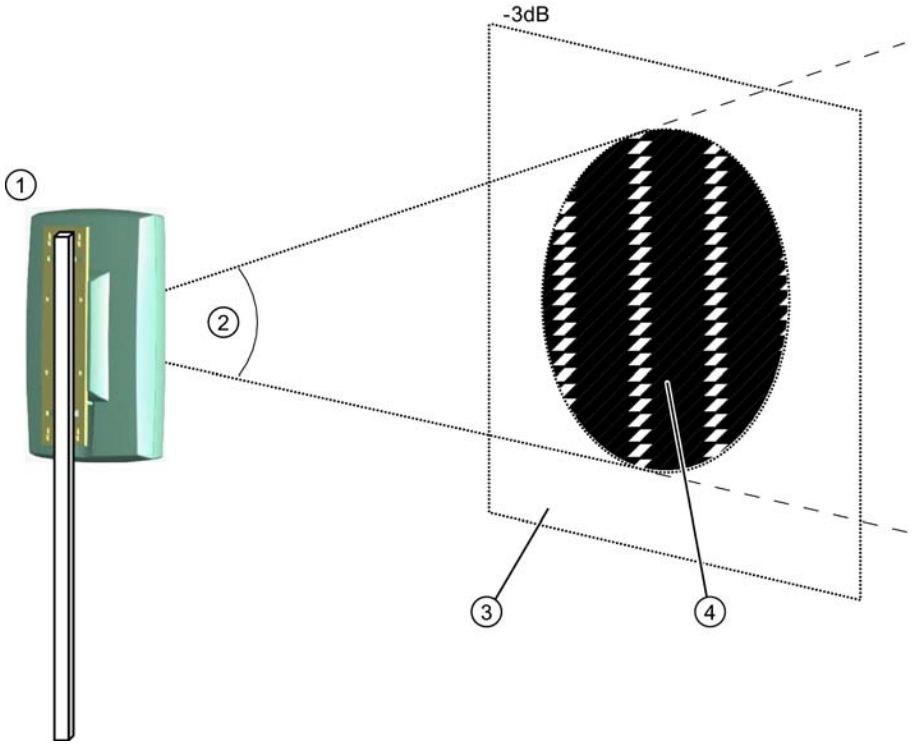
①	Beam width
②	Spurious lobe

Specifications

Selection of the beam angle within the approval directives also has effects on the field of application, since a larger beam angle allows a larger area to be covered by RFID

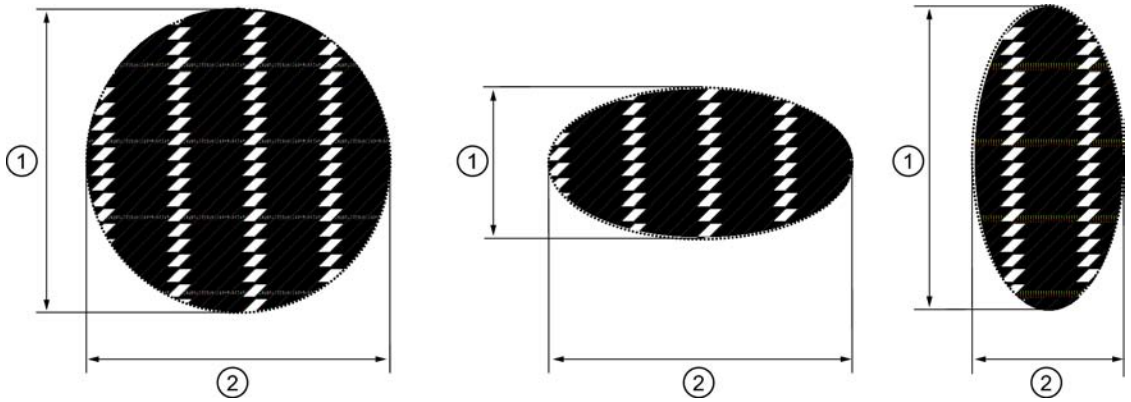
transponders. The following graphic clarifies the cross-section of the beam cone with the covered area.

Beam angle: cross-section of the beam cone with the covered area



①	Third-party antenna
②	Beam angle
③	Covered area
④	Activation or reading range

The reading range depends on the horizontal and vertical beam widths in the case of equal distances from the transmitter antenna. Depending on the mechanical mounting and the ratio between the vertical beam width ① and the horizontal beam width ②, read areas result as shown in the following graphic:

Read area depending on the beam width	
	
①	Vertical beam width
②	Horizontal beam width

6.4.5 Antenna cables

6.4.5.1 Selection criteria

You must observe the criteria listed below when selecting the appropriate antenna cable for your third-party antenna.

Characteristic impedance

Definition

If the input impedance of a device does not agree with the cable impedance, reflections occur which reduce the power transmission and can result in the appearance of resonance and thus to a non-linear frequency response.

Specifications

- You must only use coaxial antenna cables when connecting a third-party antenna.
- This antenna cable must have a nominal characteristic impedance of Z = 50 Ohm.

Antenna cable loss

In order to be able to transmit the available UHF power from the SIMATIC RF660R reader to the antenna(s), the antenna cable loss must not exceed a value of approx. 4 dB.

Dependency of the cable loss

The cable loss depends on two important factors:

- External characteristics of cable. These includes the cable length, diameter and design.
- As a result of the physical principle, the cable loss is also frequency-dependent, i.e. the cable loss increases at higher transmitter frequencies. Therefore the cable loss must be specified in the frequency band from 860 to 960 MHz.

Cable vendors usually provide tables or calculation aids for their types of cable which usually include the transmitter and receiver frequencies as well as the cable length. Therefore contact your cable vendor in order to determine the appropriate type of cable using the approximate value referred to above.

6.4.5.2 Notes on use

Shielding of the antenna cable

Coaxial antenna cables always have a shielded design and therefore radiate little of the transmitted power to the environment.

Note

Cable with double shielding

You should therefore preferentially select cable with double shielding since this provides the best damping.

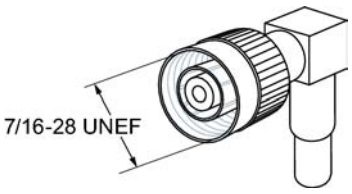
Bending radius of the antenna cable

The properties of the cable shield are influenced by mechanical loading or bending. You must therefore observe the static and dynamic bending radii specified by the cable vendor.

Connectors and adapters

You must use connectors and adapters of type "Reverse Polarity R-TNC" (male connector) for your antenna cables from a third-party supplier in order to guarantee correct connection to the SIMATIC RF660R reader.

The figure below shows the standard for a suitable thread:



You can find more information in the catalog data of your cable vendor.

6.4.6 Overview of parameterization of RF600 reader

The parameterization possibilities that are available to you for each reader of the RF600 family are outlined below. You will find detailed information on parameterization in the specified chapters of the documentation:

Readers	RF-MANAGER 2008 SP 3	SIMATIC command messages	RF-MANAGER Basic 2010	Configuration software	XML commands	RFID reader interface
RF670R	Online-Help > chapter "Introduction to RF-MANAGER > Overview of the RFID functions"		Online help > chapter "Working with RFID objects"		Function Manual RF670R, Chapter "Standard Configuration Messages"	
RF660R				"Configuration Manual SIMATIC RF660R Configuration software", chapter "Parameterizing the RF660R"	Function Manual RF660R, Chapter "Standard Configuration Messages"	
RF630R		"Configuration Manual RF620R/ RF630R", chapter "Overview of commands"				
RF620R		"Configuration Manual RF620R/ RF630R", chapter "Overview of commands"				
RF610M						Function Manual Mobile Reader, chapter"RFID Reader Interface Reference"

6.4.7 Application example

This section contains an example with specific values. Using this example it is possible to understand how the complete selection procedure for antennas, cables, and adapters as well as the settings could be carried out on an RF600 system reader.

In the example it is assumed that you wish to use your SIMATIC RF600 system with your third-party components in Germany (ETSI EN 302 208 V1.2.1).