RFID SYSTEMS

SIMATIC RF600

System Manual · 02/2013

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RFID systems SIMATIC RF600

System Manual

02/2013

J31069-D0171-U001-A14-7618

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
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

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, 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 complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of 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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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 variants of the SIMATIC RF600 system and describes the products supplied as of May 2012. If you are using older firmware versions, please refer to the 08/2011 edition of the documentation.

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. revised and extended edition: FCC approval RF620R/RF630R
10/2009	8. revised and expanded edition for multitag mode
12/2009	9. revised and extended edition
06/2010	10. revised and extended edition
09/2010	11. revised edition
08/2011	12. revised and expanded edition New reader RF640R, new antennas RF640A and RF642A
06/2012	13. 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 Abbreviations and naming conventions

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

Read/write device (SLG)	Reader
Mobile data memory, MDS, data carrier, smart label	Transponder, tag
Interface module, ASM	Communications module, CM

1.3 Navigating in the system manual

Structure of contents	Contents
Table of contents	Organization of the documentation, including the index of pages and sections
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.

NOTICE
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.

NOTICE
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.

Note

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

NOTICE

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.

NOTICE

Loss of warranty

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

Note

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 x $f^{1/2}$	0.0037 x $f^{1/2}$
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

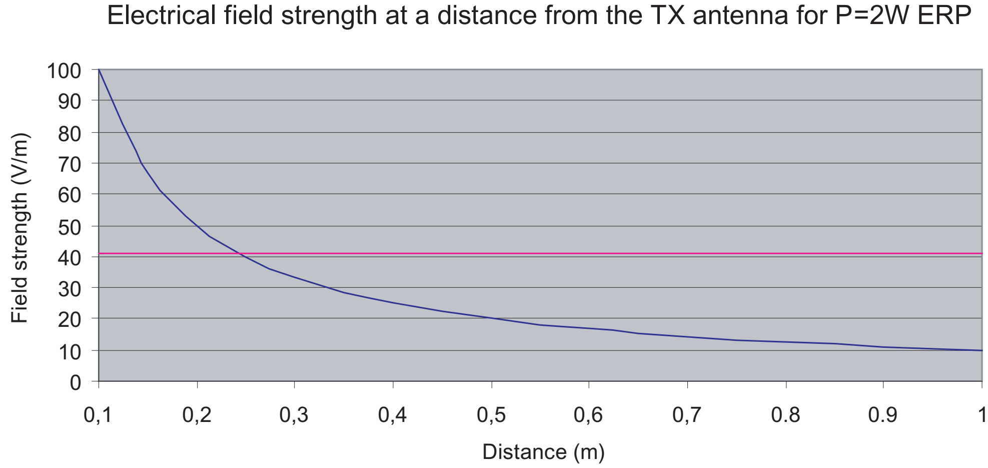
Magnetic field strength: H = 0.111 A/m

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 (1/r) 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 permissible transmit power ($1/r^2$) 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

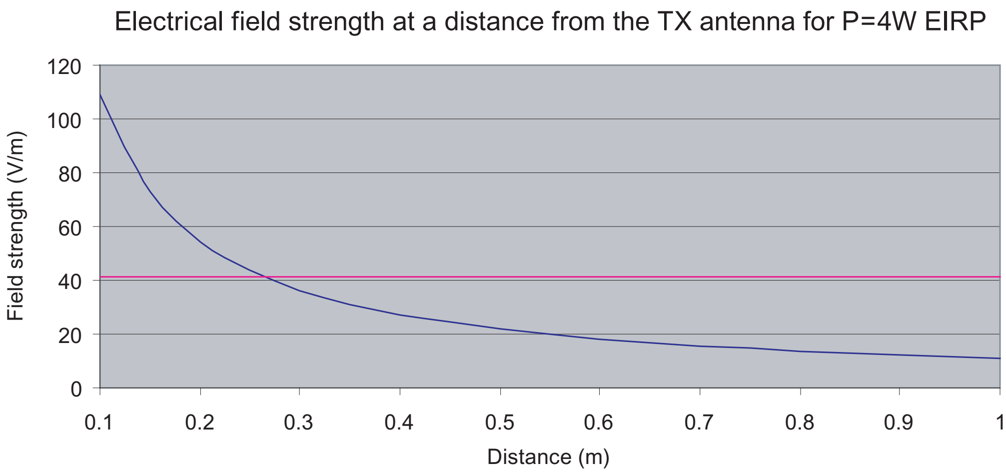
The SIMATIC RF620R (ETSI) reader has a maximum radiated power of 0.5 W ERP. The maximum safety distance is therefore 0.12 m.

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 permissible radiated power in accordance with FCC (4W EIRP), the "safety distance" d = 0.26 m. This means that personnel should not remain closer than 26 cm to the transmitter antenna for extended periods (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.



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

The values for this are as follows:

Radiated power EIRP [W]	Safety distance to transmitter antenna [m]
4.0	0.26
<2.5	>0.20

Generally a safety distance of at least 0.2 m must be maintained.

Note

Reduced maximum radiated power with RF620R/RF630R readers

The SIMATIC RF620R (FCC) reader has a maximum transmit power of 0.5 W. Thus the radiated power of 4 W EIRP cannot be exceeded with the internal antenna.

The SIMATIC RF630R (FCC) reader has a maximum transmit 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 readers (write/read devices), fitted for example on the gates of a warehouse, automatically record every movement of goods, and signal these to the higher-level 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.

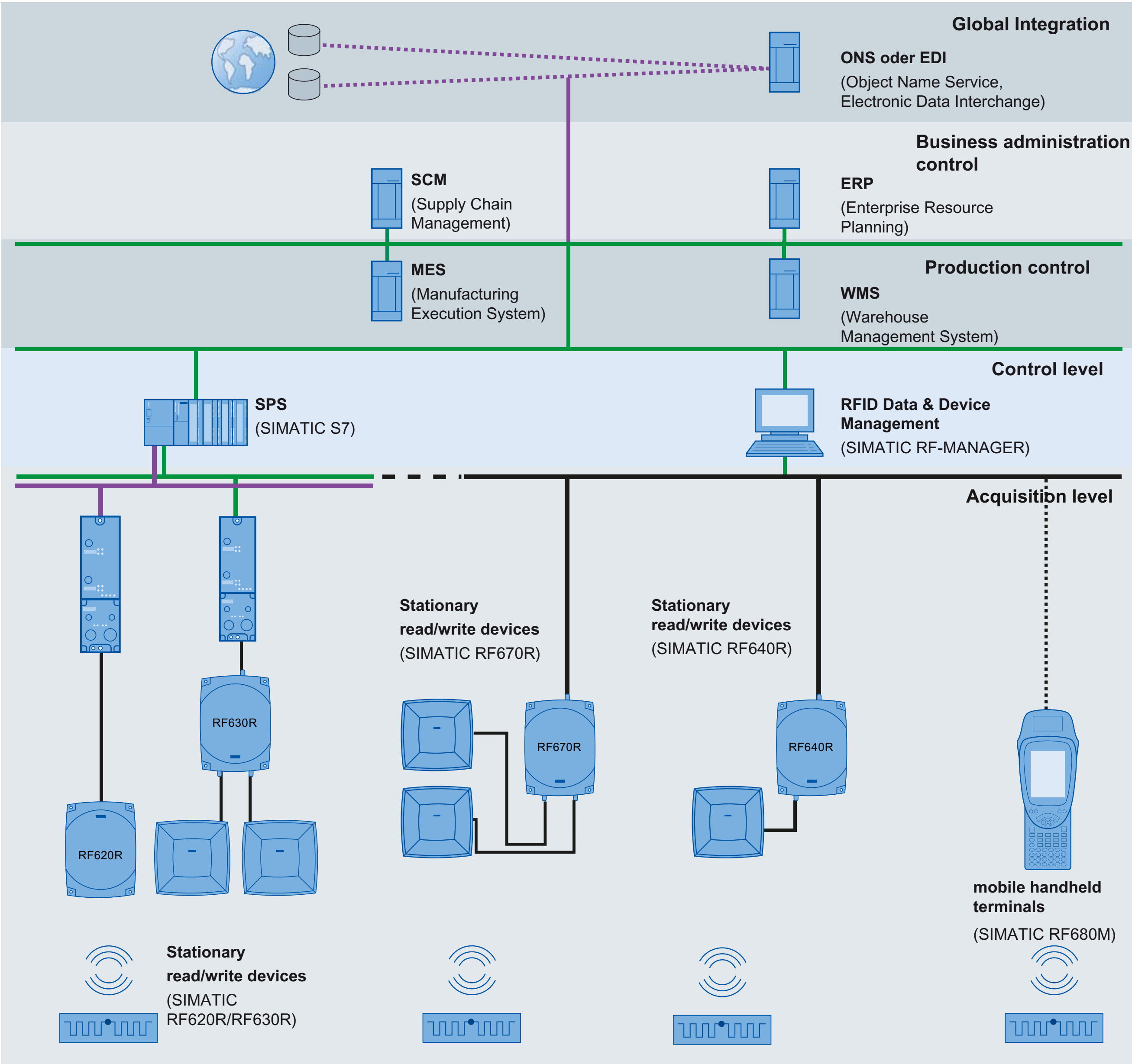


Figure 3-1 System overview of SIMATIC RF600

- **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.
	Due to its compact format and high degree of protection, the RF640R 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. It has an integrated circular polarized antenna.
	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.

RF600 products	Description
	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 RF680M 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 reader depending on the application and up to two can be connected to the RF630R reader. One antenna can be connected to the RF640R or RF620R readers as an alternative to the internal antenna.
	The SIMATIC RF640A is a circular antenna of medium size for universal applications, for example material flow and logistics systems. Depending on the application, up to 4 antennas can be connected to the RF670R reader and up to two antennas can be connected to the RF630R reader. One antenna can be connected to the RF640R or RF620R reader as an alternative to the internal antenna.

RF600 products	Description
	SIMATIC RF642A is a linear antenna of medium size for environments where a lot of metal occurs. Depending on the application, up to 4 antennas can be connected to the RF670R reader and up to two antennas can be connected to the RF630R reader. One antenna can be connected to the RF640R or RF620R reader as an alternative to the internal antenna.
	The SIMATIC RF620A is an antenna of compact, industry-standard design. It is suitable for UHF transponders with normal (far field) antenna characteristics. Depending on the application, up to 4 antennas can be connected to the RF670R reader and up to two antennas can be connected to the RF630R reader. One antenna can be connected to the RF640R or RF620R reader as an alternative to the internal antenna.
	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

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

RF620R reader	
Transmission frequency	865-868 MHz (EU, EFTA, Turkey) 902-928 MHz (USA) 920.125 - 924.875 MHz (CHINA)
Writing/reading range	Internal antenna: < 2 m External antenna: < 2.5 m
Standards	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	0.1 - 2 m
Standards	EPCglobal Class 1, Gen 2

RF640R reader	
Transmission frequency	865-868 MHz (ETSI: EU; EFTA, Turkey) 902-928 MHz (FCC: USA) 920.125 - 924.875 MHz (CMIIT: CHINA)
Writing/reading range	Internal antenna: < 3,5 m External antenna: < 4 m
Standards	EPCglobal Class 1, Gen 2

RF670R reader	
Transmission frequency	865-868 MHz (ETSI: EU; EFTA, Turkey) 902-928 MHz (FCC: USA) 920.125 - 924.875 MHz (CMIIT: CHINA)
Writing/reading range	< 4 m
Standards	EPCglobal Class 1, Gen 2

RF680M mobile handheld terminal	
Transmission frequency	865-868 MHz (EU, EFTA, Turkey) 902-928 MHz (USA)
Writing/reading range	Europe < 2 m USA < 1 m
Standards	EPCglobal Class 1, Gen 2

Transponder/tags			
Version	**Tags / Smart Labels**	**Designation**	**Standards supported**
	Smart Labels	RF630L	EPCglobal Class 1, Gen 2
	Smart Label	RF680L	EPCglobal Class 1, Gen 2
	ISO card	RF610T	EPCglobal Class 1, Gen 2
	Container tag	RF620T	EPCglobal Class 1, Gen 2
	Disc tag	RF625T	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

Software	
RF-MANAGER Basic V2	PC software for assigning parameters to the RF670R and RF640R readers System requirement: Windows XP, SP2 and higher

4 RF600 system planning

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

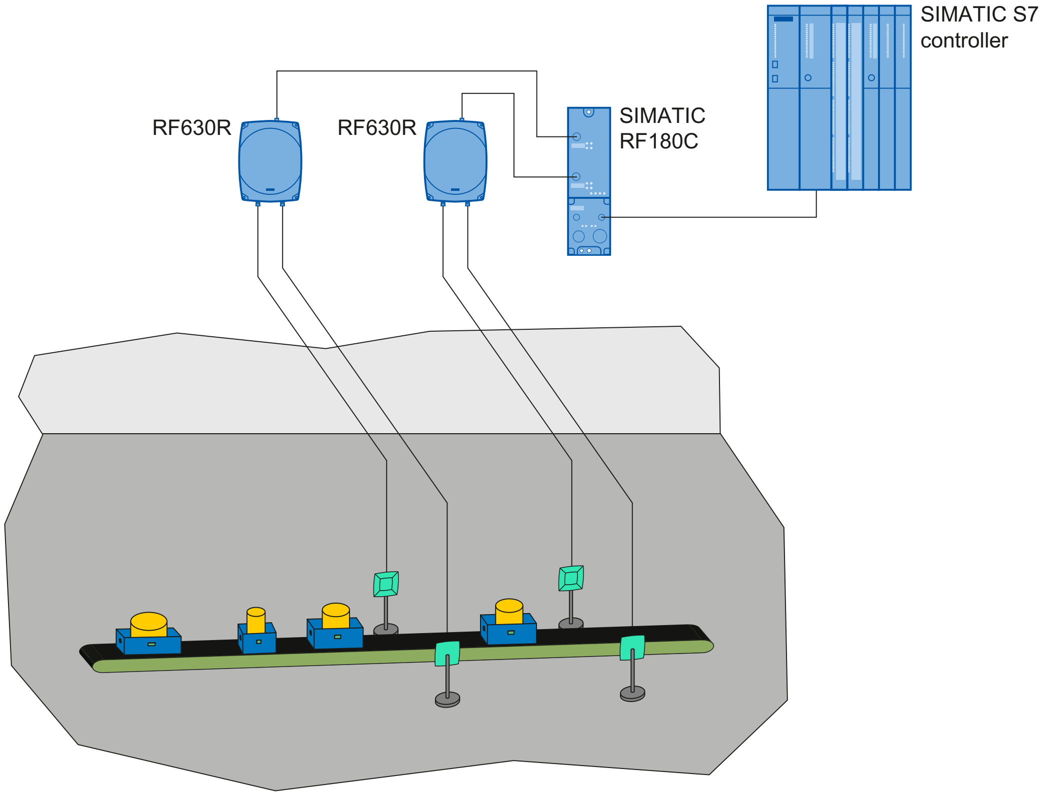
4.2 Possible system configurations

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 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

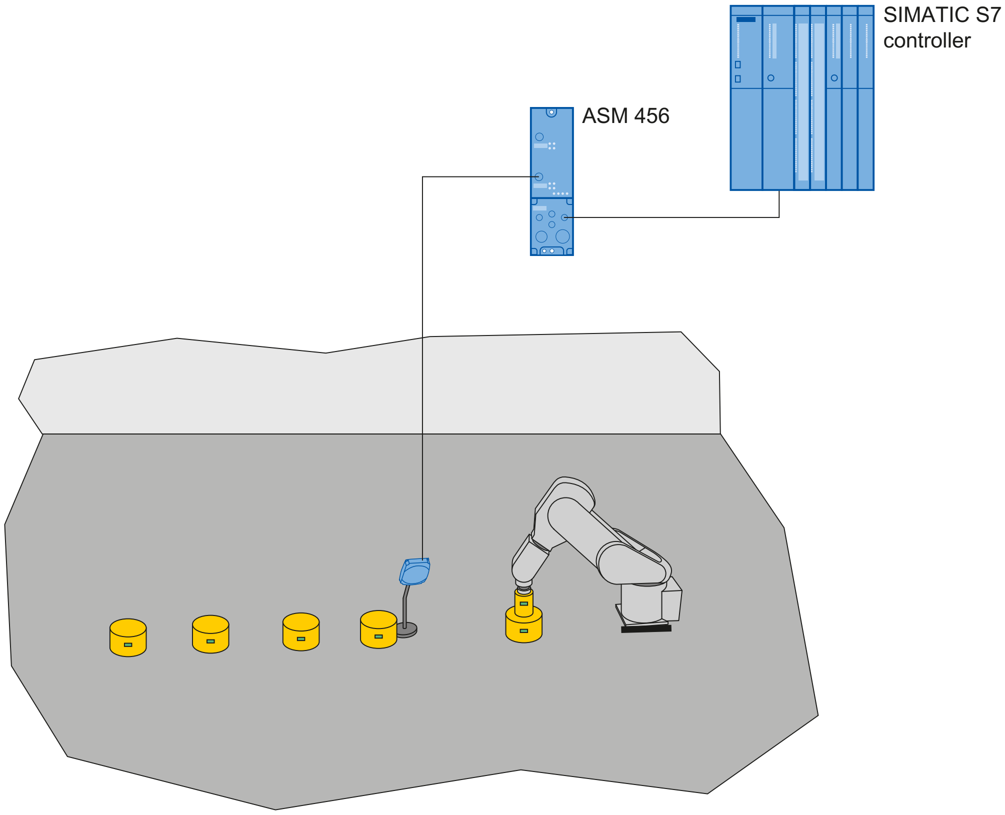
Note

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

4.2.2 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

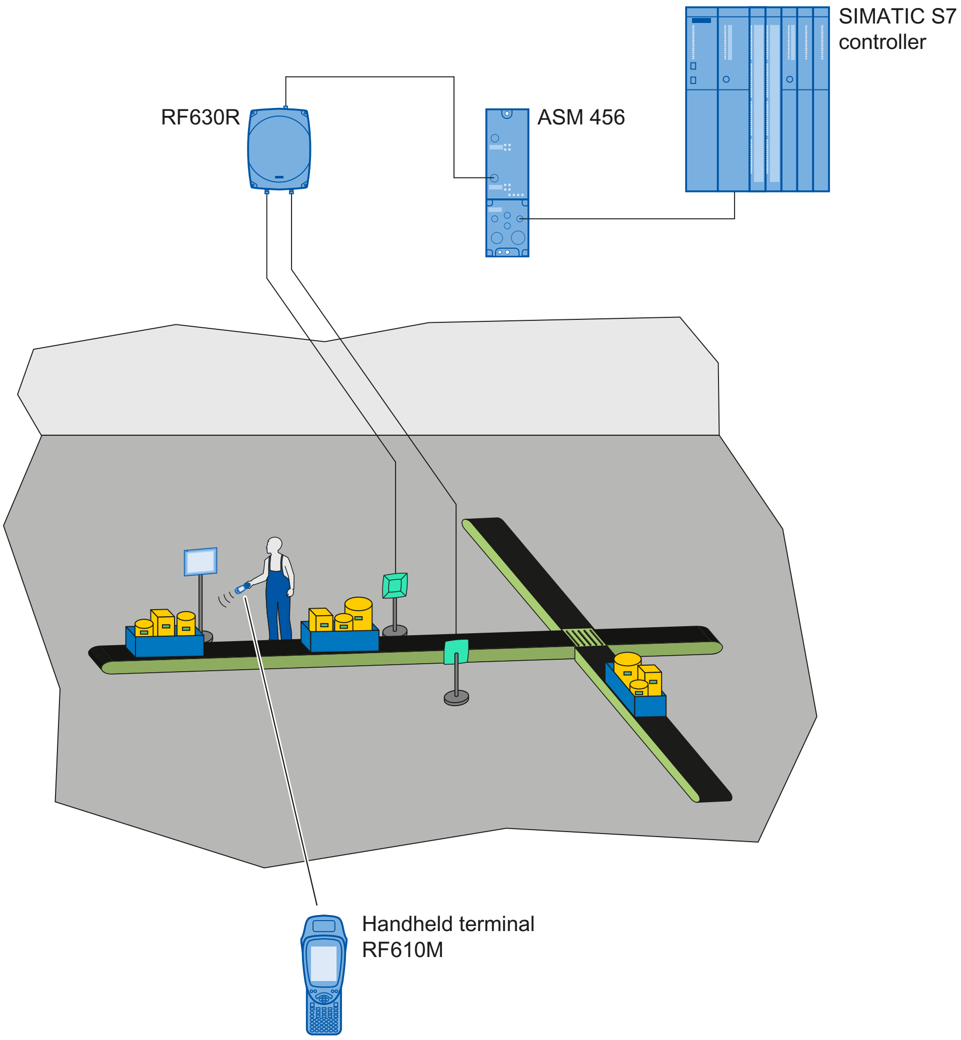
Note that the following features show sample values for the scenario. The specific data for your application may deviate from these values.

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

4.2.3 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 RF680M mobile handheld terminal is used in this example for additional analysis and visualization of the item data directly on site.

Summary of the features

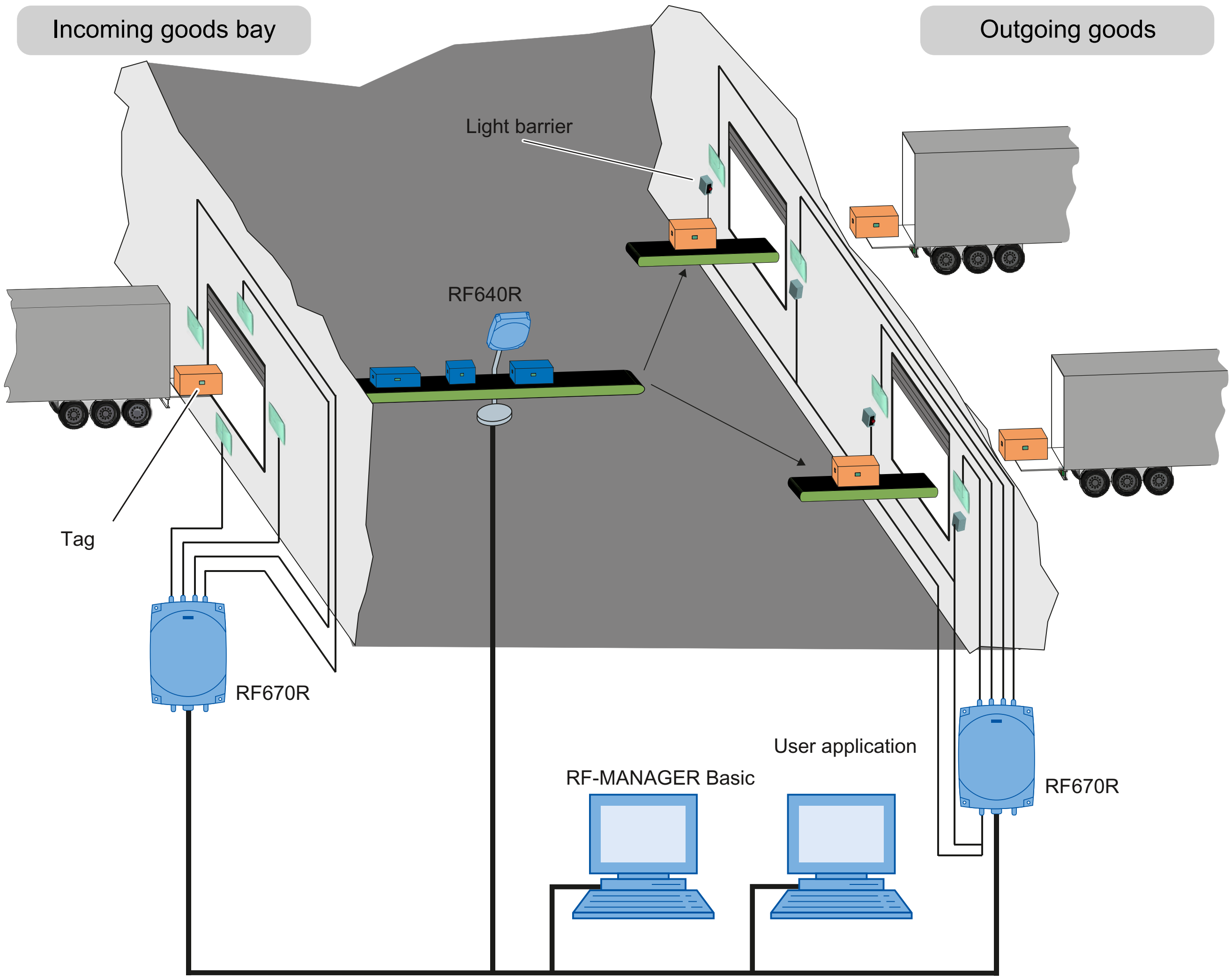
Note

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

4.2.4 Scenario incoming goods, distribution of goods and outgoing goods

The scenario comprises an RFID system with three readers. The SIMATIC RF670R reader with its four antennas monitors the incoming goods gate of a factory building hall through which pallets are delivered. Each pallet is fitted with a tag. The tags contain user data that provides information about the sender and receiver of the goods. This data is read out and passed on. The goods supplied on the pallets are processed in the factory and then exit the factory through the outgoing goods gate.



in this example, the SIMATIC RF640R reader is controlled by a light barrier and monitors a conveyor belt; the conveyor belt transports the goods towards two output gates that are assigned to different recipients. Each item has a tag that is always fitted at the same position and with the same alignment on the item. These tags also contain user data that provides information about the sender and receiver of the goods. There is a separator at the end of the conveyor belt that determines the output gate to which the goods should be directed. The separator is set according to the results from the reader and the goods are distributed.

After the separator, the goods are loaded onto pallets - each pallet is fitted with a tag. These tags also contain user data that provides information about the sender and receiver of the goods. Based on the data read by the SIMATIC RF670R reader, the pallets at the outgoing goods gate are checked to make sure that they are intended for the receiver to which the gate is assigned. Light barriers are installed to control the reader. Depending on the read results of the reader, the outgoing portal opens, or it remains closed.

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	Specified and not specified
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 54) 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.

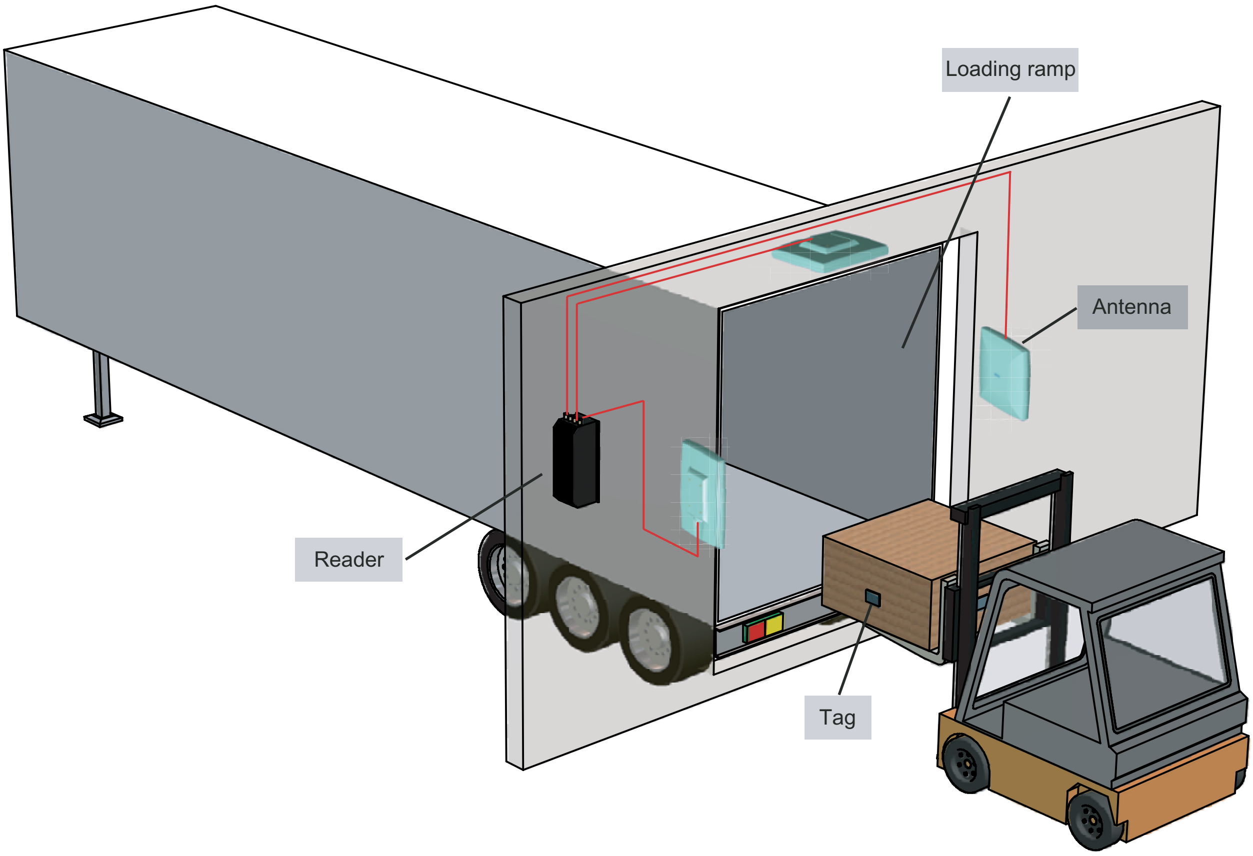
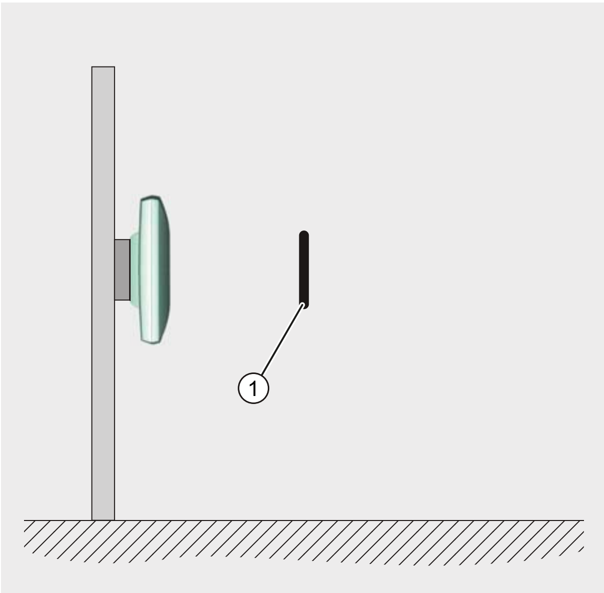
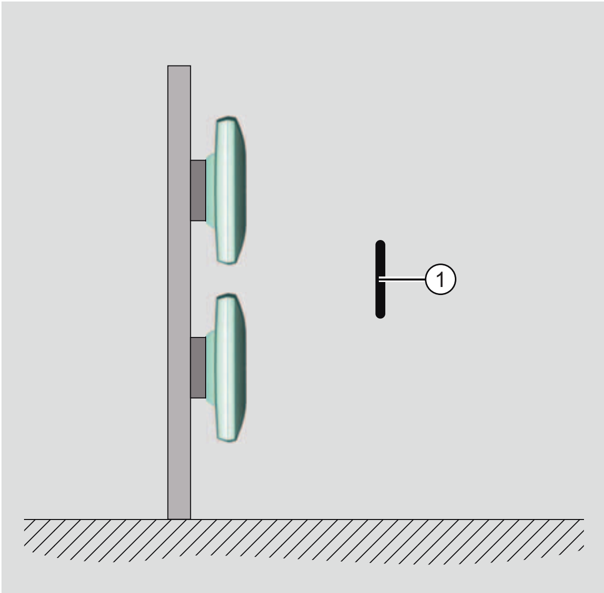


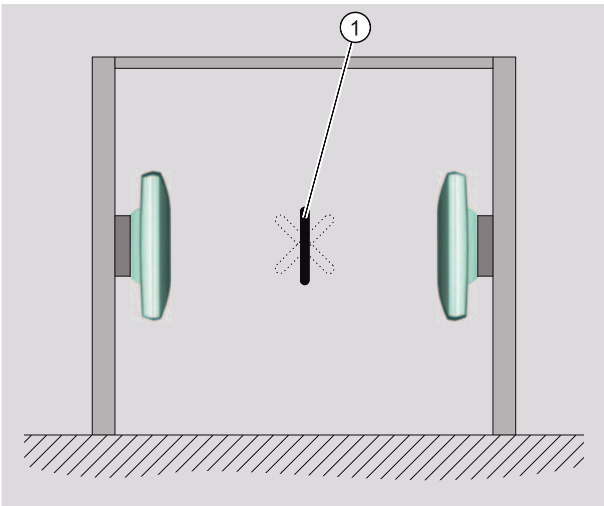
Figure 4-1 Example of an antenna configuration with three antennas

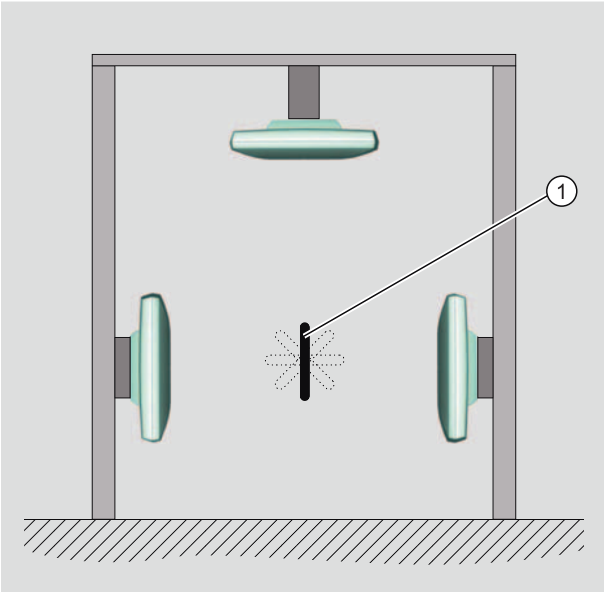
4.3.2 Possibilities and application areas for antenna configurations

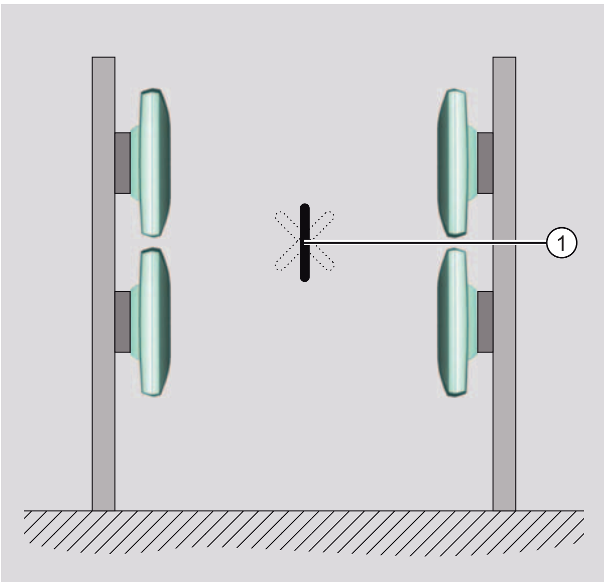
Some basic antenna configurations and possible fields of application are shown below. With the various configurations, please note that up to four external antennas can be connected to the RF670R reader, up to two can be connected to the RF630R reader and one external antenna can be connected to the RF640R or RF620R reader. The RF640R and RF620R readers also have an internal antenna.

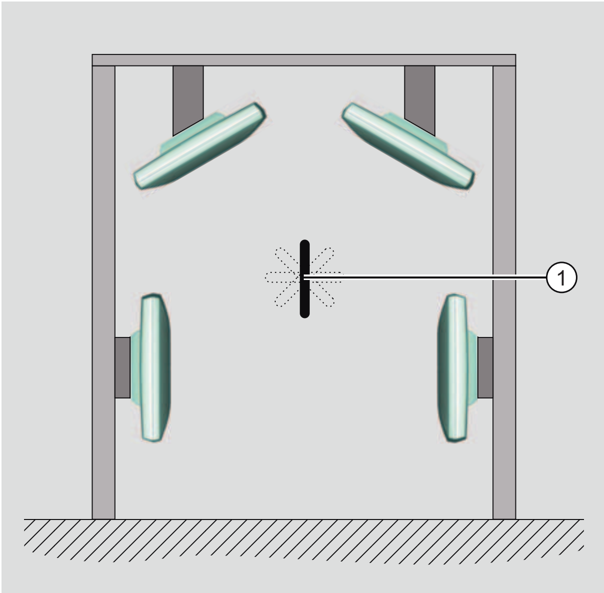
Antenna configuration 1	Description/ application areas
 	This arrangement of antennas is appropriate when the tags to be read are only located on one side of the goods to be acquired, for example, if a conveyor with passing goods has to be monitored during production and it is precisely defined on which side the tags to be read are attached. ① Tag This antenna configuration is possible with the following readers: • RF670R with one antenna • RF640R with integrated or with external antenna • RF630R with one antenna • RF620R with integrated or with external antenna

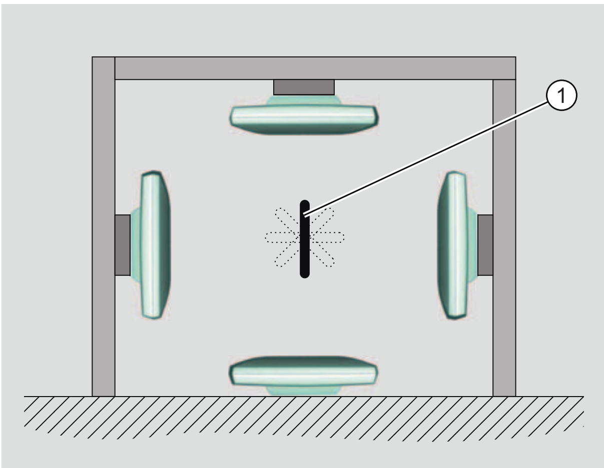
Antenna configuration 2	Description/ application areas
	This arrangement of antennas is appropriate when the tags to be read are only located on one side of the items to be identified, e.g. when pallets are to be identified on which the tags to be read must be on a prespecified side. ① Tag This antenna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

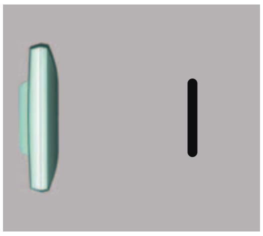
Antenna configuration 5	Description/ application areas
	Preferred for the identification of goods at loading portals: The tag is located in the field of radiation of all four antennas, so the tag position can vary more than in configuration 2 for reliable tag identification. ① Tag This antenna configuration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

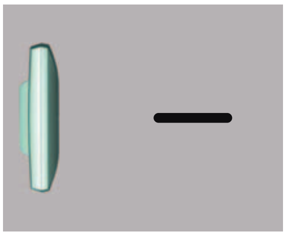
Antenna configuration 6	Description/ application areas
	Preferred for the identification of goods at loading portals: Similar to configuration 4, but the reliability of tag identification is improved as a result of the four antennas at separate locations, so the tag position is not critical. ① Tag This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

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

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.

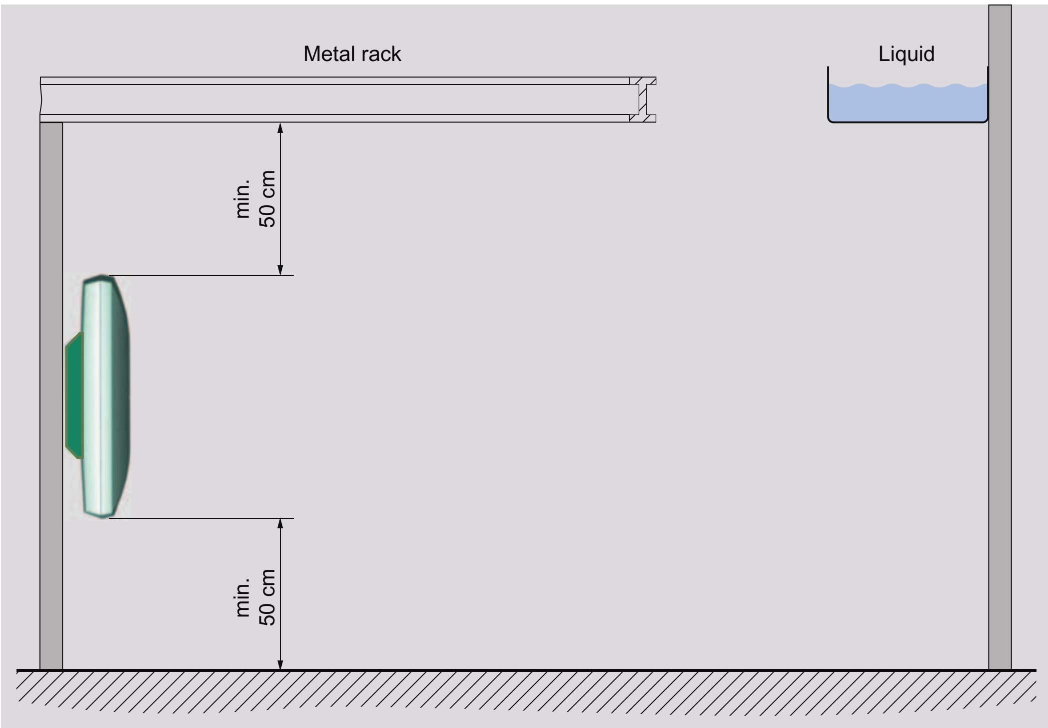


Figure 4-2 Minimum distance to the environment

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

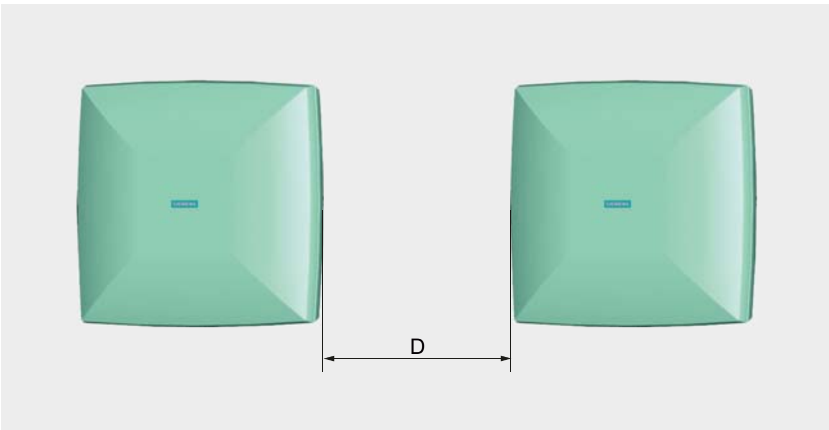


Figure 4-3 Antennas mounted adjacently horizontally or vertically

Readers	Minimum spacing D
A reader with 2 antennas	20-50 cm
Two different reader/reader antennas	80 cm *)

*) The specified spacing applies only if the various readers/reader antennas are not active at the same time. Otherwise the minimum spacing from the following section applies.

The minimum spacing 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 transponders.

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

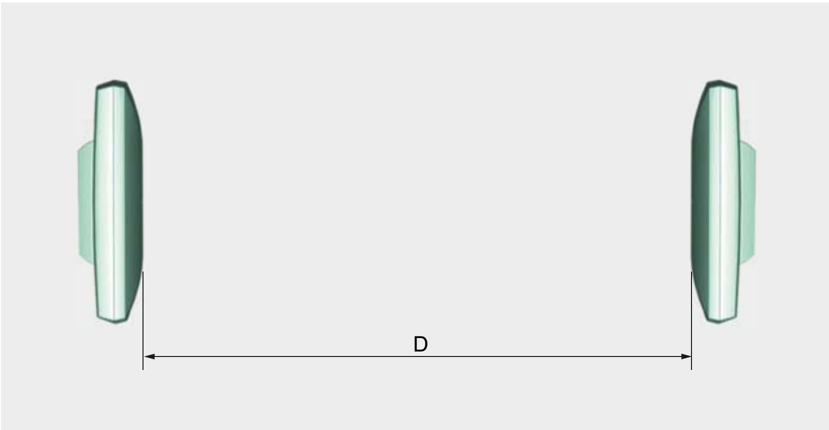


Figure 4-4 Portal configuration, maximum distance

Readers	Maximum distance D
RF670R 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.

See also

Mutual interference of readers (antennas) (Page 48)

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 out by other readers. It must be ensured that the tag can only be identified by the appropriate reader.

Technical disruptions between readers then occur particularly when they transmit on the same channel (on the same frequency). You will find more detailed information in the section "The response of electromagnetic waves in the UHF band (Page 73)".

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.

Antenna alignment and antenna spacing with an external antenna

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; RF640R with RF660A = 2000 W ERP; RF620R/RF630R = 500 mW ERP) and the antenna alignment.

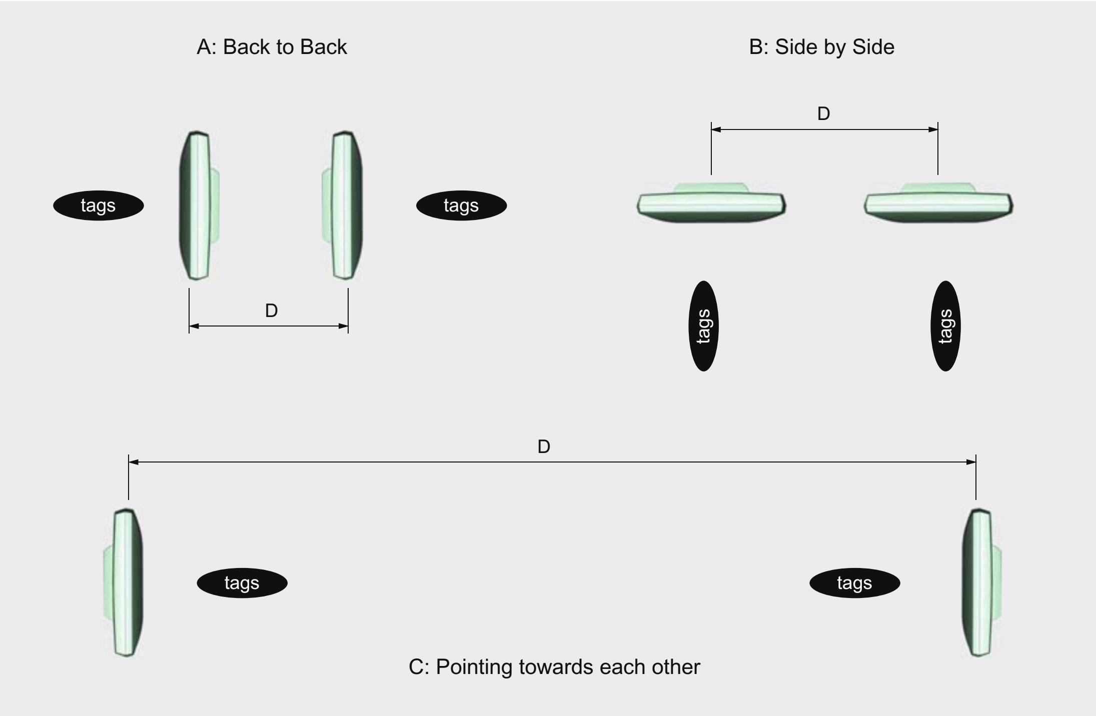


Figure 4-5 Antenna distances for different readers and identical frequencies

Antenna configuration	Antenna alignment	Minimum spacing required = D RF640R/RF670R with RF660A	Minimum spacing required = D RF620R/RF630R with RF660A
A	With backs to each other	0.5 m	0.3 m
B	Arranged laterally	1 m	0.8 m
C	Antennas point toward each other	6 m	6 m

Antenna alignment and antenna spacing for the RF620R and RF640R with an internal antenna

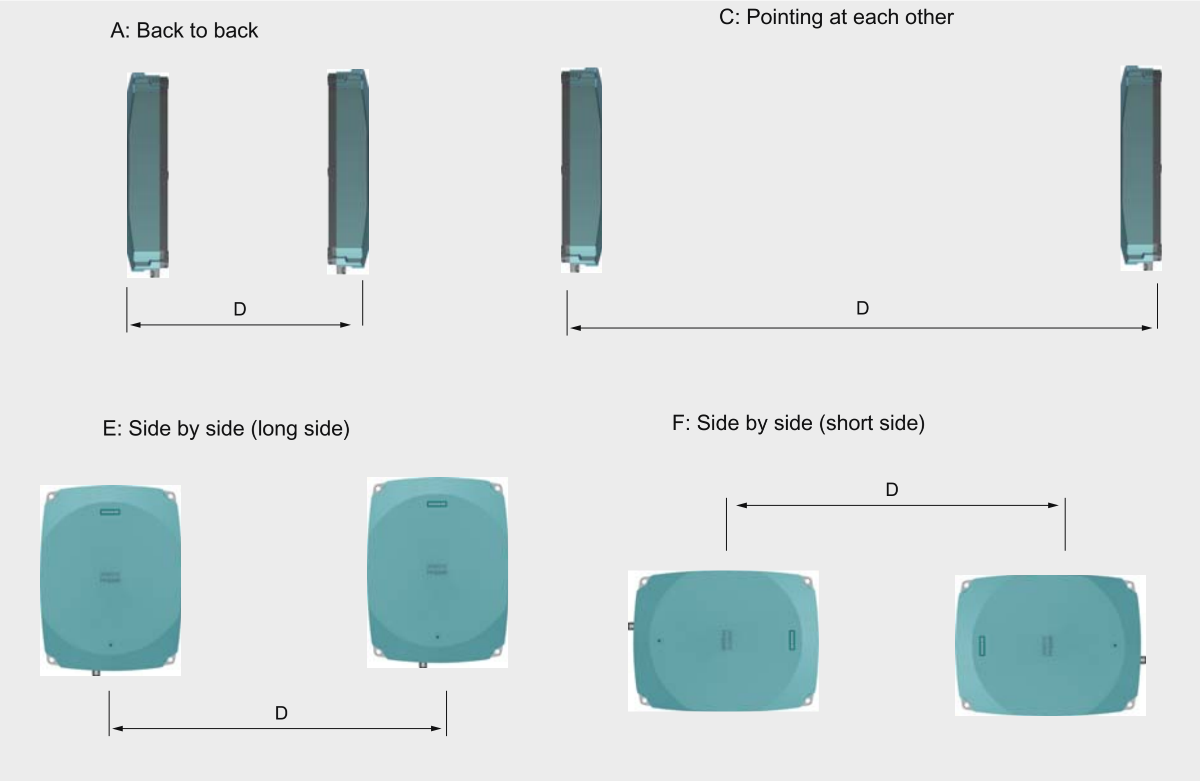


Table 4- 1 Antenna alignment and antenna spacing for the RF620R with an internal antenna

Antenna configuration	Antenna alignment	Minimum spacing required = D RF620R with internal antenna
A	Back to back	0.4 m
C	Pointing at each other	5.8 m
E	Side by side (long side)	1.4 m
F	Side by side (short side)	1.8 m

Table 4- 2 Antenna alignment and antenna spacing for the RF640R with an internal antenna

Antenna configuration	Antenna alignment	Minimum spacing required = D RF640R with internal antenna
A	Back to back	0.4 m
C	Pointing at each other	4.0 m
E	Side by side (long side)	1.4 m
F	Side by side (short side)	2.0 m

Optimization of the antenna arrangement

SIMATIC RF620R, RF640R with internal antenna

The RF620R and RF640R have an integrated, circular polarized antenna. This means that the type of antenna cannot be freely selected. This means that the interference spacing in arrangement E is greater than in arrangement F.

Note

Rotation of the reader through 90° around the z axis

Since the horizontal electrical aperture angle of the RF620R antenna is greater than the vertical aperture angle, the effects on adjacent readers can be reduced by using the reader as shown in arrangement F (see arrangements E and F).

With the SIMATIC RF660A antenna

The electrical aperture 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.

With the RF640A/RF642A antenna

The electrical aperture angles (vertical and horizontal) of the RF640A/RF642A antenna are similar. Therefore, the robustness of the readers' access to transponder data can be optimized only to a limited extent by rotating around the antenna axis.

Application example for RF620R/RF630R

The following example illustrates measures for increasing the reliability of data access to transponders for readers with internal antennas:

- The antennas are placed next to each other and are aligned parallel to each other (see arrangement B).
- The readers have been rotated through 90° around the z axis.

The table below provides you with an overview of the minimum spacing to be maintained at a radiated power of 27 dBm with a maximum number of reachable transponders:

Mode	Max. number of tags	Min. distance [m] between - two readers with internal antennas - two RF660A antennas
Single tag mode: Read	1	3
Single tag mode: Write	1	3
Multitag mode: Read	40	6
Multitag mode: Write	10	6

4.3.6 Read and write range

The read/write range between the reader/antenna and the transponder is influenced 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.
Number of transponders in the antenna field	The typical ranges always relate to a transponder installed at the maximum possible distance from the antenna. If there is more than one transponder in the antenna field, the distance to all other transponders must be less to allow them to be acquired in the antenna field. The width and height of the antenna field within which its transponders can be arranged at a certain distance from the antenna depend on the following: • The radiated power, • Only reading or reading and writing the transponders (writing requires more power, typically double the power) • The aperture angle (horizontal) • The aperture angle (vertical)

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 Static/dynamic mode

Reading or writing can be either static or dynamic.

- Reading/writing is counted as being **static** if the tag does not move in front of the antenna and is read or written.
- Reading/writing is counted as being **dynamic** if the tag moves past the antenna during reading/writing.

The following overview shows which environments are suitable for which read or write mode:

Operating mode	Read	Write
Static	Recommended in normal UHF environments	Recommended in normal UHF environments
Dynamic	Recommended under difficult UHF conditions	Not recommended in difficult UHF environments

4.3.8 Operation of several readers within restricted space

4.3.8.1 Dense Reader Mode

A special operating mode according to the standard EPC Global Class 1, Gen 2 in Dense Reader Mode allows several RF600 readers to be operated without interference in close proximity to each other. All RF600 readers operate in Dense Reader Mode according the standard EPC Global Class 1, Gen 2.

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

Special features for ETSI

In accordance with EPC Global as well as ETSI EN 302 208 V1.4.1, the four transmit channels are used for transmission with the RF670R, with the RF640R as of firmware version V1.3, and with the RF620R/RF630R (see section Regulations for UHF frequency bands in Europe (Page 75)) 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.

4.3.8.2 Optimizing tag reading accuracy

An improvement in the tag reading accuracy in an environment with a high density of readers can be achieved by aligning the antennas toward the relevant tag field, in other words 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.

4.3.8.3 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 section The response of electromagnetic waves in the UHF band (Page 73))
- Type of transponder (see section Transponder/tags (Page 265))
- Number of transponders to be detected by an antenna at a time
- Type of antenna (see section Antennas (Page 189), section Guidelines for selecting RFID UHF antennas (Page 54), and section Planning application (Page 99))
- Transponders' distance from and orientation toward antennas (see section Transponder/tags (Page 265))
- 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.

4.3.8.4 Frequency hopping

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

Procedure for FCC

Frequencyhopping is always active with 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 82)). 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 77)).

Procedure for ETSI

Frequencyhopping is optional with ETSI. According to ETSI EN 203 208 V1.2.1, Frequencyhoppingis advisable, however this is should preferably be multichannel operation with Frequencyhopping. Without Frequencyhopping, only single channel operation is possible for which the standard specifies a pause of 100 ms after each 4 s of sending.

4.3.9 Guidelines for selecting RFID UHF antennas

4.3.9.1 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 18).

4.3.9.2 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.

4.3.9.3 General application planning

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 57) and Antenna cables (Page 69).

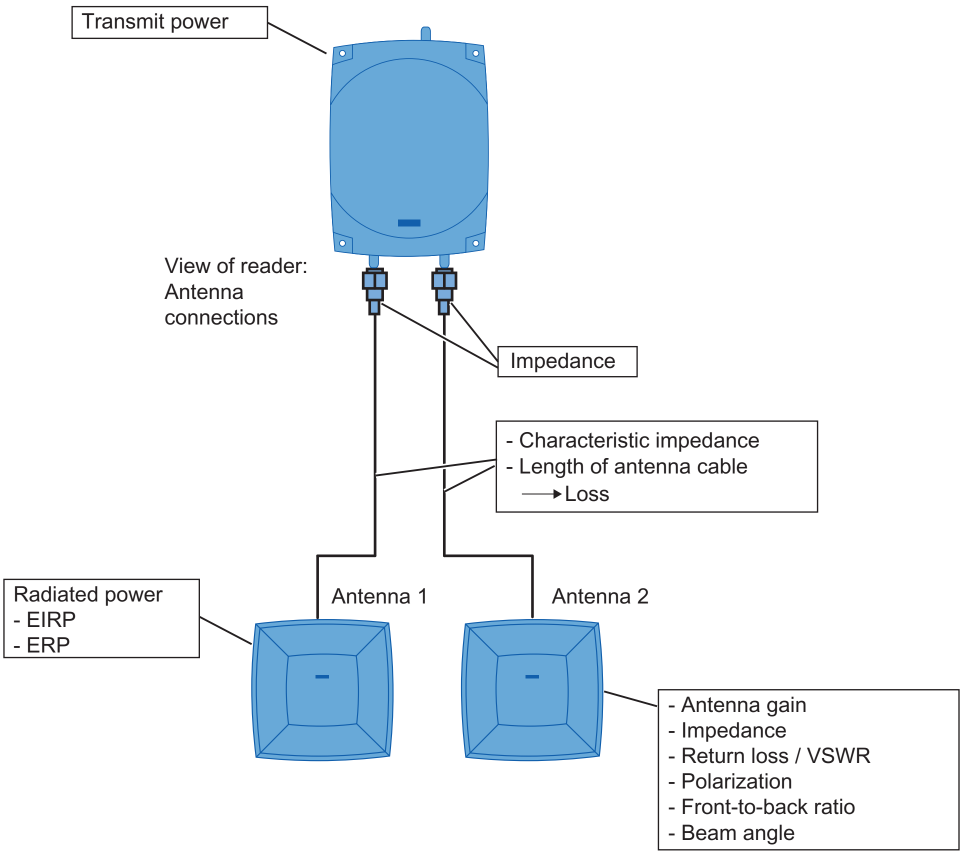


Figure 4-6 Overview of total system and influencing factors

When operating the RF600 system, additional influencing factors must also be observed such as minimum spacing between antennas in the room.

Environmental conditions

NOTICE
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.

General procedure

Depending on whether you want to use a third-party antenna or antenna cable (or both) in a combination with the RF600 system, these instructions will help you to select the components and to set the important parameters in the RF MANAGER Basic.

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 57) or Section Antenna cables (Page 69) 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. Normally, you can do this with the RF MANAGER Basic. Depending on the reader, the values can alternatively also be set via XML protocol or SIMATIC protocol. You will find an overview of the information for the parameter assignment of all RF600 system readers in the section Overview of parameterization of RF600 reader (Page 391).

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.

4.3.9.4 Antennas

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.

RF600 antennas on the other hand, are optimized for operation with RF600 readers and have all the required approvals.

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 RF600 readers 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_i 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, i.e. isotropic).

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_i:

$EIRP = P_0 * G_i$

ERP

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

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

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).

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

$$= \frac{P_0}{dBm} + \frac{G_d}{dBd} + 2{,}15 - \frac{a_k}{dB}$$

$$\frac{ERP}{dBm} = \frac{P_0}{dBm} + \frac{G_d}{dBd}$$

$$= \frac{P_0}{dBm} + \frac{G_i}{dBi} - 2{,}15$$

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.

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

$$\frac{ERP}{dBm} = \frac{P_0}{dBm} + \frac{G_d}{dBd} - \frac{a_k}{dB}$$

$$= \frac{P_0}{dBm} + \frac{G_i}{dBi} - 2{,}15 - \frac{a_k}{dB} \text{ if } \quad a_k > 0$$

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 60)). The relationship between dBi and dBic is as follows: dBi = dBic - 3
dBd	Power level with the reference variable on the dipole radiator. The relationship between dBd and dBi is as follows: dBd = dBi - 2.15
dBic	Power level with the reference variable on the isotropic radiator for circular antennas. The relationship between dBi and dBic is as follows: dBic = dBi + 3

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 ≥ 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 ≥ 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

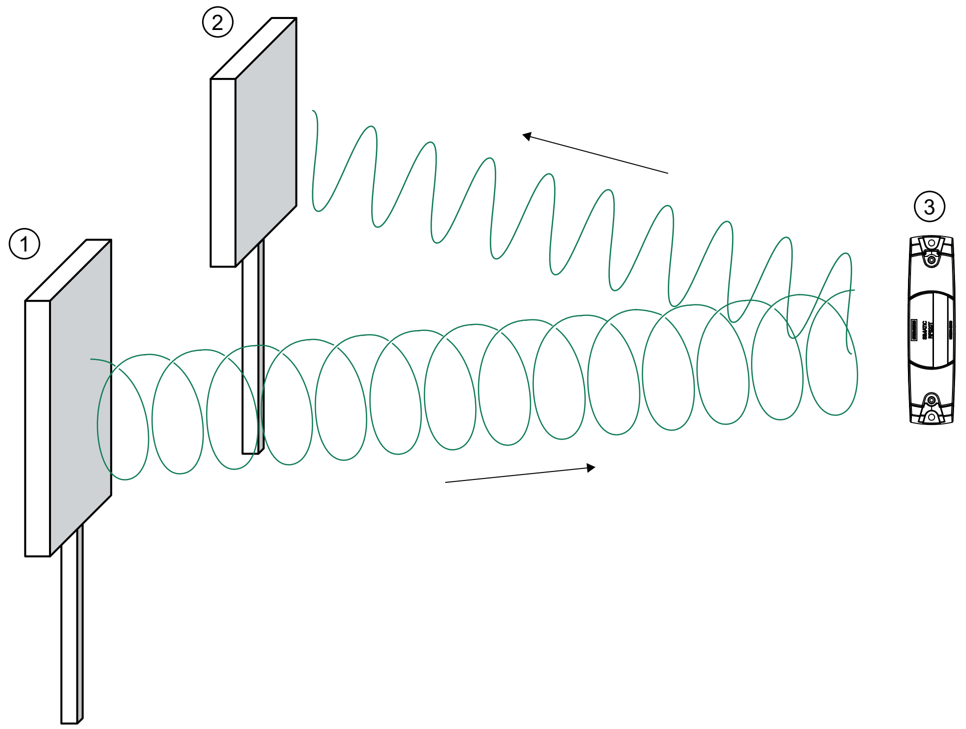
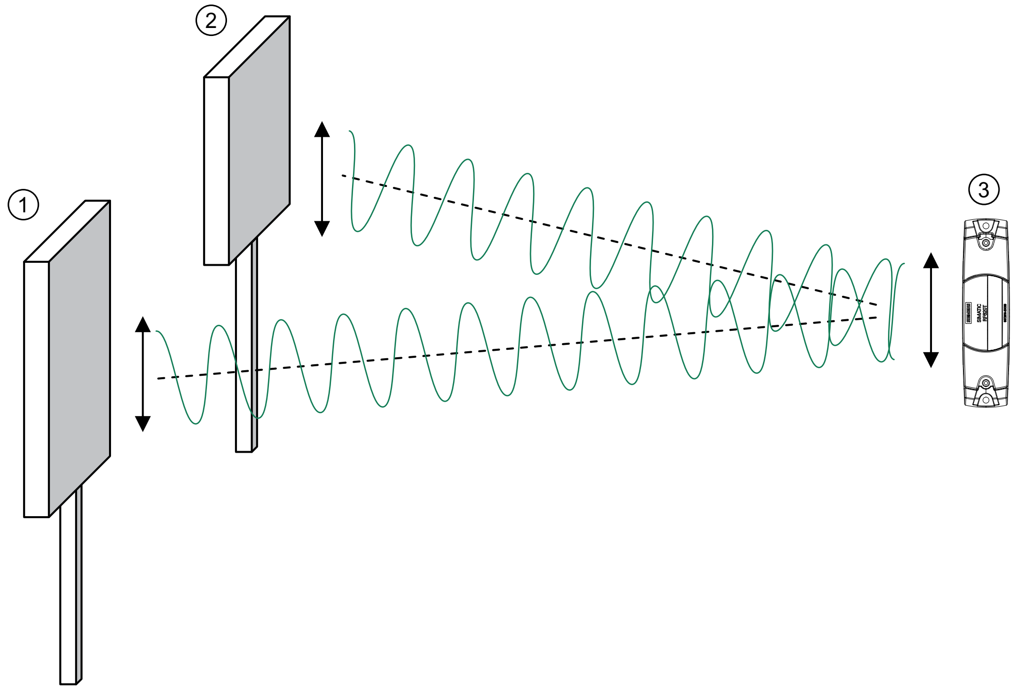


Figure 4-7 Circular polarization of antenna system and transponder

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 4-8 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 66).

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.

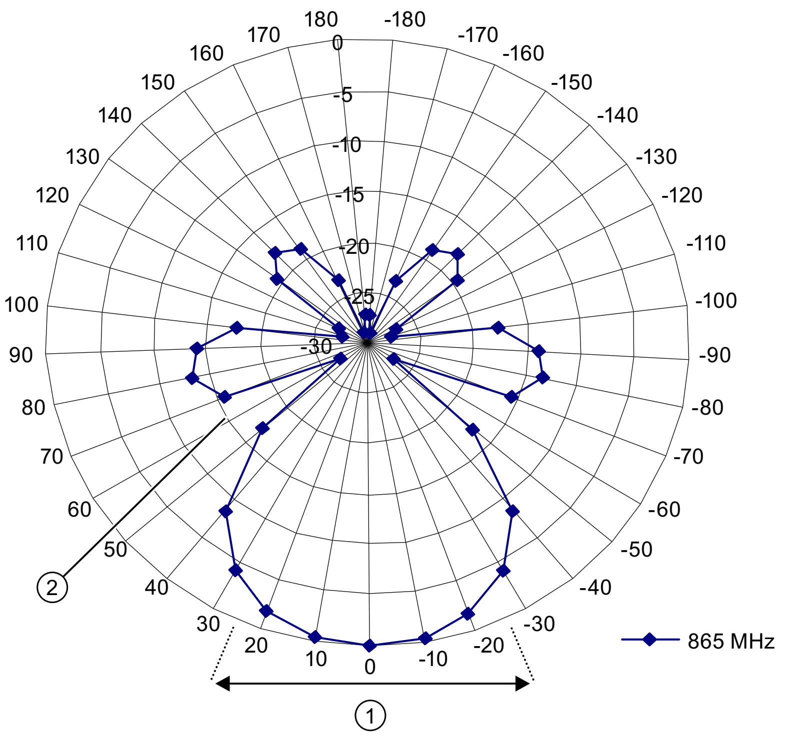
Coupling in ETSI

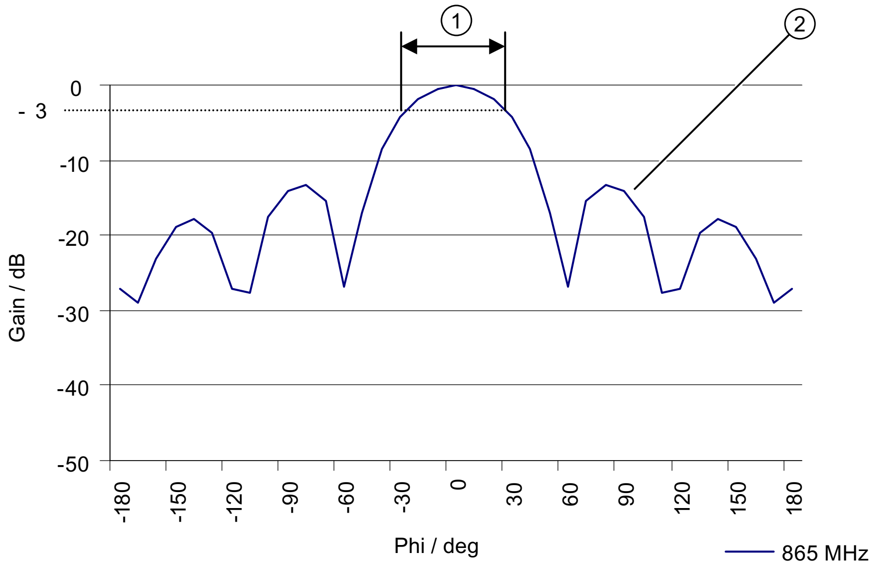
In ETSI EN 302 208 (release version V1.2.1 2008-06), the radiated power is coupled to the beam width, i.e.

- 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

Interpretation of directional radiation patterns

The following overview table will help you with the interpretation of 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

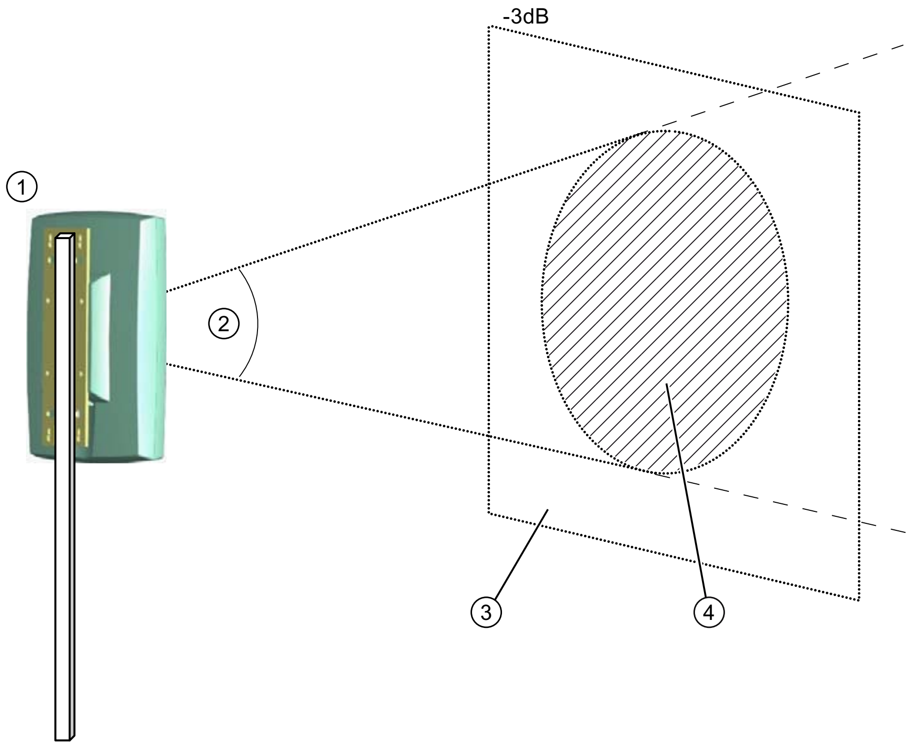
Example

As one can see in the antenna diagrams (polar or linear) above, the maximum antenna gain 0 dB is standardized. The dBr value -3 is shown graphically in both diagrams. At angles of Phi = ± 35°, the range of the antenna is only 50% of the maximum range.

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.

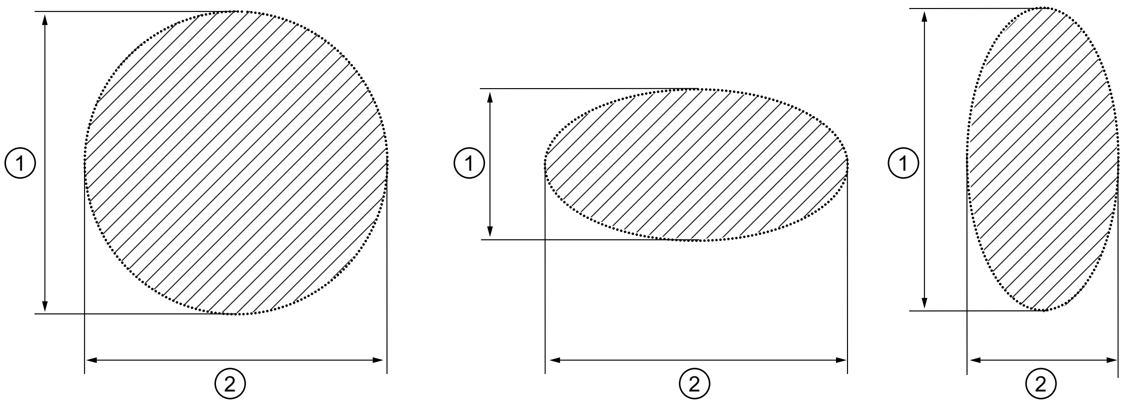
Beam angle: cross-section of the beam cone with the covered area



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

4.3.9.5 Antenna cables

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 RF600 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.

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.

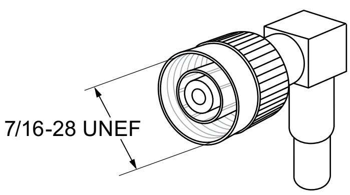
Bending radius of the antenna cable

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 ensure correct connection to the RF600 reader interface.

The figure below shows the standard for a suitable thread:



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

4.3.9.6 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 want to use your SIMATIC RF600 system with your third-party components in Germany (ETSI EN 302 208 V1.4.1).

Procedure

1. Compare the technical specifications of your antenna with the values required by the SIMATIC RF600 system.

Values	Example antenna	Required values	OK?
Frequency range	865 to 870 MHz	865 to 868 MHz	OK
Impedance	50 ohms	50 ohms	OK
VSWR	<1,5	<1,24	Not OK
Polarization	Circular, right		OK
Antenna gain	8.5 dBi	>6 dBi	OK
Half-value width horizontal/vertical	63°	≤70°	OK
Front-to-back ratio	-18 dB	≥10 dB	OK
Spurious lobe suppression	-16 dB	≥10 dB	OK
Axial ratio	2 dB	≤3 dB	OK
Maximum power	6 W	≥4 W	OK

Since the specific VSWR value of the antenna does not agree with the value required by the system, you must have this value checked. Therefore contact your antenna vendor or an EMC laboratory.

2. Compare the technical specifications of your cables and connectors with the values required by the system.
For example, you can use cables of type "LMR-195" from the company "TIMES MICROWAVE SYSTEMS". Suitable cables have e.g. an outer diameter of 5 mm. The company offers various designs of cables depending on the requirements. Numerous connectors are also available for their cables.

Values	Example cable	Required values	OK?
Cable attenuation	36.5 dB / 100 m at 900 MHz With an assumed length of 10 m, this results in a loss of 3.65 dB.	≤4 dB	OK
Impedance	50 ohms	50 ohms	OK

Values		Example connector	OK?
Type of plug on reader side	R-TNC socket	R-TNC plug	OK
Type of plug on antenna side	N socket	N plug	OK

3. Set the following parameter values depending on the reader you are using:
   - **Assigning parameters for the RF640R/RF670R using the RF-MANAGER Basic V2**
     Antenna gain: 8.5 dBi
     Cable loss: 4 dB (due to adaptation and attenuation losses of the connectors)
   - **Set parameters for the RF640R/RF670R using the XML command "setAntennaConfig"**
     In the XML command "setAntenneConfig", the following must be set for the antenna port being used:
     (antenna number="1 ... 4"), antenna gain (gain="8.5") and cable loss (cableLoss="4.0").
     Cable loss: 4 dB (due to adaptation and attenuation losses of the connectors)
   - **Setting parameters for RF620R/RF630R using SIMATIC commands**
     Since according to ETSI EN 302 208 V1.4.1 the maximum permissible radiated power is 2 W ERP, none of the transmit power settings available to the user (distance_limiting) can cause the required maximum permitted radiated power value to be exceeded. The exact radiated power of the reader, together with the antenna cables and antenna used, results from the value used in distance_limiting 0-F and the calculation in the section "Antenna parameters".
4. You then need to have your desired system requirements measured and verified according to EN 302 308 in an absorber chamber.
   You may only use your SIMATIC RF600 system with the new third-party components when this has been carried out.

4.4 Environmental conditions for transponders/tags

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 305) and SectionSIMATIC RF640T Gen 2 (Page 349) .

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

This revision of the standard EN 302 208 also supports RFID systems with multiple readers operating simultaneously. Within the frequency spectrum, 4 exclusive RFID channels are defined.

Regulations for frequency ranges according to EN 302 208 as of V1.2.1

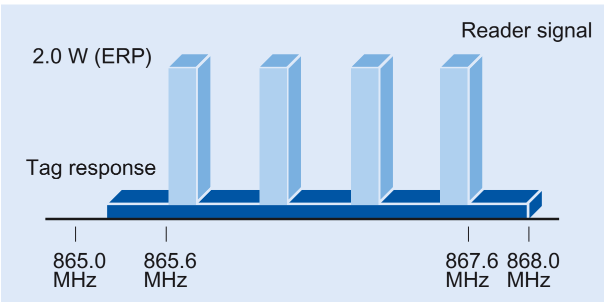
ETSI (European Telecommunications Standards Institute)

Specifications according to European standard EN 302 208:

- UHF band: 865 to 868 MHz
- Radiated 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 are operated with this setting since November 4, 2008 (publication of the standard in the Official Journal of the European Union).

4.6.2 Regulations for UHF frequency ranges in Argentina

The regulations for the UHF frequency range in Argentina are identical to the Regulations for UHF frequency bands in the USA (Page 82).

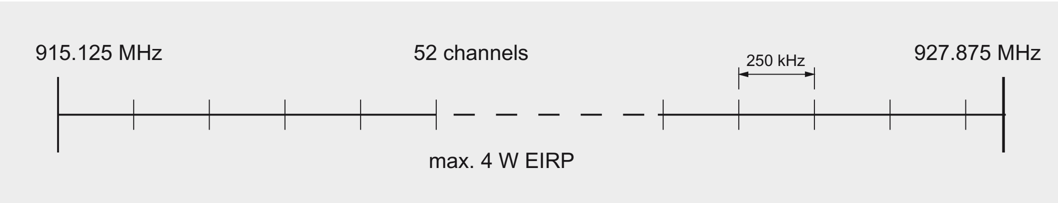
4.6.3 Regulations for UHF frequency ranges in Bolivia

The regulations for the UHF frequency range in Bolivia are identical to the Regulations for UHF frequency bands in the USA (Page 82).

4.6.4 Regulations for UHF frequency ranges in Brazil

FCC subband (Federal Communications Commission)

- UHF band: 915.125…927.875 MHz
- Radiated power: max. 4 W (EIRP)
- Number of channels: 52
- Frequency hopping



Frequency hopping

This technique is intended to prevent mutual interference between readers. The reader changes its transmission channel in a random or programmed sequence (FHSS). 52 available channels mean that the probability is low that two readers will be operating on the same frequency.

4.6.5 Regulations for UHF frequency ranges in Canada

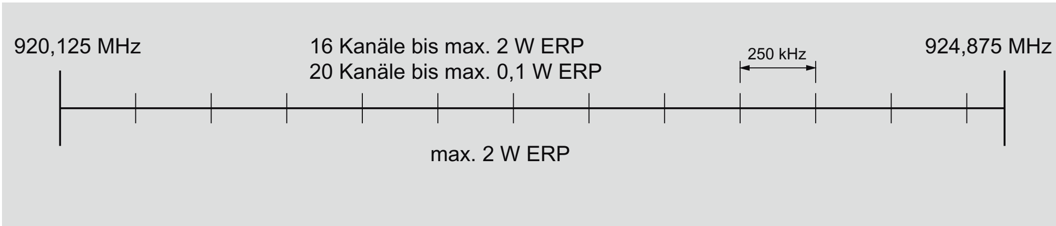
Regulations for UHF frequency ranges in Canada are identical to the Regulations for UHF frequency bands in the USA (Page 82).

4.6.6 Regulations for UHF frequency bands in China

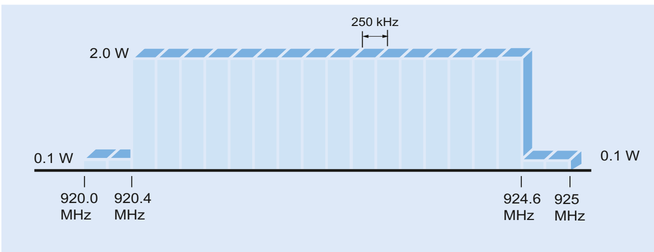
Regulations for UHF frequency ranges in China

FCC subband (Federal Communications Commission)

- UHF band: 920.125 to 924.875 MHz in 250 kHz channel blocks.
- Radiated 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

<table>
<tr><th>Sub bands</th><th>Frequency range</th><th>Power</th></tr>
<tr><td rowspan="3">
</td><td>920.125 to 920.375 MHz</td><td>0.1 W ERP</td></tr>
<tr><td>920.625 to 924.375 MHz</td><td>2.0 W ERP</td></tr>
<tr><td>924.625 to 924.875 MHz</td><td>0.1 W ERP</td></tr>
</table>

Frequency hopping

This technique is intended to 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.

4.6.7 Regulations for UHF frequency ranges in India

This regulation for UHF frequencies in India operates based on the standard ETSI EN 302 208 V1.4.1. It also supports RFID systems with multiple readers operating simultaneously. Within the frequency spectrum, 10 exclusive RFID channels are defined.

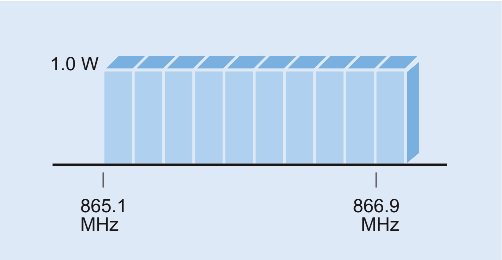
Regulations for frequency ranges in India

Based on European standard ETSI EN 302 208 V1.4.1:

- UHF band: 865…867 MHz
- Transmit power: max. 1 W
- Radiated power: < 4 W (EIRP)
- Channel bandwidth: 200 KHz, channel spacing 200 kHz
- Number of channels: 10
  - 865.1
  - 865.3
  - 865.5
  - 865.7
  - 865.9
  - 866.1
  - 866.3
  - 866.5
  - 866.7
  - 866.9

Channel assignment

- The UHF band from 865 to 866 MHz is occupied with 10 RFID channels:



4.6.8 Regulations for UHF frequency ranges in Mexico

Regulations for UHF frequency ranges in Mexico are identical to the Regulations for UHF frequency bands in the USA (Page 82).

4.6.9 Regulations for UHF frequency ranges in Russia

This regulation for UHF frequencies in Russia operates based on the standard ETSI EN 302 208 V1.4.1. It also supports RFID systems with multiple readers operating simultaneously. Within the frequency spectrum, 8 exclusive RFID channels are defined.

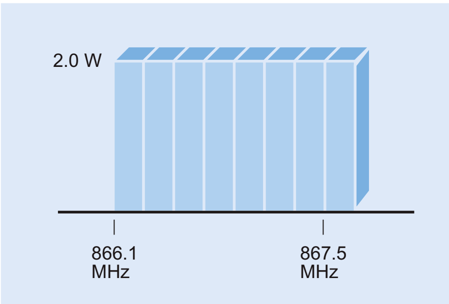
Regulations for frequency bands according to EN 302 208 V1.4.1

Based on European standard ETSI EN 302 208 V1.4.1:

- UHF band: 866.1…867.6 MHz
- Radiated power: max. 2 W (ERP)
- Channel bandwidth: 200 KHz, channel spacing 200 kHz
- Number of channels: 8
  - 866.1
  - 866.3
  - 866.5
  - 866.7
  - 866.9
  - 867.1
  - 867.3
  - 867.5

Channel assignment

- The UHF band from 866 to 867 MHz is occupied with 8 RFID channels:

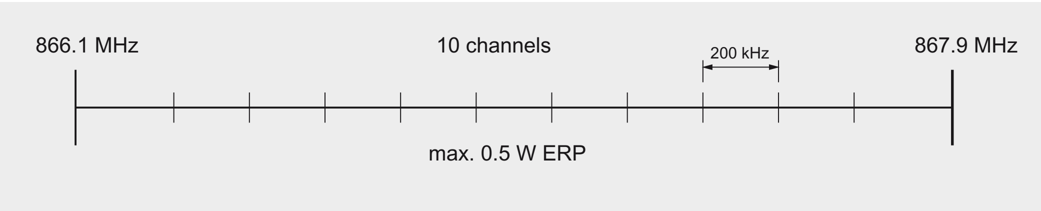


4.6.10 Regulations for UHF frequency bands in Singapore (866-869 MHz band)

Regulations applicable to frequency ranges

Based on European standard ETSI EN 302 208 V1.4.1:

- UHF band: 866.1 to 867.9 MHz
- Radiated power: max. 0.5 W (ERP)
- Channel bandwidth: 200 kHz
- Number of channels: 10



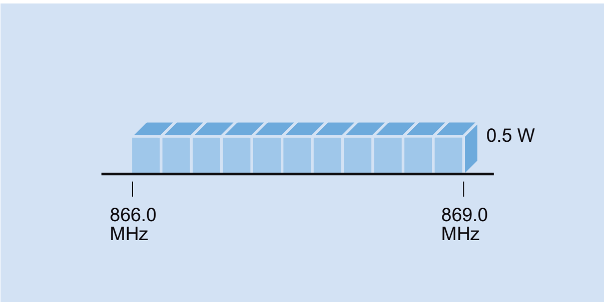
Note

Exceeding the maximum permitted radiated power of 0.5 W ERP

If you want to use this profile with a RF600 reader, during configuration you must make sure tha a maximum of 0.5 W (ERP) is used.

Also ensure that you use no channels outside of the specified frequency band.

Channel assignment

Sub bands	Frequency range	Power
	866.1 to 867.9 MHz	0.5 W ERP

4.6.11 Regulations for UHF frequency ranges in South Africa

Regulations for UHF frequency ranges in South Africa are identical to the Regulations for UHF frequency bands in Europe (Page 75).

4.6.12 Regulations for UHF frequency ranges in South Korea

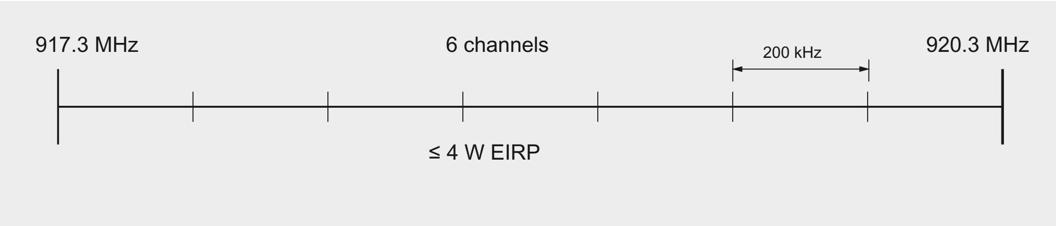
This regulation for UHF frequency ranges in South Korea operates in the FCC subband. It also supports RFID systems with multiple readers operating simultaneously. Within the frequency spectrum, 6 exclusive RFID channels are defined. The maximum channel dwell time is 400 ms.

FCC subband (Federal Communications Commission):

- UHF band: 917.2…920.4 MHz
- Radiated power: ≤ 4 Watt (EIRP)
- Channel bandwidth: 200 KHz, channel spacing 600 kHz
- Number of channels: 6
  - 917.3
  - 917.9
  - 918.5
  - 919.1
  - 919.7
  - 920.3
- Frequency hopping

Channel assignment

- The UHF band from 917.3 to 920.3 MHz is occupied with 10 RFID channels:



4.6.13 Regulations for UHF frequency bands in Thailand (FCC band)

The regulations for UHF-FCC frequency bands in Thailand are identical to the regulations for Regulations for UHF frequency bands in the USA (Page 82).

4.6.14 Regulations for UHF frequency bands in Thailand (ETSI band)

The regulations for UHF-ETSI frequency bands in Thailand are identical to the regulations for Regulations for UHF frequency bands in Europe (Page 75).

4.6.15 Regulations for UHF frequency bands in the USA

FCC (Federal Communications Commission)

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

Frequency hopping

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

4.7 Guidelines for electromagnetic compatibility (EMC)

4.7.1 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.

Note

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.

4.7.2 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.

4.7.3 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

- Plan a meshed grounding concept.
- 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.

4.7.4 Propagation of electromagnetic interference

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

- Interference source
- Coupling path
- Interference sink

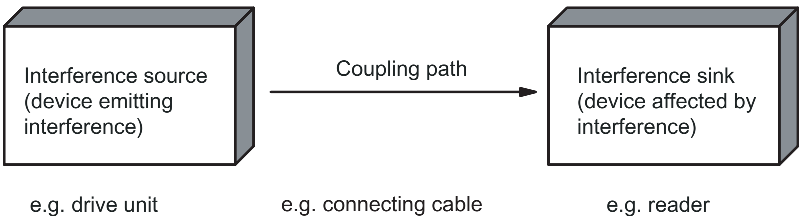


Figure 4-9 Propagation of interference

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- 3 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:

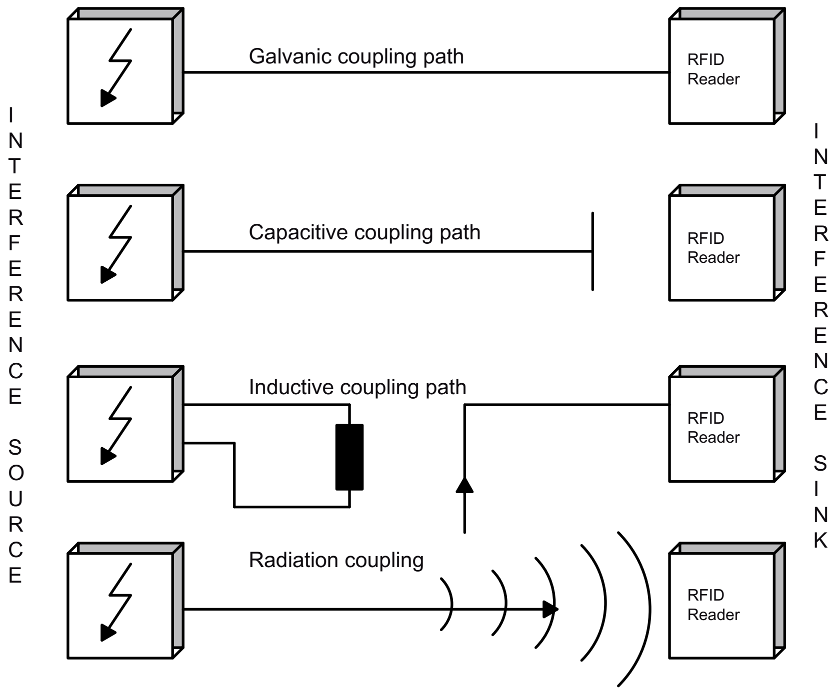


Figure 4-10 Ways in which interference can be coupled in

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

Table 4- 4 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

4.7.5 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.

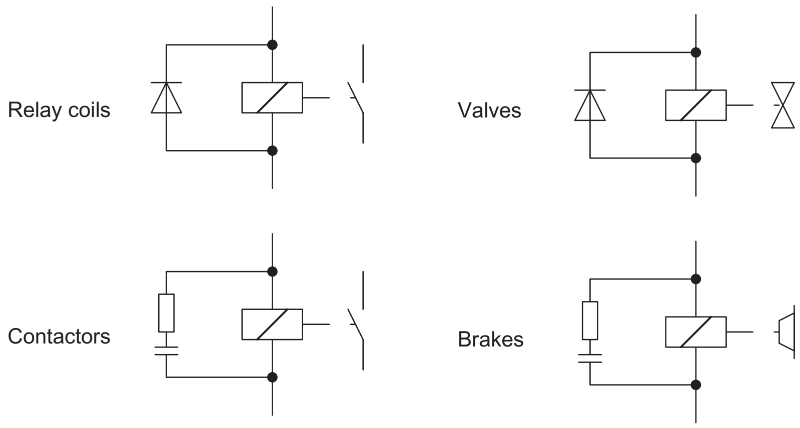


Figure 4-11 Suppression of inductance

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.

4.7.6 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.

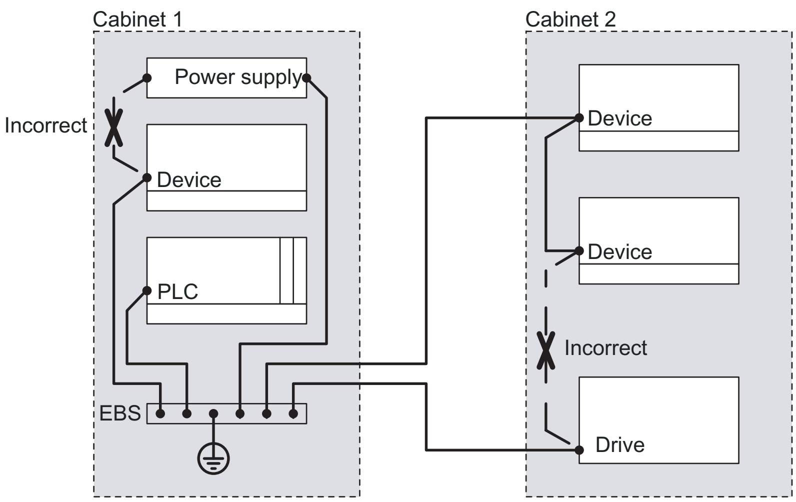


Figure 4-12 Equipotential bonding (EBS = Equipotential bonding strip)

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.

4.7.7 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

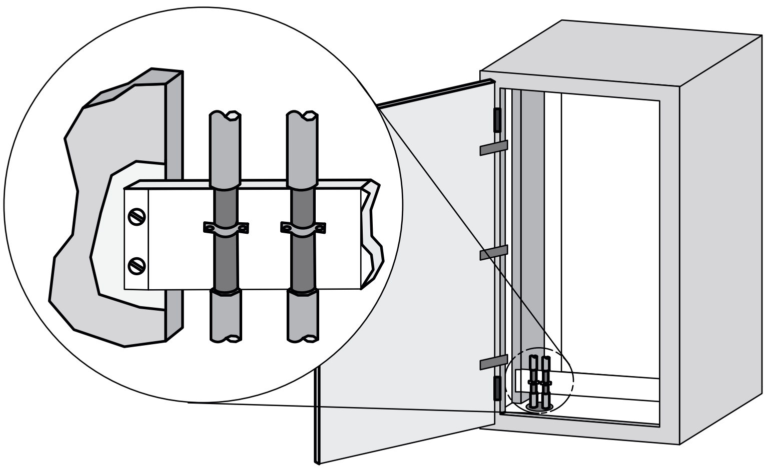


Figure 4-13 Cable shielding

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.

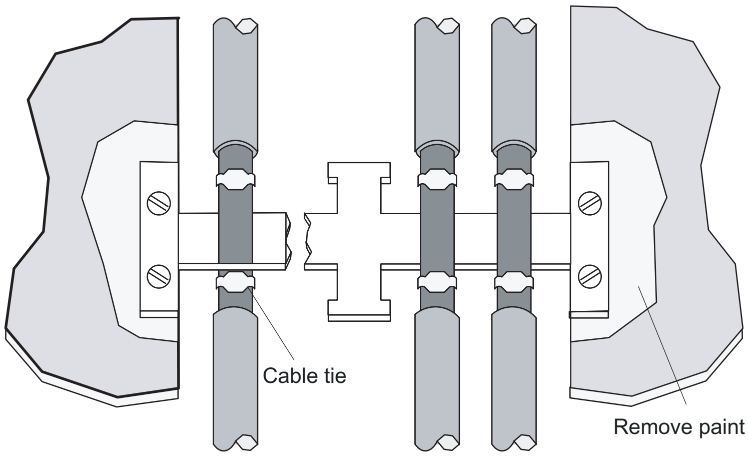


Figure 4-14 Connection of shielding bus

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.

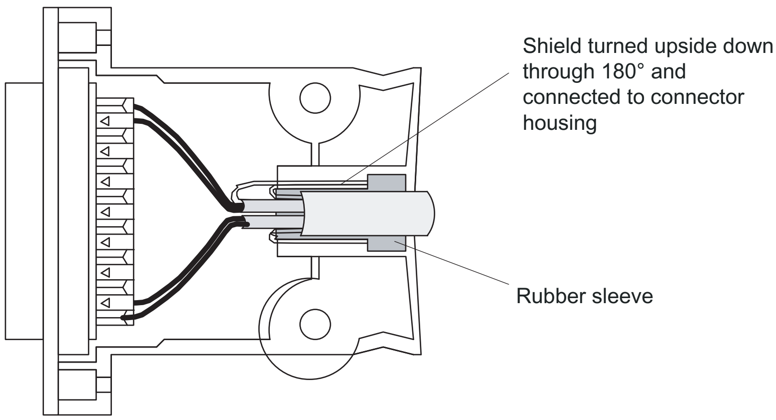


Figure 4-15 Interruption of shielded cables

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 RF640R	SIMATIC RF630R	SIMATIC RF620R
Air interface / standards supported		EPCglobal Class 1 Gen 2	EPCglobal Class 1 Gen 2	EPCglobal Class 1 Gen 2	EPCglobal Class 1 Gen 2
ETSI variant		Available	Available	Available	Available
FCC variant		Available	Available	Available	Available
CMIIT variant		Available	Available	Available	Available
LEDs		1	1	1	1
Interfaces					
	Number of external antennas via RTNC	4	1	2	1
	Available internal antennas	-	1	-	1
	Ethernet	1 x RJ-45 connection according to IEC PAS 61076-3-117	1 x RJ-45 connection according to IEC PAS 61076-3-117	-	-
	RS232	-	-	-	-
	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	2 (8-pin M12) log "0": 0…7 V log "1": 15…24 V	-	-
	Digital outputs (short-circuit proof)	4 (12-pin M12) 24 V; 0.5 A each	2 (8-pin M12) 24 V; 0.5 A each	-	-
	Power supply	24 VDC (4-pin M12) 20 to 30 V (2.2 A) external	24 VDC (4-pin M12) 20 to 30 V (2.2 A) external	via CM	via CM
Max. radiated power ETSI and CMIIT in ERP		2 W ERP	1.6 W ERP 1) 2 W ERP	1.2 W ERP	0.8 W ERP 1) 1.2 W ERP
Max. radiated power FCC in EIRP		4 W EIRP	3.3 W EIRP 1) 4 W EIRP	2.0 W EIRP	1.3 W EIRP 1) 2 W EIRP
max. transmit power ETSI and CMIIT		30 dBm 1 W	30 dBm 1 W	27 dBm 0.5 W	27 dBm 0.5 W
max. transmit power FCC		31 dBm 1.25 W	31 dBm 1.25 W	27 dBm 0.5 W	27 dBm 0.5 W
Max. transmission rate of the communication interface		10/100 Mbps	10/100 Mbps	115.2 kbps	115.2 kbps

Features	SIMATIC RF670R	SIMATIC RF640R	SIMATIC RF630R	SIMATIC RF620R
Max. data rate reader-to-tag	80 Kbps (ETSI) 160 Kbps (FCC)	80 Kbps (ETSI) 160 Kbps (FCC)	40 kbps	40 kbps
Max. data rate tag-to-reader	160 kbps (ETSI) 320 kbps (FCC)	160 kbps (ETSI) 320 kbps (FCC)	160 kbps	160 kbps

1) internal antenna

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. For readers with the new hardware version (MLFB: 6GT2811-5BA00-xAA1), a maximum of one external UHF RFID antenna can be connected via a TNC reverse connector as an alternative to the integrated antenna.

The maximum HF power output is 0.5 W at the reader output. The SIMATIC RF620R is connected to a SIMATIC S7 controller via an ASM interface module. The degree of protection is IP65.

Pos.	Description
(1)	TNC-reverse interface for connection of ANT
(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 RF620R (ETSI) "6GT2811-5BA00-0AAx" is suitable for the frequency band 865 to 868 MHz UHF (EU, EFTA, Turkey). The reader supports the ETSI EN 302 208 V1.2.1 (4-channel plan) standard up to and including ETSI EN 302 208 V1.4.1 standard (4-channel plan).
- The RF620R (FCC) "6GT2811-5BA00-1AAx" is suitable for the frequency bands 902 to 928 MHz.
- The RF620R (CMIIT) "6GT2811-5BA00-2AA1" is suitable for the frequency band 920.125 to 924.875 MHz (China)
- An external antenna can be connected and configured as an alternative to the internal antenna for RF620R "6GT2811-5BA00-xAA1"
- 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 number
RF620R (ETSI) reader for EU, EFTA, Turkey	6GT2811-5BA00-0AA0 6GT2811-5BA00-0AA1
RF620R (FCC) reader for North America	6GT2811-5BA00-1AA0 6GT2811-5BA00-1AA1
RF620R (CMIIT) reader for China	6GT2811-5BA00-2AA1

Ordering data for antennas and antenna cables

For readers with an external antenna connector (MLFB: 6GT2811-5BA00-xAA1), the following antennas and antenna cables are available:

Product	Order number
Antennas • RF620A antenna for EU, EFTA, Turkey (868 MHz) • RF620A antenna for China and USA (915 MHz) • RF640A antenna (865 to 928 MHz) • RF642A antenna (865 to 928 MHz) • RF660A antenna for EU, EFTA, Turkey (868 MHz) • RF660A antenna for China and USA (915 MHz)	 • 6GT2812-1EA00 • 6GT2812-1EA01 • 6GT2812-0GA08 • 6GT2812-1GA08 • 6GT2812-0AA00 • 6GT2812-0AA01
Antenna cable • 3 m (cable attenuation: 1.0 dB) • 5 m (cable attenuation: 1.25 dB, suitable for drag chains) • 10°m (cable attenuation: 2.0 dB) • 10°m (cable attenuation: 4.0 dB) • 15 m (cable attenuation: 4.0 dB, suitable for drag chains) • 20 m (cable attenuation: 4.0 dB)	 • 6GT2815-0BH30 • 6GT2815-2BH50 • 6GT2815-1BN10 • 6GT2815-0BN10 • 6GT2815-2BN15 • 6GT2815-0BN20

Ordering data (accessories)

Product	Order number
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
Antenna mounting kit	6GT2890-0AA00
Set of protective caps Contains 3 protective caps for antenna output and one protective cap for digital I/O interface (required for IP65 degree of protection when some connectors are unused)	6GT2898-4AA00
RFID DVD "Software & Documentation"	6GT2080-2AA20

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 section Error messages and flashing codes (Page 398)

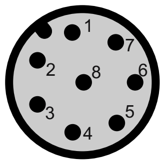
Note

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")
- Parameter assignment is incorrect (black list, RSSI threshold)
- 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	Unassigned
	8	Earth (shield)

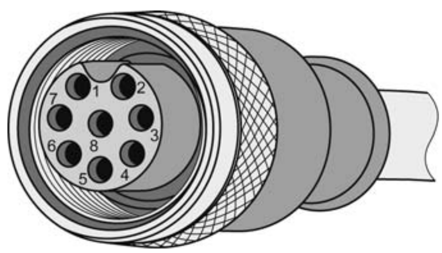
The knurled bolt of the M12 plug is not connected to the shield (on the reader side).

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 socket
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.

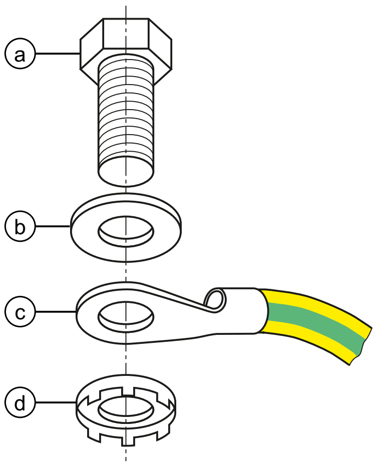
Note

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 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.

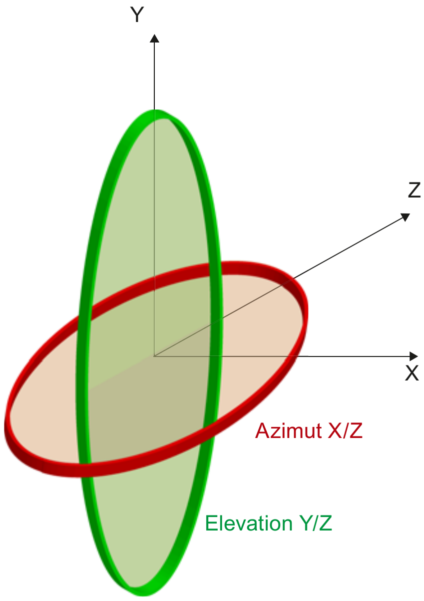
In order to avoid this, always keep a minimum distance of 3 m between two readers with the maximum radiated power of 500 mW ERP.

Dense Reader Mode (DRM)

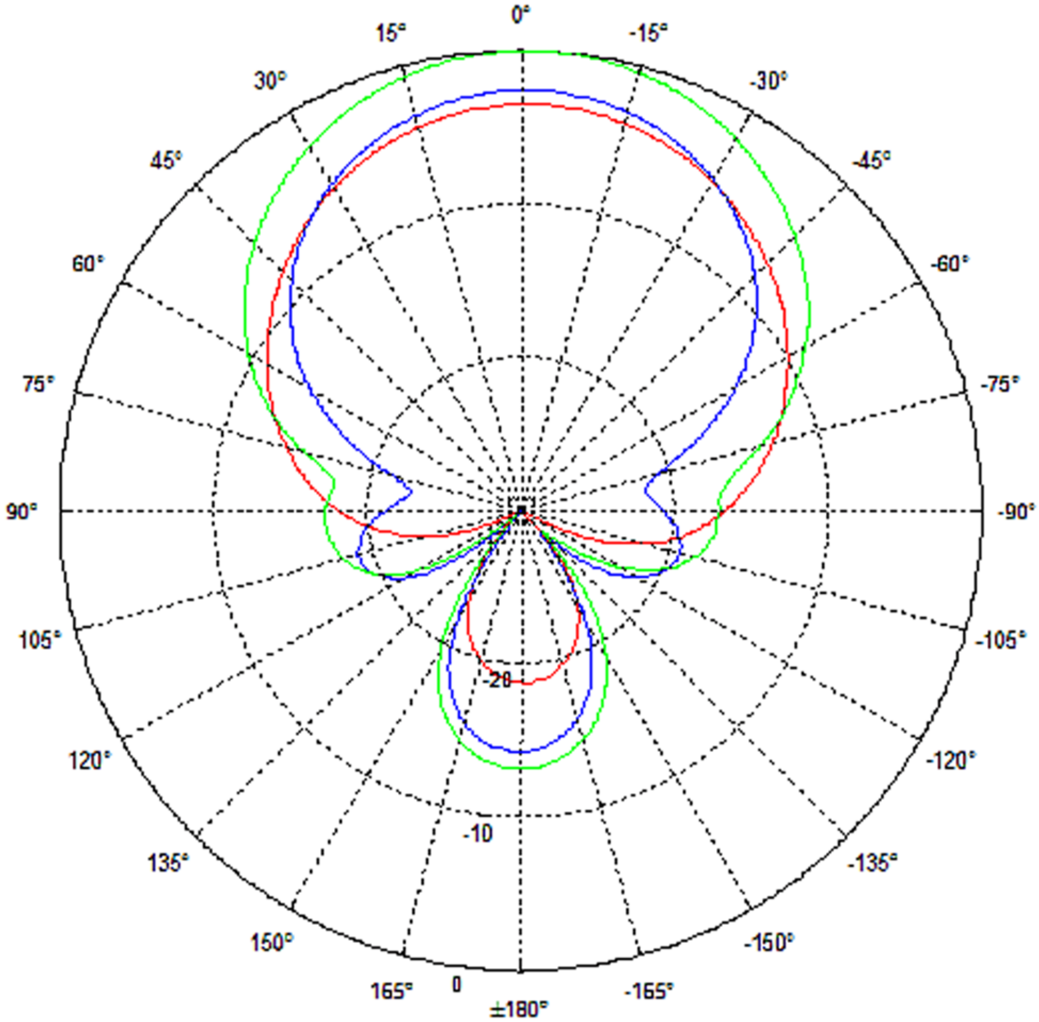
The readers can also interfere with each other (secondary fields), if the channels (Reader TX, Transponder TX) overlap. In order to prevent a transponder channel overlapping with a reader channel, we recommend that the Dense Reader Mode (DRM) is used.

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 characteristics, the vertical plane (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)



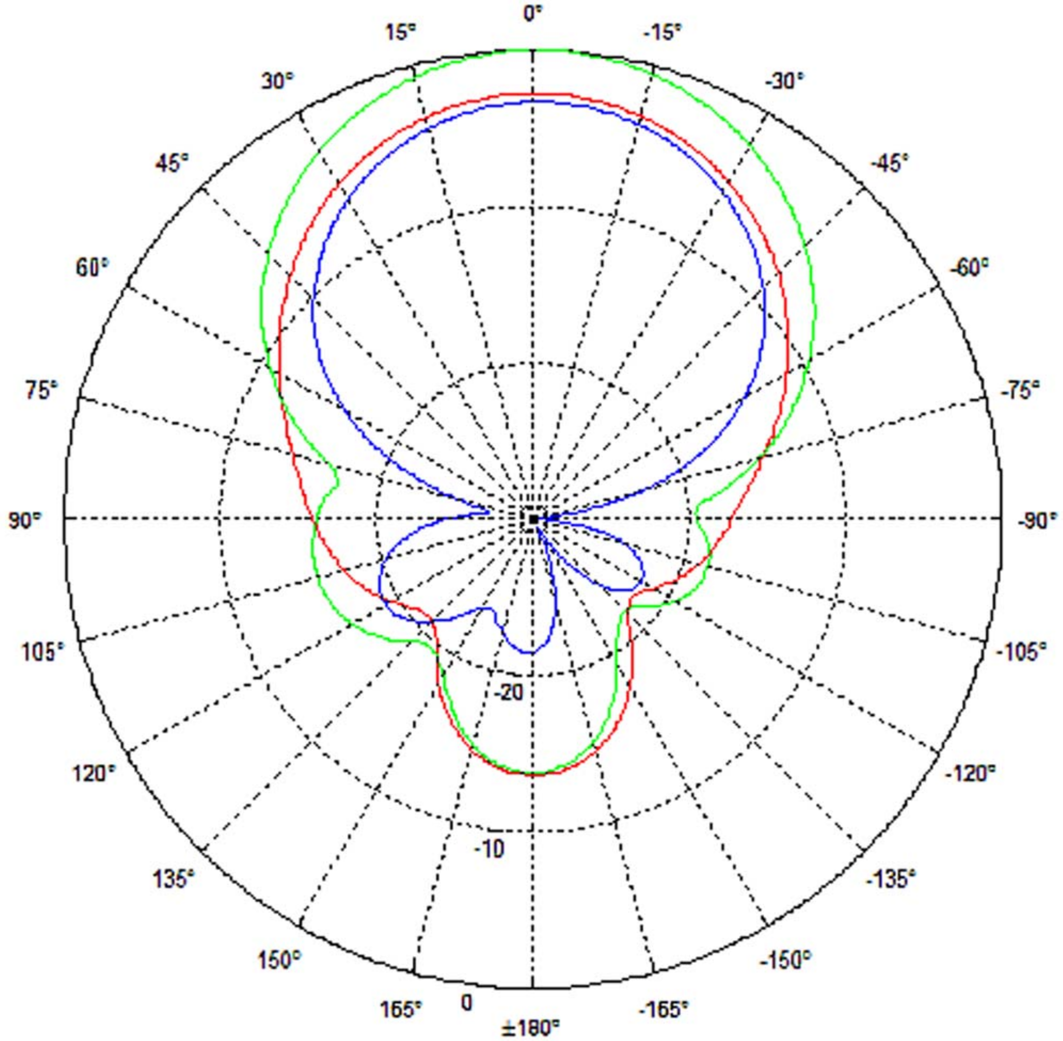
Vertical component of the polarization direction of the antenna

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

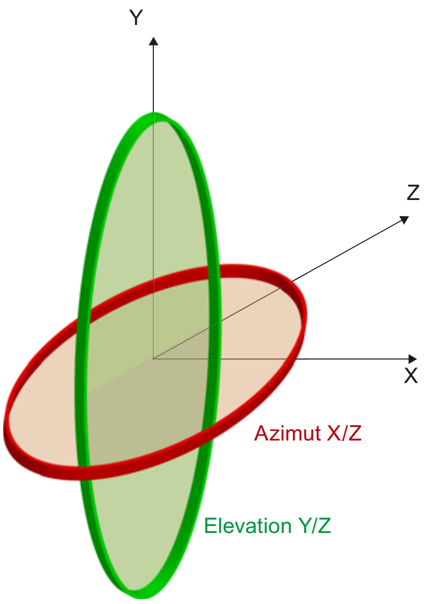
Table 5- 2 Maximum linear electrical aperture angle at 865 MHz:

Azimuth section	77,7°
Elevation section	66,1°
Typical antenna gain in the frequency range 865 to 868 MHz	4.0 dBi
Antenna axis ratio	0.7 dB

See also section Guidelines for selecting RFID UHF antennas (Page 54)

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 characteristics, the vertical plane (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)

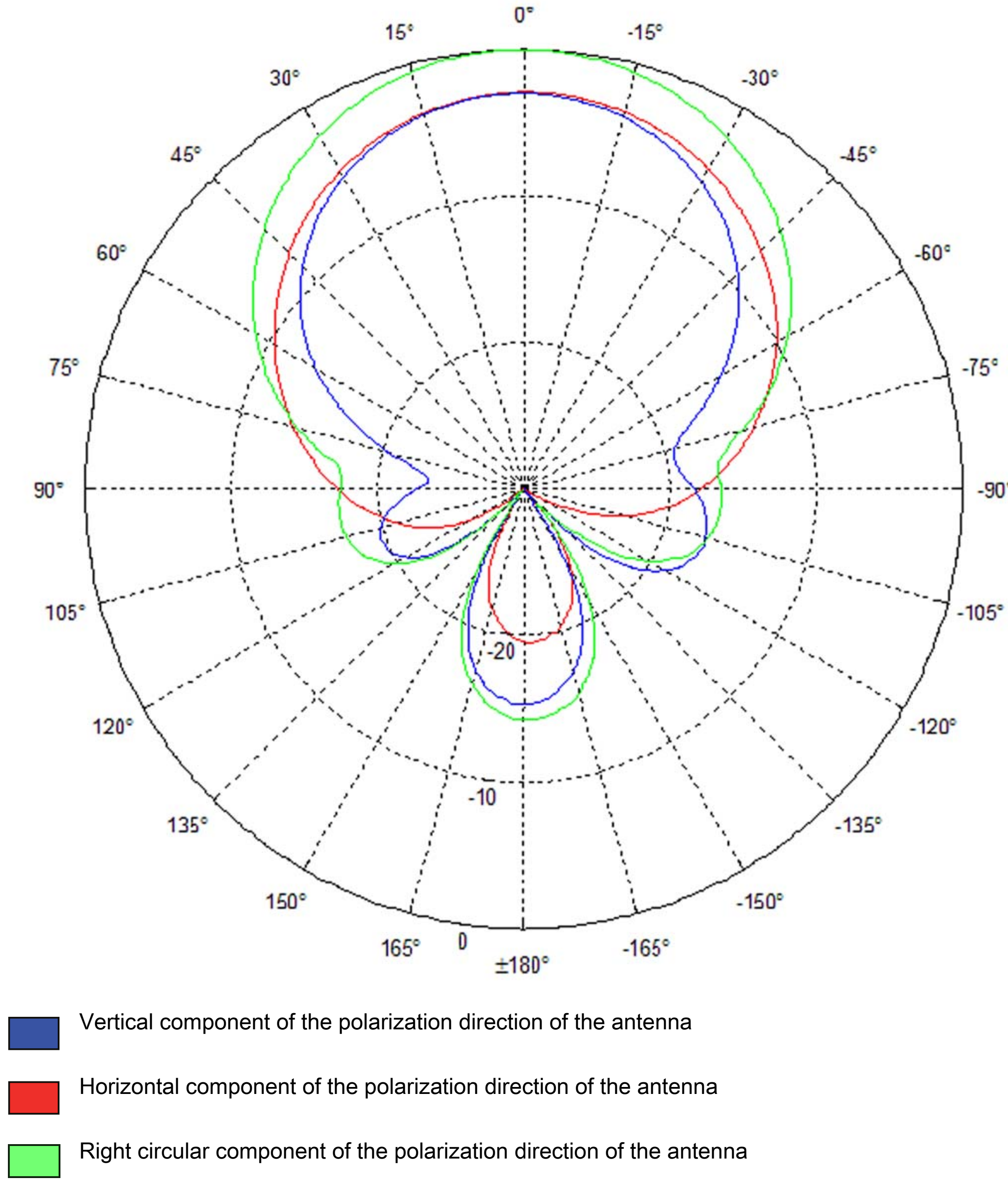
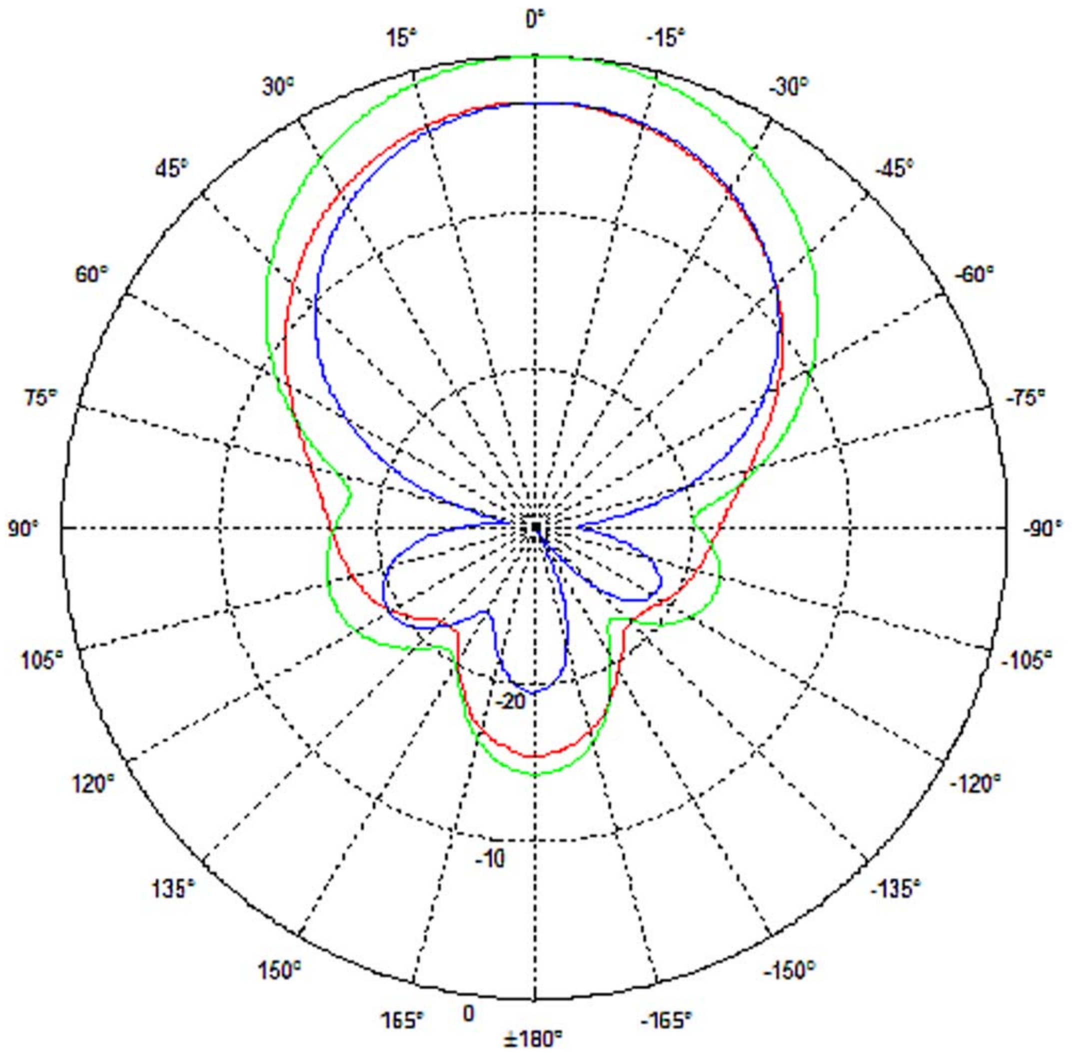


Figure 5-3 Azimuth section

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 aperture angle at 865 MHz:

Azimuth section	75,4 °
Elevation section	69,1 °
Typical antenna gain in the frequency range 902 to 928 MHz	4.0 dBi ± 0.5 dB
Antenna axis ratio	<1 dB

see also section Guidelines for selecting RFID UHF antennas (Page 54).

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 100), 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
Make sure that the wall or ceiling can hold four times the total weight of the device.

Note

Close unused connectors

If you do not use connectors on the reader, it is advisable to close the unused connectors with protective caps. You can order the protective cap set using the MLFB specified in the section "Ordering data".

Note

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 section FCC information (Page 116) RF620R or section FCC information (Page 133) 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 262)). 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 113).

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).

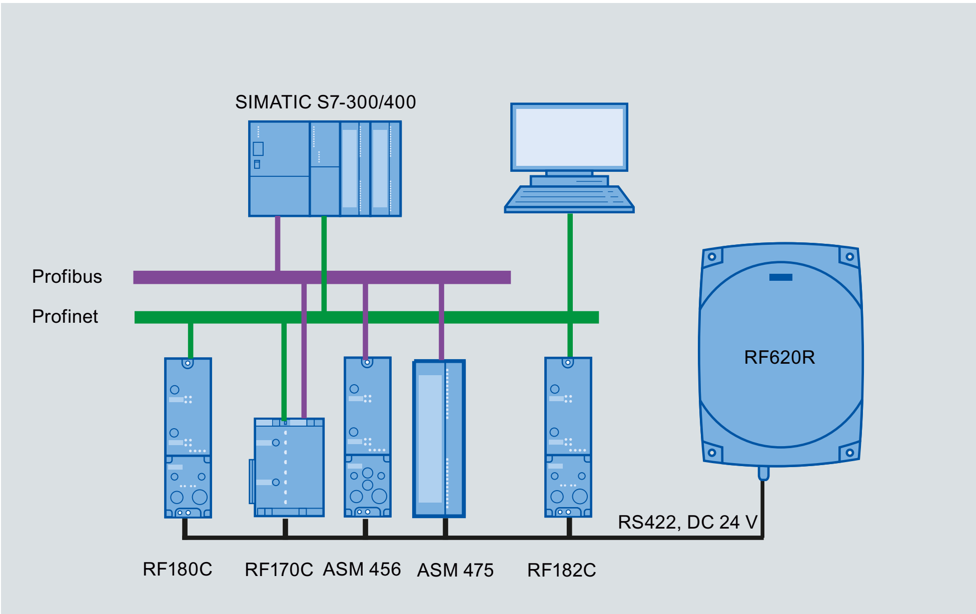


Figure 5-5 Overview of configuration of the RF620R reader

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 Integration in SIMATIC networks (Page 392) .

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)
	Antenna connectors	1 x RTNC plug
	Software	SIMATIC S7
MTBF in years		18.2

Technical and electrical characteristics		
Power supply • Permitted range	21.6 to 30 VDC [1]	
Power supply	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
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
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 VDC supply: safe (electrical) isolation of extra-low voltage (SELV / PELV acc. to EN 60950)

Mechanical environmental conditions	
Shock resistant acc. to EN 60068-2-27 Vibration acc. to 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 allowed 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 RF620R (ETSI)	
Electromagnetic compatibility	ETSI EN 301 489-1 / -3
	ETSI EN 302 208 V1.3.1 ETSI EN 302 208 V1.4.1
Approvals/Conformity	• Radio acc. to R&TTE guidelines, EN 301 489 • CE • ETSI EN 302-208 V1.1.1 • ETSI EN 302-208 V1.3.1 • ETSI EN 302-208 V1.4.1 • 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 specifications	
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 radiated power with internal antenna • ETSI/CMIIT: • FCC	 • ≤ 0.8 W ERP • ≤ 1.3 W EIRP
Effective radiated power with external antenna • ETSI/CMIIT: • FCC	 • ≤ 1.2 W ERP • ≤ 2.0 W EIRP
Transmit power	≤ 0.5 W

Reading range	
Readers mounted on the same side	Max. 2 m (recommended maximum value for configuration; depending on the transponder)

ETSI frequencies	
Frequency range for Europe, EFTA, Turkey, South Africa, Thailand (ETSI) ETSI EN 302 208 V1.4.1 (valid since October 23, 2012, publication in the Official Journal of the European Union)	865.7 ... 867.5 MHz (4 channels LBT optional at max. 2 W ERP)
Frequency range India	865 ... 867 MHz (10 channels at max. 4 W EIRP)
Frequency range Russia	866,1 ... 867.6 MHz (8 channels at 2 W ERP)
Frequency range Singapore	866 ... 869 MHz (11 channels at 0.5 W ERP)

FCC frequencies	
Frequency range USA; Argentina, Bolivia, Canada, Mexico, Thailand (FCC)	902 ... 928 MHz (50 channels at max. 4 W EIRP, frequency hopping)
Frequency range Brazil	915,125 ... 927.875 MHz (52 channels at max. 4 W EIRP, frequency hopping)
Frequency range South Korea	917,1 ... 920.4 MHz (7-16 channels at max. 4 W EIRP, frequency hopping)

CMIIT frequencies	
Frequency range China	920,625 ... 924.375 MHz (16 subchannels at 2 W ERP)

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. 18 tags per second

5.1.6 Dimension drawings

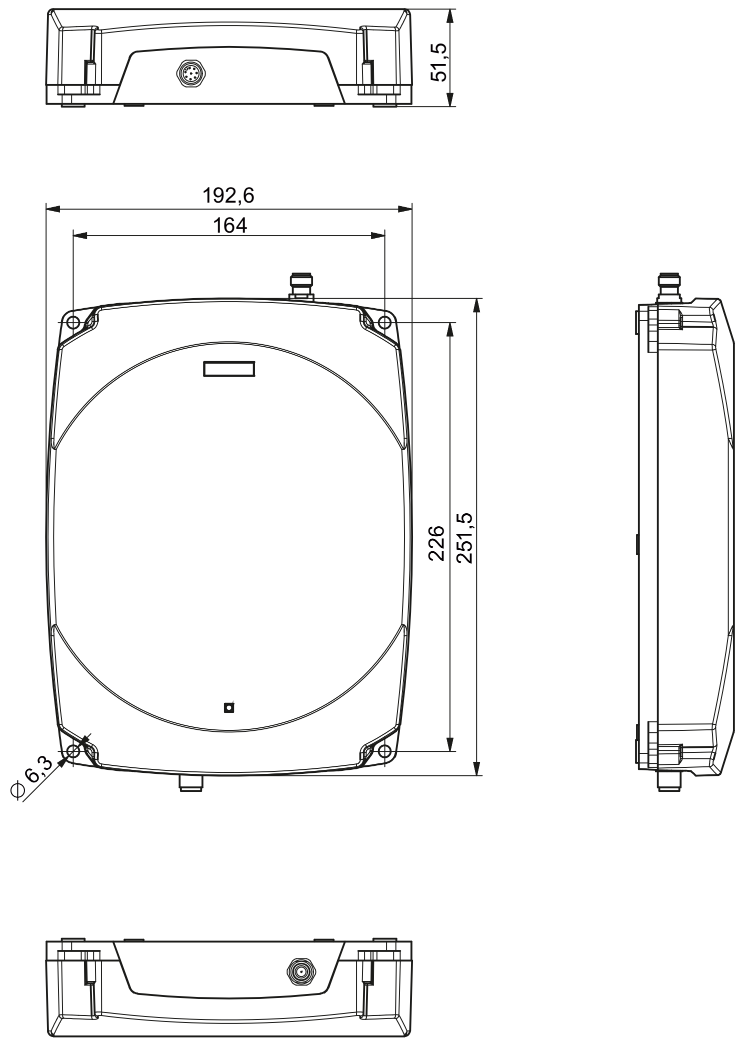


Figure 5-6 Dimension drawing for RF620R

All dimensions in mm (± 0.5 mm tolerance)

5.1.7 Certificates and approvals

Note

Marking on the readers according to specific approval

The certificates and approvals listed here apply only if the corresponding mark is found on the readers.

Table 5- 4 6GT2811-5BA00-0AA0, 6GT2811-5BA00-0AA1

Certificate	Description
CE	Conformity with R&TTE directive
TA-2012/548	South Africa radio approval: Radio Equipment Type Approval

5.1.7.1 Country-specific certifications

Table 5- 5 6GT2811-5BA00-1AA0, 6GT2811-5BA00-1AA1

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-RF620R (for 6GT2811-5BA00-1AA0) FCC ID: NXW-RF600R (for 6GT2811-5BA00-1AA1)
Industry Canada Radio Standards Specifications	RSS-210 Issue 7, June 2007, Sections 2.2, A8 IC: 267X-RF620R (for 6GT2811-5BA00-1AA0) IC: 267X-RF600R, Model RF620R-2 (for 6GT2811-5BA00-1AA1)
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

Standard	
ANATEL	Brazil wireless approval Marking on the reader (6GT2811-5BA00-1AA0):  Marking on the reader (6GT2811-5BA00-1AA1):  Statement about approval: Este equipamento opera em caráter secundário, isto é, não tem direito à proteção contra interferência prejudicial, mesmo de estações do mesmo tipo e não pode causar interferência a sistemas operando em caráter primário. Reader certificate: ANATEL 3377-12-4061
	KCC Certification Marking on the reader: Type of equipment: A급 기기 (업무용 방송통신기자재) Class A Equipment (Industrial Broadcasting & Communication Equipment) 이 기기는 업무용(A급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라 며, 가정외의 지역에서 사용하는 것을 목적으로 합니다. This equipment is Industrial (Class A) electromagnetic wave suitability equipment and seller or user should take notice of it, and this equipment is to be used in the places except for home. Reader certificate: KCC-CRM-RF5-RF620R
H-11388	Argentina radio approval: Registro de la COMISION NACIONAL DE COMUNICACIONES
RCPSIRF12-0772	Mexico radio approval: CERTIFICADO DE HOMOLOGACION

Table 5- 6 6GT2811-5BA00-2AA1

Standard	
CMIIT Certification	China radio approval Marking on the reader: CMIIT ID: 2012DJ2916

5.1.7.2 FCC information

Siemens SIMATIC RF620R (FCC): 6GT2811-5BA00-1AA0, 6GT2811-5BA00-1AA1

FCC ID: NXW-RF620R (for 6GT2811-5BA00-1AA0)
FCC ID: NXW-RF600R (for 6GT2811-5BA00-1AA1)

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.

5.1.7.3 IC-FCB information

Siemens SIMATIC RF620R (FCC): 6GT2811-5BA00-1AA0, 6GT2811-5BA00-1AA1

IC: 267X-RF620R (for 6GT2811-5BA00-1AA0)
IC: 267X-RF600R, Model: RF620R-2 (for 6GT2811-5BA00-1AA1)

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.

Transmitter power and antenna information for antennas with a gain less than 6 dBi:

This device has been designed to operate with the SIMATIC RF620A antenna 902-928, the SIMATIC RF640A antenna 902-928 as well as the SIMATIC RF660A antenna 902-928 listed below, and having a maximum gain of 5,5 dBi. Arbitrary transmission power settings in combination with 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.

Transmitter power and antenna information for antennas with a gain greater 6 dBi:

This device requires professional installation. Antennas with a gain greater 6 dBi may be used provided the system does not exceed the radiation power of 4000 mW E.I.R.P. This device has been designed to operate with the SIMATIC RF642A antenna 902-928 exceeding the maximum gain of 5,5 dBi under the restriction that the RF power at the input of the antenna must be set to meet the following relation: RF power (dBm) ≤ 30 dBm – (antenna gain (dBi) – 6 dBi) Other antennas or system configurations for antennas having a gain greater than 6 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 Ohms.

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.

	Pos.	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) "6GT2811-4AA00-0AAx" is suitable for the frequency band 865 to 868 MHz UHF (EU, EFTA, Turkey). The reader supports the standard ETSI EN 302 208 V1.2.1 (4-channel plan).
- The RF630R (FCC) "6GT2811-4AA00-1AAx" is suitable for 902 to 928 MHz.

- The RF630R (CMIIT) "6GT2811-4AA00-2AA1" 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 number
RF630R (ETSI) reader for EU, EFTA, Turkey	6GT2811-4AA00-0AA0 6GT2811-4AA00-0AA1
RF630R (FCC) reader for the USA	6GT2811-4AA00-1AA0 6GT2811-4AA00-1AA1
RF630R (CMIIT) reader for China	6GT2811-4AA00-2AA1

Ordering data for antennas and antenna cables

Product	Order number
Antennas • RF620A antenna for EU, EFTA, Turkey (868 MHz) • RF620A antenna for China and USA (915 MHz) • RF640A antenna (865 to 928 MHz) • RF642A antenna (865 to 928 MHz) • RF660A antenna for EU, EFTA, Turkey (868 MHz) • RF660A antenna for China and USA (915 MHz)	 • 6GT2812-1EA00 • 6GT2812-1EA01 • 6GT2812-0GA08 • 6GT2812-1GA08 • 6GT2812-0AA00 • 6GT2812-0AA01
Antenna cable • 3 m (cable attenuation: 1.0 dB) • 5 m (cable attenuation: 1.25 dB, suitable for drag chains) • 10 m (cable attenuation: 2.0 dB) • 10 m (cable attenuation: 4.0 dB) • 15 m (cable attenuation: 4.0 dB, suitable for drag chains) • 20 m (cable attenuation: 4.0 dB)	 • 6GT2815-0BH30 • 6GT2815-2BH50 • 6GT2815-1BN10 • 6GT2815-0BN10 • 6GT2815-2BN15 • 6GT2815-0BN20

Ordering data (accessories)

Product	Order number
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
Antenna mounting kit	6GT2890-0AA00
Set of protective caps Contains 3 protective caps for antenna output and one protective cap for digital I/O interface (required for IP65 degree of protection when some connectors are unused)	6GT2898-4AA00
RFID DVD "Software & Documentation"	6GT2080-2AA20

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 section Error messages and flashing codes (Page 398)

Note

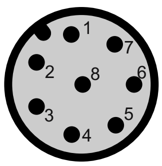
LED not lit yellow?

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")
- Parameter assignment is incorrect (black list, RSSI threshold)
- 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	Unassigned
	8	Earth (shield)

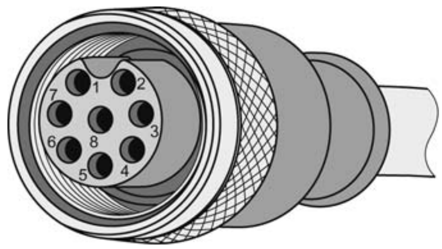
The knurled bolt of the M12 plug is not connected to the shield (on the reader side).

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- 7 RS 422 - on reader side

M12 pin	Core color	Pin assignment	View of M12 socket
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 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).

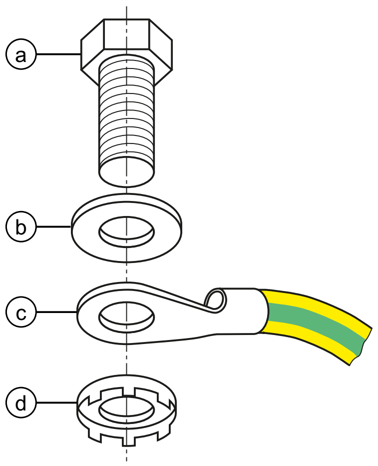
WARNING

Hazardous voltage due to lightning strikes

Death or serious injury may occur as a result of lightning strikes to antennas mounted outside buildings.

If the reader is operated with antennas mounted outside buildings, it is imperative that the reader is electrically connected to the ground potential.

Ground connection



(a)	Hexagon-head screw
(b)	Plain washer
(c)	Cable lug
(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. Note the minimum distances between the antennas for the antenna configuration (see section Specified minimum and maximum spacing of antennas (Page 45) .

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 section Specified minimum and maximum spacing of antennas (Page 45) .

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

Note

Close unused connectors

If you do not use connectors on the reader, it is advisable to close the unused connectors with protective caps. You can order the protective cap set using the MLFB specified in the section "Ordering data".

⚠ 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 130).

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).

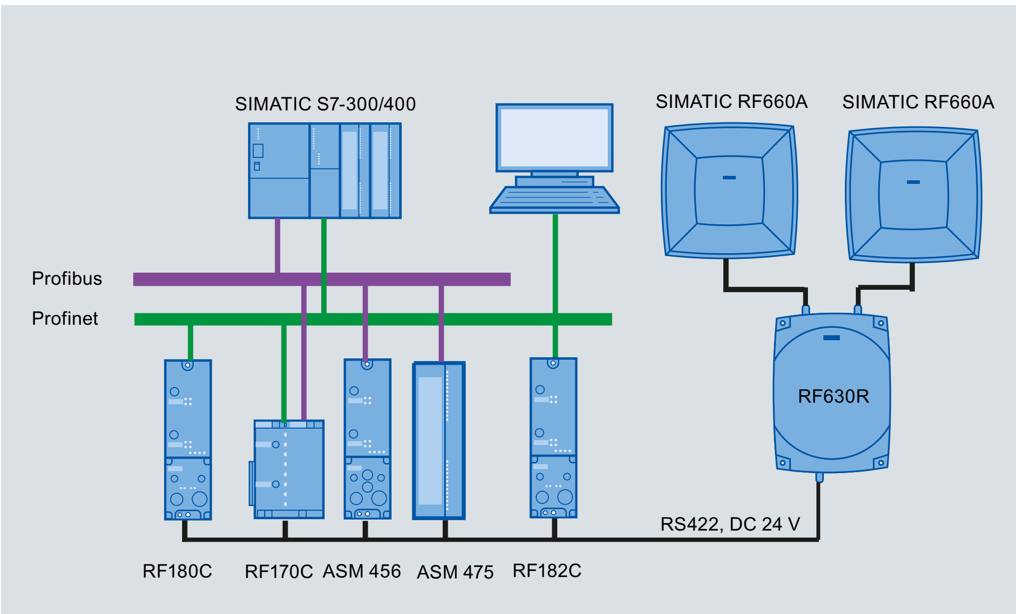


Figure 5-7 Overview of configuration of the RF630R reader

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 Integration in SIMATIC networks (Page 392) .

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 connectors	2 x RTNC plug
	RS422	1 x plug (8-pin M12)
	Software	SIMATIC S7
MTBF in years		18.2

Thermal and electrical properties			
Power supply • Permitted range		21.6 to 30 VDC [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 VDC supply: safe (electrical) isolation of extra-low voltage (SELV / PELV acc. to EN 60950)

Mechanical environmental conditions	
Shock resistant acc. to EN 60068-2-27 Vibration acc. to 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 allowed 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 V1.3.1 ETSI EN 302 208 V1.4.1
Approvals/Conformity	• Radio acc. to R&TTE guidelines, EN 301 489 • CE • ETSI EN 302-208 V1.1.1 • ETSI EN 302-208 V1.3.1 • ETSI EN 302-208 V1.4.1 • 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 specifications	
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 • ETSI/CMIIT: • FCC:	 • < < 1.2 W ERP • < 2 W EIRP
Transmit power	≤ 0.5 W ERP

Reading range	
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)

ETSI frequencies	
Frequency range for Europe, EFTA, Turkey, South Africa, Thailand (ETSI) ETSI EN 302 208 V1.4.1 (valid since October 23, 2012, publication in the Official Journal of the European Union)	865.7 ... 867.5 MHz (4 channels LBT optional at max. 2 W ERP)
Frequency range India	865 ... 867 MHz (10 channels at max. 4 W EIRP)
Frequency range Russia	866,1 ... 867.6 MHz (8 channels at 2 W ERP)
Frequency range Singapore	866 ... 869 MHz (11 channels at 0.5 W ERP)

FCC frequencies	
Frequency range USA; Argentina, Bolivia, Canada, Mexico, Thailand (FCC)	902 ... 928 MHz (50 channels at max. 4 W EIRP, frequency hopping)
Frequency range Brazil	915,125 ... 927.875 MHz (52 channels at max. 4 W EIRP, frequency hopping)
Frequency range South Korea	917,1 ... 920.4 MHz (7-16 channels at max. 4 W EIRP, frequency hopping)

CMIIT frequencies	
Frequency range China	920,625 ... 924.375 MHz (16 subchannels at 2 W ERP)

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

Operation with 2 antennas

If you have configured 2 antennas as a gate, both antennas must be turned on at the same time. The reader multiplexes both antennas internally. The multiplexing time is typically 100 ms (internal read time per antenna).

5.2.6 Dimension drawings

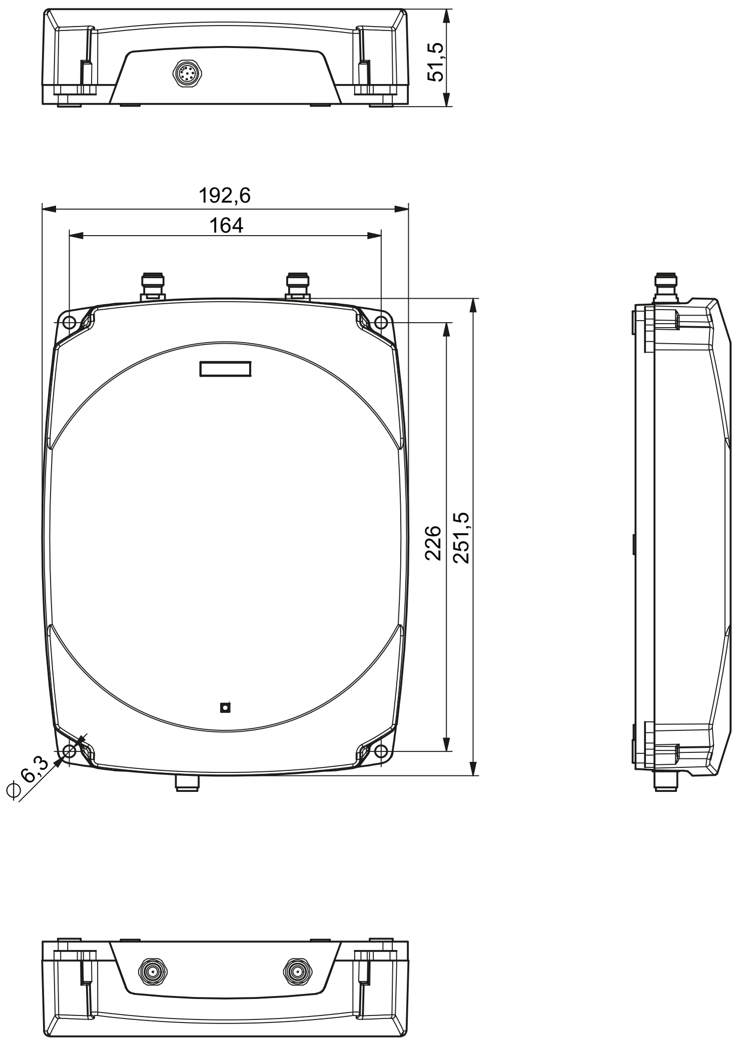


Figure 5-8 Dimension drawing for RF630R

All dimensions in mm (± 0.5 mm tolerance)

5.2.7 Certificates and approvals

Note

Marking on the readers according to specific approval

The certificates and approvals listed here apply only if the corresponding mark is found on the readers.

Table 5- 8 6GT2811-4AA00-0AA0, 6GT2811-4AA00-1AA1

Certificate	Description
	Conformity with R&TTE directive
TA-2012/548	South Africa radio approval: Radio Equipment Type Approval

Table 5- 9 6GT2811-4AA00-1AA0, 6GT2811-4AA00-1AA1

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-RF630R (for 6GT2811-4AA00-1AA0) FCC ID: NXW-RF600R (for 6GT2811-4AA00-1AA1)
Industry Canada Radio Standards Specifications	RSS-210 Issue 7, June 2007, Sections 2.2, A8 IC: 267X-RF630 (for 6GT2811-4AA00-1AA0) IC: 267X-RF600R, Model: RF630R-2 (for 6GT2811-4AA00-1AA1)
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

Standard	
	Brazil wireless approval Marking on the reader (6GT2811-4AA00-1AA0): Marking on the reader (6GT2811-4AA00-1AA1): Statement about approval: Este equipamento opera em caráter secundário, isto é, não tem direito à proteção contra interferência prejudicial, mesmo de estações do mesmo tipo e não pode causar interferência a sistemas operando em caráter primário. Reader certificate: ANATEL 3377-12-4061
	KCC Certification Marking on the reader: Type of equipment: A급 기기 (업무용 방송통신기자재) Class A Equipment (Industrial Broadcasting & Communication Equipment) 이 기기는 업무용(A급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라 며, 가정외의 지역에서 사용하는 것을 목적으로 합니다. This equipment is Industrial (Class A) electromagnetic wave suitability equipment and seller or user should take notice of it, and this equipment is to be used in the places except for home. Reader certificate: KCC-CRM-RF5-RF630R
H-11409	Argentina radio approval: Registro de la COMISION NACIONAL DE COMUNICACIONES
RCPSIRF12-0879	Mexico radio approval: CERTIFICADO DE HOMOLOGACION

Table 5- 10 6GT2811-4AA00-2AA1

Standard	
CMIIT Certification	China radio approval Marking on the reader: CMIIT ID: 2012DJ2917

5.2.7.1 FCC information

Siemens SIMATIC RF630R (FCC): 6GT2811-4AA00-1AA0, 6GT2811-4AA00-1AA1

FCC ID: NXW-RF630R (for 6GT2811-4AA00-1AA0)
FCC ID: NXW-RF600R (for 6GT2811-4AA00-1AA1)

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, 6GT2811-4AA00-1AA1

IC: 267X-RF630 (for 6GT2811-4AA00-1AA0)
IC: 267X-RF600, Model: RF630R-2 (for 6GT2811-4AA00-1AA1)

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.

Transmitter power and antenna information for antennas with a gain less than 6 dBi:

This device has been designed to operate with the SIMATIC RF620A antenna 902-928, the SIMATIC RF640A antenna 902-928 as well as the SIMATIC RF660A antenna 902-928 listed below, and having a maximum gain of 5,5 dBi. Arbitrary transmission power settings in combination with 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.

Transmitter power and antenna information for antennas with a gain greater 6 dBi:

This device requires professional installation. Antennas with a gain greater 6 dBi may be used provided the system does not exceed the radiation power of 4000 mW E.I.R.P. This device has been designed to operate with the SIMATIC RF642A antenna 902-928 exceeding the maximum gain of 5,5 dBi under the restriction that the RF power at the input of the antenna must be set to meet the following relation: RF power (dBm) ≤ 30 dBm – (antenna gain (dBi) – 6 dBi) Other antennas or system configurations for antennas having a gain greater than 6 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 Ohms.

5.3 RF640R reader

5.3.1 Description

5.3.1.1 Overview

The SIMATIC RF640R is an active stationary reader in the UHF frequency range with an integrated antenna. As an alternative, an external UHF RFID antenna can be connected via a TNC reverse connector.

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.

	Pos.	Description
	(1)	TNC reverse interface for connecting an antenna
	(2)	LED status indicator
	(3)	24 VDC 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 RF640R (ETSI) "6GT2811-3BA00-0AA0" is suitable for the frequency band 865 to 868°MHz UHF (EU, EFTA, Turkey). The reader supports the current standard ETSI EN 302 208 V1.4.1 (4-channel plan).
- The RF640R (FCC) "6GT2811-3BA00-1AA0" is suitable for the frequency band 902 to 928°MHz.
- The RF640R (CMIIT) "6GT2811-3BA00-2AA0" is suitable for the frequency band 920.125 to 924.875 MHz.
- You can choose between an internal or external antenna
- IP65 degree of protection
- 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.
- 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 RF640R

Product	Order number
RF640R (ETSI) reader for EU, EFTA, Turkey	6GT2811-3BA00-0AA0
RF640R (FCC) reader for the USA	6GT2811-3BA00-1AA0
RF640R (CHINA) reader for CMIIT	6GT2811-3BA00-2AA0

Ordering data for antennas and antenna cables

For readers with an external antenna connector (MLFB: 6GT2811-3BA00-xAA0), the following antennas and antenna cables are available:

Product	Order number
Antennas • RF620A antenna for EU, EFTA, Turkey (868 MHz) • RF620A antenna for FCC (915 MHz) • RF640A antenna (865 to 928 MHz) • RF642A antenna (865 to 928 MHz) • RF660A antenna for EU, EFTA, Turkey (868 MHz) • RF660A antennas for the USA and China (915°MHz)	 • 6GT2812-1EA00 • 6GT2812-1EA01 • 6GT2812-0GA08 • 6GT2812-1GA08 • 6GT2812-0AA00 • 6GT2812-0AA01
Antenna cable • 3 m (cable attenuation: 1.0 dB) • 5 m (cable attenuation: 1.25 dB, suitable for drag chains) • 10 m (cable attenuation: 4.0 dB) • 10 m (cable attenuation: 2.0 dB) • 15 m (cable attenuation: 4.0 dB, suitable for drag chains) • 20 m (cable attenuation: 4.0 dB)	 • 6GT2815-0BH30 • 6GT2815-2BH50 • 6GT2815-0BN10 • 6GT2815-1BN10 • 6GT2815-2BN15 • 6GT2815-0BN20

Ordering data (accessories)

Product	Order number
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	 • 6GT2891-0DH50 • 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

Product	Order number
24 V connecting cable 5 m between reader and power supply (for RF640R 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 interface (required for IP65 degree of protection when some connectors are unused)	6GT2898-4AA00
RFID DVD "Software & Documentation"	6GT2080-2AA20

5.3.1.3 Status display

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

Green LED	Red LED	Orange LED	Meaning
Off	Off	Off	The device is not connected to a power supply.
Flashing	Off	Off	In normal operation, no communication with the reader has taken place for a longer period of time.
On	Off	Off	The device is ready. The connection is established.
Off	Off	Flashing	More than one tag is in the field.
Off	Off	On	The device is starting up. The connection is established. Exactly one tag is in the field during normal operation.
Off	Flashing	Off	Error states with flash codes (see section Flashing codes of the RF600 readers with Ethernet interface (Page 397))
Off	flashes 2x	Off	At the end of the startup

Note

LED is not lit orange?

If the LED does not light up orange 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

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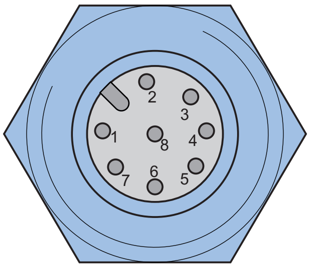
For more detailed information on the flash codes of the reader see section Flashing codes of the RF600 readers with Ethernet interface (Page 397)

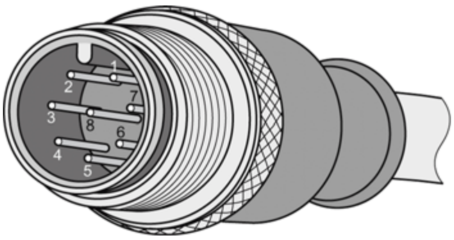
5.3.1.4 Pin assignment of the digital I/O interface

Pin assignment, socket

Digital I/O socket (on reader side)	Pin	Pin assignment
	1	GND (output to supply the digital outputs [not electrically isolated])
	2	VCC (output for supplying the digital outputs [not RF310M, RF680M electrically isolated])
	3	DO common
	4	DO 0
	5	DO 1
	6	DI 0
	7	DI common
	8	DI 1
	Shield	is applied to the reader housing so that the knurled ring is connected to GND of the reader.

View of the connector

Table 5- 11 Digital I/O, for cable with open cable ends

View of M12 connector	M12 pin	Wire color	Pin assignment
	1	white	GND (output to supply the digital outputs [not electrically isolated])
	2	brown	VCC (output for supplying the digital outputs [not electrically isolated])
	3	green	DO common
	4	yellow	DO 0
	5	gray	DO 1
	6	pink	DI 0
	7	blue	DI common
	8	red	DI 1
	Knurled ring	Shield	Knurled ring connected to GND of the reader

Wiring diagram M8 plug (cable end)

You will need to assemble your reader cable with a suitable connector that fits the interface shown above. Keep to the following wiring diagram:

Figure 5-9 Wiring diagram M8 connector

5.3.1.5 Connection scheme for the digital I/O interface

Connection possibilities

You can connect the RF640R reader in different ways. In general, the outputs and inputs should be connected as follows:

Output Outport (0), (1)

- Each output is rated for 0.5 A current and is electronically protected.
- Two digital outputs can be operated simultaneously each with up to 0.5 A (up to 1.0 A in total).
- The outputs are optically isolated through optocouplers.

Input Inport (0), (1)

- The inputs are optically isolated through optocouplers.
- Level Low 0 ... 3 V; High 3.6 to 24 V
- Sampling rate < 20 ms

The following diagrams illustrate various connection possibilities.

Voltage infeed through internal source (no electrical isolation)

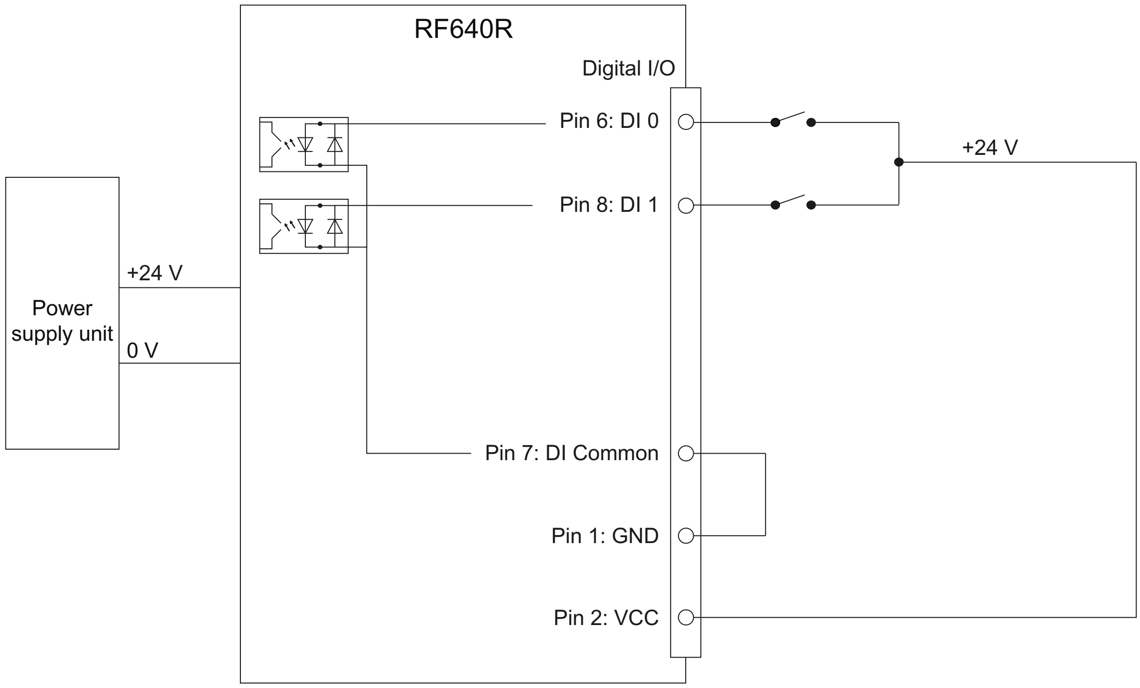


Figure 5-10 Example circuit 1: Digital inputs

Alternative connection possibilities:

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

Voltage infeed through external source

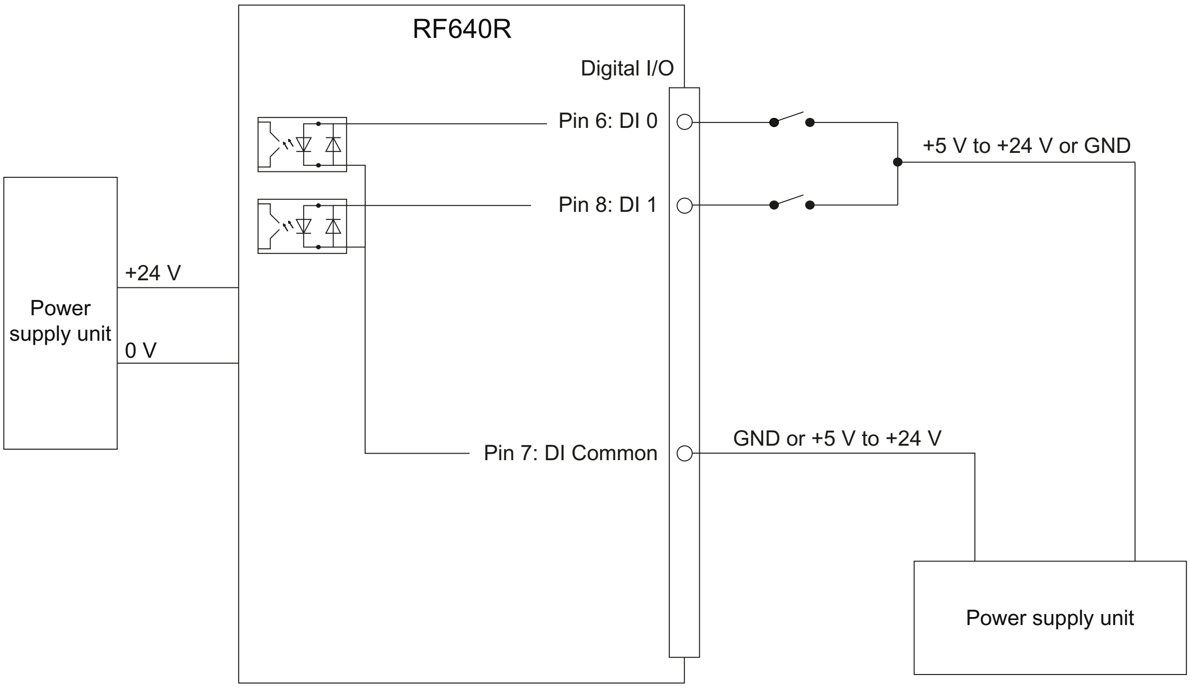


Figure 5-11 Example circuit 2: Digital inputs

Voltage infeed through external source with various voltages

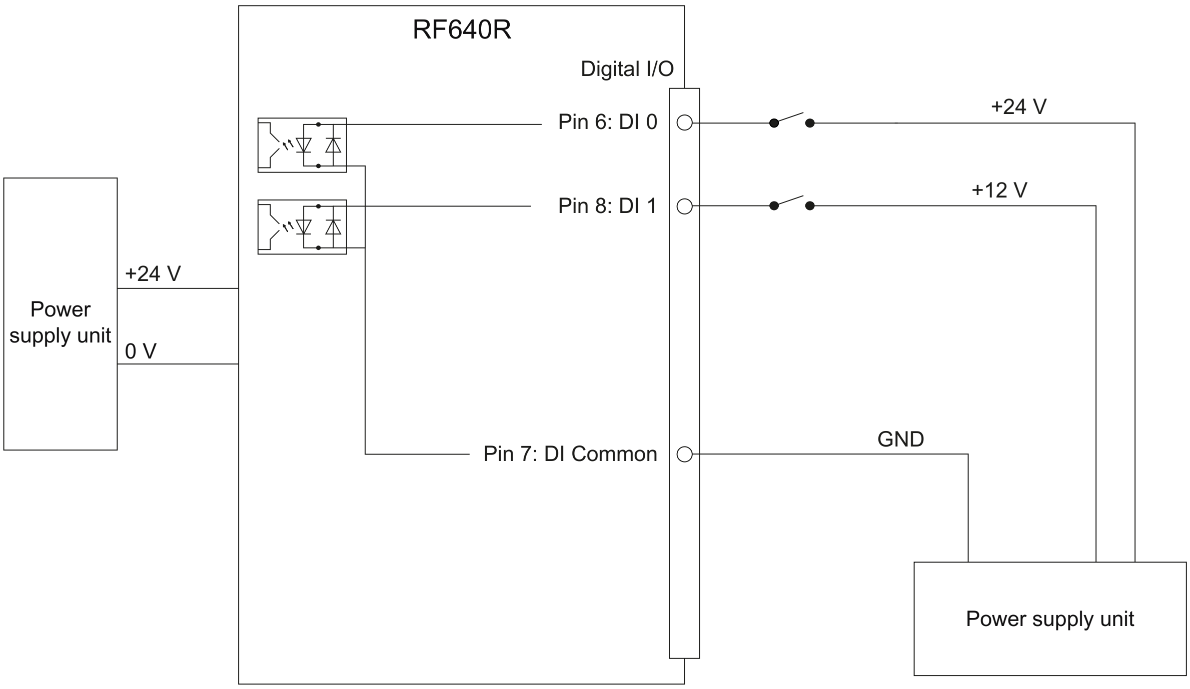


Figure 5-12 Example circuit 3: Digital inputs

Voltage infeed through internal source

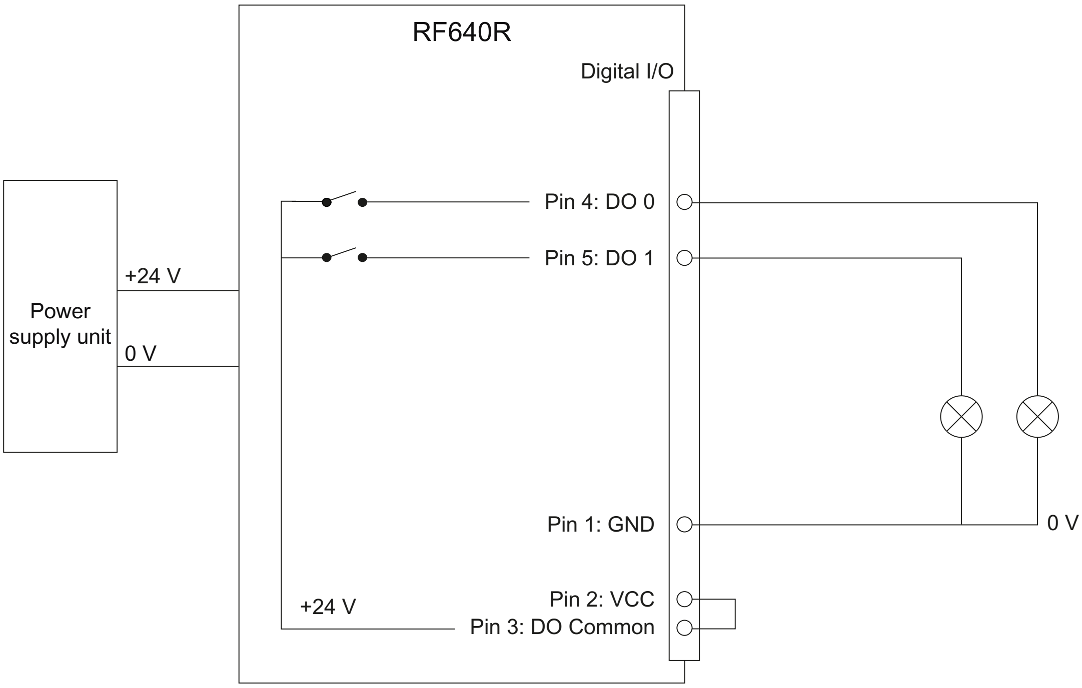


Figure 5-13 Example circuit 4: Digital outputs

Alternative connection possibilities:

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

Voltage infeed through external source

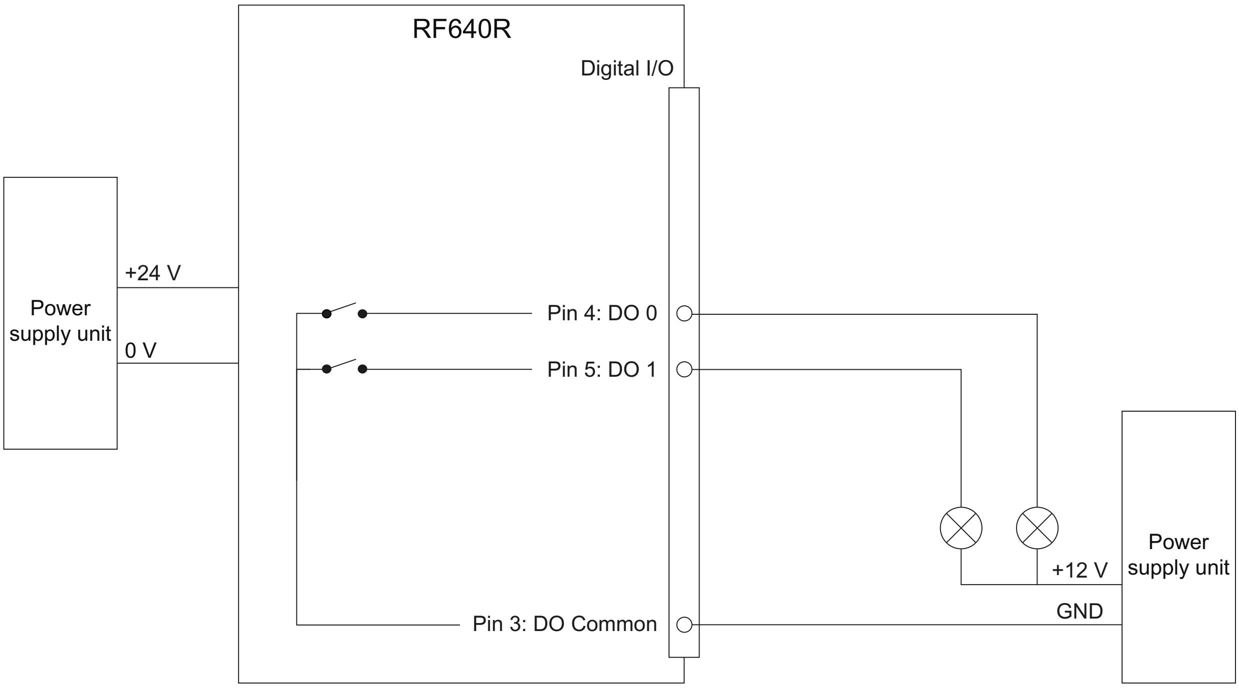


Figure 5-14 Example circuit 5: Digital outputs

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

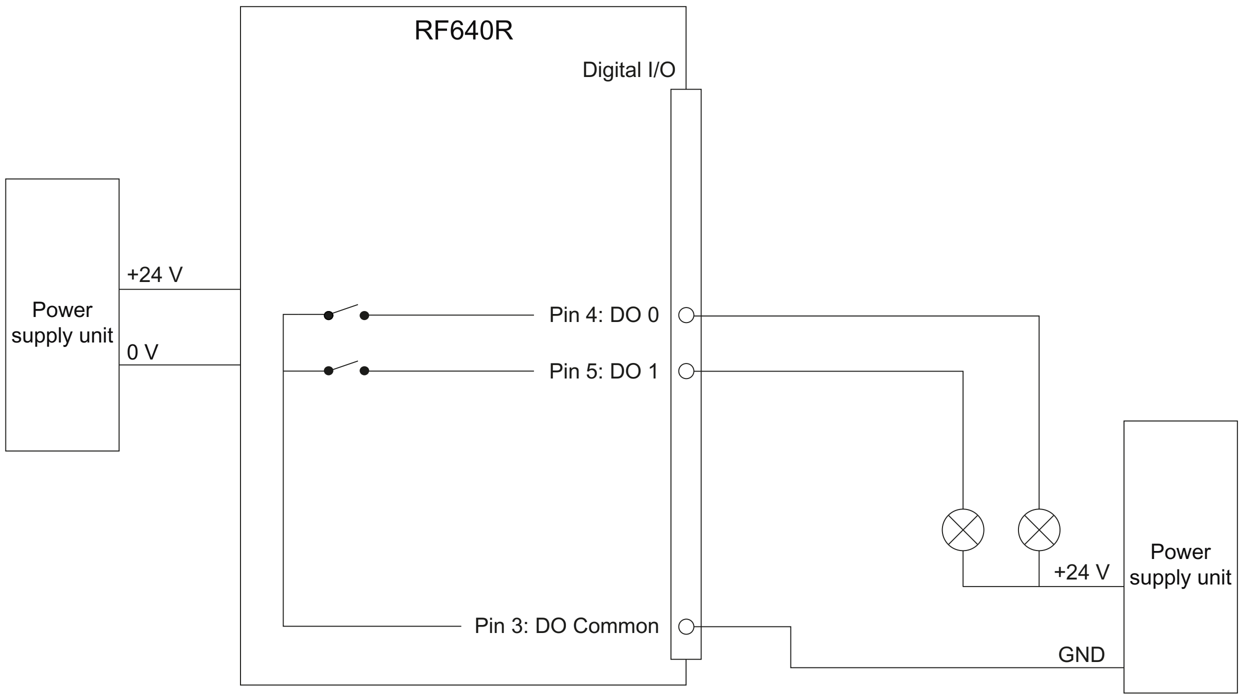
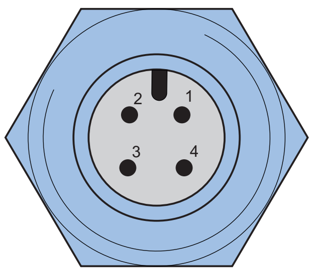


Figure 5-15 Example circuit 6: Digital outputs

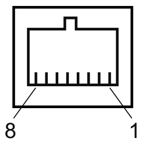
5.3.1.6 Pin assignment for power supply

Pin assignment of the power connections

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

The power connector of the RF640R is conforms with the PNO standard, in other words, normal PROFINET IO connectors fit this interface.

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

Note

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 136)) 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

Note

No autocrossover

The RF640R reader does not support autocrossover!

5.3.1.8 Grounding connection

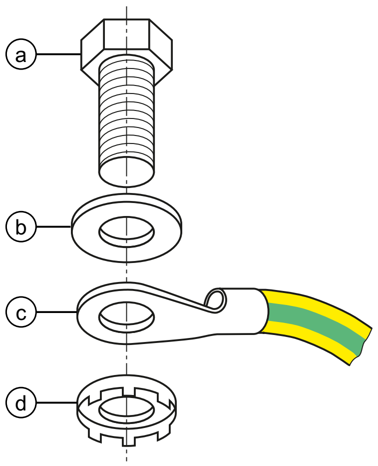
The RF640R can be electrically connected to ground potential by a contact washer. The tightening torque must be increased in this case to ensure that electrical contact is made (2.7 Nm).

WARNING

Hazardous voltage due to lightning strikes

Death or serious injury may occur as a result of lightning strikes to antennas mounted outside buildings.

If the reader is operated with antennas mounted outside buildings, it is imperative that the reader is electrically connected to the ground potential.

Ground connection		
	(a)	Hexagon-head screw
	(b)	Plain washer
	(c)	Cable lug
	(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 Selecting the antenna

With the SIMATIC RF640R, there are two ways of using the antenna that are mutually exclusive:

- Either you use the internal antenna of the reader
- Or you connect an external antenna to the interface of the reader. The internal antenna of the reader can then, however, not be used at the same time.

You can select the active antenna using the configuration software, "RF-MANAGER Basic V2".

5.3.2.2 Internal antenna

Minimum mounting clearances of two readers

The RF640R has a circular polarized antenna. At 2000 mW ERP radiated power, due to the aperture 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 6 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.

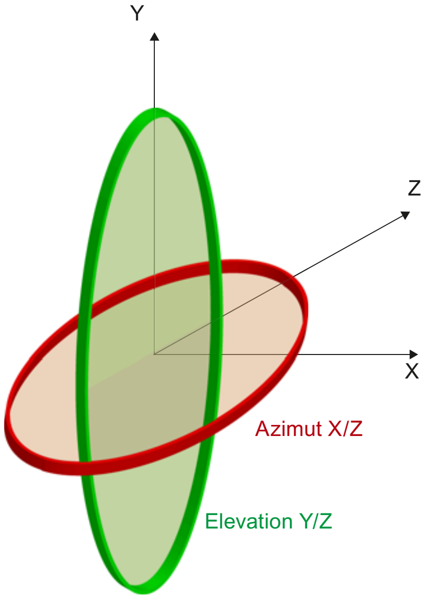
Note

Protective cap

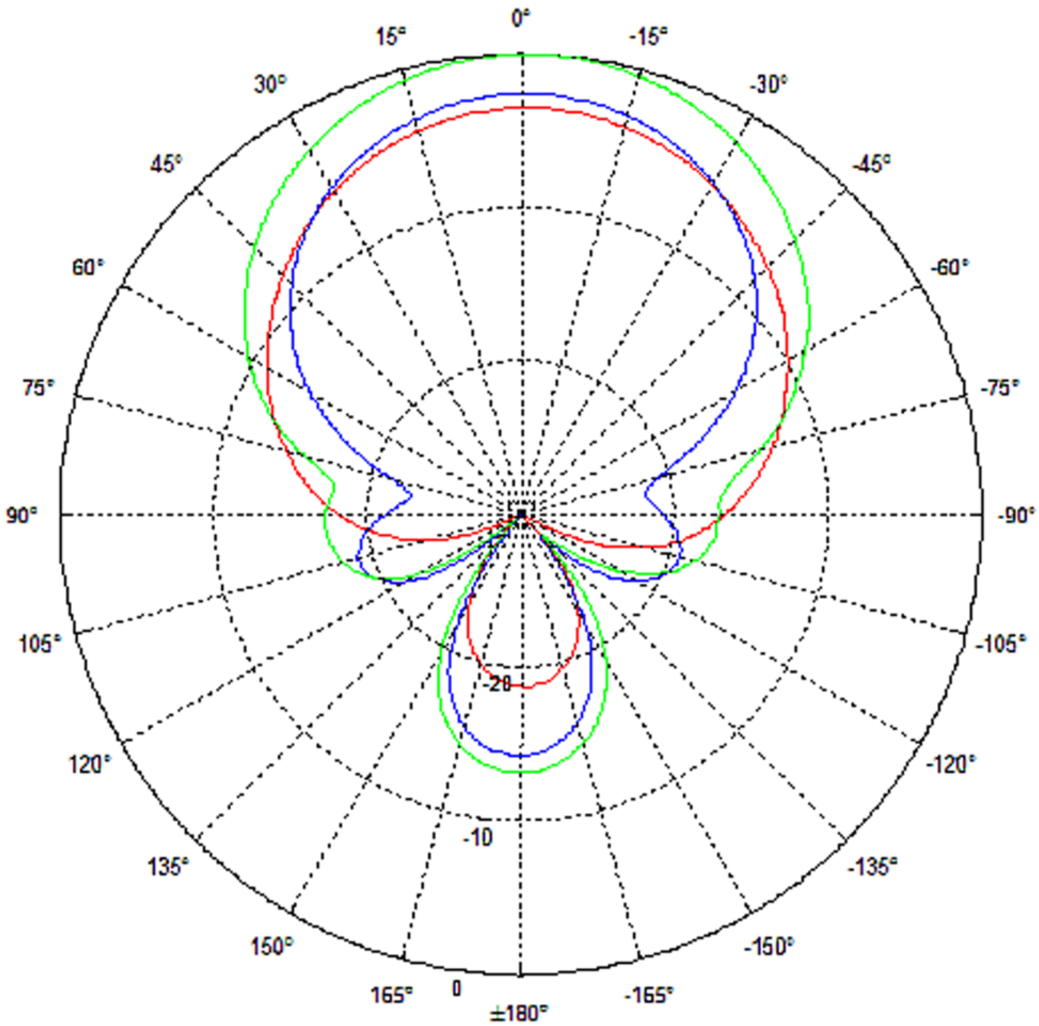
If you use the internal antenna of the reader, we recommend that you close the external, unused antenna connector on the reader using the supplied protective cap.

Antenna diagram for RF640R (ETSI)

The following radiation diagrams show the directional characteristics of the internal antenna of the RF640R (ETSI) reader. For the spatial presentation of the directional characteristics, the vertical plane (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)



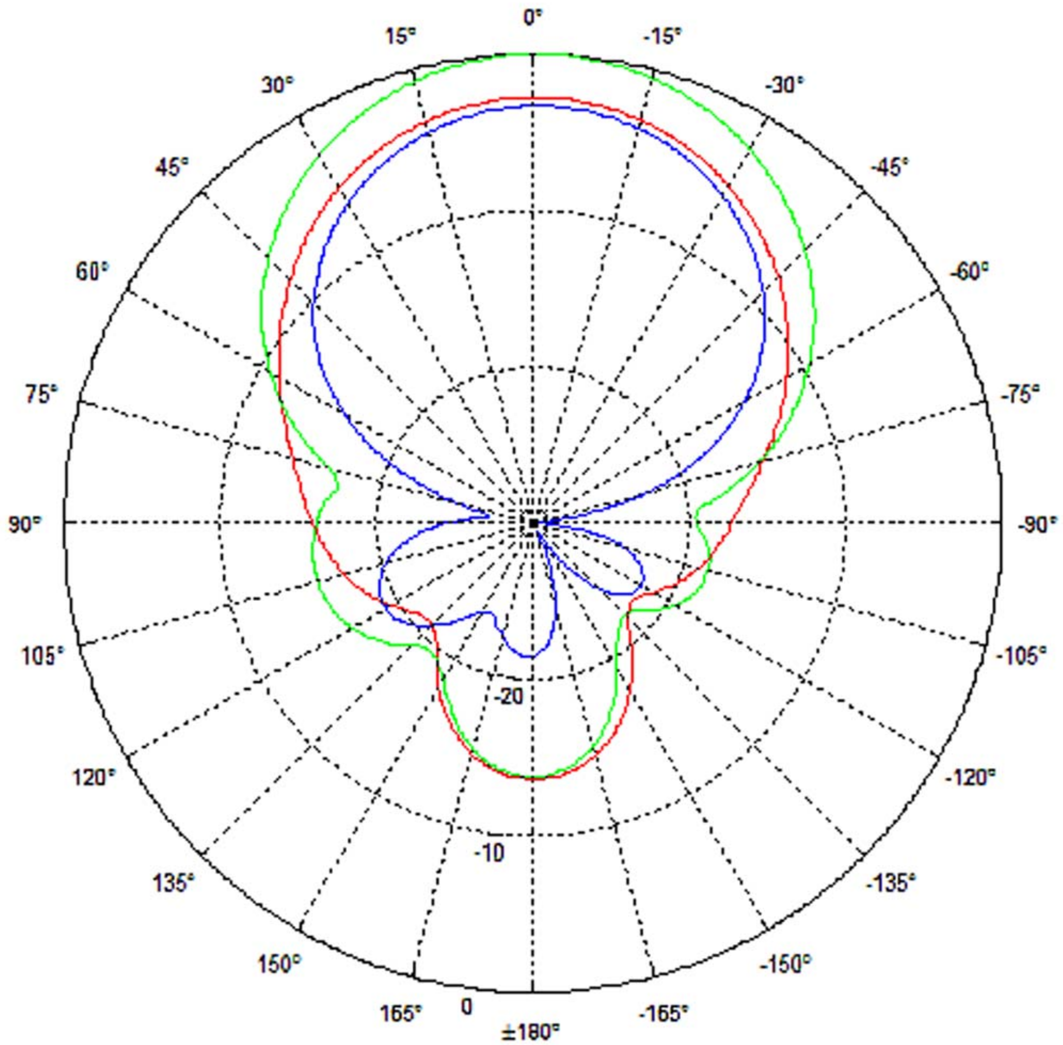
Vertical component of the polarization direction of the antenna

Horizontal component of the polarization direction of the antenna

Right circular component of the polarization direction of the antenna

Figure 5-16 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 5-17 Elevation section

Overview of the antenna parameters

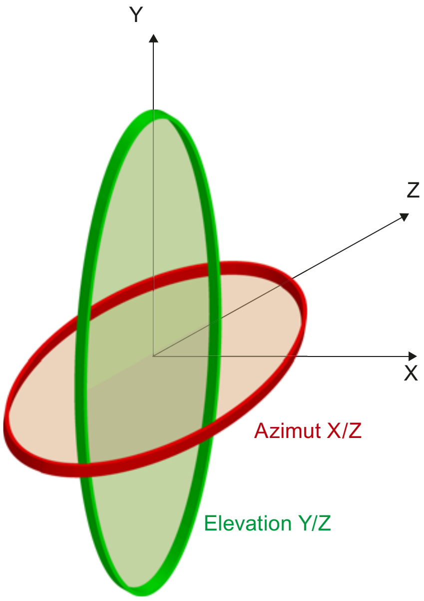
Table 5- 12 Maximum linear electrical aperture angle at 865 MHz:

Azimuth section	77,7°
Elevation section	66,1°
Typical antenna gain in the frequency range 865 to 868 MHz	4.0 dBi
Antenna axis ratio	0.7 dB

See also section Guidelines for selecting RFID UHF antennas (Page 54)

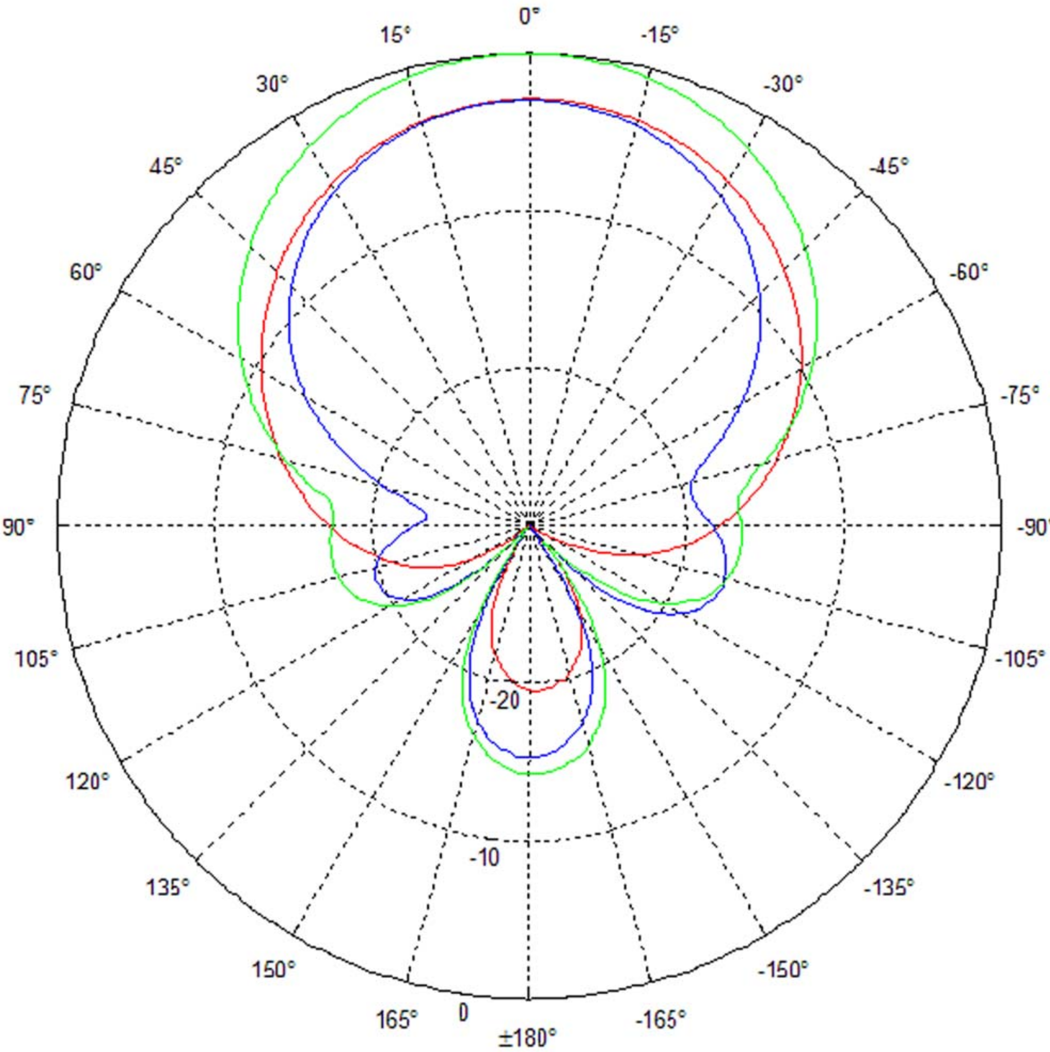
Antenna diagram for RF640R (FCC)

The following radiation diagrams show the directional characteristics of the internal antenna of the RF640R (FCC) reader. For the spatial presentation of the directional characteristics, the vertical plane (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)



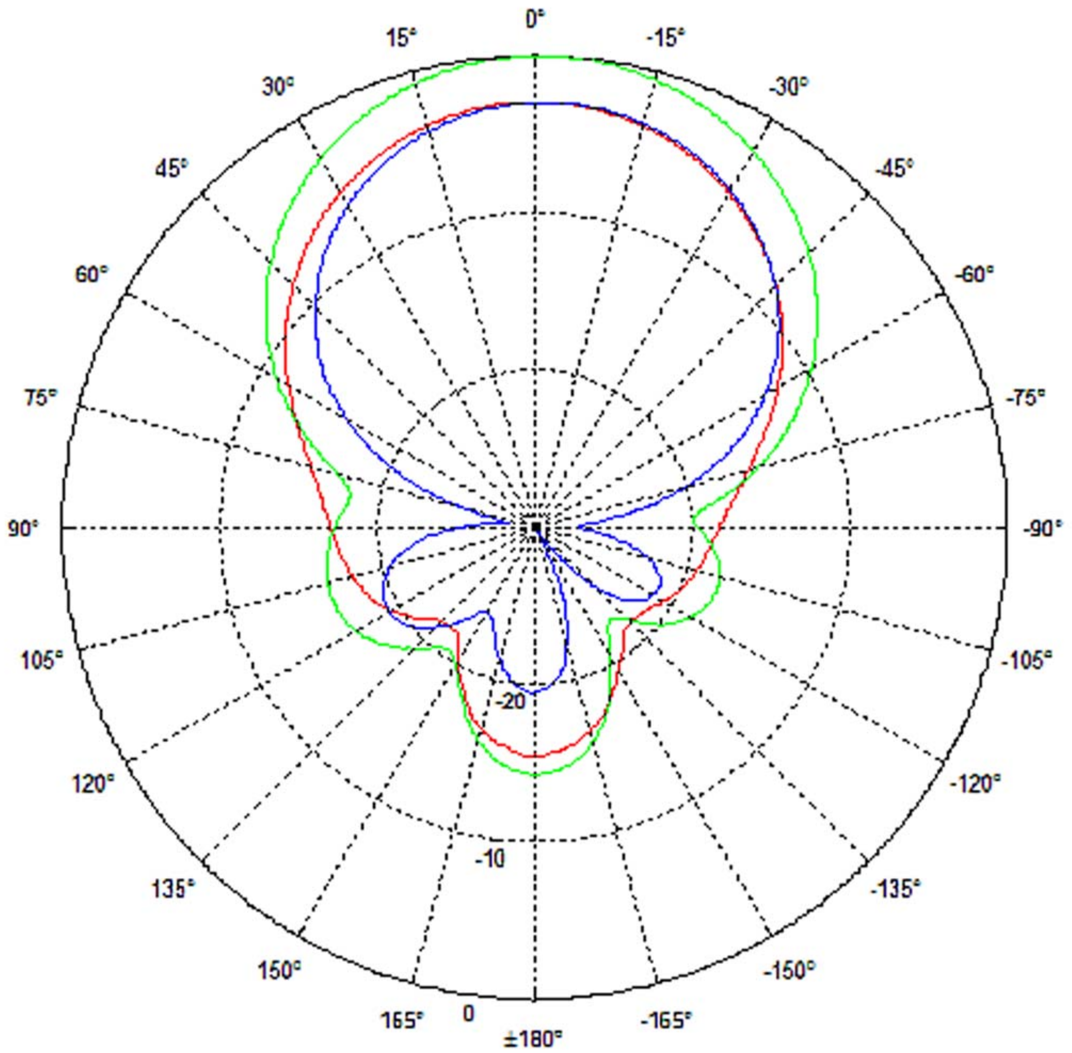
Vertical component of the polarization direction of the antenna

Horizontal component of the polarization direction of the antenna

Right circular component of the polarization direction of the antenna

Figure 5-18 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 5-19 Elevation section

Overview of the antenna parameters

Table 5- 13 Maximum linear electrical aperture angle at 865 MHz:

Azimuth section	75,4 °
Elevation section	69,1 °
Typical antenna gain in the frequency range 902 to 928 MHz	4.0 dBi ± 0.5 dB
Antenna axis ratio	<1 dB

see also section Guidelines for selecting RFID UHF antennas (Page 54).

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 RF640R (ETSI) (Page 148), 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.

Antenna/read point configurations

The RF640R reader has an internal circular polarized antenna. You can cover one read point with this antenna. When several RF640R readers are used, the readers are addressed via the SIMATIC level.

5.3.2.3 External antenna

Preassembled standard cables in lengths of 3 m, 5 m, 15 m and 20 m are available to connect the antenna.

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

Examples of possible antenna reading point configurations

- A data source with an external antenna for a reading point.
- As an alternative, a data source with an internal antenna for a reading point.

5.3.3 Installing / mounting

Requirement

WARNING

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

Note

Close unused connectors

If you do not use connectors on the reader, it is advisable to close the unused connectors with protective caps. You can order the protective cap set using the MLFB specified in the section "Ordering data".

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 section Mounting with antenna mounting kit (Page 262)). 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 160).

5.3.4 Configuration/integration

An Ethernet interface is available for integrating the device into system environments/networks. Over the Ethernet interface and with a direct connection to the PC, the RF640R can be configured in two different ways:

- Using RF-MANAGER Basic V2
- Using a user application (XML commands)

The communication interface transfers the data over the RF-MANAGER Basic 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. signal lights) can be directly implemented using the write/read device via two digital inputs and outputs.

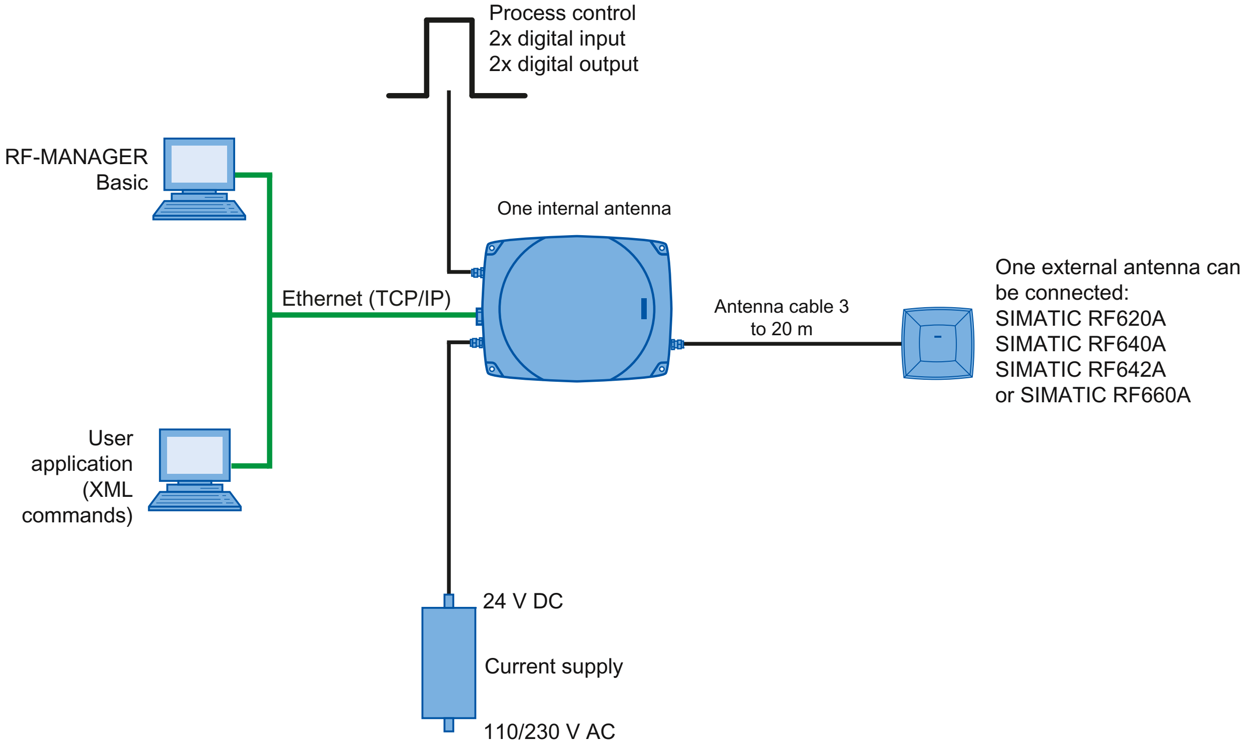


Figure 5-20 Overview of configuration of the RF640R reader

5.3.5 Technical data

5.3.5.1 Mechanical data

Mechanical data		
Weight		approx. 1700 g
Housing dimensions (L x W x H)		252 x 193 x 52 mm, without connections
Material for housing top section		ABS (GF 20), silicone-free
Material for housing bottom section		Aluminum
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		
	Antenna connectors	1 x RTNC plug
	Power supply	1 x plug (4-pin M12)
	Digital I/O interface	1 x socket (8-pin M12)
	Digital inputs	2
	Digital outputs	2 (500 mA each; max. 1000 mA in total)
	Ethernet	RJ-45 TCP/IP (push-pull) 10/100 Mbps
MTBF in years		14.3

Thermal and electrical properties			
Power supply • Permitted range		20 to 30 VDC [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 transmit power / 1600 mW ERP radiated power)	Power requirement (at 1000 mW transmit power / 1600 mW ERP radiated power)
	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 VDC supply: safe (electrical) isolation of extra-low voltage (SELV / PELV acc. to EN 60950)

Mechanical environmental conditions	
Shock resistant acc. to EN 60068-2-27 Vibration acc. to 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 allowed 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 EN 302 208 V1.3.1 EN 302 208 V1.4.1
Approvals/Conformity	• Radio according to the R&TTE directive • CE • ETSI EN 302 208 V1.3.1 • ETSI EN 302 208 V1.4.1 • Reader degree of protection acc. to EN 60529 (IP65) • RoHS-compliant according to EU Directive 2002/95/EC • Human exposure

EMC & approvals for FCC 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

5.3.5.2 Technical data according to EPC and ISO

Technical specifications	
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 radiated power with internal antenna • ETSI/CMIIT: • FCC	 • ≤ 1.6 W ERP • ≤ 3.3 W EIRP
Effective radiated power with external antenna • ETSI/CMIIT: • FCC	 • ≤ 2.0 W ERP • ≤ 4.0 W EIRP
Transmit power • ETSI/CMIIT: • FCC	 • ≤ 1.0 W • ≤ 1.25 W

Reading range	
Antennas mounted on opposing sides (portal configuration)	max. 10 m
Antennas mounted on the same side	max. 5 m (dependent on transponder)

ETSI frequencies	
Frequency range for Europe, EFTA, Turkey, South Africa, Thailand (ETSI) ETSI EN 302 208 V1.4.1 (valid since October 23, 2012, publication in the Official Journal of the European Union)	865.7 ... 867.5 MHz (4 channels LBT optional at max. 2 W ERP)
Frequency range India	865 ... 867 MHz (10 channels at 4 W EIRP)
Frequency range Russia	866,1 ... 867.6 MHz (8 channels at 2 W ERP)
Frequency range Singapore	866 ... 869 MHz (11 channels at 0.5 W ERP)

FCC frequencies	
Frequency range USA; Argentina, Bolivia, Canada, Mexico, Thailand (FCC)	902 ... 928 MHz (50 channels at max. 4 W EIRP, frequency hopping)
Frequency range Brazil	915,125 ... 927.875 MHz (52 channels at max. 4 W EIRP, frequency hopping)
Frequency range South Korea	917,1 ... 920.4 MHz (7-16 channels at max. 4 W EIRP, frequency hopping)

CMIIT frequencies	
Frequency range China	920,625 ... 924.375 MHz (16 subchannels at 2 W ERP)

5.3.6 Dimension drawings

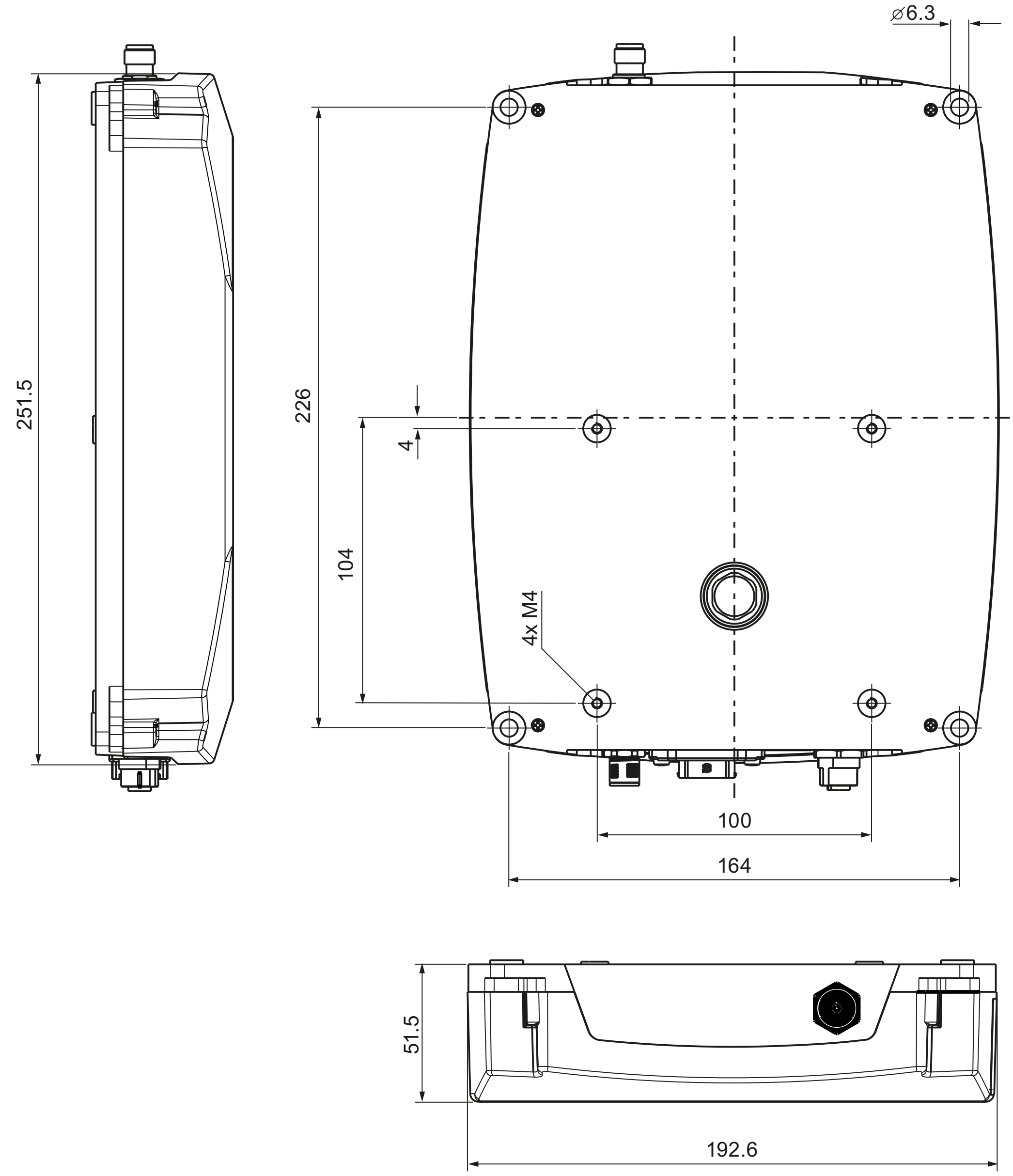


Figure 5-21 Dimensional drawing of RF640R

All dimensions in mm (± 0.5 mm tolerance)

5.3.7 Certificates and approvals

Note

Marking on the readers according to specific approval

The certificates and approvals listed here apply only if the corresponding mark is found on the readers.

Table 5- 14 6GT2811-3BA00-0AA0

Certificate	Description
CE	Conformity with R&TTE directive
TA-2012/548	South Africa approval: Radio Equipment Type Approval

Table 5- 15 6GT2811-3BA00-1AA0

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 A digital device, pursuant to Part 15 of the FCC Rules. FCC ID: NXW-RF600R
Industry Canada Radio Standards Specifications	RSS-210 Issue 6, Sections 2.2, A8 IC: 267X-RF600R, Model RF640R
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

Standard	
ANATEL	Brazil radio approval Marking on the reader:  Statement about approval: Este equipamento opera em caráter secundário, isto é, não tem direito à proteção contra interferência prejudicial, mesmo de estações do mesmo tipo e não pode causar interferência a sistemas operando em caráter primário. Reader certificate: ANATEL 3377-12-4061
	KCC Certification Marking on the reader: Type of equipment: A급 기기 (업무용 방송통신기자재) Class A Equipment (Industrial Broadcasting & Communication Equipment) 이 기기는 업무용(A급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라 며, 가정외의 지역에서 사용하는 것을 목적으로 합니다. This equipment is Industrial (Class A) electromagnetic wave suitability equipment and seller or user should take notice of it, and this equipment is to be used in the places except for home. Reader certificate: KCC-CRM-RF5-RF640R
H-11386	Argentina radio approval: Registro de la COMISION NACIONAL DE COMUNICACIONES
RCPSIRF12-0880	Mexico radio approval: CERTIFICADO DE HOMOLOGACION

Table 5- 16 6GT2811-3BA00-2AA1

Standard	
CMIIT Certification	China radio approval Marking on the reader: CMIIT ID: 2012DJ2918

5.3.7.1 FCC information

Siemens SIMATIC RF640R (FCC): 6GT2811-3BA00-1AA0

FCC ID: NXW-RF600R

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.

5.3.7.2 IC-FCB information

Siemens SIMATIC RF640R (FCC): 6GT2811-3BA00-1AA0

IC 267X-RF600R, Model RF640R

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.

Transmitter power and antenna information for antennas with a gain less than 6 dBi:

This device has been designed to operate with the SIMATIC RF620A antenna 902-928, the SIMATIC RF640A antenna 902-928 as well as the SIMATIC RF660A antenna 902-928 listed below, and having a maximum gain of 5,5 dBi. Arbitrary transmission power settings in combination with 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.

Transmitter power and antenna information for antennas with a gain greater 6 dBi:

This device requires professional installation. Antennas with a gain greater 6 dBi may be used provided the system does not exceed the radiation power of 4000 mW E.I.R.P. This device has been designed to operate with the SIMATIC RF642A antenna 902-928 exceeding the maximum gain of 5,5 dBi under the restriction that the RF power at the input of the antenna must be set to meet the following relation: RF power (dBm) ≤ 30 dBm – (antenna gain (dBi) – 6 dBi) Other antennas or system configurations for antennas having a gain greater than 6 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 Ohms.

5.4 RF670R reader

5.4.1 Description

5.4.1.1 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.

	Pos.	Description
	(1)	TNC reverse interfaces for connecting up to four antennas
	(2)	LED status indicator
	(3)	24 VDC 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 (CMIIT) "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)

5.4.1.2 Ordering data

Ordering data for RF670R

Product	Order number
RF670R (ETSI) reader basic unit for EU, EFTA, Turkey	6GT2811-0AB00-0AA0
RF670R (FCC) reader basic unit for the USA	6GT2811-0AB00-1AA0
RF670R (CMIIT) reader basic unit for China	6GT2811-0AB00-2AA0

Ordering data for antennas and antenna cables

Product	Order number
Antennas • RF620A antenna for EU, EFTA, Turkey (868 MHz) • RF620A antenna for FCC (915 MHz) • RF640A antenna (865 to 928 MHz) • RF642A antenna (865 to 928 MHz) • RF660A antenna for EU, EFTA, Turkey (868 MHz) • RF660A antennas for the USA and China (915°MHz)	 • 6GT2812-1EA00 • 6GT2812-1EA01 • 6GT2812-0GA08 • 6GT2812-1GA08 • 6GT2812-0AA00 • 6GT2812-0AA01
Antenna cable • 3 m (cable attenuation: 1.0 dB) • 5 m (cable attenuation: 1.25 dB, suitable for drag chains) • 10 m (cable attenuation: 4.0 dB) • 10 m (cable attenuation: 2.0 dB) • 15 m (cable attenuation: 4.0 dB, suitable for drag chains) • 20 m (cable attenuation: 4.0 dB)	 • 6GT2815-0BH30 • 6GT2815-2BH50 • 6GT2815-0BN10 • 6GT2815-1BN10 • 6GT2815-2BN15 • 6GT2815-0BN20

Ordering data (accessories)

Product	Order number
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

Product	Order number
Set of protective caps Contains 3 protective caps for antenna output and one protective cap for digital I/O interface (required for IP65 degree of protection when some connectors are unused)	6GT2898-4AA00
RFID DVD "Software & Documentation"	6GT2080-2AA20

5.4.1.3 Status display

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

Green LED	Red LED	Orange LED	Meaning
Off	Off	Off	The device is not connected to a power supply.
Flashing	Off	Off	In normal operation, no communication with the reader has taken place for a longer period of time.
On	Off	Off	The device is ready. The connection is established.
Off	Off	Flashing	More than one tag is in the field.
Off	Off	On	The device is starting up. The connection is established. Exactly one tag is in the field during normal operation.
Off	Flashing	Off	Error states with flash codes (see section Flashing codes of the RF600 readers with Ethernet interface (Page 397))
Off	flashes 2x	Off	At the end of the startup

Note

LED is not lit orange?

If the LED does not light up orange 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

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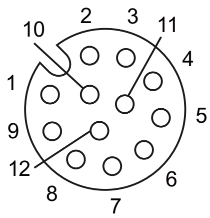
For more detailed information on the flash codes of the reader see section Flashing codes of the RF600 readers with Ethernet interface (Page 397)

5.4.1.4 Pin assignment of the digital I/O interface

View of socket (reader end)

Table 5- 17

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 will need to assemble your reader cable with a suitable connector that fits the interface shown above. Keep to the following wiring diagram:

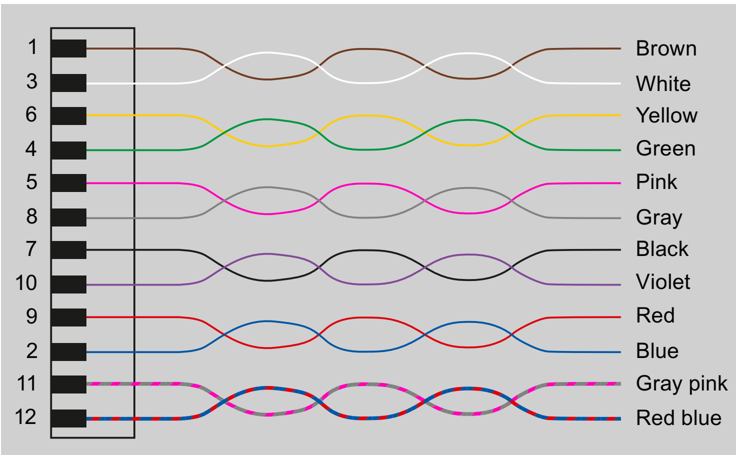


Figure 5-22 M12 connector wiring diagram

5.4.1.5 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.
- 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)

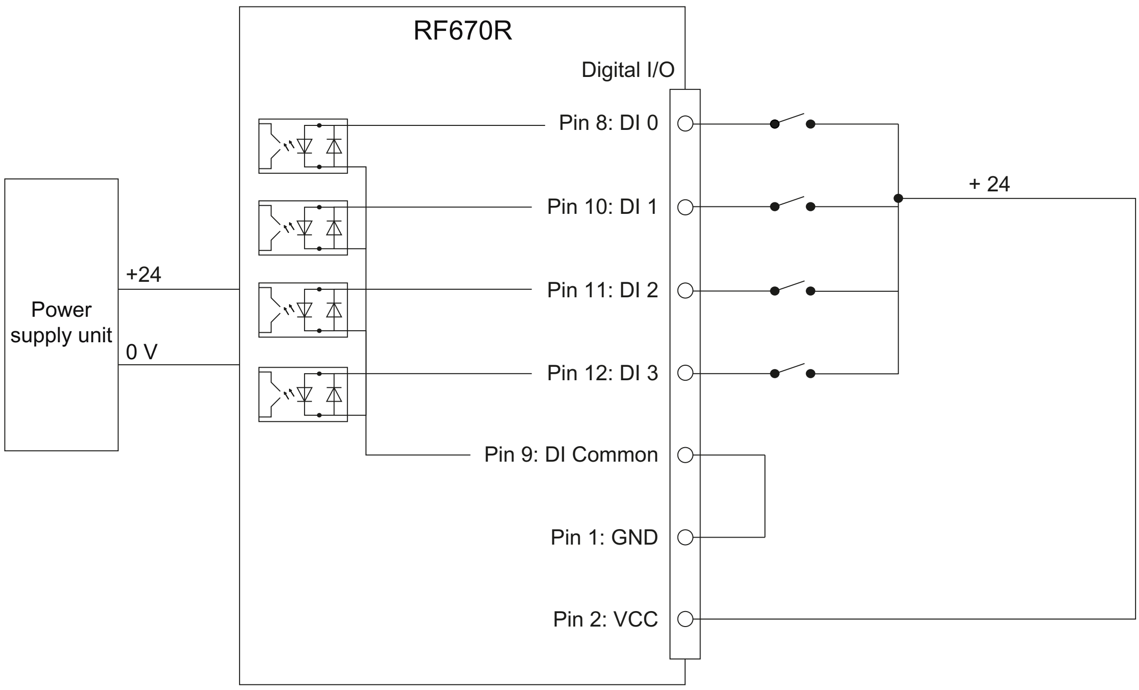


Figure 5-23 Example circuit 1: Digital inputs

Alternative connection possibilities:

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

Voltage infeed through external source

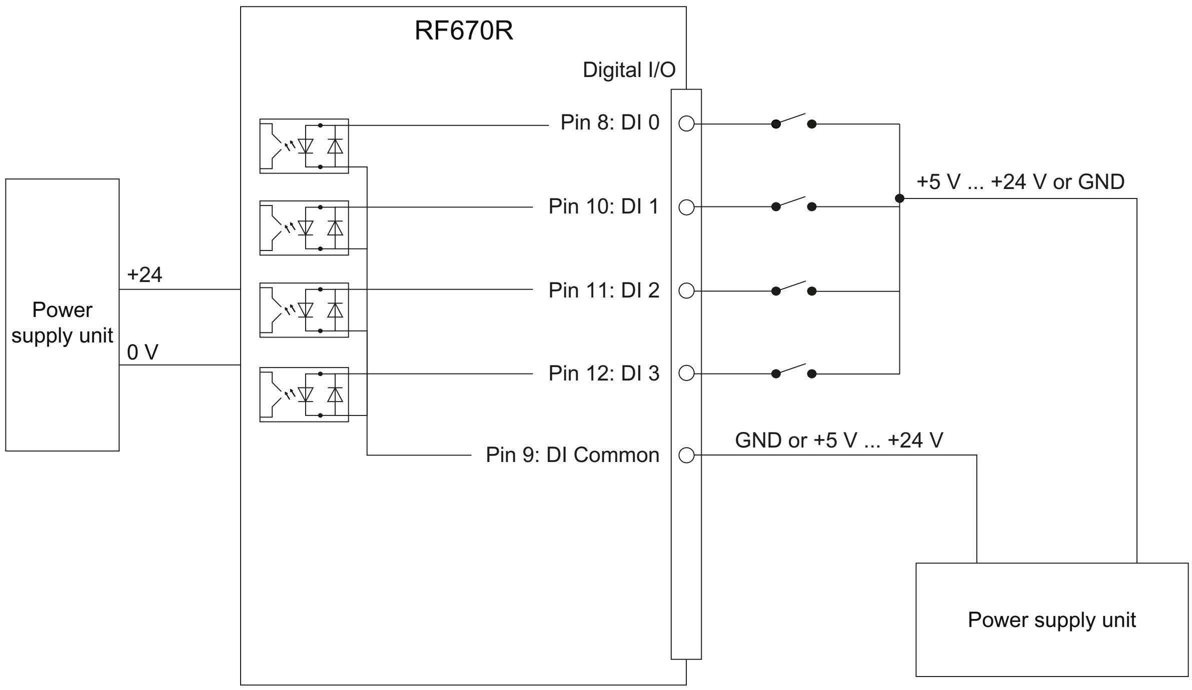


Figure 5-24 Example circuit 2: Digital inputs

Voltage infeed through external source with various voltages

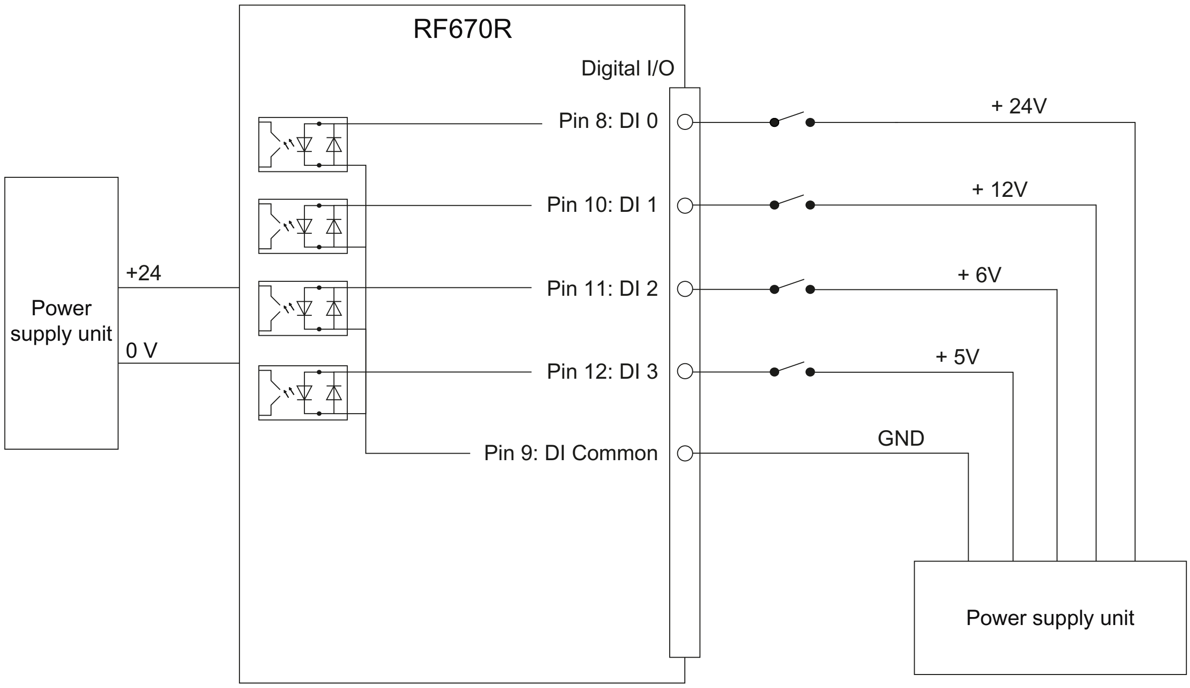


Figure 5-25 Example circuit 3: Digital inputs

Voltage infeed through internal source

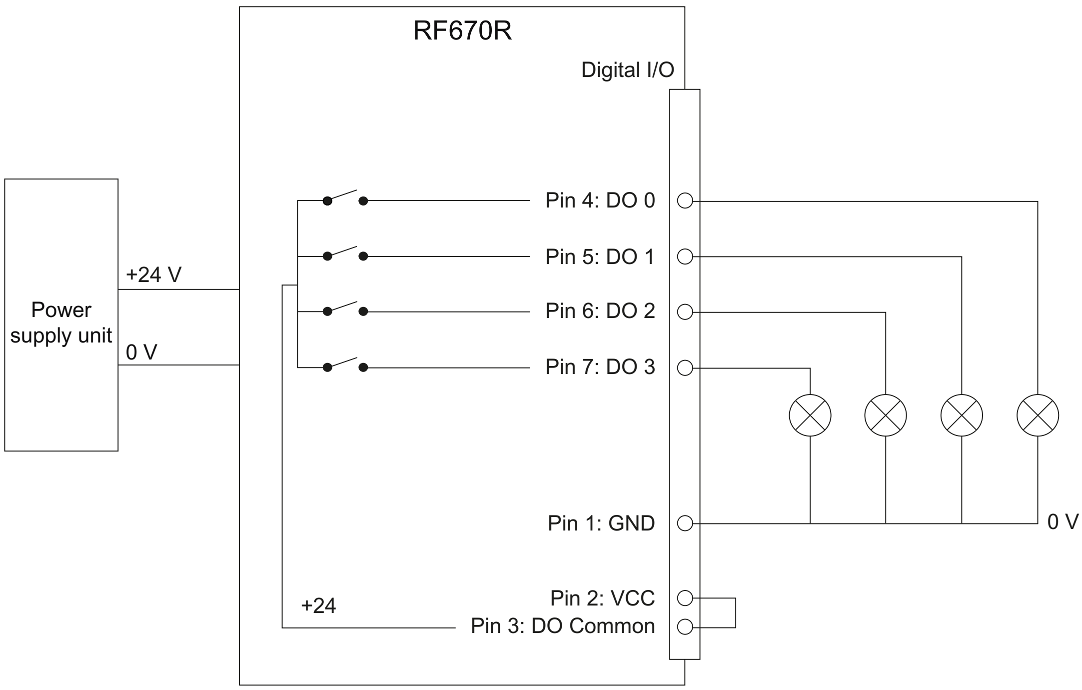


Figure 5-26 Example circuit 4: Digital outputs

Alternative connection possibilities:

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

Voltage infeed through external source

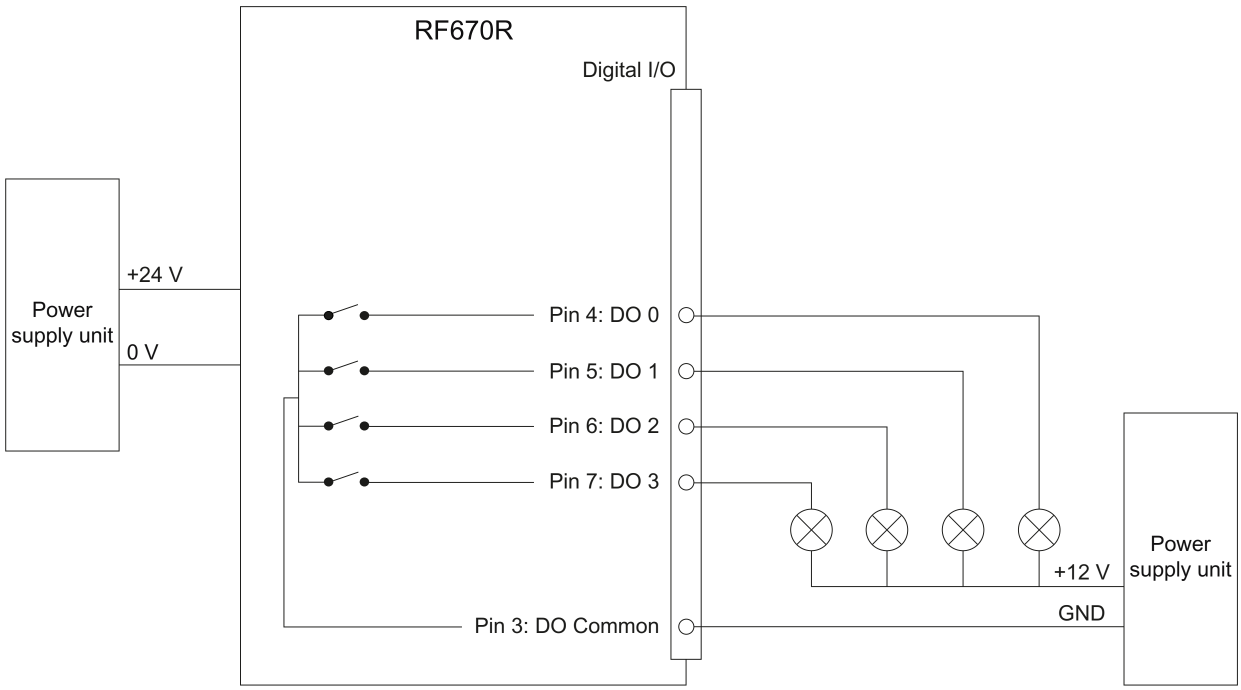


Figure 5-27 Example circuit 5: Digital outputs

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

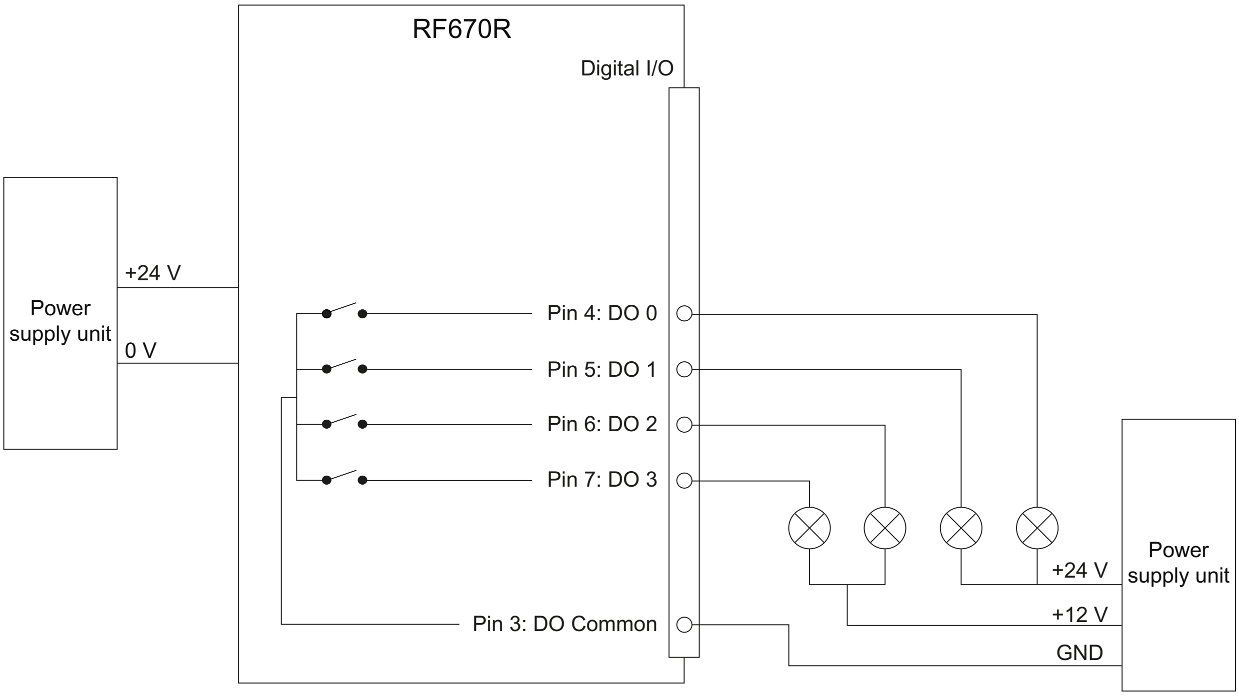
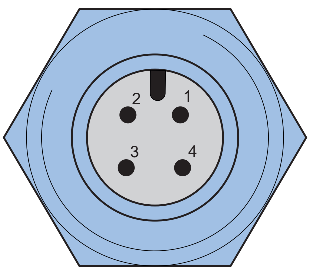


Figure 5-28 Example circuit 6: Digital outputs

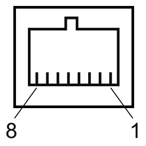
5.4.1.6 Pin assignment for power supply

Pin assignment of the power connections

Power connector (on reader side)	Pin	Pin assignment
	1 2 3 4	24 VDC 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.

5.4.1.7 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

Note

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 166)) 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

---

Note

No autocrossover

The RF670R reader does not support autocrossover!

5.4.1.8 Grounding connection

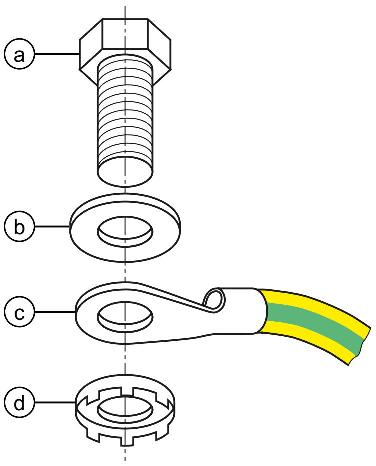
The RF670R can be electrically connected to the ground potential through a contact washer. The tightening torque must be increased in this case to ensure that electrical contact is made (2.7 Nm).

WARNING

Hazardous voltage due to lightning strikes

Death or serious injury may occur as a result of lightning strikes to antennas mounted outside buildings.

If the reader is operated with antennas mounted outside buildings, it is imperative that the reader is electrically connected to the ground potential.

Ground connection		
	(a)	Hexagon-head screw
	(b)	Plain washer
	(c)	Cable lug
	(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

5.4.2 Planning the use

5.4.2.1 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. When connecting multiple antennas, note the information in the section "Specified minimum and maximum spacing of antennas (Page 45)".

With RF-MANAGER Basic V2 , 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.

5.4.3 Installing / mounting

Requirement

WARNING
Make sure that the wall or ceiling can hold four times the total weight of the device.

Note

Close unused connectors

If you do not use connectors on the reader, it is advisable to close the unused connectors with protective caps. You can order the protective cap set using the MLFB specified in the section "Ordering data".

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 section Mounting with antenna mounting kit (Page 262)). 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 182).

5.4.4 Configuration/integration

5.4.4.1 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 V2

The communication interface transfers the data over the RF-MANAGER Basic 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.

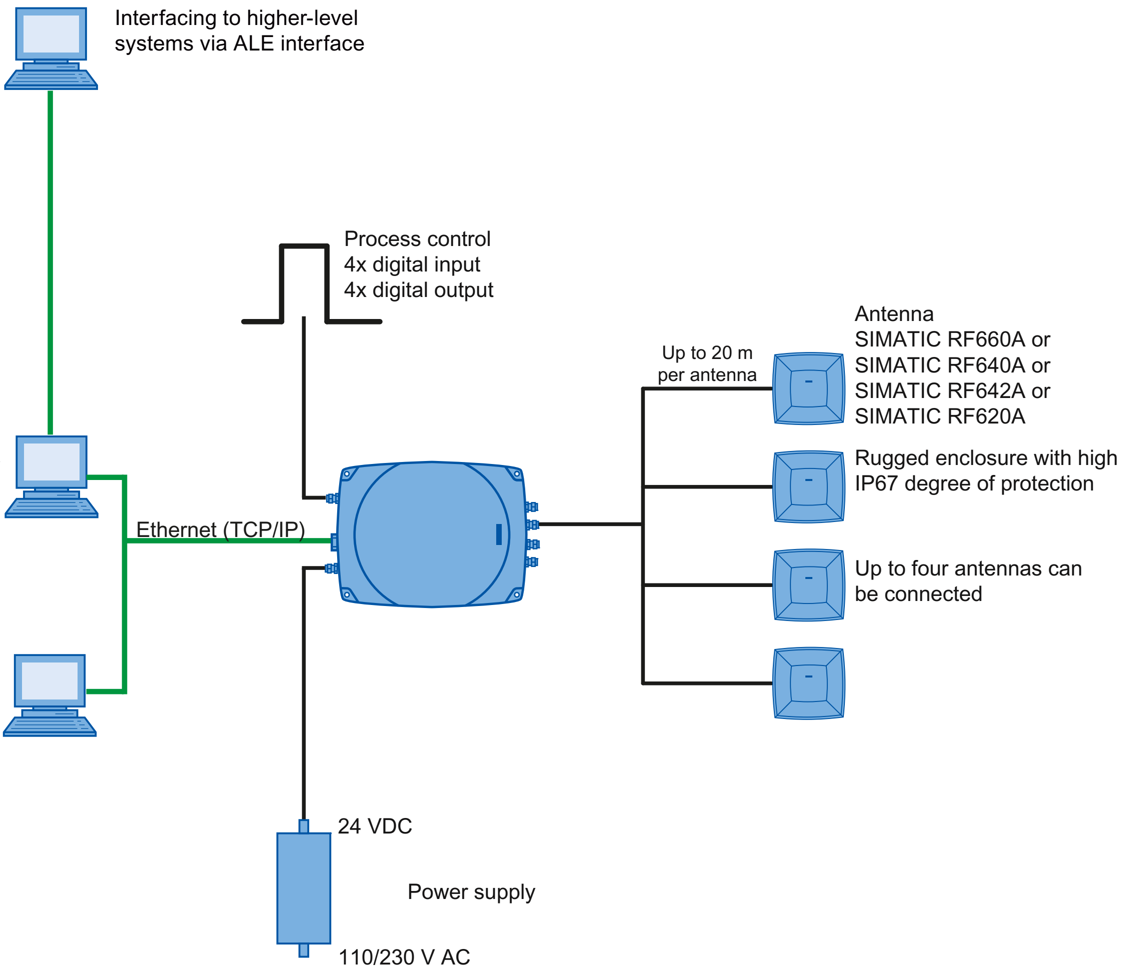


Figure 5-29 Overview of configuration of the RF670R reader

5.4.5 Technical data

5.4.5.1 Mechanical data

Mechanical data		
Weight		approx. 1800 g
Housing dimensions (L x W x H)		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 connectors	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	RJ-45 TCP/IP (push-pull) 10/100 Mbps
MTBF in years		16

Thermal and electrical properties			
Power supply • Permitted range		20 to 30 VDC [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 transmit power)	Power requirement (at 1000 mW transmit power)
	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 VDC supply: safe (electrical) isolation of extra-low voltage (SELV / PELV acc. to EN 60950)

Mechanical environmental conditions	
Shock resistant acc. to EN 60068-2-27 Vibration acc. to 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 allowed 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 EN 302 208 V1.3.1 EN 302 208 V1.4.1
Approvals/Conformity	• Radio according to the R&TTE directive • CE • ETSI EN 302 208 V1.3.1 • ETSI EN 302 208 V1.4.1 • Reader degree of protection acc. to EN 60529 (IP65) • RoHS-compliant according to EU Directive 2002/95/EC • Human exposure

EMC & approvals for FCC 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

5.4.5.2 Technical data according to EPC and ISO

Technical specifications	
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 radiated power • ETSI/CMIIT: • FCC:	 • ≤ 2 W ERP • ≤ 4 W EIRP
Transmit power • ETSI/CMIIT: • FCC:	 • ≤ 1.0 W • ≤ 1.25 W

Reading range	
Antennas mounted on opposing sides (portal configuration)	max. 10 m
Antennas mounted on the same side	max. 5 m (dependent on transponder)

ETSI frequencies	
Frequency range for Europe, EFTA, Turkey, South Africa, Thailand (ETSI) ETSI EN 302 208 V1.4.1 (valid since October 23, 2012, publication in the Official Journal of the European Union)	865.7 ... 867.5 MHz (4 channels LBT optional at max. 2 W ERP)
Frequency range India	865 ... 867 MHz (10 channels at max. 4 W EIRP)
Frequency range Russia	866,1 ... 867.6 MHz (8 channels at 2 W ERP)
Frequency range Singapore	866 ... 869 MHz (11 channels at 0.5 W ERP)

FCC frequencies	
Frequency range USA; Argentina, Bolivia, Canada, Mexico, Thailand (FCC)	902 ... 928 MHz (50 channels at max. 4 W EIRP, frequency hopping)
Frequency range Brazil	915,125 ... 927.875 MHz (52 channels at max. 4 W EIRP, frequency hopping)
Frequency range South Korea	917,1 ... 920.4 MHz (7-16 channels at max. 4 W EIRP, frequency hopping)

CMIIT frequencies	
Frequency range China	920,625 ... 924.375 MHz (16 subchannels at 2 W ERP)

5.4.6 Dimension drawings

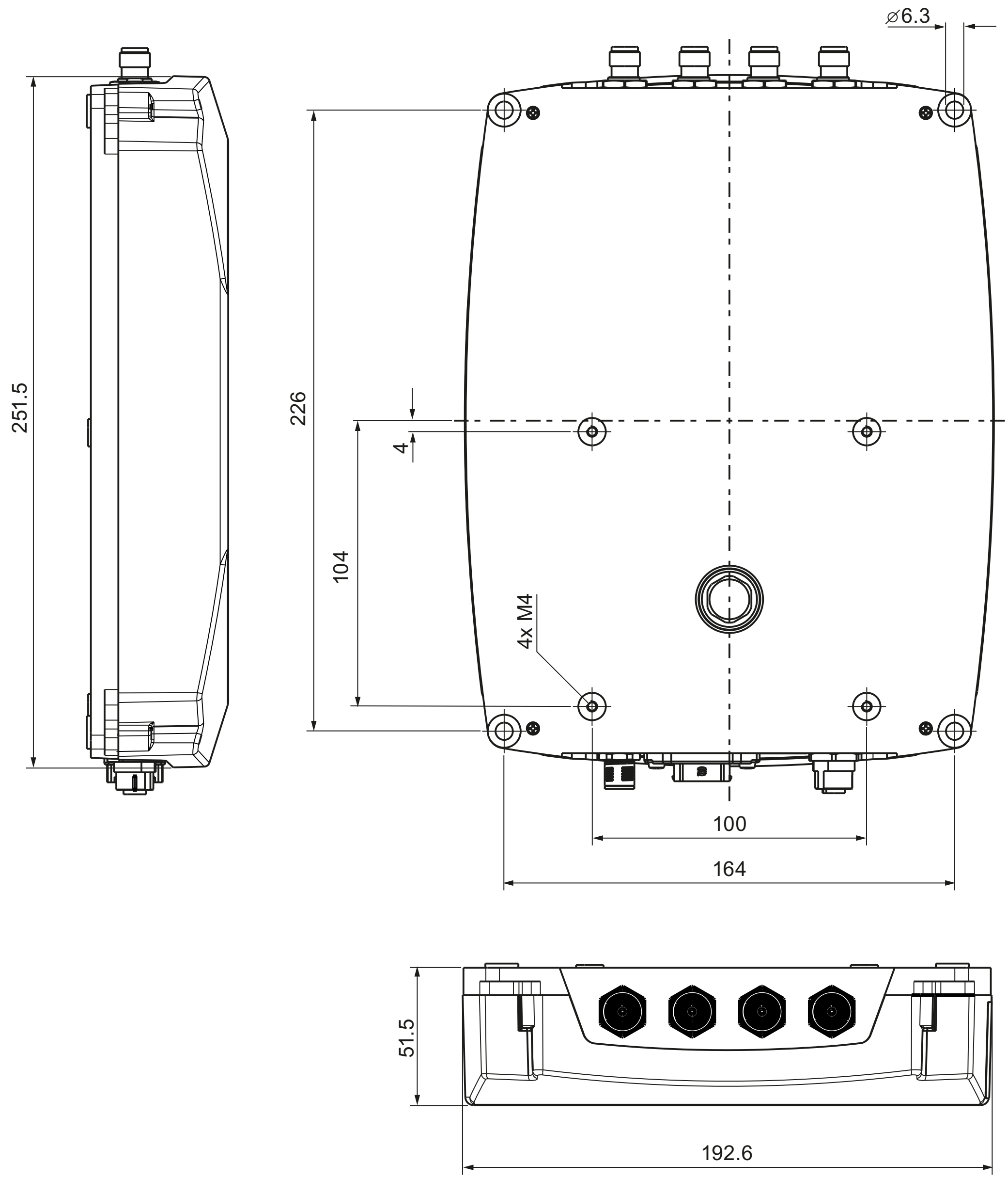


Figure 5-30 Dimension drawing for RF670R

All dimensions in mm (± 0.5 mm tolerance)

5.4.7 Certificates and approvals

Note

Marking on the readers according to specific approval

The certificates and approvals listed here apply only if the corresponding mark is found on the readers.

Table 5- 18 6GT2811-0AB00-0AA0

Certificate	Description
	Conformity with R&TTE directive
TA-2012/548	South Africa radio approval: Radio Equipment Type Approval

Table 5- 19 6GT2811-0AB00-1AA0

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-RF670 (as of FS: A1) FCC ID: NXW-RF600R (as of FS: C1)
Industry Canada Radio Standards Specifications	RSS-210 Issue 7, June 2007, Sections 2.2, A8 IC: 267X-RF670 (as of FS: A1) IC: NXW-RF600R, model RF670R-2 (as of FS: C1)
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

Standard	
	Brazil wireless approval Marking on the reader (as of FS: A):  Marking on the reader (as of FS: B1):  Statement relating to approval: Este equipamento opera em caráter secundário, isto é, não tem direito à proteção contra interferência prejudicial, mesmo de estações do mesmo tipo e não pode causar interferência a sistemas operando em caráter primário. Certificate of the reader (as of FS: A): ANATEL 2270-11-4061 Certificate of the reader (as of FS: B1): ANATEL 3377-12-4061
	KCC Certification Marking on the reader: Type of equipment: A급 기기 (업무용 방송통신기자재) Class A Equipment (Industrial Broadcasting & Communication Equipment) 이 기기는 업무용(A급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라 며, 가정외의 지역에서 사용하는 것을 목적으로 합니다. This equipment is Industrial (Class A) electromagnetic wave suitability equipment and seller or user should take notice of it, and this equipment is to be used in the places except for home. Reader certificate: KCC-CRM-RF5-RF670R
H-11390	Argentina radio approval: Registro de la COMISION NACIONAL DE COMUNICACIONES
RCPSIRF12-0881	Mexico radio approval: CERTIFICADO DE HOMOLOGACION

Table 5- 20 6GT2811-0AB00-2AA1

Standard	
CMIIT Certification	China radio approval Marking on the reader: CMIIT ID: 2011DJ0748

5.4.7.1 FCC information

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

FCC ID: NXW-RF670 (as of FS: A1)
FCC ID: NXW-RF600R (as of FS: C1)

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.

5.4.7.2 IC-FCB information

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

IC: 267X-RF670 (as of FS: A1)
IC: NXW-RF600R, model: RF670R-2 (as of FS: C1)

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.

Transmitter power and antenna information for antennas with a gain less than 6 dBi:

This device has been designed to operate with the SIMATIC RF620A antenna 902-928, the SIMATIC RF640A antenna 902-928 as well as the SIMATIC RF660A antenna 902-928 listed below, and having a maximum gain of 5,5 dBi.

Arbitrary transmission power settings in combination with 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.

Transmitter power and antenna information for antennas with a gain greater 6 dBi:

This device requires professional installation. Antennas with a gain greater 6 dBi may be used provided the system does not exceed the radiation power of 4000 mW E.I.R.P. This device has been designed to operate with the SIMATIC RF642A antenna 902-928 exceeding the maximum gain of 5,5 dBi under the restriction that the RF power at the input of the antenna must be set to meet the following relation: RF power (dBm) ≤ 30 dBm – (antenna gain (dBi) – 6 dBi) Other antennas or system configurations for antennas having a gain greater than 6 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 Ohms.

5.5 Reader RF680M

5.5.1 Description

SIMATIC RF680M 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.

5.5.2 Field of application and features

Device variants for different frequency ranges

The SIMATIC RF680M device is available in two variants:

- For the European frequency ranges
- For the US frequency ranges

Implementation environment, field of application and features

- Field of application

  The SIMATIC RF680M mobile reader can be used in a harsh environment. The device is extremely rugged and protected against spray water. The backlit display is easy to read even under unfavorable lighting conditions.
- RFID system

  The SIMATIC RF680M mobile reader is intended especially for the SIMATIC RF600 RFID system. The device can be used to process all RF600 tags and compatible transponders.
- Tag standards

  It is not possible to edit data memories of other RFID systems. The following tag standards are supported:

  – ISO 18000-6c (EPC Class1 GEN2)
- API software interface

  The SIMATIC RF680M Mobile Reader is supplied with an API software interface that can be used by customized user programs.
- Additional functional units for the SIMATIC RF680M mobile reader

  All other functional units of SIMATIC RF680M, such as barcode scanners and WLAN can be accessed via the interfaces supplied by the PSION device manufacturer. The descriptions and development tools can be obtained from the PSION websites.

You can perform the following functions with the SIMATIC RF680M mobile reader:

Functions

- Reading the tag ID
- Reading the data from the tag (data memory)
- Writing the data to the tag
- Reading and displaying the ID number of the tag (Tag/Scan)
- Writing the tag ID to a transponder
- Displaying reader status
- Representing and editing the data in hexadecimal, ASCII and binary format
- Activatable/deactivatable password protection for all write functions and for terminating the program
- Menu prompting in English and German (switchable)
- Saving of the read-in RF600 data to files in the mobile reader. The mobile reader has approximately 900 MB available for this purpose.
- Easy creation of your own RFID applications with the Software Application Interface (API)

The RFID read/write unit of RF600 is integrated into the PSION basic unit.

You will find more detailed information on the RF680M mobile reader in the operating instructions of the SIMATIC RF680M Mobile Reader.

6 Antennas

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 range		865-868 MHz	902-928 MHz	865-868 MHz	902-928 MHz
Impedance		50 Ohm nominal			
Antenna gain		-10…-5 dBi		7 dBi	6 dBi
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	
Mounting type		2 x M5 screws		4 screws M4 (VESA 100 mount system)	
Degree of protection		IP67			
Permitted ambient temperature		-25 °C to +75 °C			
Number of connectable antennas per reader					
	RF620R	1 antenna			
	Max. radiated power	80 mW ERP / 130 mW EIRP		1200 mW ERP	1600 mW EIRP
	RF630R	1 or 2 antennas			
	Max. radiated power	80 mW ERP / 130 mW EIRP		1200 mW ERP	1600 mW EIRP
	RF640R	1 antenna			
	Max. radiated power	100 mW ERP / 300 mW EIRP		2000 mW ERP	4000 mW EIRP
	RF670R	1, 2, 3 or 4 antennas			
	Max. radiated power	100 mW ERP / 300 mW EIRP		2000 mW ERP	4000 mW EIRP

Features	RF640A antenna		RF642A antenna	
Material	PA 12, silicon-free			
Frequency range	865-868 MHz	902-928 MHz	865-868 MHz	902-928 MHz
Impedance	50 Ohm nominal			
Antenna gain	4 dBi (7 dBic)	4.3 dBi (7.3 dBic)	6 dBi	7 dBi
VSWR (standing wave ratio)	Max. 1.25	Max. 1.6	Max. 1.4	
Polarization	RH circular		Linear	
Radiating/receiving angle	Horiz. plane: 80°	Horiz. plane: 75°	Horiz. plane: 75°	Horiz. plane: 80°
	Vertic. plane: 75°	Vertic. plane: 85°	Vertic. plane: 70°	Vertic. plane: 70°
Connector	RTNC coupling		RTNC coupling	
Mounting type	4 screws M4 (VESA 100 mount system)			
Degree of protection	IP67			
Permitted ambient temperature	-25 °C to +75 °C			
Number of connectable antennas per reader				
RF620R	1 antenna			
Max. radiated power	< 610 mW ERP	≤1070 mW EIRP	< 1000 mW ERP	2000 mW EIRP
RF630R	1 or 2 antennas			
Max. radiated power	< 610 mW ERP	≤1070 mW EIRP	< 1000 mW ERP	2000 mW EIRP
RF640R	1 antenna			
Max. radiated power	≤1300 mW ERP	≤2700 mW EIRP	2000 mW ERP	4000 mW EIRP
RF670R	1, 2, 3 or 4 antennas			
Max. radiated power	≤1300 mW ERP	≤2700 mW EIRP	2000 mW ERP	4000 mW EIRP

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 section Alignment of transponders to the antenna (Page 196)
	Writing/reading range	Approx. 0.5 m depending on the transponder (see section Read/write ranges (Page 205))
	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)
	Polarization	Linear
	Degree of protection	IP67

Frequency bands

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

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

Function

The SIMATIC RF620A is used for transmitting and receiving RFID signals in the UHF frequency range. 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
	5 m, suitable for drag chains (cable loss 1.25 dB)	6GT2815-2BH50
	10 m (cable loss 2.0 dB)	6GT2815-1BN10
	10 m (cable loss 4.0 dB)	6GT2815-0BN10
	15 m, suitable for drag chains (cable loss 4.0 dB)	6GT2815-2BN15
	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

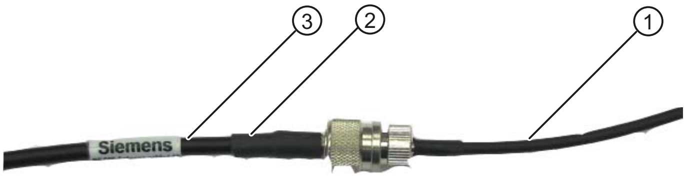
Note

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 and bending cycles of the cable

Cable designation	Order no.	Length [m]	Cable loss [dB]	Bending radius [mm]	Bending cycle
RF620A connecting cable				15	1 Mal
Antenna cable	6GT2815-0BH30	3	1	51	1 Mal
Antenna cable, suitable for drag chains	6GT2815-2BH50	5	1,25	48	1)
Antenna cable	6GT2815-1BN10	10	2	77	1 Mal
Antenna cable	6GT2815-0BN10	10	4	51	1 Mal
Antenna cable, suitable for drag chains	6GT2815-2BN15	15	4	24	1)
Antenna cable	6GT2815-0BN20	20	4	77	1 Mal

1) With cables suitable for drag chains, 3 million bending cycles at a bending radius of 6.5 m and bending through ± 180 ° are permitted.

6.2.4.2 Connecting RF620A to an RF600 reader

Preassembled standard cables in lengths of 3 m, 5 m, 10 m, 15 m and 20 m are available to connect the antenna.

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 you close the remaining antenna connector on the RF600 reader using the supplied protective cap.

Connection of two antennas

When using two antennas on the RF600 readers, there are no limitations regarding its positioning.

Note

Protective cap

If you use the internal antenna of the reader, we recommend that you close the external, unused antenna connector on the reader using the supplied protective cap.

6.2.5 Parameter settings of RF620A for RF620R/RF630R

Operation within the EU, EFTA, or Turkey according to EN 302 208 V1.4.1

Note

Limitation of the radiated power according to EN 302 208 V1.4.1

RF600 systems that are put into operation within the EU, EFTA, or Turkey (ETSI) can be operated with an RF640A antenna with a maximum radiated power of up to 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP).

By adjusting the transmit power of up to 500 mW ERP (or 27 dBm ERP, 800 mW EIRP, 29.15 dBm EIRP) and taking into account the RF620A antenna gain of -5 dBi and the cable loss associated with the antenna cable, the radiated power of the antenna cannot be exceeded. You can make the power settings using the "distance_limiting" parameter. You will find more detailed information on the parameters in the section Parameter assignment manual RF620R/RF630R (http://support.automation.siemens.com/WW/view/en/33287195).

Operation in China

The national approval for RF600 systems in China means a restriction to 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP). The possible combination of antenna gain, cable loss, and max. 500 mW radiated power of the RF630R reader means it is not possible to exceed 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP).

Operation in the USA, Canada

Note

Limitation of the radiated power to 4000 mW EIRP (36 dBm EIRP)

So that the FCC and IC-FCB requirements are met, the radiated power may not exceed 4000 mW EIRP (36 dBm EIRP). Therefore the system must satisfy the following relation:

- Conducted power P dBm of the RF600 reader (< 30 dBm)
- Antenna gain G_i dBi in the FCC frequency band (≤ 4.3 dBi)
- Cable loss a_k dB (≥ 1 dB)

$P(dBm) \leq 30\ dBm - (G_i - 6\ dBi) + a_k$

Due to the low antenna gain of -5 dB and the maximum transmit power of 500 mW of the reader, the maximum permitted radiated power cannot be exceeded.

6.2.6 Parameter settings of RF620A for RF640R/RF670R

Operation within the EU, EFTA, or Turkey

Note

Limitation of the radiated power according to EN 302 208 V1.4.1

RF600 systems that are put into operation within the EU, EFTA, or Turkey (ETSI) can be operated with an RF640A antenna with a maximum radiated power of 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP).

By adjusting the radiated power of up to 70 mW ERP (or 18.85 dBm ERP, 120 mW EIRP, 21 dBm EIRP), the RF620A antenna gain of -5 dBi and the cable loss associated with the antenna cable, the radiated power of the reader is correctly configured and the radiated power at the antenna is not exceeded.

Operation in China

By setting a max. radiated power of 1300 mW ERP 70 mW ERP (or 18.85 dBm ERP, 120 mW EIRP, 21 dBm EIRP), the RF620A antenna gain of -5 dBi (-2 dBic) and the cable loss associated with the antenna cable, the corresponding transmit power of the reader is correctly configured.

Operation in the USA, Canada

Note

Limitation of the radiated power to 4000 mW EIRP (36 dBm EIRP)

So that the FCC and IC requirements are met, the radiated power may not exceed 4000 mW EIRP (36 dBm EIRP). Therefore the system must satisfy the following relation:

- Conducted power P dBm of the RF600 reader (< 30 dBm)
- Antenna gain G_i dBi in the FCC frequency band (≤ 4.3 dBi)
- Cable loss a_k dB (≥ 1 dB)

$P(dBm) \leq 30\ dBm - (G_i - 6\ dBi) + a_k$

Due to the low antenna gain of -5 dB and the maximum transmit power of 500 mW of the reader, the maximum permitted radiated power cannot be exceeded.

6.2.7 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.

Polarization axis

Figure 6-2 Polarization axis

Alignment

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

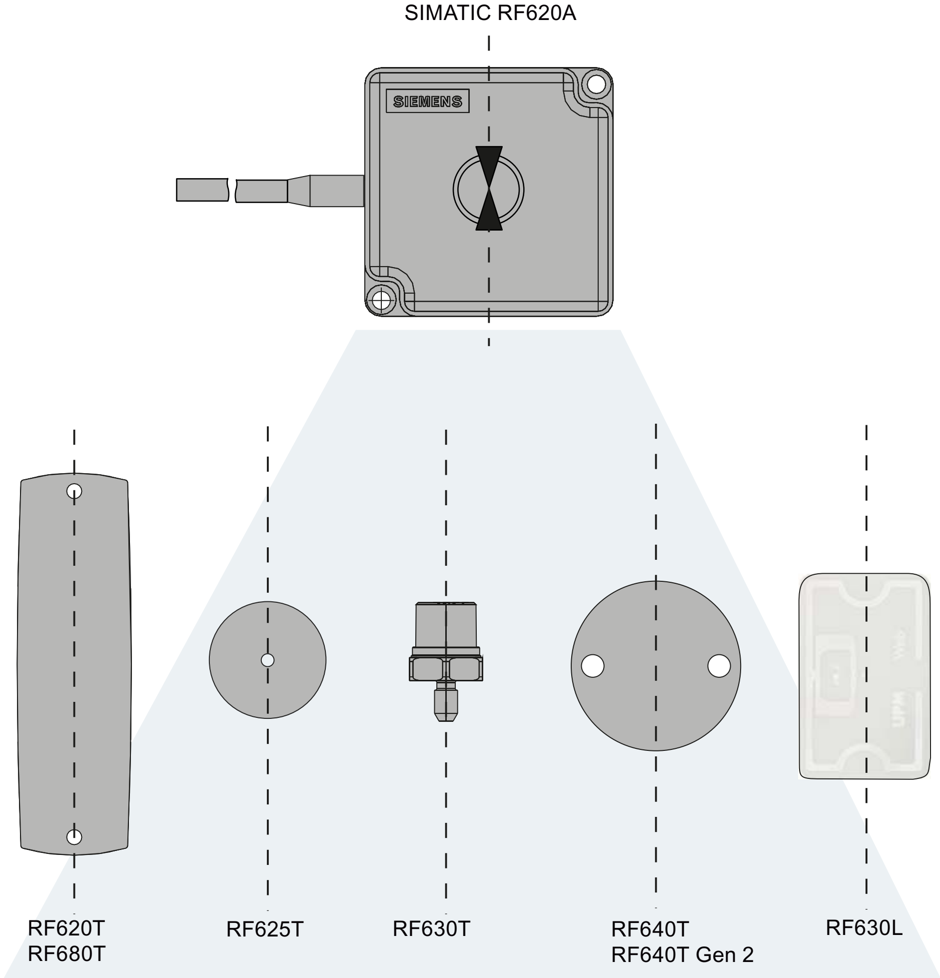


Figure 6-3 Antenna/transponder alignment

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

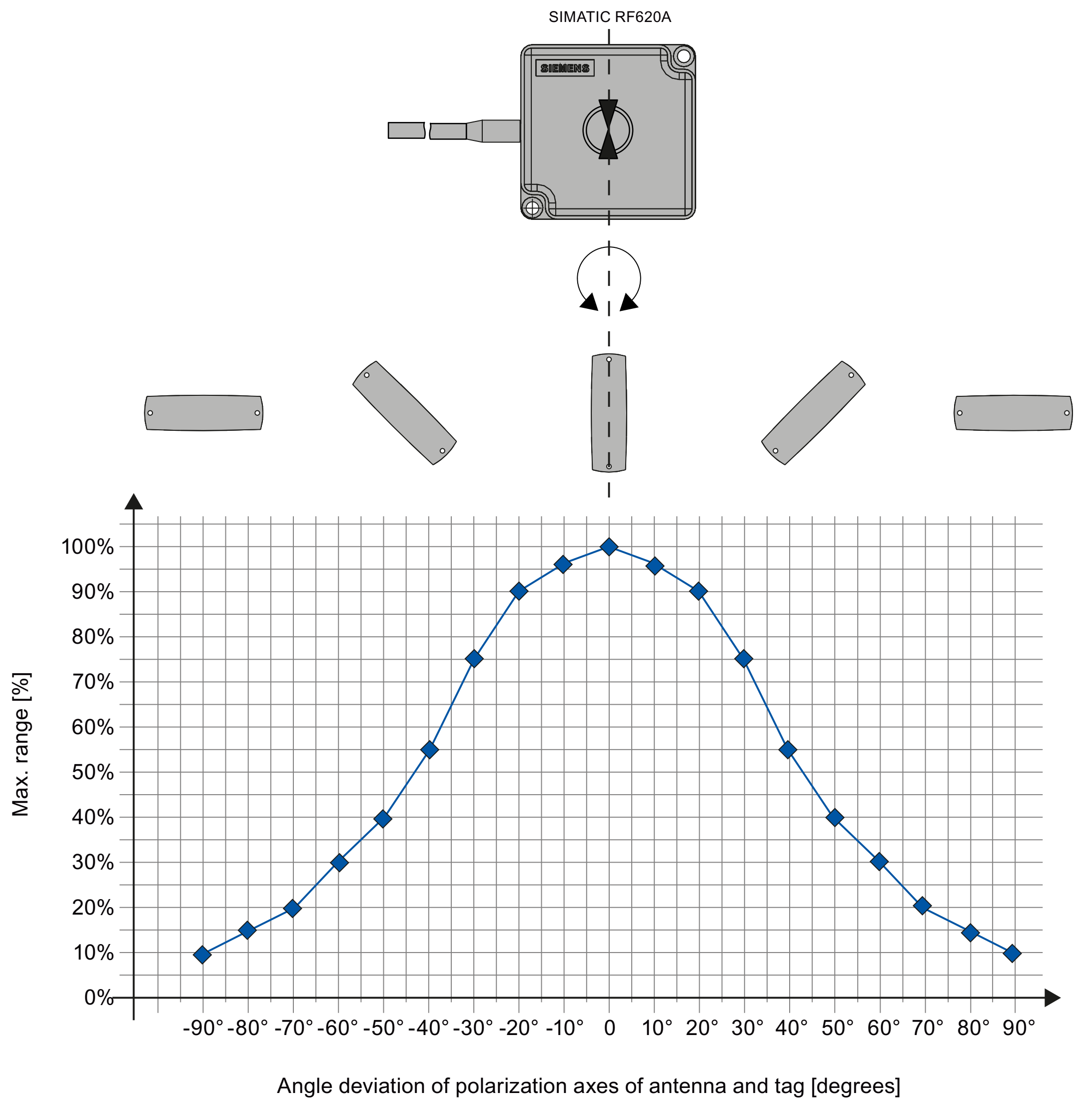


Figure 6-4 Angle deviation diagram for alignment

6.2.8 Antenna patterns

6.2.8.1 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.

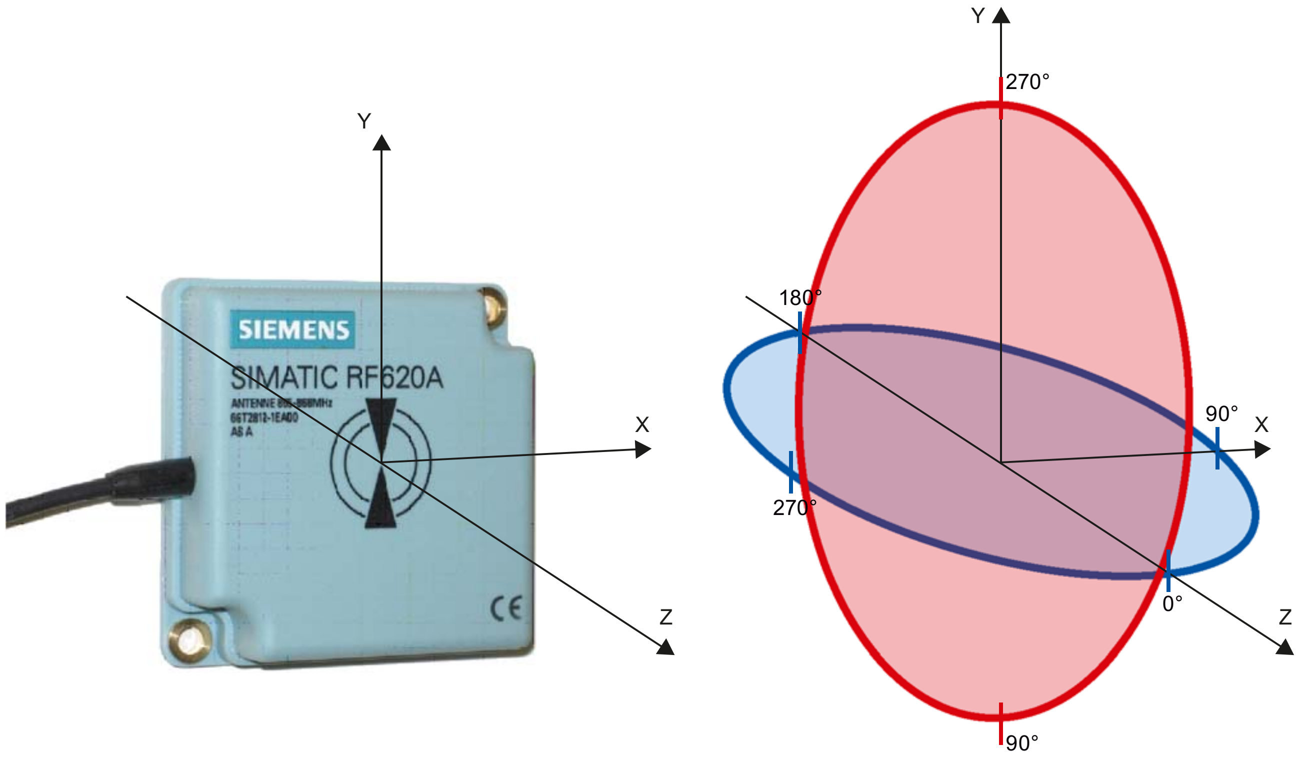


Figure 6-5 Reference system

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 .

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)

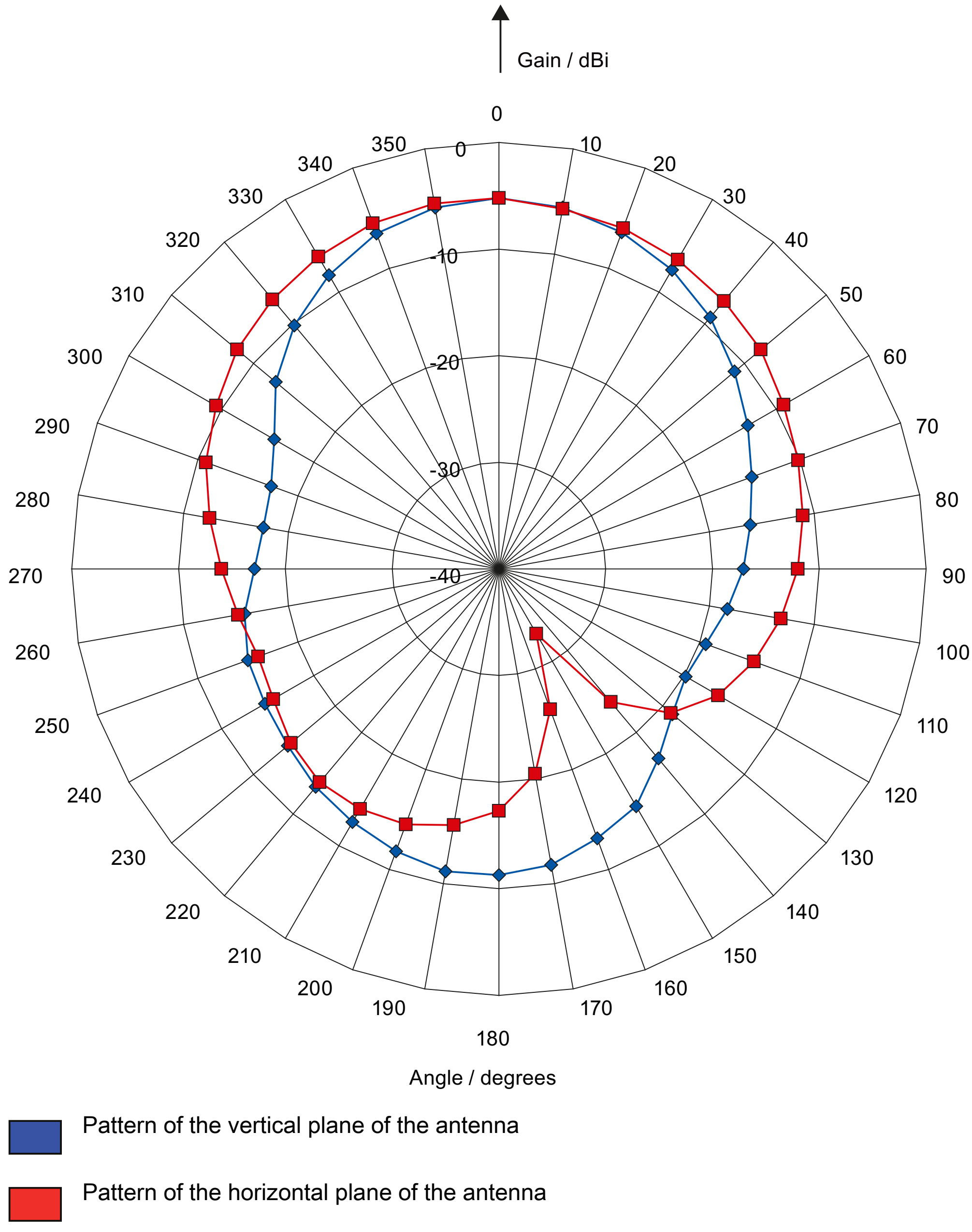


Figure 6-6 Directional radiation pattern RF620A ETSI on metallic mounting surface

Directional radiation pattern ETSI on non-metallic mounting surface

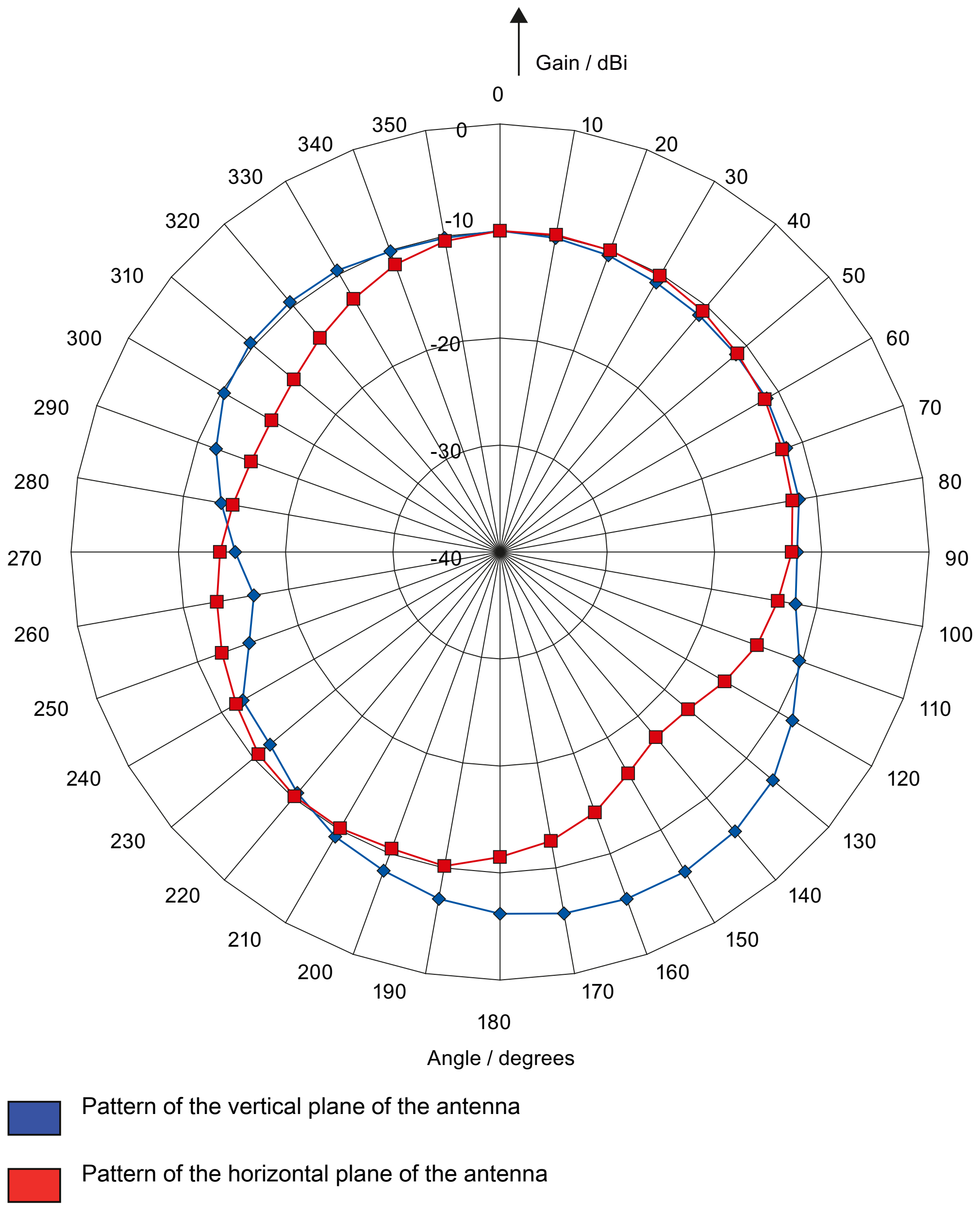


Figure 6-7 Directional radiation pattern RF620A ETSI on non-metallic mounting surface

6.2.8.2 Antenna pattern FCC

Directional radiation pattern USA (FCC)

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

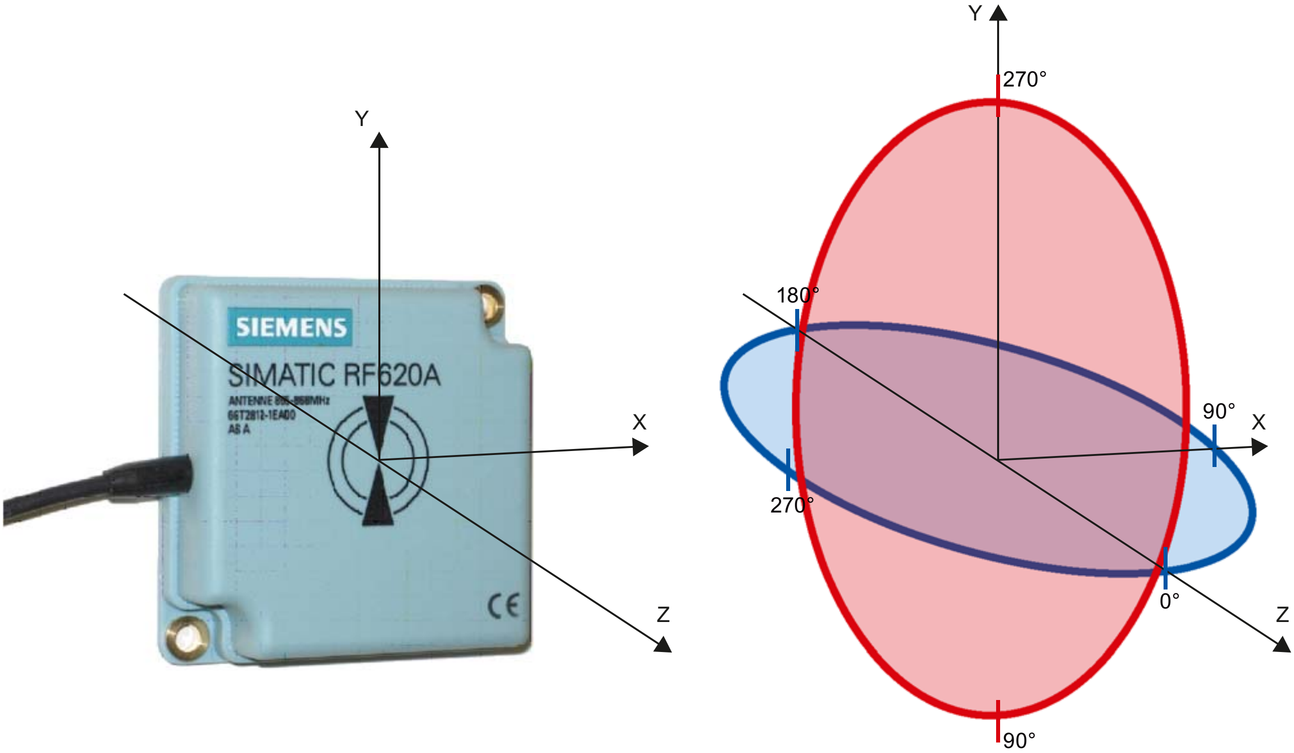


Figure 6-8 Reference system

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 .

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)

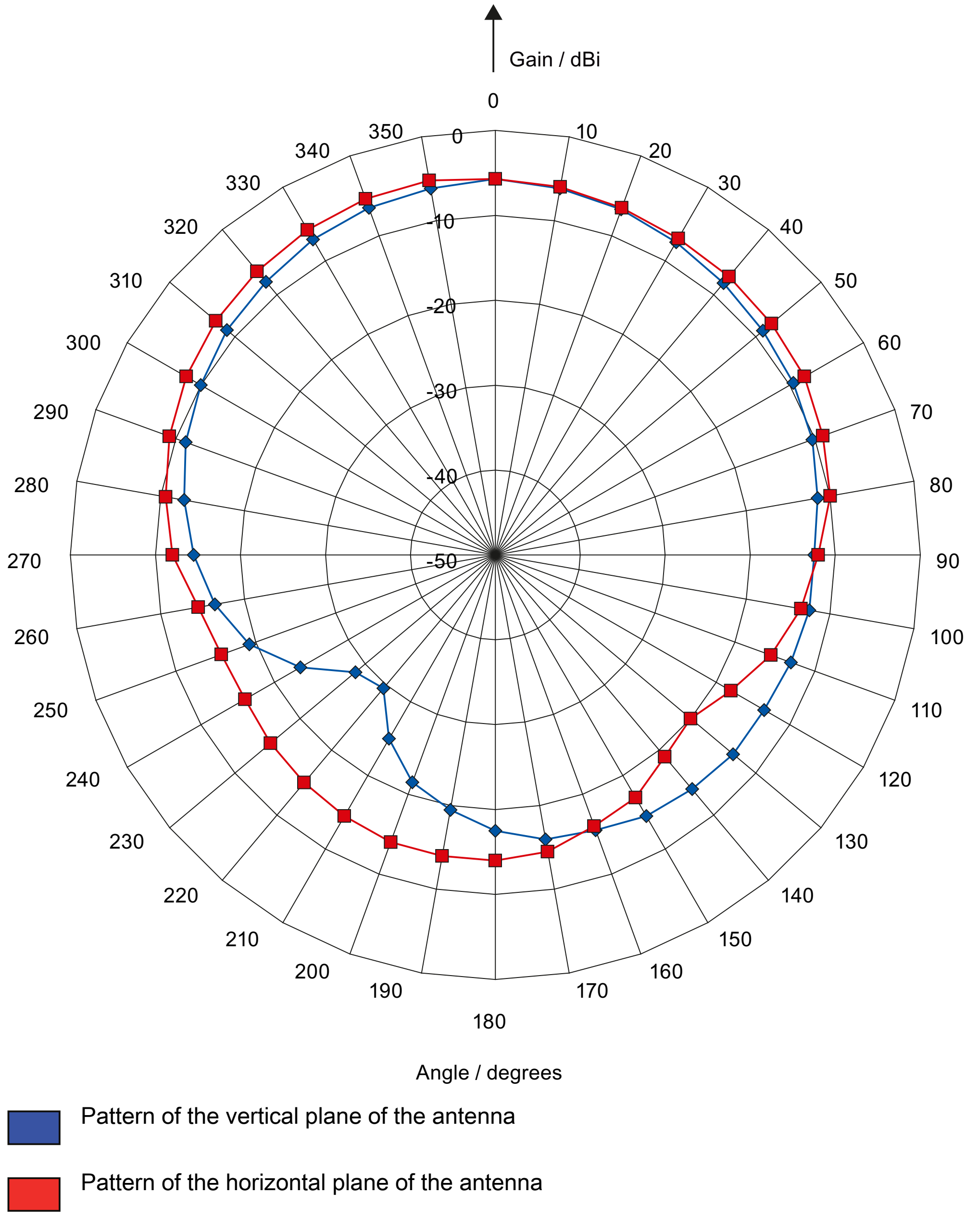


Figure 6-9 Directional radiation pattern of the RF620A (FCC) on metallic mounting surface

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

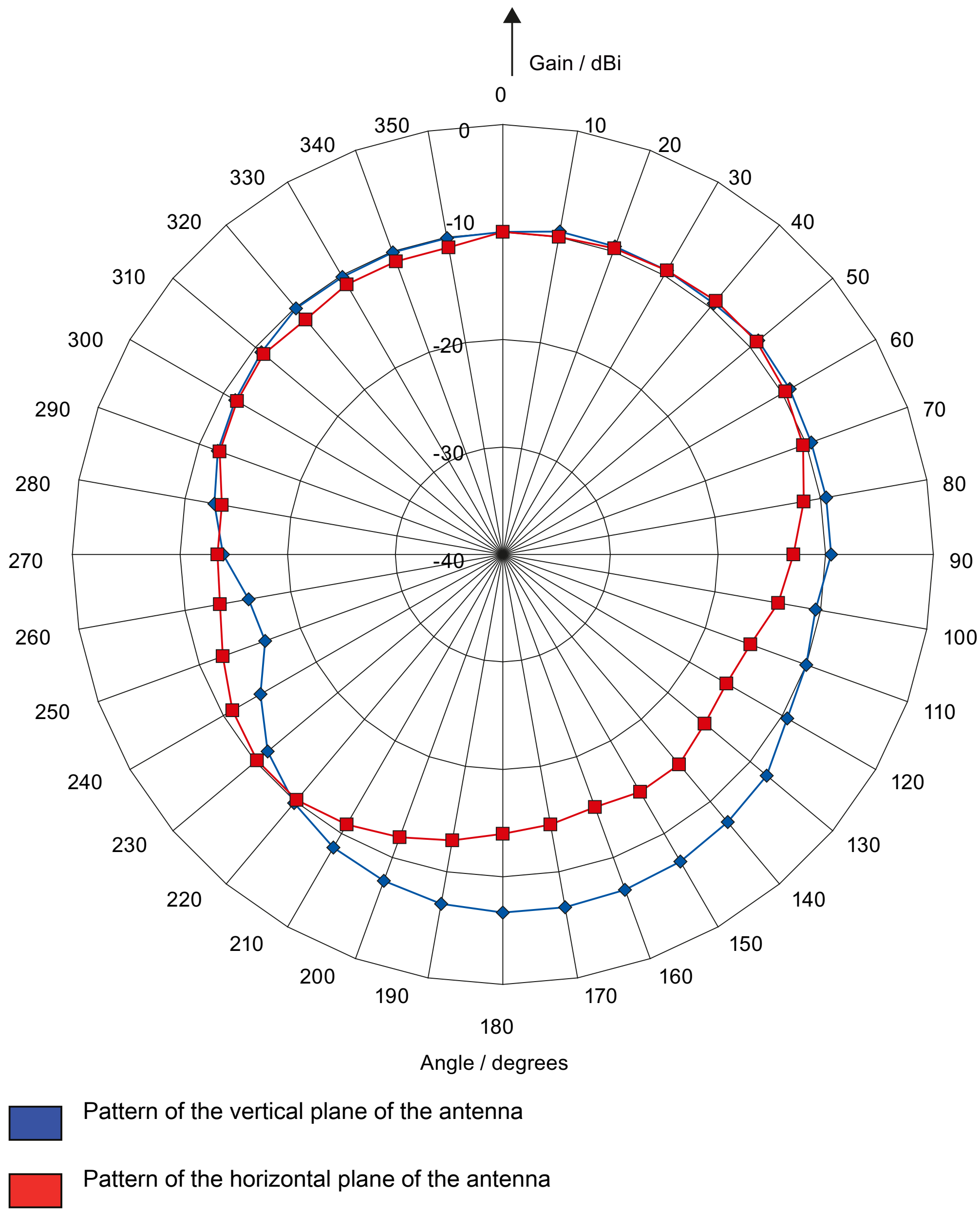


Figure 6-10 Directional radiation pattern of the RF620A (FCC) on non-metallic mounting surface

6.2.8.3 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 can be seen from the Antenna pattern ETSI (Page 199), 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 and the associated representation of the reference system).

6.2.9 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

Tolerances

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, suitable for drag chains	6GT2815-2BH50	5	1,25	98
Antenna cable	6GT2815-1BN10	10	2	90
Antenna cable	6GT2815-0BN10	10	4	70
Antenna cable, suitable for drag chains	6GT2815-2BN15	15	4	70
Antenna cable	6GT2815-0BN20	20	4	70

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

Reading ranges RF620R/RF630R

Table 6- 3 Reading ranges RF620R/RF630R

Transponder	Connection to RF620R/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, -2AB02-0AX0)	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
RF625T	30 [2)]	25 [2)]	45 [2)]	30 [2)]
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

Writing ranges RF620R/RF630R

Table 6- 4 Writing ranges RF620R/RF630R

Transponder	Connection to RF620R/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, -2AB02-0AX0)	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
RF625T	20 2)	5 2)	20 2)	10 2)
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 RF640R/RF670R

Table 6- 5 Reading ranges RF640R/RF670R

Transponder	Connection to RF640R/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, -2AB02-0AX0)	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
RF625T	50 2)	45 2)	60 2)	45 2)
RF630T	40 2)	35 2)	50 2)	35 2)
RF640T	40 2)	35 2)	40 2)	30 2)

Transponder	Connection to RF640R/RF670R			
	RF620A ETSI on metal [cm]	RF620A ETSI on non-metal [cm]	RF620A FCC on metal [cm]	RF620A on non-metal [cm]
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

Writing ranges RF640R/RF670R

Table 6- 6 Writing ranges RF640R/RF670R

Transponder	Connection to RF640R/RF670R			
	RF620A ETSI on metal	RF620A ETSI on non-metal	RF620A FCC on metal	RF620A on non-metal
RF630L (6GT2810-2AB00, -2AB01, -2AB02-0AX0)	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
RF625T	40 2)	30 2)	45 2)	30 2)
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

6.2.10 Technical data

Table 6- 7 General technical specifications RF620A

Feature	SIMATIC RF620A ETSI	SIMATIC RF620A FCC
Dimensions (L x W x H)	75 x 75 x 20 mm	
Color	Pastel turquoise	
Material	PA 12 (polyamide 12)	
	Silicone-free	
Frequency range	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 (because antenna gain < 6 dBi)
Max. power	2 W	1 W
Impedance	50 ohms	
Antenna gain	-10 dBi ... -5 dBi	
	Depends on background, refer to the section Antenna pattern ETSI (Page 199)	Depends on background, refer to the section Antenna pattern FCC (Page 202)
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 199)	• Horizontal plane: 130° • Vertical plane: 105° See section Antenna pattern FCC (Page 202)
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 • Transport and storage	 • -20 °C to +70 °C • -40 °C to +85 °C	
MTBF in years		
Degree of protection according to EN 60529	IP67	
Weight, approx.	90 g	

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

6.2.11 Dimension drawing

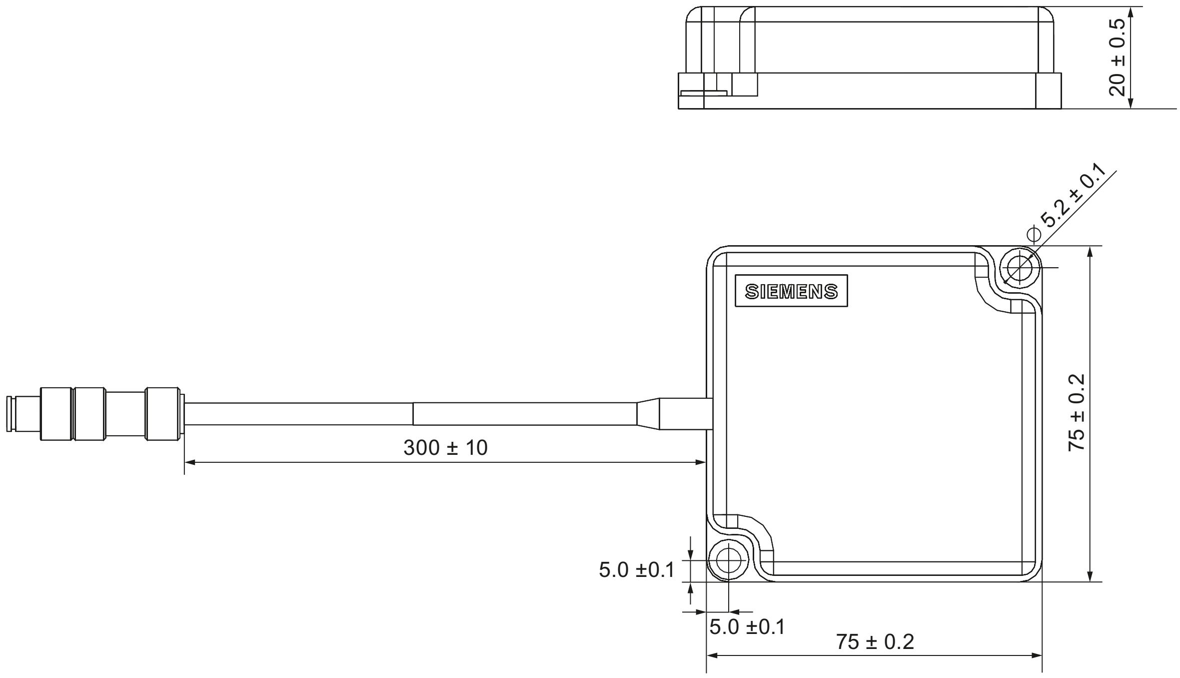


Figure 6-11 Dimension drawing RF620A

All dimensions in mm

6.2.12 Approvals & certificates

Table 6- 8 6GT2812-1EA00

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

Table 6- 9 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-RF600R (for RF620R: 6GT2811-5BA00-1AA1, RF630R: 6GT2811-4AA00-1AA1, RF640R: 6GT2811-3BA00-1AA0, RF670R as of FS C1: 6GT2811-0AB00-1AA0) • FCC ID: NXW-RF630R (for 6GT2811-4AA00-1AA0) • FCC ID: NXW-RF670 (for RF670R as of FS A1: 6GT2811-0AB00-1AA0)
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 (for 6GT2811-4AA00-1AA0) • IC: 267X-RF670, RF670R FS A1 (for 6GT2811-0AB00-1AA0) • IC: 267X-RF600R, Model RF620R-2 (for 6GT2811-5BA00-1AA1) • IC: 267X-RF600R, Model RF630R-2 (for 6GT2811-4AA00-1AA1) • IC: 267X-RF600R, Model RF640R (for 6GT2811-3BA00-1AA0) • IC: 267X-RF600R, model RF670R-2 as of FS C1 (for 6GT2811-0AB00-1AA0)
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 Antenna RF640A

6.3.1 Description

SIMATIC RF640A	Features	
	Field of application	The SIMATIC RF640A is a universal UHF antenna of compact, industry-standard design with medium range.
	Frequency range	865 to 928 MHz
	Polarization	RH circular Suitable for RF600 transponders that can pass in parallel with the antenna regardless of their orientation.
	Writing/reading range	max. 4.0 m
	Mounting	4 x M4 (VESA 100 fixing system)
	Connector	30 cm connecting cable (connected permanently to the antenna) and RTNC coupling An antenna cable is required for connection to the reader, e.g. 6GT2815-0BH30)
	Readers that can be connected	All RF600 readers with external antenna connectors
	Dimensions in mm	185 x 185 x 45
	Degree of protection	IP67

Frequency ranges

The antenna is available for broadband. It can therefore be used for two different frequency ranges that have been specified for the regions of Europe and China/USA respectively.

- The antenna for Europe (EU, EFTA countries) operates in the frequency range from 865 to 868 MHz.
- The antenna for China, the USA, and Canada operates in the frequencyrange from 902 to 928 MHz.

Function

The SIMATIC RF640A is used for transmitting and receiving RFID signals in the UHF frequency range. The antennas are connected to the SIMATIC RF600 readers via antenna cables that are available in different lengths.

6.3.2 Ordering data

Table 6- 10 Ordering data RF640A

Product	Order no.
SIMATIC RF640A	6GT2812-0GA08

Accessories

Table 6- 11 Ordering data (accessories)

Product		Order no.
Connecting cable between reader and antenna	3 m (cable loss 1.0 dB)	6GT2815-0BH30
	5 m, suitable for drag chains (cable loss 1.25 dB)	6GT2815-2BH50
	10 m (cable loss 2.0 dB)	6GT2815-1BN10
	10 m (cable loss 4.0 dB)	6GT2815-0BN10
	15 m, suitable for drag chains (cable loss 4.0 dB)	6GT2815-2BN15
	20 m (cable loss 4.0 dB)	6GT2815-0BN20
Antenna mounting kit	See "RF600 System Manual", Chapter "Antennas" > "Mounting types"	6GT2890-0AA00

6.3.3 Installation and assembly

6.3.3.1 RF640A mounting types

VESA 100 mounting system

A standardized VESA 100 mounting system is provided to mount the antenna. The mounting system consists of four fixing holes for M4 screws at intervals of 100 mm.

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.

Antenna Mounting Kit

The Antenna Mounting Kit allows the fine adjustment of the antenna field by setting the solid angle (see "RF600 System Manual", chapter "Antennas" > "Mounting types").

6.3.4 Connecting an antenna to the reader

The SIMATIC RF640A antenna must be connected to the reader using an antenna cable.

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

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

Requirement

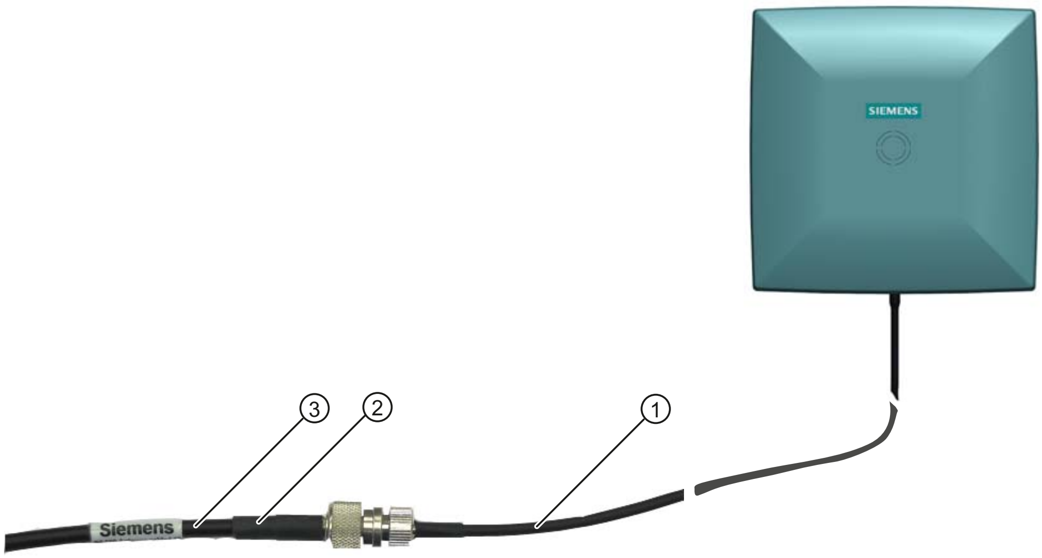
Note

Use of Siemens antenna cable

To ensure optimum functioning of the antenna, it is recommended that a Siemens antenna cable be 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 RF640A antenna connection (30 cm connecting cable)
② RF600 antenna cable
③ Strain relief (should take place at this position)

Figure 6-12 Strain relief

6.3.4.1 Bending radii and bending cycles of the cable

Cable designation	Order No.	Length [m]	Cable loss [dB]	Bending radius [mm]	Bending cycle
RF640A antenna connection	Fixed connection to antenna	0.3	-	15	1 Mal
Antenna cable	6GT2815-0BH30	3	1	51	1 Mal
Antenna cable (suitable for drag chains)	6GT2815-2BH50	5	1,25	48	1)
Antenna cable	6GT2815-1BN10	10	2	77	1 Mal
Antenna cable	6GT2815-0BN10	10	4	51	1 Mal
Antenna cable (suitable for drag chains)	6GT2815-0BN20	15	4	24	1)
Antenna cable	6GT2815-0BN20	20	4	77	1 Mal

1) With cables suitable for drag chains, 3 million bending cycles at a bending radius of 6.5 m and bending through ± 180 ° are permitted.

6.3.5 Parameter settings of RF640A for RF620R/RF630R

Operation within the EU, EFTA, or Turkey according to EN 302 208 V1.4.1

Note

Limitation of the radiated power according to EN 302 208 V1.4.1

RF600 systems that are put into operation within the EU, EFTA, or Turkey (ETSI) can be operated with an RF640A antenna with a maximum radiated power of up to 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP).

By adjusting the transmit power of up to 500 mW ERP (or 27 dBm ERP, 800 mW EIRP, 29.15 dBm EIRP) and taking into account the RF640A antenna gain of 4 dBi (6 dBic) and the cable loss associated with the antenna cable (see table), the radiated power of the antenna cannot be exceeded. You can make the power settings using the "distance_limiting" parameter. You will find more detailed information on the parameters in the section Parameter assignment manual RF620R/RF630R (http://support.automation.siemens.com/WW/view/en/33287195).

Operation in China

The national approval for RF600 systems in China means a restriction to 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP). The possible combination of antenna gain, cable loss, and max. 500 mW radiated power of the RF630R reader means it is not possible to exceed 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP).

Operation in the USA, Canada

Note

Limitation of the radiated power to 4000 mW EIRP (36 dBm EIRP)

So that the FCC and IC-FCB requirements are met, the radiated power may not exceed 4000 mW EIRP (36 dBm EIRP). Therefore the system must satisfy the following relation:

- Conducted power P dBm of the RF600 reader (< 30 dBm)
- Antenna gain G_i dBi in the FCC frequency band (≤ 4.3 dBi)
- Cable loss a_k dB (≥ 1 dB)

$P(dBm) \leq 30\ dBm - (G_i - 6\ dBi) + a_k$

6.3.6 Parameter settings of RF640A for RF640R/RF670R

Operation within the EU, EFTA, or Turkey

Note

Limitation of the radiated power according to EN 302 208 V1.4.1

RF600 systems that are put into operation within the EU, EFTA, or Turkey (ETSI) can be operated with an RF640A antenna with a maximum radiated power of 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP).

By adjusting the radiated power of up to 1300 mW ERP (or 31.15 dBm ERP, 2140 mW EIRP, 33.3 dBm EIRP), the RF640A antenna gain of 4 dBi (7 dBic) and the cable loss associated with the antenna cable (see table), the radiated power of the reader is correctly configured and the radiated power at the antenna is thus not exceeded.

Operation in China

By setting a max. radiated power of 1300 mW ERP (or 31.15 dBm ERP, 2140 mW EIRP, 33.3 dBm EIRP), the RF640A antenna gain of 4.3 dBi (7.3 dBic) and the cable loss associated with the antenna cable (see table), the radiated power of the reader is correctly configured.

Operation in the USA, Canada

Note

Limitation of the radiated power to 4000 mW EIRP (36 dBm EIRP)

So that the FCC and IC requirements are met, the radiated power may not exceed 4000 mW EIRP (36 dBm EIRP). Therefore the system must satisfy the following relation:

- Conducted power P dBm of the RF600 reader (< 30 dBm)
- Antenna gain G_i dBi in the FCC frequency band (≤ 4.3 dBi)
- Cable loss a_k dB (≥ 1 dB)

$P(dBm) \leq 30\ dBm - (G_i - 6\ dBi) + a_k$

6.3.7 Antenna patterns

6.3.7.1 Antenna radiation patterns in the ETSI frequency band

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.

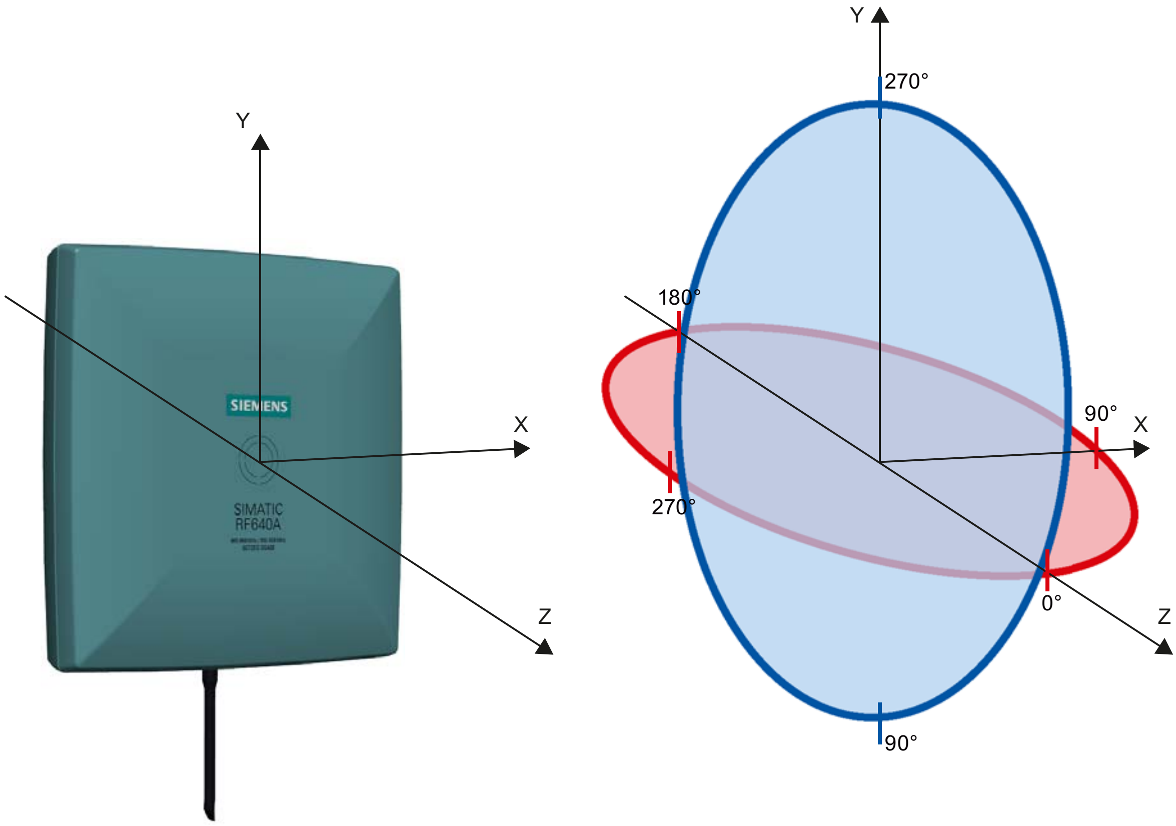


Figure 6-13 Reference system

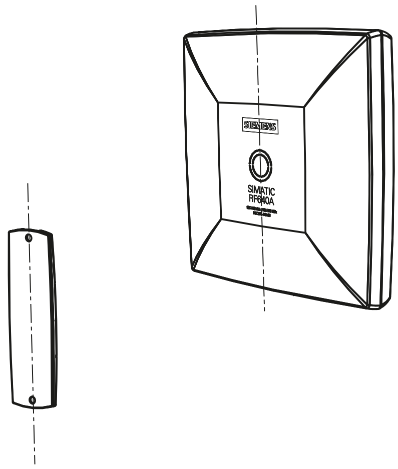
The half-power beam width of the antenna is defined by the angle between the two -3 dB points. Which range (in %) corresponds to the dB values in the patterns can be obtained from this table (Page 228).

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 patterns in the ETSI frequency band

Polarization axis and axis of symmetry are parallel

In a configuration based on the following directional radiation pattern of the antenna, the axis of symmetry of the antenna and the polarization axis of the transponder are parallel.



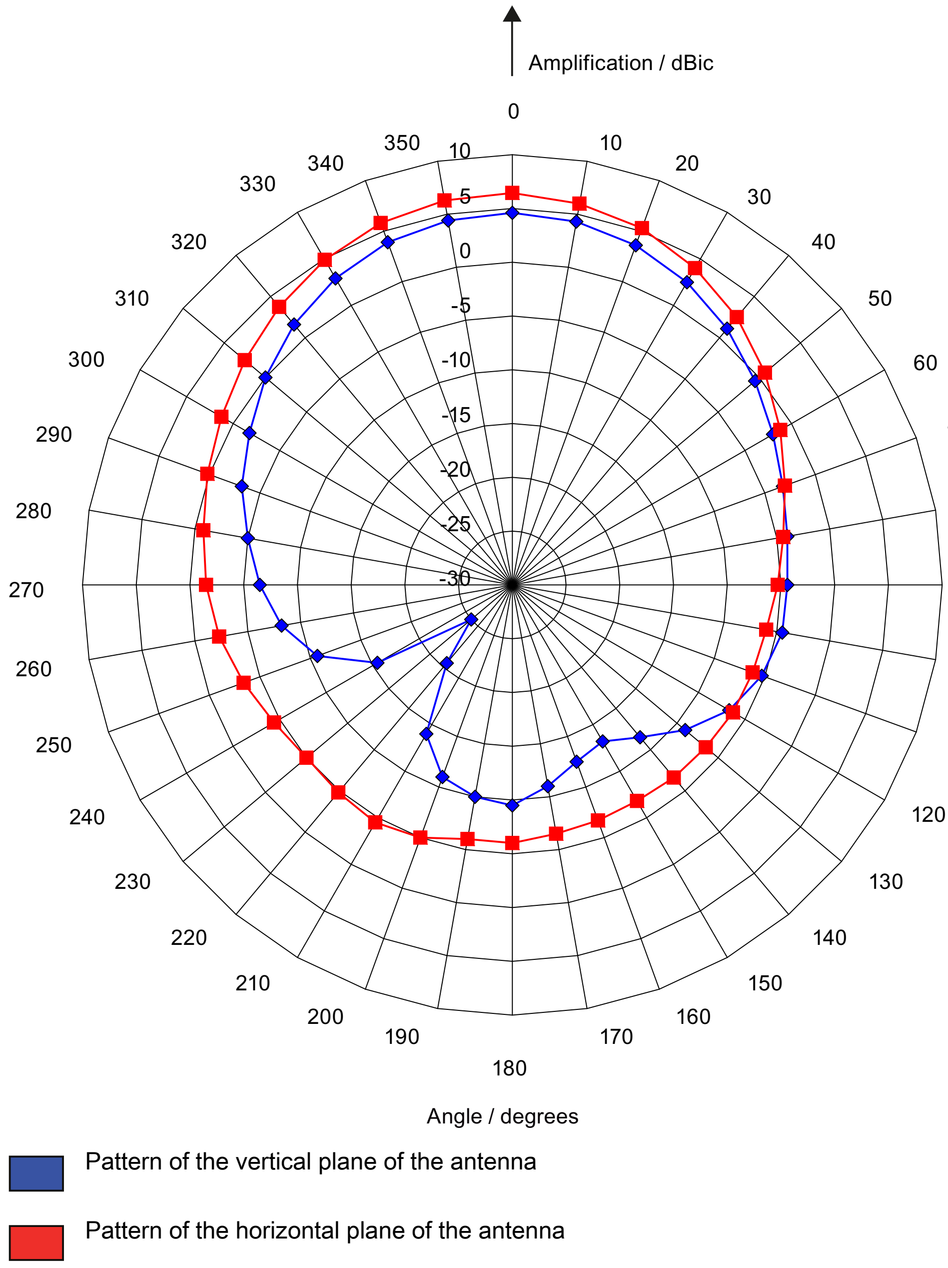
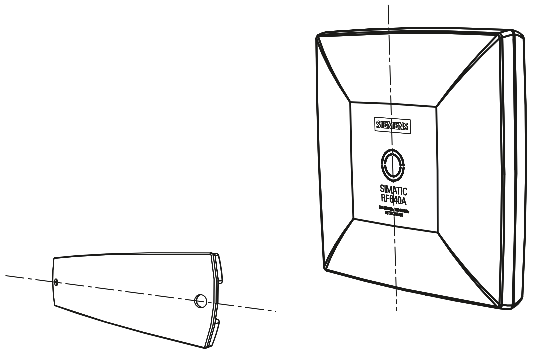


Figure 6-14 The RF640A directional radiation pattern in the ETSI frequency band, polarization axis of the transponder, and axis of symmetry of the antenna are parallel to each other.

Polarization axis and axis of symmetry are orthogonal to each other

In a configuration based on the following directional radiation pattern of the antenna, the axis of symmetry of the antenna and the polarization axis of the transponder are orthogonal to each other.



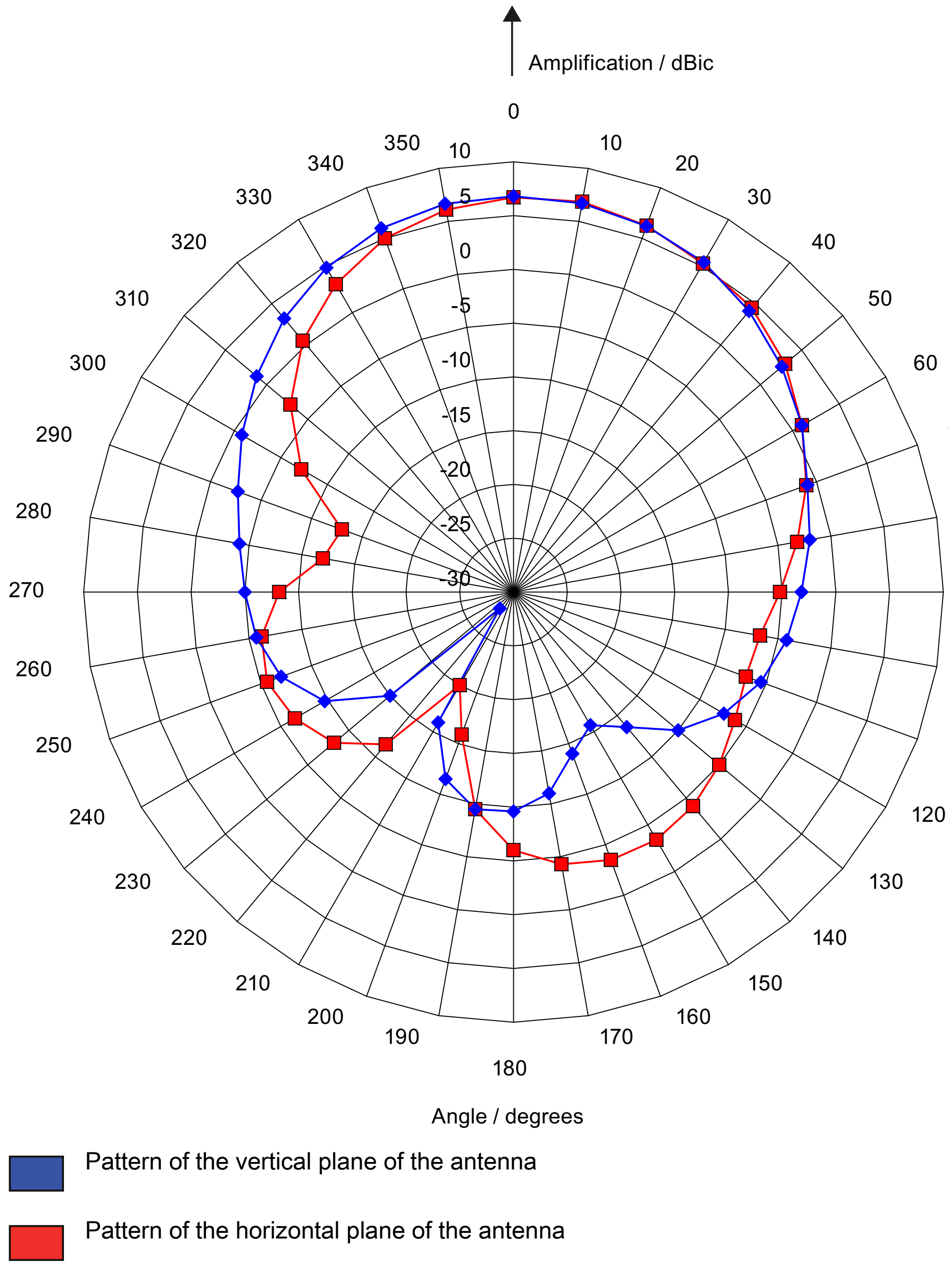


Figure 6-15 The RF640A directional radiation pattern in the ETSI frequency band, axis of symmetry of the antenna, and polarization axis of the transponder are orthogonal to each other

6.3.7.2 Antenna radiation patterns in the FCC frequency band

Directional radiation pattern USA (FCC)

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

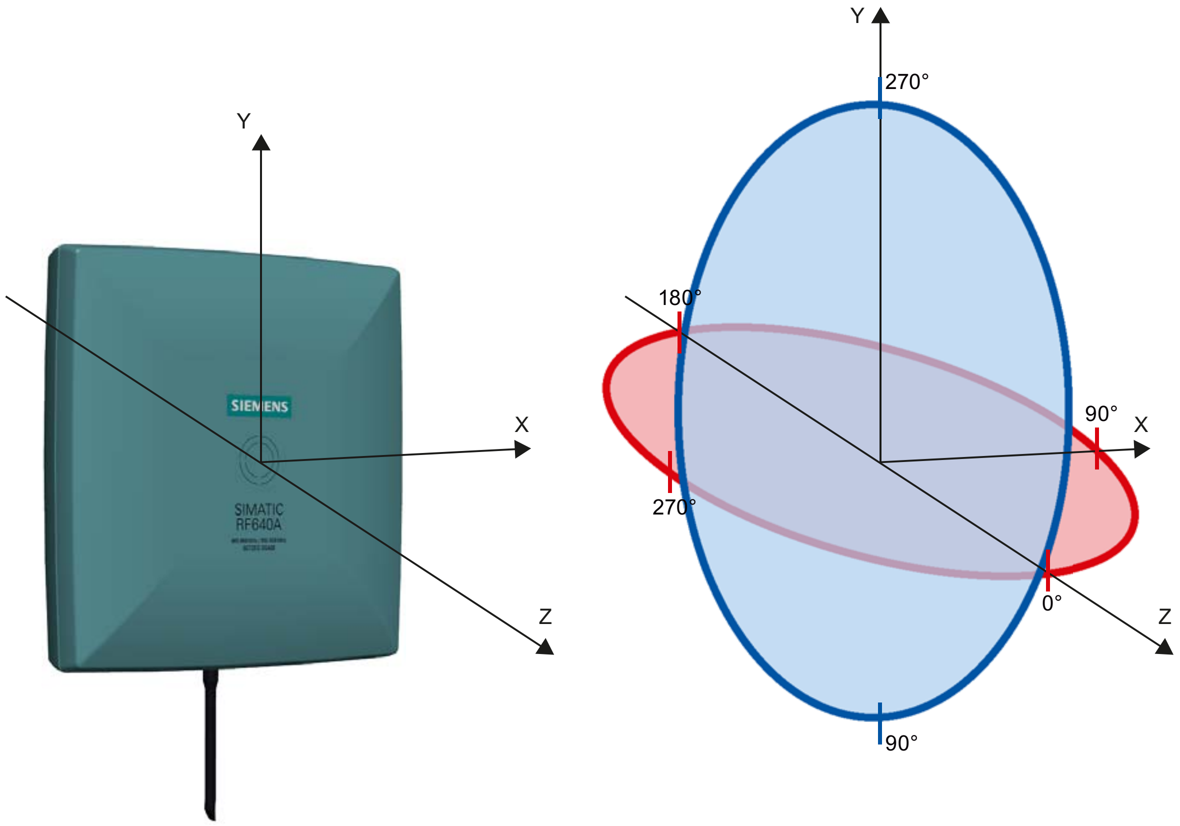


Figure 6-16 Reference system

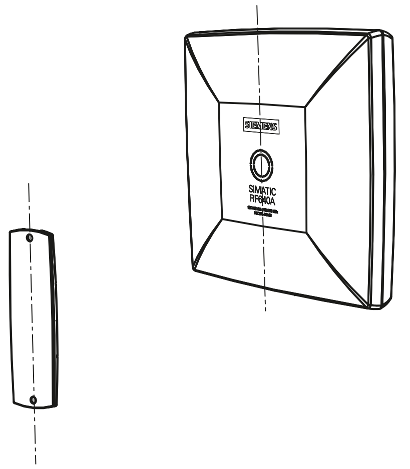
The half-power beam width of the antenna is defined by the angle between the two -3 dB points (corresponding to half the power referred to the maximum power). Which range (in %) corresponds to the dB values in the patterns can be obtained from this table (Page 228).

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 in the FCC frequency band

Polarization axis and axis of symmetry are parallel

In the following directional radiation pattern of the antenna, the axis of symmetry of the antenna and the polarization axis of the transponder are parallel.



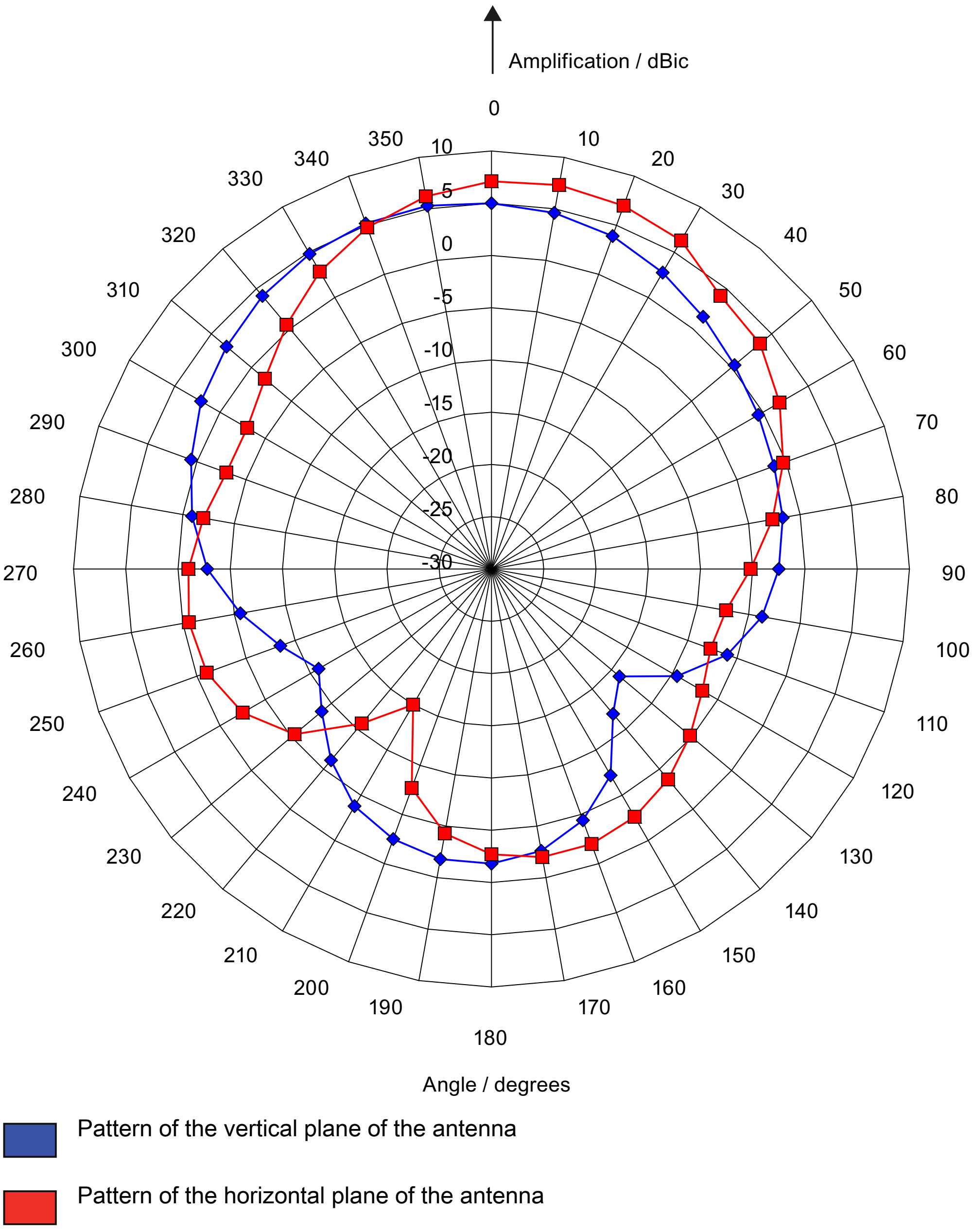
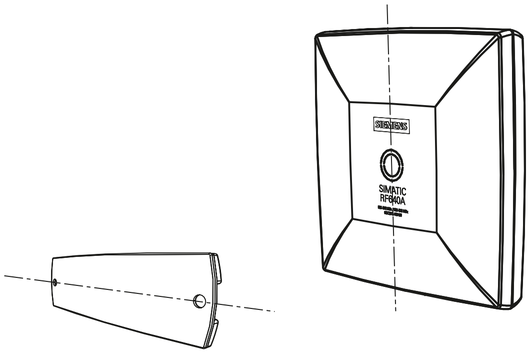


Figure 6-17 The RF640A directional radiation pattern in the FCC frequency band, polarization axis of the transponder, and axis of symmetry of the antenna are parallel to each other

Polarization axis and axis of symmetry are orthogonal to each other

In the following directional radiation pattern of the antenna, the axis of symmetry of the antenna and the polarization axis of the transponder are orthogonal to each other.



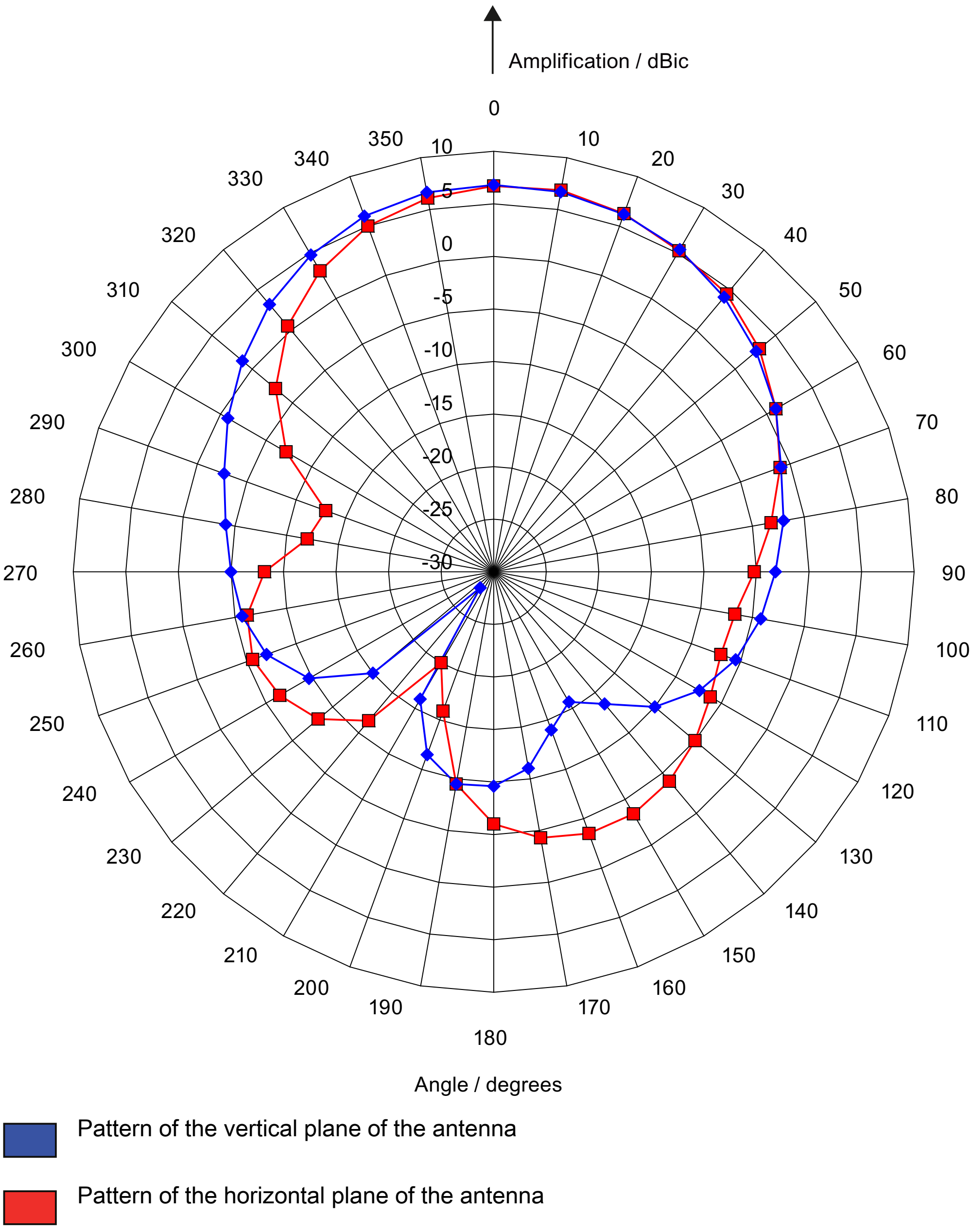


Figure 6-18 The RF640A directional radiation pattern in the FCC frequency band, axis of symmetry of the antenna, and polarization axis of the transponder are orthogonal to each other

6.3.7.3 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/dBic value and a second dBi/dBic 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 can be seen in Directional radiation patterns in the ETSI frequency band (Page 219), the maximum antenna gain in the vertical plane is 3.45 dBi (6.45 dBic). In this plane, and with the polarization axis of the transponder parallel to the axis of symmetry of the antenna, the antenna gain drops to about 0.5 dBic at +50° or 310°. Therefore the dBr value is -6. The antenna range is only 50% of the maximum range at + 50° or 310° 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 219) and the associated representation of the reference system (Page 218)).

6.3.8 Technical data

Table 6- 12 General technical specifications RF640A

Feature	SIMATIC RF640A
Dimensions (L x W x H)	185 x 185 x 45 mm
Color	Pastel turquoise
Material	PA 12 (polyamide 12)
	Silicone-free
Frequency range	865 to 928 MHz
Plug connection	30 cm antenna connection coaxial cable with RTNC coupling, fixed connection to antenna An antenna cable is required for connection to the reader, e.g.: 6GT2815-0BH30
Max. radiated power according to ETSI	• RF620R, RF630R: < 610 mW ERP • RF640R, RF670R: ≤1300 mW ERP
Max. radiated power according to CMIIT	• RF620R, RF630R: ≤650 mW ERP • RF640R, RF670R: ≤ 1300 mW ERP
Max. radiated power according to FCC	• RF620R, RF630R: ≤ 1070 mW EIRP • RF640R, RF670R: ≤2700 mW EIRP
Max. power	2000 mW
Impedance	50 ohms
Antenna gain	ETSI frequency band: 4 dBi (7 dBic)
	FCC frequency band: 4.3 dBi (7.3 dBic)
VSWR (standing wave ratio)	ETSI frequency band: Max. 1.25
	FCC frequency band: Max. 1.6
Polarization	RH circular
Aperture angle for transmitting/receiving	ETSI frequency band: • Horizontal plane: 80° • Vertical plane: 75° See ETSI antenna pattern
	FCC frequency band: • Horizontal plane: 75° • Vertical plane: 85° See FCC antenna pattern
Front-to-back ratio	ETSI frequency band: 14 dB ± 2.4 dB (depends on orientation of the transponder)
	FCC frequency band: 9 dB ± 2.7 dB (depends on orientation of the transponder)
Shock resistant to EN 60068-2-27	30 g
Vibration resistant to EN 60068-2-6	10 g

Feature	SIMATIC RF640A
Attachment of the antenna	4 screws M4 (VESA 100 fastening system)
Tightening torque (at room temperature)	≤ 2 Nm
Ambient temperature • Operation • Transport and storage	 • -25 °C to +75 °C • -40 °C to +85 °C
MTBF in years	445
Degree of protection according to EN 60529	IP67
Weight, approx.	600 g

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

6.3.9 Dimension drawing

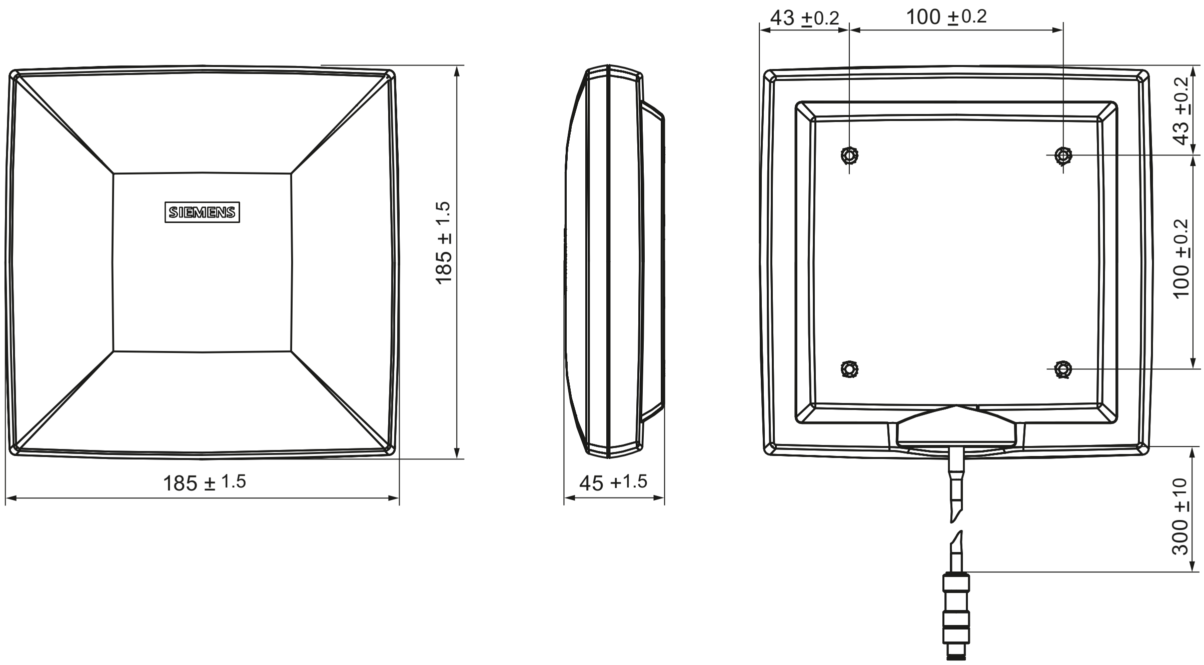


Figure 6-19 Dimension drawing RF640A

All dimensions in mm

6.3.10 Approvals & certificates

Table 6- 13 6GT2812-0GA08

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

Table 6- 14 6GT2812-0GA08

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. The FCC approval is granted in association with the FCC approval of the following RF600 readers: • FCC ID: NXW-RF600R (for RF620R: 6GT2811-5BA00-1AA1, RF630R: 6GT2811-4AA00-1AA1, RF640R: 6GT2811-3BA00-1AA0, RF670R FS C1: 6GT2811-0AB00-1AA0) • FCC ID: NXW-RF630R (for 6GT2811-4AA00-1AA0) • FCC ID: NXW-RF670 (for RF670R as of FS A1: 6GT2811-0AB00-1AA0
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 (for 6GT2811-4AA00-1AA0) • IC: 267X-RF670, RF670R FS A1 (for 6GT2811-0AB00-1AA0) • IC: 267X-RF600R, Model RF620R-2 (for 6GT2811-5BA00-1AA1) • IC: 267X-RF600R, Model RF630R-2 (for 6GT2811-4AA00-1AA1) • IC: 267X-RF600R, Model RF640R (for 6GT2811-3BA00-1AA0) • IC: 267X-RF600R, model RF670R-2 as of FS C1 (for 6GT2811-0AB00-1AA0)
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

6.4 Antenna RF642A

6.4.1 Description

SIMATIC RF642A	Features	
	Field of application	The SIMATIC RF642A is a universal UHF antenna of compact, industry-standard design with medium range.
	Frequency range	865 to 928 MHz
	Polarization	Linear polarization Suitable for RF600 transponders that are uniformly aligned while directed past the antenna.
	Writing/reading range	max. 5.0 m
	Mounting	4 x M4 (VESA 100 fixing system)
	Connector	30 cm connecting cable (connected permanently to the antenna) and RTNC coupling An antenna cable is required for connection to the reader, e.g. 6GT2815-0BH30)
	Readers that can be connected	All RF600 readers with external antenna connectors
	Dimensions in mm	185 x 185 x 45
	Degree of protection	IP67

Frequency ranges

The antenna is available for broadband. It can therefore be used for two different frequency ranges that have been specified for the regions of Europe and China/USA respectively.

- The antenna for Europe (EU, EFTA countries) operates in the frequency range of 865 to 868 MHz.
- The antenna for China, the USA, and Canada operates in the frequency range of 902 to 928 MHz.

Function

The SIMATIC RF642A is used for transmitting and receiving RFID signals in the UHF range. The antennas are connected to the SIMATIC RF600 readers via antenna cables that are available in different lengths.

6.4.2 Ordering data

Table 6- 15 Ordering data RF642A

Product	Order no.
SIMATIC RF642A	6GT2812-1GA08

Accessories

Table 6- 16 Ordering data (accessories)

Product		Order no.
Connecting cable between reader and antenna	3 m (cable loss 1.0 dB)	6GT2815-0BH30
	5 m, suitable for drag chains (cable loss 1.25 dB)	6GT2815-2BH50
	10 m (cable loss 2.0 dB)	6GT2815-1BN10
	10 m (cable loss 4.0 dB)	6GT2815-0BN10
	15 m, suitable for drag chains (cable loss 4.0 dB)	6GT2815-2BN15
	20 m (cable loss 4.0 dB)	6GT2815-0BN20
Antenna mounting kit	See "RF600 System Manual", Chapter "Antennas" > "Mounting types"	6GT2890-0AA00

6.4.3 Installation and assembly

6.4.3.1 RF640A mounting types

VESA 100 mounting system

A standardized VESA 100 mounting system is provided to mount the antenna. The mounting system consists of four fixing holes for M4 screws at intervals of 100 mm.

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.

Antenna Mounting Kit

The Antenna Mounting Kit allows the fine adjustment of the antenna field by setting the solid angle (see "RF600 System Manual", chapter "Antennas" > "Mounting types").

6.4.4 Connecting an antenna to the reader

The SIMATIC RF642A antenna must be connected to the reader using an antenna cable.

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

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

Requirement

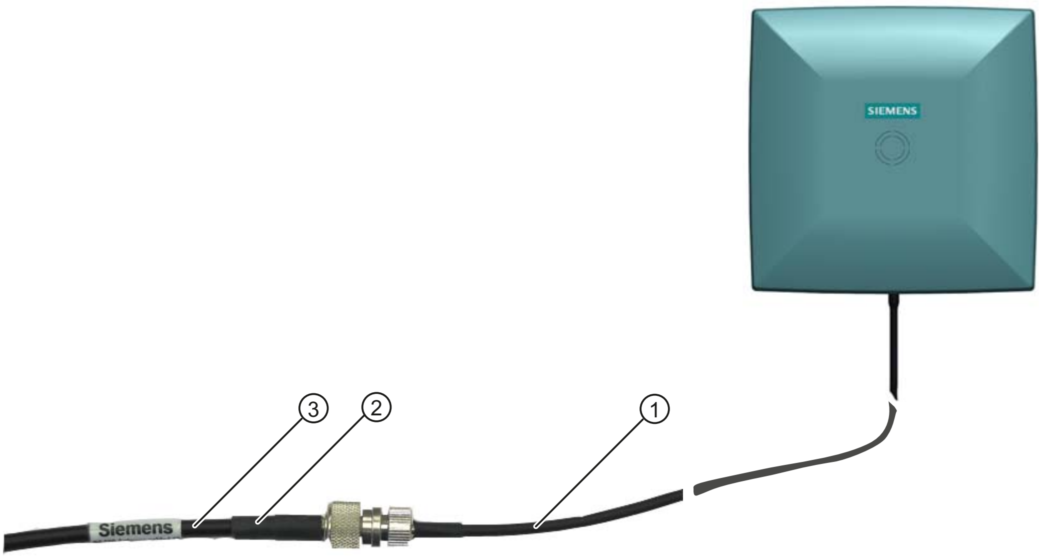
Note

Use of Siemens antenna cable

To ensure optimum functioning of the antenna, it is recommended that a Siemens antenna cable be 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 RF642A antenna connection (30 cm connecting cable)
② RF600 antenna cable
③ Strain relief (should take place at this position)

Figure 6-20 Strain relief

6.4.4.1 Bending radii and bending cycles of the cable

Cable designation	Order No.	Length [m]	Cable loss [dB]	Bending radius [mm]	Bending cycle
RF642A antenna connection	Fixed connection to antenna	0,3	-	-	1 Mal
Antenna cable	6GT2815-0BH30	3	1	51	1 Mal
Antenna cable (suitable for drag chains)	6GT2815-2BH50	5	1,25	48	1)
Antenna cable	6GT2815-1BN10	10	2	77	1 Mal
Antenna cable	6GT2815-0BN10	10	4	51	1 Mal
Antenna cable (suitable for drag chains)	6GT2815-0BN20	15	4	24	1)
Antenna cable	6GT2815-0BN20	20	4	77	1 Mal

1) With cables suitable for drag chains, 3 million bending cycles at a bending radius of 6.5 m and bending through ± 180 ° are permitted.

6.4.5 Alignment of transponders to the antenna

Polarization axis

Since the RF642A 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 6-21 Polarization axis

Alignment

The following diagram shows the optimum alignment of the RF600 transponders to the RF642A antenna.

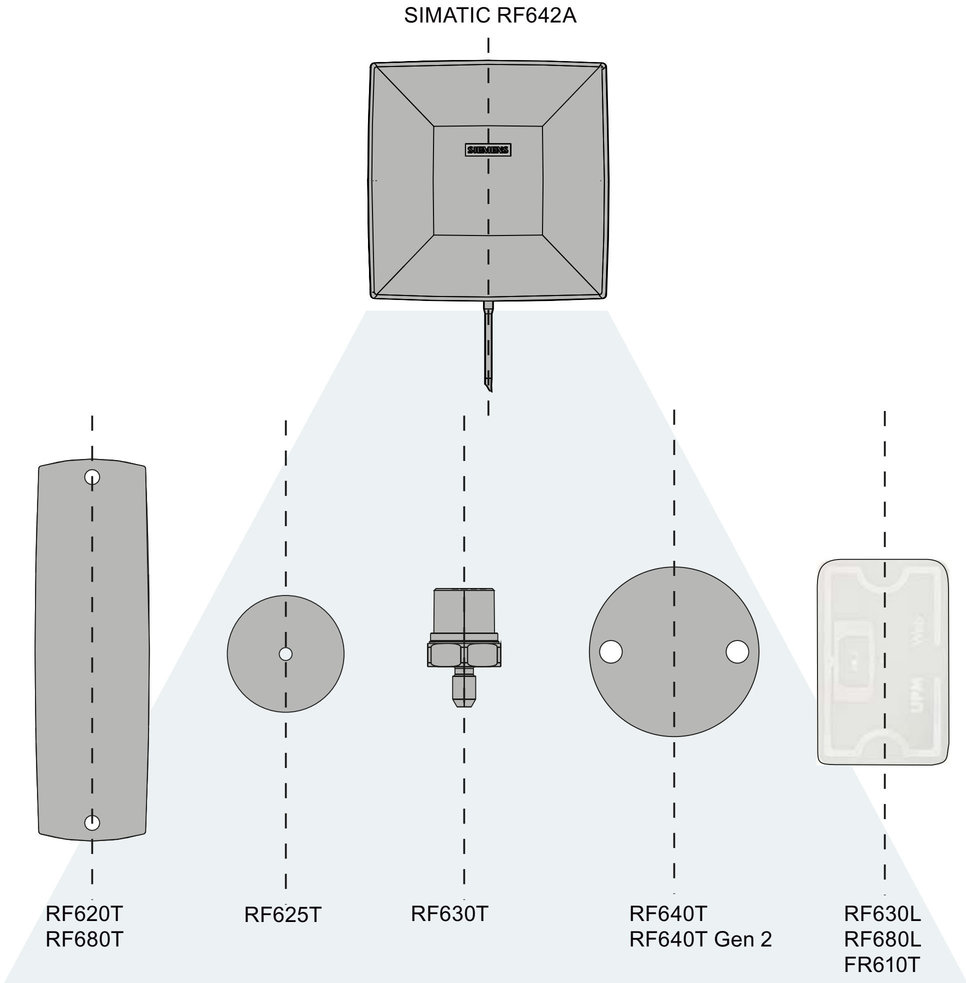


Figure 6-22 Antenna/transponder alignment

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

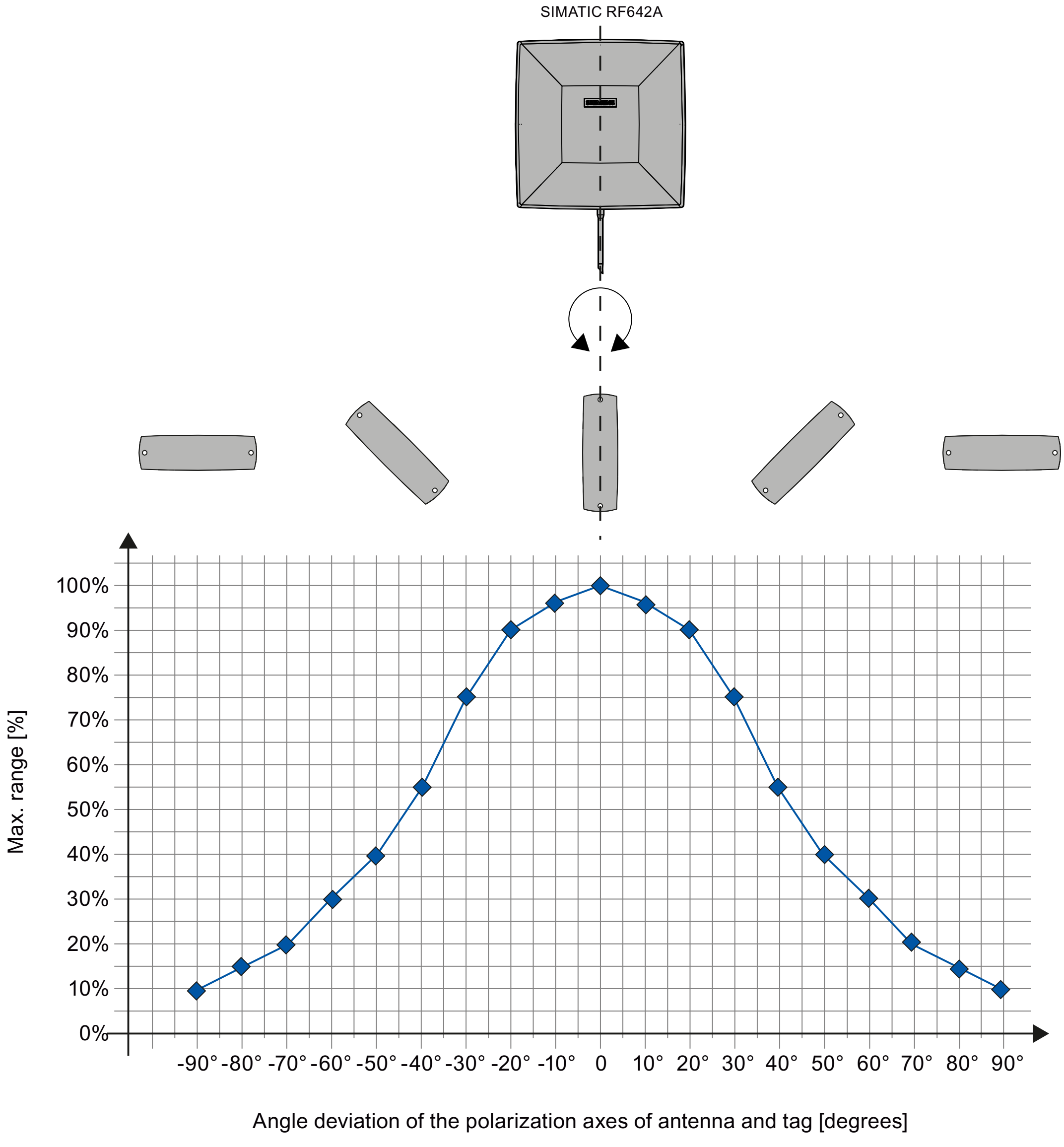


Figure 6-23 Angle deviation diagram for alignment

6.4.6 Parameter settings of RF642A for RF620R/RF630R

Operation within the EU, EFTA, or Turkey according to EN 302 208 V1.4.1

Note

Limitation of the radiated power according to EN 302 208 V1.4.1

RF600 systems that are put into operation within the EU, EFTA, or Turkey (ETSI) can be operated with an RF642A antenna with a maximum radiated power of up to 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP).

By adjusting the transmit power of up to 500 mW ERP (or 27 dBm ERP, 800 mW EIRP, 29.15 dBm EIRP) and taking into account the RF642A antenna gain of 6 dBi and the cable loss associated with the antenna cable (see table), the radiated power of the antenna cannot be exceeded. You can make the power settings using the "distance_limiting" parameter. You will find more detailed information on the parameters in the section Parameter assignment manual RF620R/RF630R (http://support.automation.siemens.com/WW/view/en/33287195).

Operation in China

The national approval for RF600 systems in China means a restriction to 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP). The possible combination of antenna gain (7 dbi), cable loss, and max. 500 mW transmit power of the RF630R reader means it is not possible to exceed 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP).

Operation in the USA, Canada

Note

Limitation of the radiated power to 4000 mW EIRP (36 dBm EIRP) with an antenna gain of 7 dBi

The antenna must be commissioned by qualified personnel. Antennas with a gain >6 dBi may be commissioned, as long as the effective radiated power of 4000 mW EIRP (36 dBm EIRP) is not exceeded.

To comply with FCC and IC-FCB requirements, the system must satisfy the following relation:

- Conducted power P dBm of the RF600 reader (< 30 dBm)
- Antenna gain G_i dBi in the FCC frequency band (≤ 7 dBi)
- Cable loss a_k dB (≥ 1 dB)

$P(dBm) \leq 30\ dBm - (G_i - 6\ dBi) + a_k$

6.4.7 Parameter settings of RF642A for RF640R/RF670R

Operation within the EU, EFTA, or Turkey

Note

Limitation of the radiated power according to EN 302 208 V1.4.1

RF600 systems that are put into operation within the EU, EFTA, or Turkey (ETSI) can be operated with an RF642A antenna with a maximum radiated power of 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP).

By adjusting the radiated power of up to 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP), the RF642A antenna gain of 6 dBi and the cable loss associated with the antenna cable (see table), the radiated power of the reader is correctly configured and the radiated power at the antenna is thus not exceeded.

Operation in China

By setting a max. radiated power of 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP), the RF642A antenna gain of 7 dBi and the cable loss associated with the antenna cable (see table), the radiated power is correctly configured in the reader.

Operation in the USA, Canada

Note

Limitation of the radiated power to 4000 mW EIRP (36 dBm EIRP) with an antenna gain of 7 dBi

The antenna must be commissioned by qualified personnel. Antennas with a gain >6 dBi may be commissioned, as long as the effective radiated power of 4000 mW EIRP (36 dBm EIRP) is not exceeded.

To comply with FCC and IC-FCB requirements, the system must satisfy the following relation:

- Conducted power P dBm of the RF600 reader (< 30 dBm)
- Antenna gain G_i dBi in the FCC frequency band (≤ 7 dBi)
- Cable loss a_k dB (≥ 1 dB)

$P(dBm) \leq 30\ dBm - (G_i - 6\ dBi) + a_k$

6.4.8 Antenna patterns

6.4.8.1 Antenna radiation patterns in the ETSI frequency band

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.

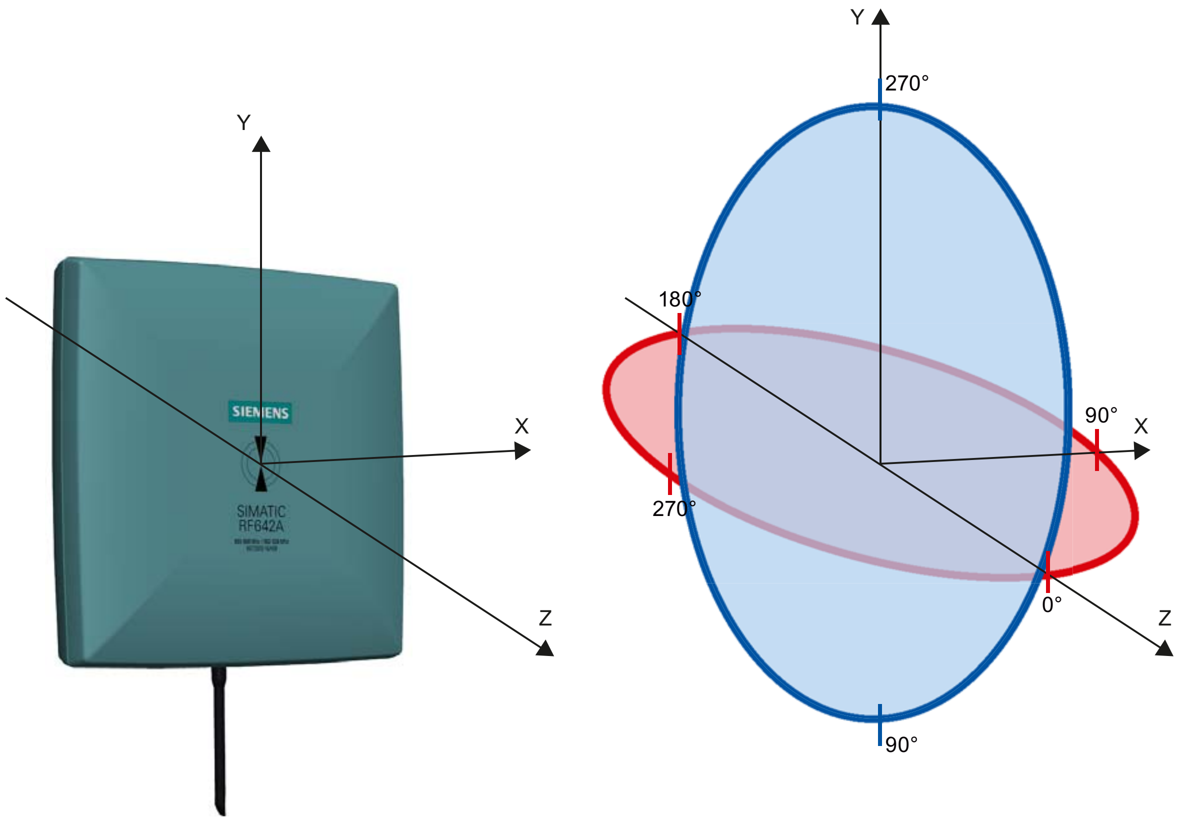


Figure 6-24 Reference system

The half-power beam width 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 .

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 in the ETSI frequency band

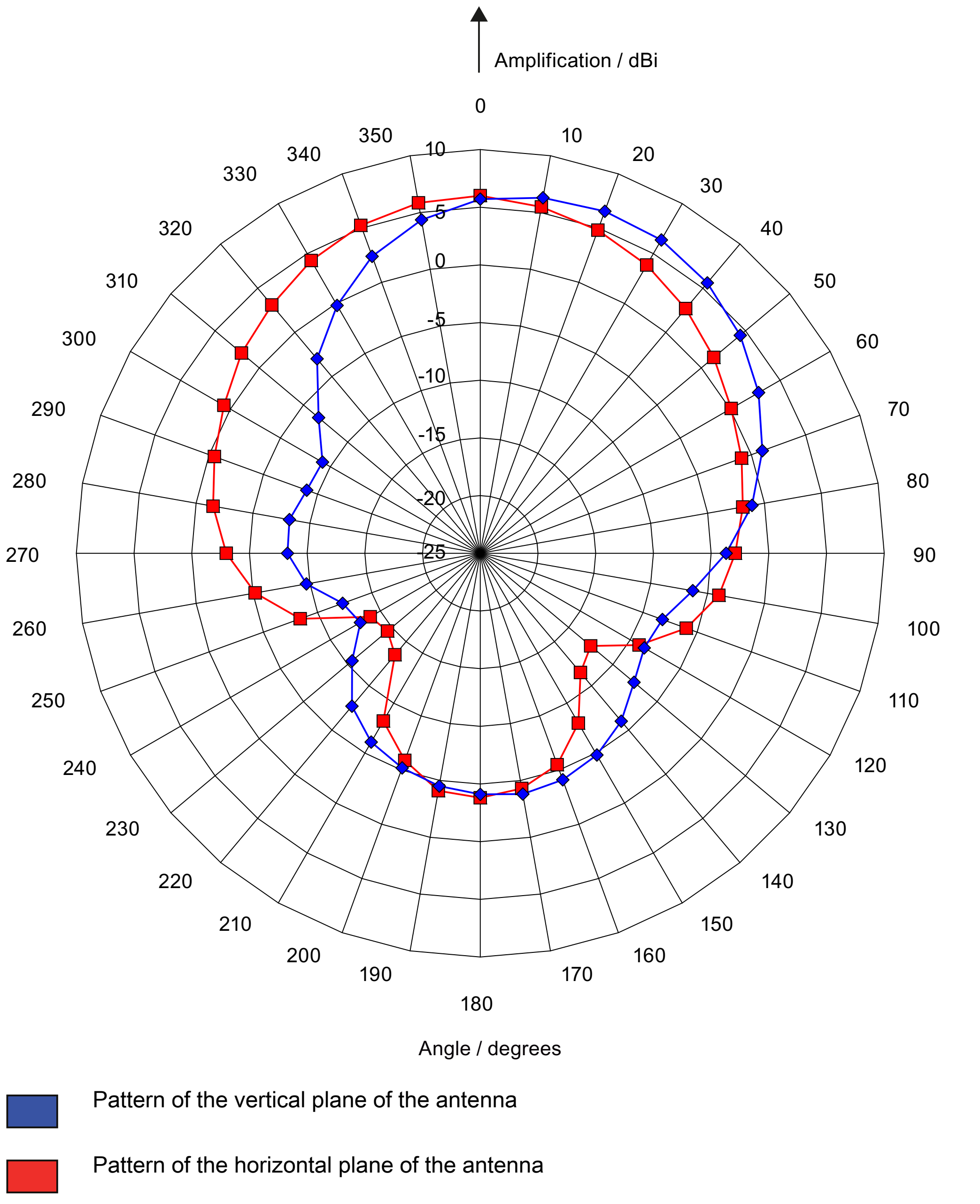


Figure 6-25 Directional radiation pattern of RF642A in the ETSI frequency band

6.4.8.2 Antenna radiation patterns in the FCC frequency band

Directional radiation pattern USA (FCC)

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

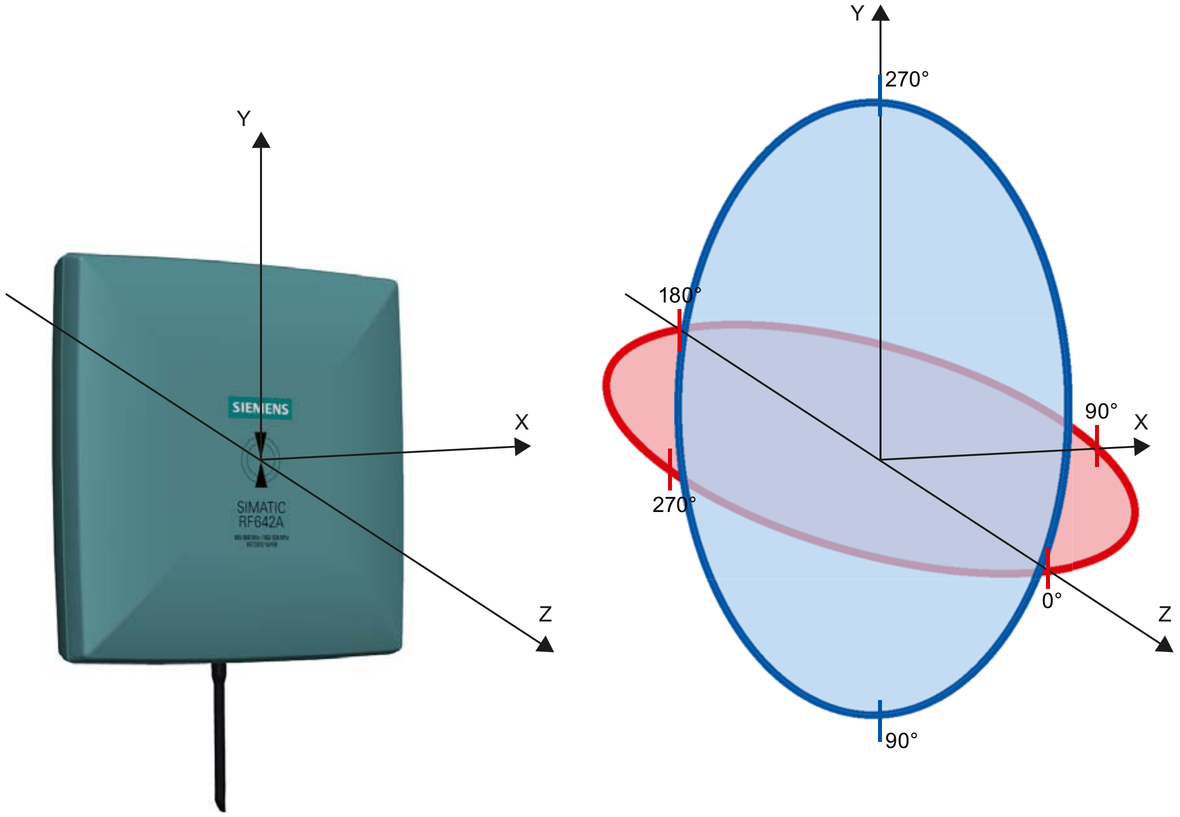


Figure 6-26 Reference system

The half-power beam width 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 .

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 of the RF642A in the FCC frequency band

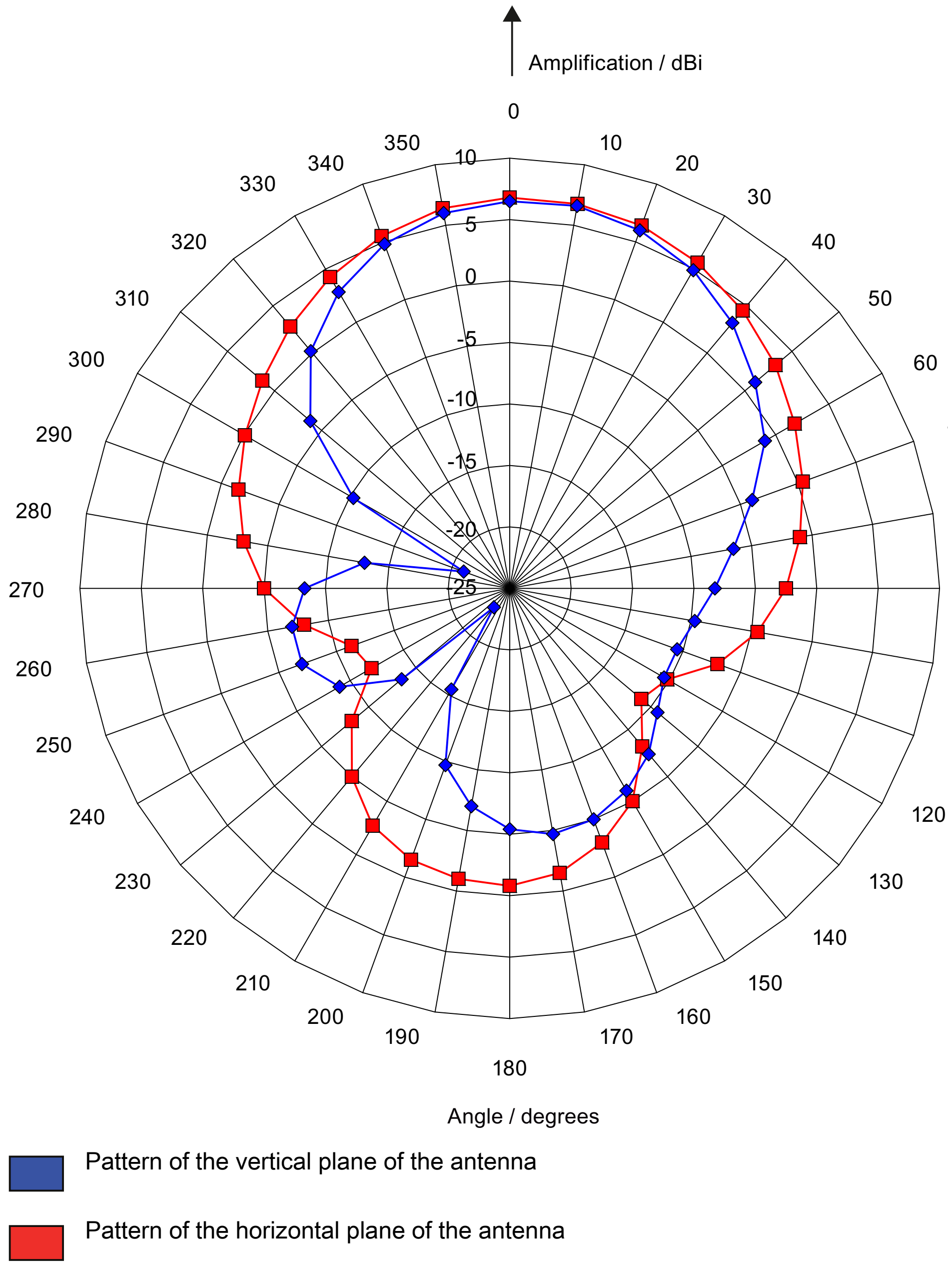


Figure 6-27 Directional radiation pattern of the RF642A in the FCC frequency band

6.4.8.3 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 can be seen in Directional radiation pattern in the ETSI frequency band (Page 242), the maximum antenna gain in the horizontal plane is 6 dBi. In this plane and with the parallel polarization axis at +70° or 300°, the antenna gain dropped to about 0 dBi. Therefore the dBr value is 6. The antenna range is only 70° of the maximum range at + 50° or +300° from the Z axis within the horizontal plane (see values shown in red in the directional radiation pattern: Characteristic of the vertical plane of the antenna (Page 241) and the associated representation of the reference system (Page 241)).

6.4.9 Technical data

Table 6- 17 General technical specifications RF642A

Feature	SIMATIC RF642A
Dimensions (L x W x H)	185 x 185 x 45 mm
Color	Pastel turquoise
Material	PA 12 (polyamide 12)
	Silicone-free
Frequency range	865 to 928 MHz
Plug connection	30 cm coaxial cable with RTNC coupling An antenna cable is required for connection to the reader, e.g.: 6GT2815-0BH30

Feature	SIMATIC RF642A
Max. radiated power according to ETSI	• RF620R, RF630R: < 970 mW ERP • RF640R, RF670R: ≤ 1900 mW ERP
Max. radiated power according to CMIIT	• RF620R, RF630R: < 1200 mW ERP • RF640R, RF670R: ≤ 2000 mW ERP
Max. radiated power according to FCC	• RF620R, RF630R: ≤2000 mW EIRP • RF640R, RF670R: ≤4000 mW EIRP
Max. power	2000 mW
Impedance	50 ohms
Antenna gain	ETSI frequency band: 6 dBi
	FCC frequency band: 7 dBi
VSWR (standing wave ratio)	max.: 1.4
Polarization	Linear polarization
Aperture angle for transmitting/receiving	ETSI frequency band: • Horizontal plane: 75° • Vertical plane: 70° See ETSI antenna pattern
	FCC frequency band: • Horizontal plane: 80° • Vertical plane: 70° See FCC antenna pattern
Front-to-back ratio	ETSI frequency band: 10 dB
	FCC frequency band: 9.8 dB ± 2.2 dB
Shock resistant to EN 60068-2-27	30 g
Vibration resistant to EN 60068-2-6	10 g
Attachment of the antenna	4 screws M4 (VESA 100 fastening system)
Tightening torque (at room temperature)	≤ 2 Nm
Ambient temperature • Operation • Transport and storage	 • -25 °C to +75 °C • -40 °C to +85 °C
MTBF in years	16880
Degree of protection according to EN 60529	IP65
Weight, approx.	600 g

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

6.4.10 Dimension drawing

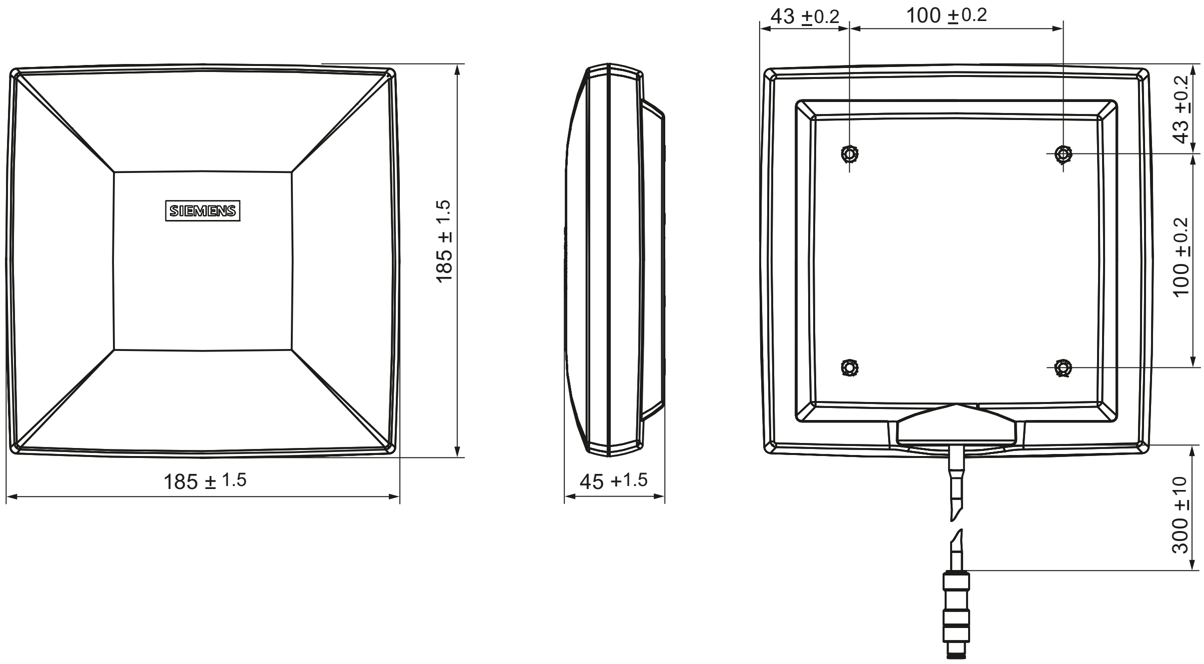


Figure 6-28 Dimensional drawing of RF642A

All dimensions in mm

6.4.11 Approvals & certificates

Table 6- 18 6GT2812-1GA08

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

Table 6- 19 6GT2812-1GA08

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. The FCC approval is granted in association with the FCC approval of the following RF600 readers: • FCC ID: NXW-RF600R (for RF620R: 6GT2811-5BA00-1AA1, RF630R: 6GT2811-4AA00-1AA1, RF640R: 6GT2811-3BA00-1AA0, RF670R as of FS C1: 6GT2811-0AB00-1AA0) • FCC ID: NXW-RF630R (for 6GT2811-4AA00-1AA0) • FCC ID: NXW-RF670 (for RF670R as of FS A1: 6GT2811-0AB00-1AA0)
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 (for 6GT2811-4AA00-1AA0) • IC: 267X-RF670, RF670R FS A1 (for 6GT2811-0AB00-1AA0) • IC: 267X-RF600R, Model RF620R-2 (for 6GT2811-5BA00-1AA1) • IC: 267X-RF600R, Model RF630R-2 (for 6GT2811-4AA00-1AA1) • IC: 267X-RF600R, Model RF640R (for 6GT2811-3BA00-1AA0) • IC: 267X-RF600R, model RF670R-2 as of FS C1 (for 6GT2811-0AB00-1AA0)
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

6.5 RF660A antenna

6.5.1 Description

SIMATIC RF660A	Features	
	Field of application	The SIMATIC RF660A is a universal medium range UHF antenna with a compact design suitable for use in industry.
	Frequency ranges	• 865 to 928 MHz (ETSI) • 902 to 928 MHz (FCC)
	Polarization	RH circular Suitable for RF600 transponders that can pass in parallel with the antenna regardless of their orientation.
	Writing/reading range	max. X m
	Mounting	4 x M4 (VESA 100 mounting system)
	Connector	RTNC
	Readers that can be connected	All RF600 readers with external antenna connectors
	Dimensions in mm	313 x 313 x 80
	Degree of protection	IP67

Frequency ranges

The antenna is available for broadband. It can therefore be used for two different frequency ranges that have been specified for the regions of Europe and China/USA respectively.

- The antenna for Europe (EU, EFTA countries) operates in the frequency range of 865 to 868 MHz.
- The antenna for China, the USA, and Canada operates in the frequency range of 902 to 928 MHz.

Function

The SIMATIC RF660A is used to transmit and receive RFID signals in the UHF range. The antennas are connected to the SIMATIC RF600 readers via antenna cables that are available in different lengths.

Ordering data

Description	Machine-Readable Product Code
RF660A antenna for Europe (865-868)	6GT2812-0AA00
RF660A antenna for China and the USA (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
	5 m, suitable for drag chains (cable loss 1.25 dB)	6GT2815-2BH50
	10 m (2 dB cable attenuation)	6GT2815-1BN10
	10 m (4 dB cable attenuation)	6GT2815-0AN10
	15 m, suitable for drag chains (cable loss 4.0 dB)	6GT2815-2BN15
	20 m (4 dB cable attenuation)	6GT2815-0AN20

6.5.2 Installation and assembly

6.5.2.1 RF660A mounting types

VESA 100 mounting system

A standardized VESA 100 mounting system is provided to mount the antenna. The mounting system consists of four fixing holes for M4 screws at intervals of 100 mm.

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.

Antenna Mounting Kit

The Antenna Mounting Kit allows the fine adjustment of the antenna field by setting the solid angle (see "RF600 System Manual", chapter "Antennas" > "Mounting types").

6.5.3 Connecting an antenna to a reader

The SIMATIC RF660A 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.

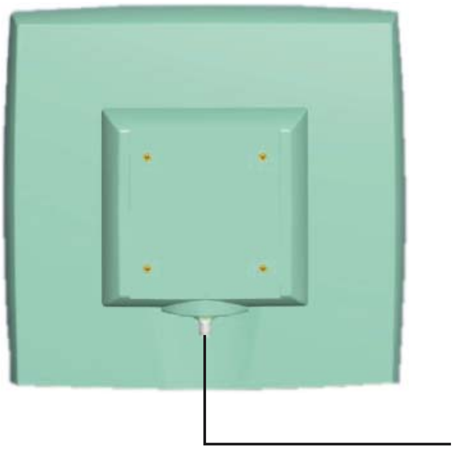


Figure 6-29 Rear of antenna with RTNC connection

Connecting RF660A to RF640R/RF670R

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.

6.5.3.1 Bending radii and bending cycles of the cable

Cable designation	Order No.	Length [m]	Cable loss [dB]	Bending radius [mm]	Bending cycle
Antenna cable	6GT2815-0BH30	3	1	51	1 Mal
Antenna cable (suitable for drag chains)	6GT2815-2BH50	5	1,25	1)	1)
Antenna cable	6GT2815-1BN10	10	2	77	1 Mal
Antenna cable	6GT2815-0BN10	10	4	51	1 Mal
Antenna cable (suitable for drag chains)	6GT2815-0BN20	15	4	1)	1)
Antenna cable	6GT2815-0BN20	20	4	77	1 Mal

1) With cables suitable for drag chains, 3 million bending cycles at a bending radius of 6.5 mm and bending through ± 180° are permitted.

6.5.4 Parameter settings of RF660A for RF620R/RF630R

Operation within the EU, EFTA, or Turkey

Note

Limitation of the radiated power according to EN 302 208 V1.4.1

RF600 systems that are put into operation within the EU, EFTA, or Turkey (ETSI) can be operated with an RF660A antenna with a maximum radiated power of up to 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP).

By adjusting the transmit power of up to 500 mW ERP (or 27 dBm ERP, 800 mW EIRP, 29.15 dBm EIRP) and taking into account the RF660A antenna gain of 7 dBi (9 dBic) and the cable loss associated with the antenna cable (see table (Page 252)), the radiated power of the antenna cannot be exceeded. You can make the power settings using the "distance_limiting" parameter. You will find more detailed information on the parameters in the section Parameter assignment manual RF620R/RF630R (http://support.automation.siemens.com/WW/view/en/33287195).

Operation in China

The national approval for RF600 systems in China means a restriction to 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP). The possible combination of antenna gain, cable loss, and max. 500 mW radiated power of the RF620R/RF630R reader means it is not possible to exceed 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP).

Operation in the USA, Canada

Note

Limitation of the radiated power to 4000 mW EIRP (36 dBm EIRP)

So that the FCC and IC-FCB requirements are met, the radiated power may not exceed 4000 mW EIRP (36 dBm EIRP). Therefore the system must satisfy the following relation:

- Conducted power P dBm of the RF600 reader (< 30 dBm)
- Antenna gain G_i dBi in the FCC frequency band (≤ 4.3 dBi)
- Cable loss a_k dB (≥ 1 dB)

P(dBm) ≤ 30 dBm - (G_i - 6 dBi) + a_k

6.5.5 Parameter settings of RF660A for RF640R/RF670R

Operation within the EU, EFTA, or Turkey

Note

Limitation of the radiated power according to EN 302 208 V1.4.1

RF600 systems that are put into operation within the EU, EFTA, or Turkey (ETSI) can be operated with an RF660A antenna with a maximum radiated power of 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP).

By adjusting the radiated power of up to 1300 mW ERP (or 31.15 dBm ERP, 2140 mW EIRP, 33.3 dBm EIRP), the RF660A antenna gain of 7 dBi (9 dBic) and the cable loss associated with the antenna cable (see table (Page 252)), the radiated power of the reader is correctly configured and the radiated power at the antenna is not exceeded.

Operation in China

By setting a max. radiated power of 1300 mW ERP (or 31.15 dBm ERP, 2140 mW EIRP, 33.3 dBm EIRP), the RF660A antenna gain of 6 dBi (8 dBic) and the cable loss associated with the antenna cable (see table (Page 252)), the radiated power of the reader is correctly configured.

Operation in the USA, Canada

Note

Limitation of the radiated power to 4000 mW EIRP (36 dBm EIRP)

So that the FCC and IC requirements are met, the radiated power may not exceed 4000 mW EIRP (36 dBm EIRP). Therefore the system must satisfy the following relation:

- Conducted power P dBm of the RF600 reader (< 30 dBm)
- Antenna gain G_i dBi in the FCC frequency band (≤ 4.3 dBi)
- Cable loss a_k dB (≥ 1 dB)

$P(\text{dBm}) \leq 30\ \text{dBm} - (G_i - 6\ \text{dBi}) + a_k$

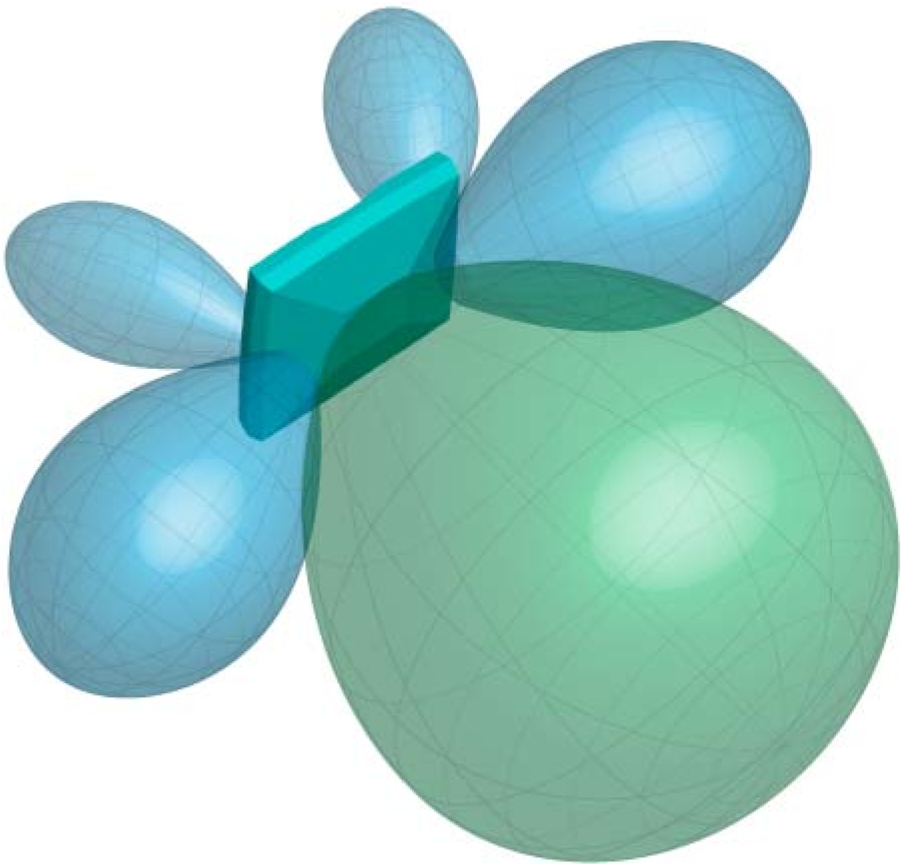
6.5.6 Antenna patterns

6.5.6.1 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.



Main field (processing field)

Secondary fields

Figure 6-30 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.

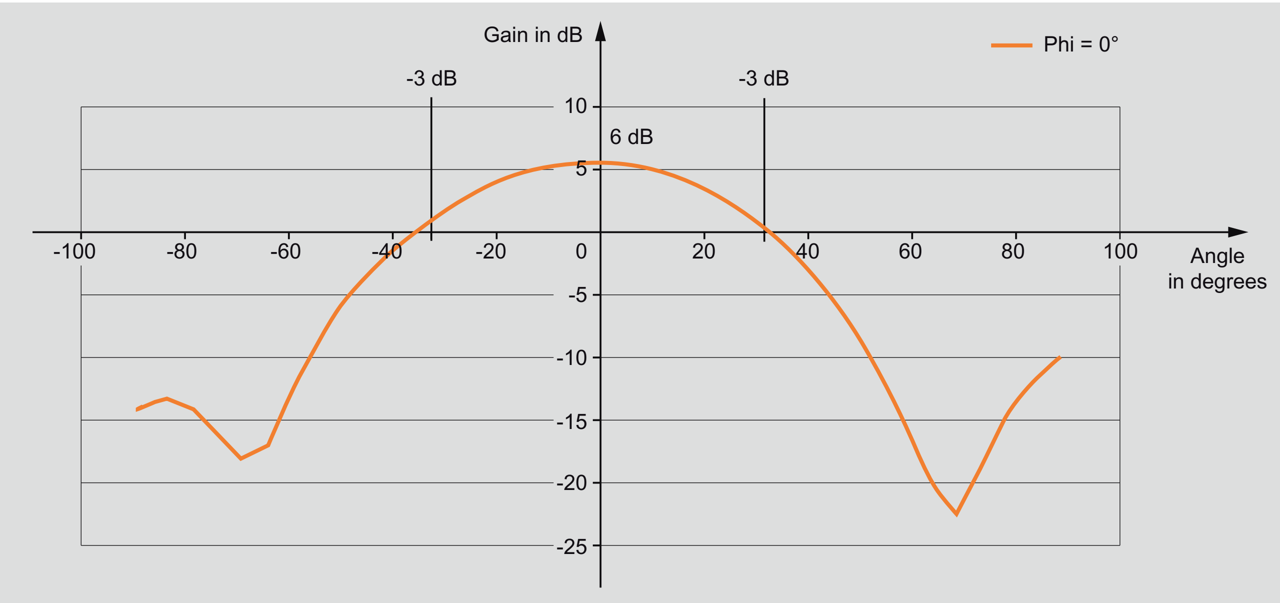


Figure 6-31 Directional radiation pattern of the antenna (at 865 MHz, horizontal alignment)

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.

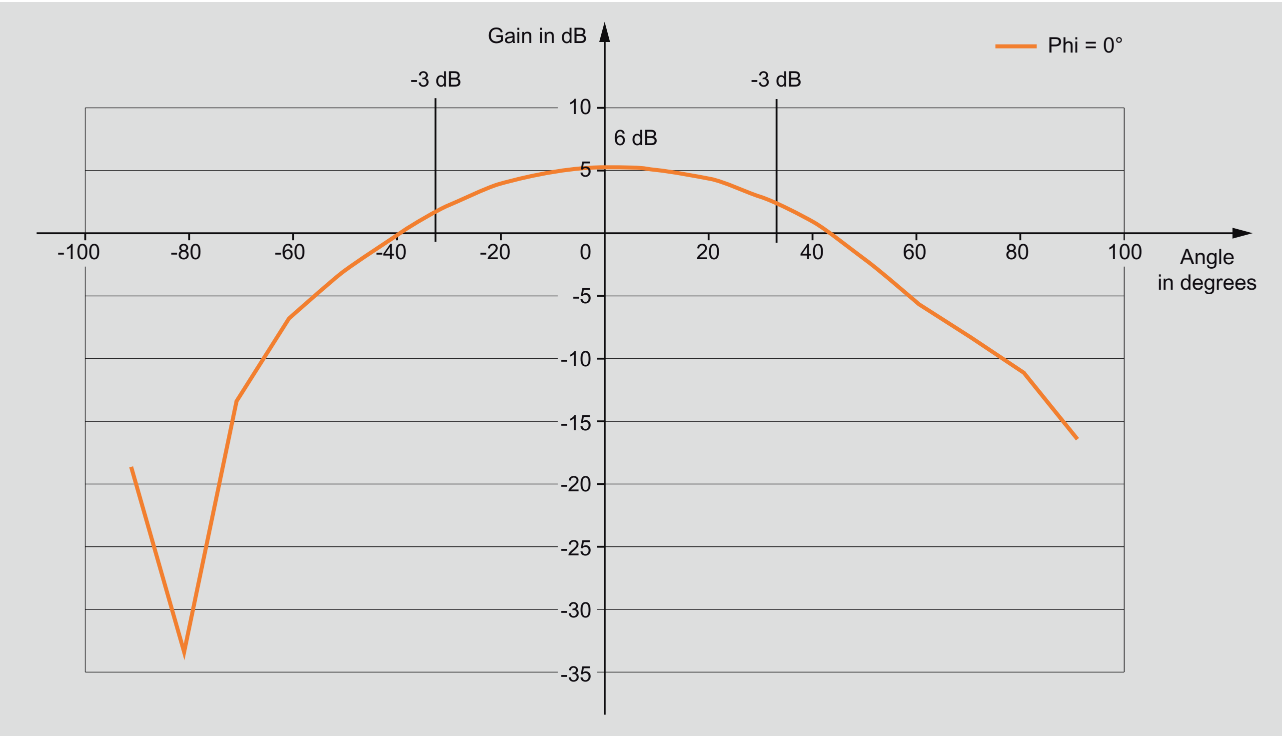


Figure 6-32 Directional radiation pattern of the antenna (at 915 MHz, horizontal alignment)

6.5.7 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 255), 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.

6.5.8 Technical data

Table 6- 20 General technical specifications RF660A

Feature	SIMATIC RF660A ETSI	SIMATIC RF660A FCC
Dimensions (L x W x H)	313 x 313 x 80 mm	
Color	Pastel turquoise	
Material	PA 12 (polyamide 12)	
	Silicone-free	
Frequency range	865 to 868 MHz	902 to 928 MHz
Plug connection	RTNC	
Max. radiated power according to ETSI	• RF620R, RF630R: < 1200 mW ERP • RF640R, RF670R: < 2000 mW ERP	-
Max. radiated power according to CMIIT	-	• RF620R, RF630R: < 1000 mW ERP • RF640R, RF670R: < 2000 mW ERP
Max. radiated power according to FCC	-	• RF620R, RF630R: < 1600 mW EIRP • RF640R, RF670R: < 4000 mW EIRP
Max. power	2000 mW	
Impedance	50 ohms	
Antenna gain	7 dBi (5-7 dBic)	6 dBi (> 6 dBic)
VSWR (standing wave ratio)	Max. 2:1	
Polarization	RH circular	
Aperture angle for transmitting/receiving	55° - 60°	60° - 75°
Front-to-back ratio	-	-
Attachment of the antenna	4 screws M4 (VESA 100 mount system)	
Tightening torque (at room temperature)	≤ 2 Nm	

Feature	SIMATIC RF660A ETSI	SIMATIC RF660A FCC
Ambient temperature • Operation • Transport and storage	 • -20 °C to +70 °C • -40 °C to +85 °C	
MTBF in years	2 x 10^9	
Degree of protection according to EN 60529	IP67	
Weight, approx.	1.2 kg	

6.5.9 Dimension drawing

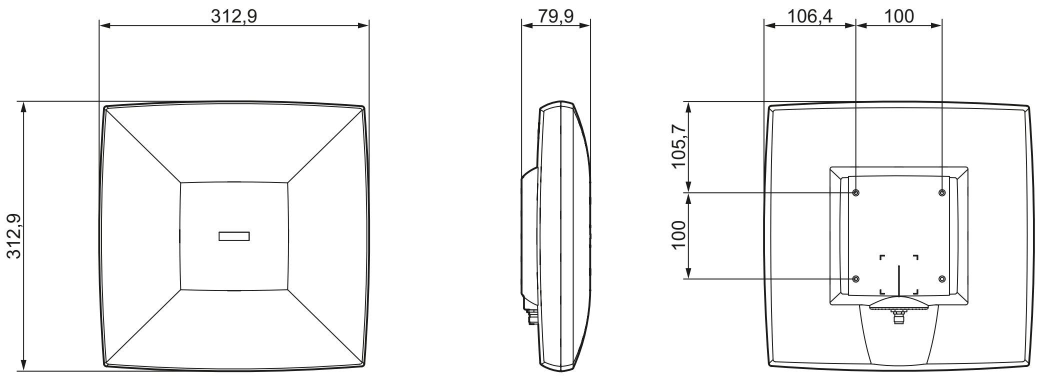


Figure 6-33 Dimension drawing RF660A

All dimensions in mm (± 0.5 mm tolerance)

6.5.10 Approvals & certificates

Table 6- 21 6GT2812-0AA00

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

Table 6- 22 6GT2812-0AA01

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-RF600R (for RF620R: 6GT2811-5BA00-1AA1, RF630R: 6GT2811-4AA00-1AA1, RF640R: 6GT2811-3BA00-1AA0, RF670R as of FS C1: 6GT2811-0AB00-1AA0) • FCC ID: NXW-RF630R (for 6GT2811-4AA00-1AA0) • FCC ID: NXW-RF670 (for RF670R as of FS A1: 6GT2811-0AB00-1AA0)
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 (for 6GT2811-4AA00-1AA0) • IC: 267X-RF670, RF670R FS A1 (for 6GT2811-0AB00-1AA0) • IC: 267X-RF600R, Model RF620R-2 (for 6GT2811-5BA00-1AA1) • IC: 267X-RF600R, Model RF630R-2 (for 6GT2811-4AA00-1AA1) • IC: 267X-RF600R, Model RF640R (for 6GT2811-3BA00-1AA0) • IC: 267X-RF600R, model RF670R-2 as of FS C1 (for 6GT2811-0AB00-1AA0)
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

6.6 Mounting types

6.6.1 Overview

The following readers and antennas feature a standardized VESA 100 fixing system (4 x M4):

- SIMATIC RF620R/RF630R/RF640R/RF670R
- SIMATIC RF640A
- SIMATIC RF660A

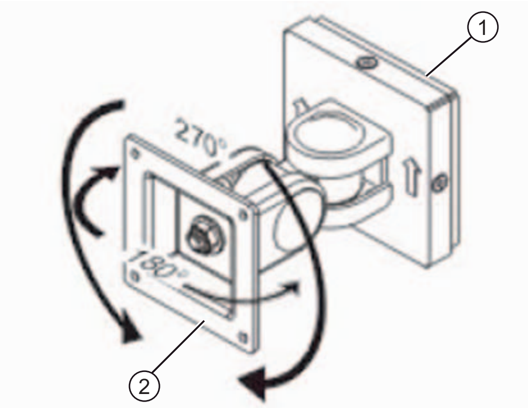
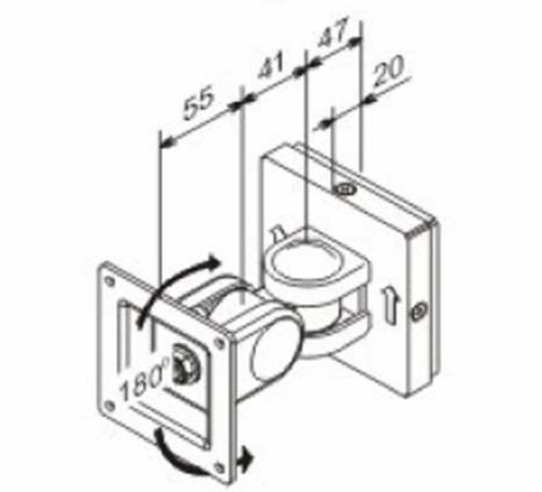
It is used to fix the above-mentioned antennas in place through a mounting plate or the antenna mounting kit.

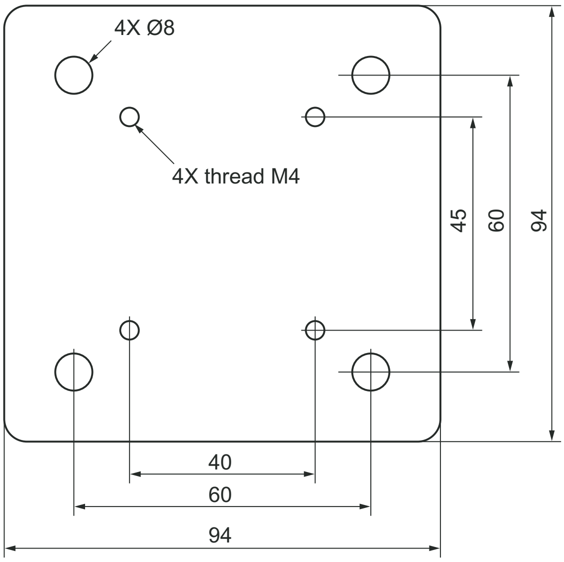
6.6.2 Ordering data

Description	Machine-Readable Product Code
Antenna mounting kit	6GT2890-0AA00

6.6.3 Mounting with antenna mounting kit

Flexible mounting is possible using the antenna mounting kit.
An antenna can then be rotated through any angle in space.

Antenna mounting kit	Description
	Swivel range of wall mounting (1) Wall side (2) Antenna side
	Distances for wall mounting

Antenna mounting kit	Description
	VESA adapter plate from VESA 75 x 75 to VESA 100 x 100 The VESA adapter plate is required for fixing the antenna to the antenna mounting kit.
	Hole drilling template for fixing the antenna mounting kit to the wall

Transponder/tags

7

7.1 Overview

7.1.1 Mode of operation of transponders/tags

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

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

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

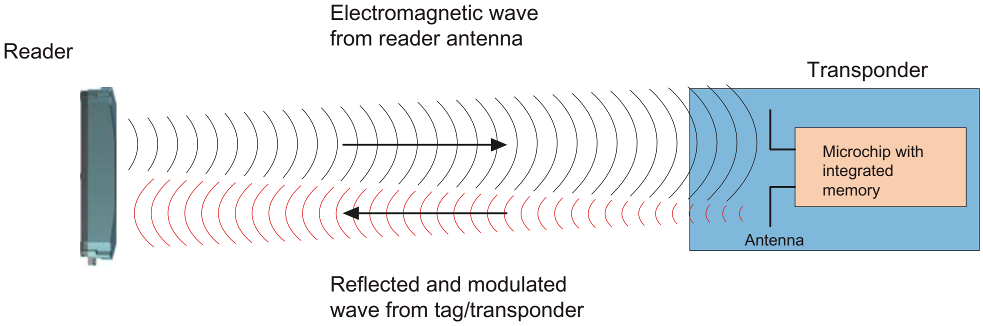


Figure 7-1 Mode of operation of transponders

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

7.1.2 Transponder classes and generations

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

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

- EPC Global Class 1 Gen 2 with full EPC Global Profile (ISO 18000-6C)

Support for protocol types using the RF600

The definition of the transponders/tags according to ISO 18000-6 (corresponds to EPC Global Class 1 Gen 2) refers to implementation of the air-interface protocols.

EPC Global

RF600 supports the EPCglobal class 1. EPCglobal class 1 includes passive tags with the following minimum characteristics:

- EPC ID (Electronic Product Code IDentifier)
- Tag ID
- A function which permanently ensures that tags no longer respond.
- Optional use or suppression of tags
- Optional password-protected access control
- Optional USER memory area.

The programming is performed by the customer (cannot be reprogrammed after locking)

7.1.3 Electronic Product Code (EPC)

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

There are different EPC number schemes with different data lengths. Below is the structure of a GID-96-bit code (EPC Global Tag Data Standards V1.1 Rev. 1.27) :

Header	EPC Manager	Object Class	Serial Number
34	**0000B57**	**00132B**	**000027**
8 bit	28 bit	24 bit	36 bit

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

The Siemens UHF transponders are all suitable for working with EPC and other number schemes. Before a transponder can work with a number scheme, the relevant numbers must first be written to the transponder.

Allocation of the ECP ID by the tag manufacturer

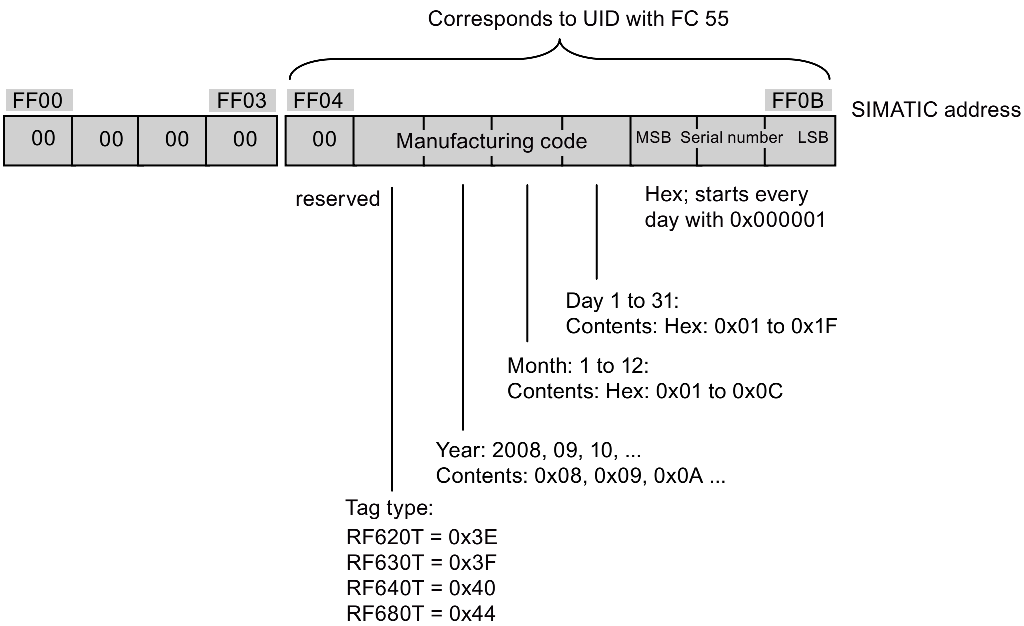


Figure 7-2 Allocation of the EPC ID on delivery of the tag

7.1.4 SIMATIC memory configuration of the RF600 transponders and labels

SIMATIC memory configuration

The following graphic shows the structure of the virtual SIMATIC memory for the RF620R/RF630R reader and explains the function of the individual memory areas. The SIMATIC memory configuration is based on the 4 memory banks, as they are defined in EPC Global.

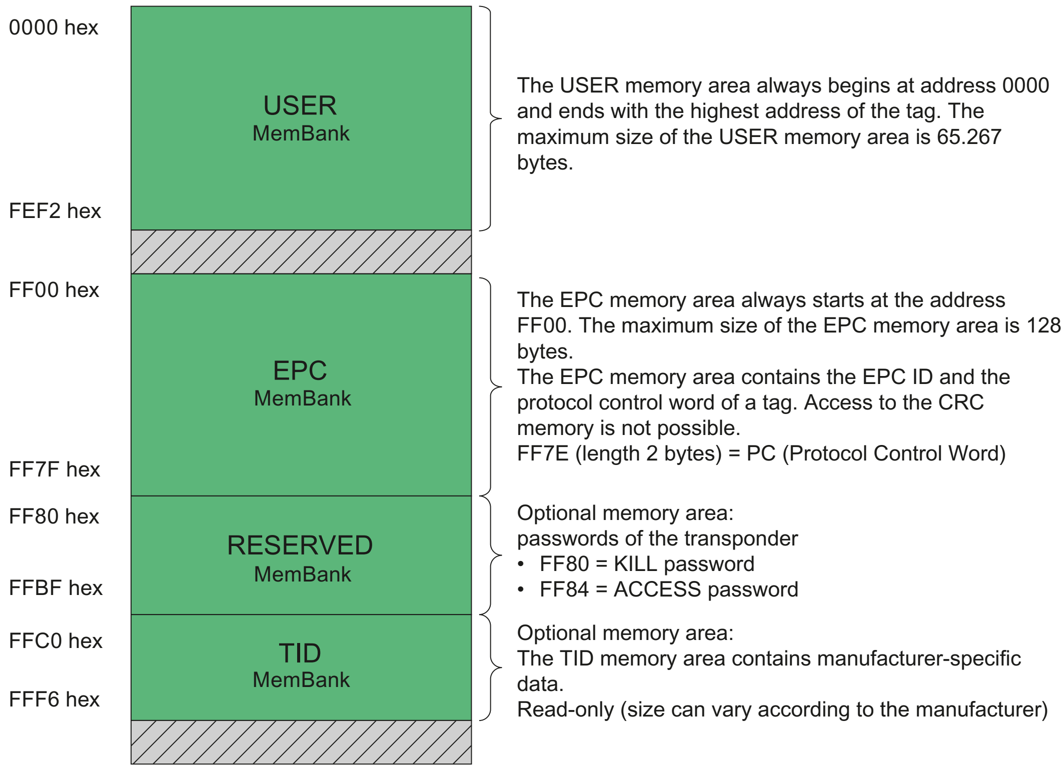


Figure 7-3 SIMATIC memory areas of the RF600 transponders

Special memory configuration of the RF600 transponders and labels

Tags	Chip type	User [hex]	EPC		TID	RESERVED (passwords)	Special	
			Range (preset length)	Access			KILL-PW	Lock function
RF630L (-2AB00, -2AB01)	Impinj Monza 2	00 - 3F	FF00-FF0B (96 bits = FF00-FF0B)	read/ write	FFC0-FFC7	FF80-FF87	Yes	Yes
RF630L (-2AB02)	Impinj Monza 4QT 1)	00 - 3F	FF00-FF0F (96 bits = FF00-FF0B)	read/ write	FFC0-FFC9	FF80-FF87	Yes	Yes
RF630L (-2AB03)	NXP G2XM	00 - 3F	FF00-FF1D (96 bits = FF00-FF0B)	read/ write	FFC0-FFC7	FF80-FF87	Yes	Yes
RF680L	NXP G2XM	00 - 3F	FF00-FF1D (96 bits = FF00-FF0B)	read/ write	FFC0-FFC7	FF80-FF87	Yes	Yes
RF610T	NXP G2XM	00 - 3F	FF00-FF1D (96 bits = FF00-FF0B)	read/ write	FFC0-FFC7	FF80-FF87	LOCKED	Yes
RF610T ATEX	NXP G2XM	00 - 3F	FF00-FF1D (96 bits = FF00-FF0B)	read/ write	FFC0-FFC7	FF80-FF87	LOCKED	Yes
RF620T	Impinj Monza 4QT 1)	00 - 3F	FF00-FF0F (96 bits = FF00-FF0B)	read/ write	FFC0-FFC9	FF80-FF87	LOCKED	Yes
RF625T	Impinj Monza 4QT 1)	00 - 3F	FF00-FF0F (96 bits = FF00-FF0B)	read/ write	FFC0-FFC9	FF80-FF87	LOCKED	Yes
RF630T	NXP G2XM	00 - 3F	FF00-FF1D (96 bits = FF00-FF0B)	read/ write	FFC0-FFC7	FF80-FF87	LOCKED	Yes
RF640T	NXP G2XM	00 - 3F	FF00-FF1D0B (96 bits = FF00-FF0B)	read/ write	FFC0-FFC7	FF80-FF87	LOCKED	Yes
RF680T	NXP G2XM	00 - 3F	FF00-FF1D (96 bits = FF00-FF0B)	read/ write	FFC0-FFC7	FF80-FF87	LOCKED	Yes

1) Uses User Memory Indicator (UMI).

Note

Default EPC ID

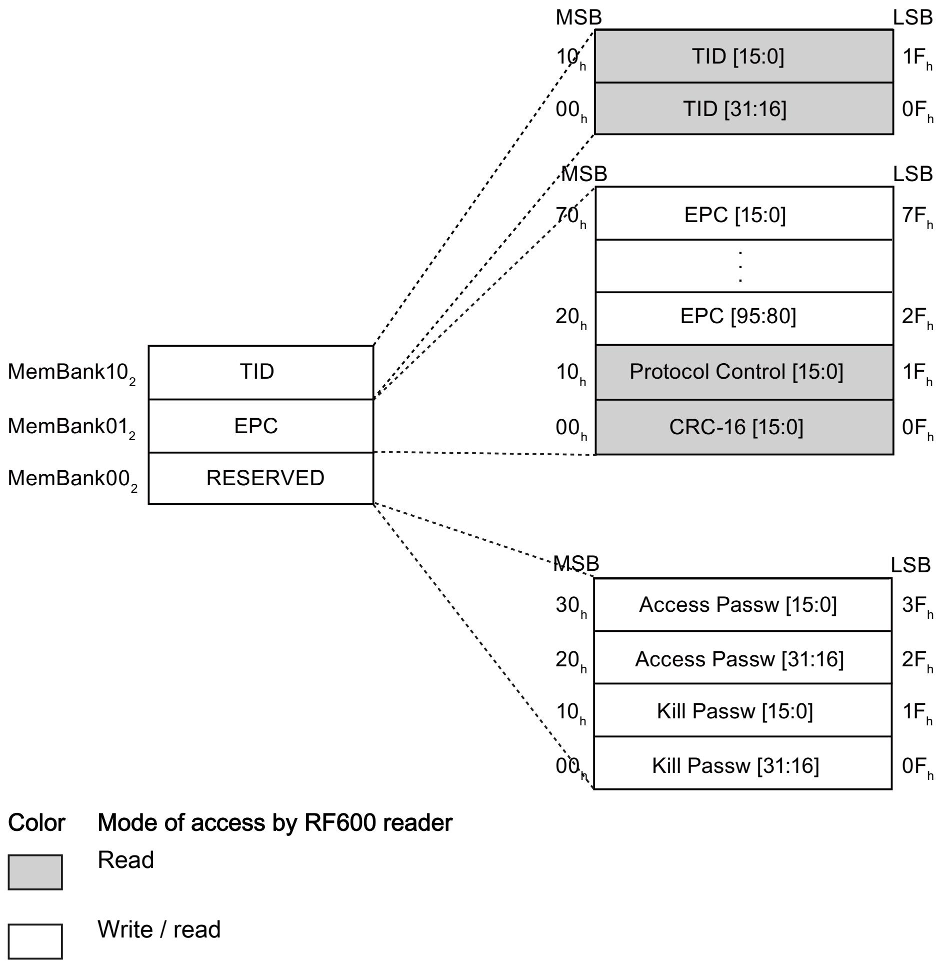
When an RF610T-RF680T transponder is supplied, a 12 byte long identifier is assigned by the manufacturer as the EPC ID according to a number scheme (see "Assignment of the ECP ID by the manufacturer").

Memory map of the ISO 18000-6C Monza 2 chip according to EPC

The memory of the ISO 18000-6C Monza 2 chip is divided logically into four different memory banks:

Memory bank (decimal)	Memory type	Description
MemBank 11_2	USER	User-writable USER memory area
MemBank 10_2	TID	Is defined by the manufacturer, contains the class identifier and serial number of a transponder.
MemBank 01_2	EPC	Contains the EPC UID, the protocol and the CRC of a transponder. You can write to the EPC memory area. In the delivery condition, the memory contents can have the following states: • empty • containing the same data • containing different data
MemBank 00_2	RESERVED	Contains the access and kill password.

The graphic below illustrates the exact memory utilization. Each box in the right part of the graphic represents one word (16 bits) in the memory.

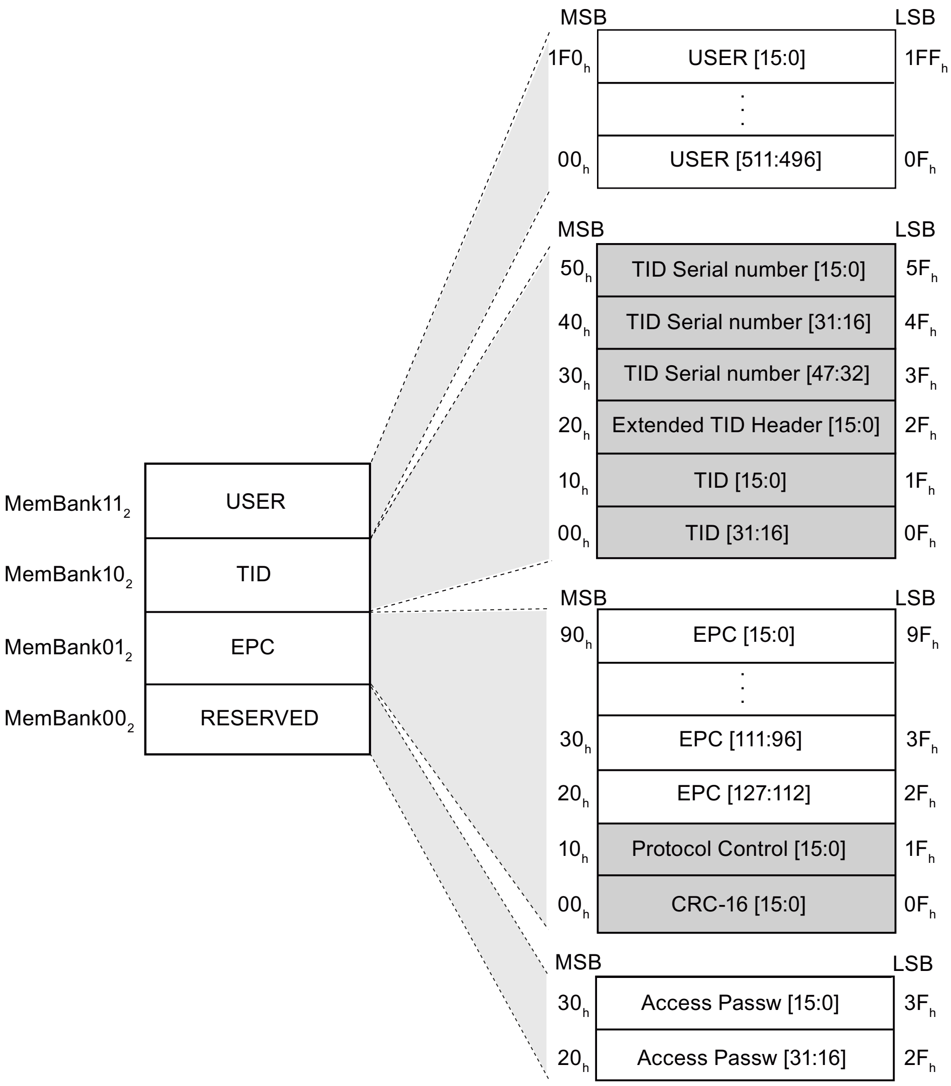


Memory map of the ISO 18000-6C Monza 4QT chip according to EPC

The memory of the ISO 18000-6C Monza 4QT chip is divided logically into four different memory banks:

Memory bank (decimal)	Memory type	Description
MemBank 11_2	USER	User-writable USER memory area
MemBank 10_2	TID	Is defined by the manufacturer, contains the class identifier and serial number of a transponder.
MemBank 01_2	EPC	Contains the EPC data, the protocol information and the CRC data of a transponder. You can write to the EPC memory area. In the delivery condition, the memory contents can have the following states: • containing the same data • containing different data
MemBank 00_2	RESERVED	Contains the access and kill password.

The graphic below illustrates the exact memory utilization. Each box in the right part of the graphic represents one word (16 bits) in the memory.



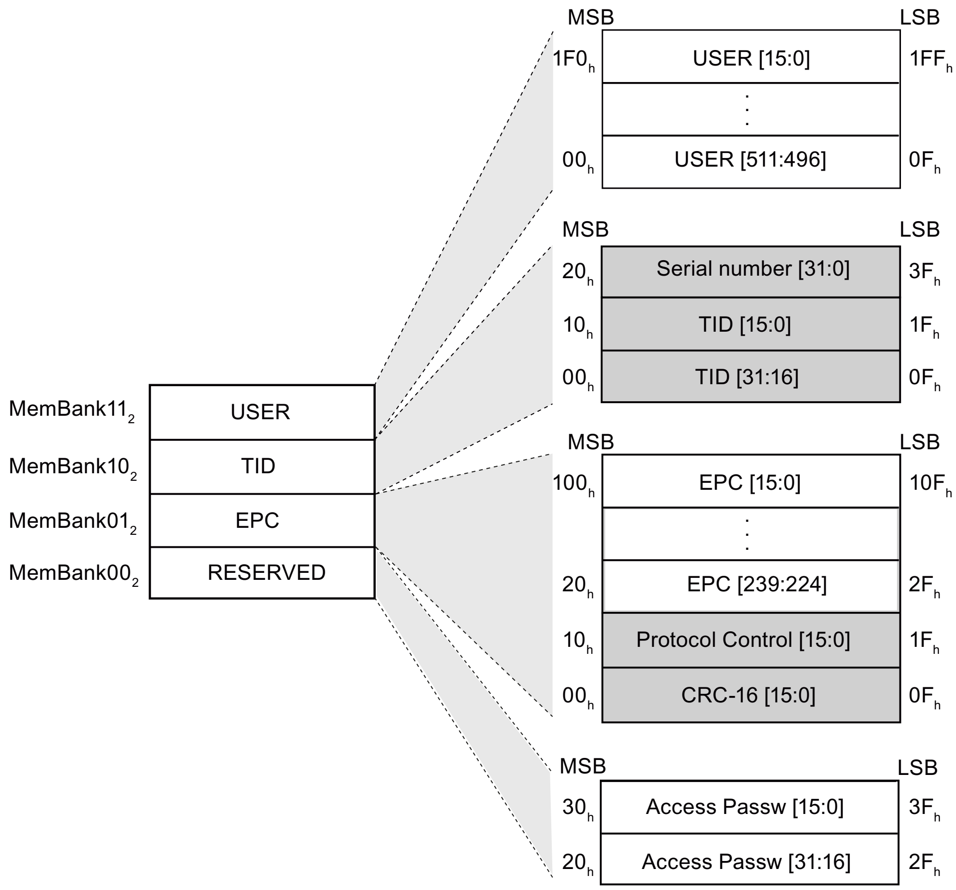
Color	Mode of access by RF600 reader
(grey)	Read
(white)	Write / read

Memory map of the ISO 18000-6C G2XM chip according to EPC

The memory of the ISO 18000-6C G2XM chip is divided logically into four different memory banks:

Memory bank (decimal)	Memory type	Description
MemBank 11_2	USER	User-writable USER memory area
MemBank 10_2	TID	Is defined by the manufacturer, contains the class identifier and serial number of a transponder.
MemBank 01_2	EPC	Contains the EPC data, the protocol information and the CRC data of a transponder. You can write to the EPC memory area. In the delivery condition, the memory contents can have the following states: • containing the same data • containing different data
MemBank 00_2	RESERVED	Contains the access and kill password.

The graphic below illustrates the exact memory utilization. Each box in the right part of the graphic represents one word (16 bits) in the memory.



Color	Mode of access by RF600 reader
	Read
	Write / read

Parameterization

Which parameter assignment options available to you for which reader of the RF600 family is outlined in the section "Overview of parameterization of RF600 reader (Page 391)". Detailed information for parameterization as well as examples for describing and reading specific memory areas can be found in the referenced chapters of the documentation.

7.1.5 Minimum distances and maximum ranges

The following section describes the configuration of the antenna and transponder relative to each other. The aim of the section is to help you achieve the maximum ranges listed here in a typical electromagnetic environment. One of the main focuses of the section is the effect of the mounting surface of the transponder on the write/read distance.

As the requirements for achieving the maximum distances specified here, note the following points:

- Operate the readers with the maximum possible and permitted transmit power.
- With external antennas, the antenna cable 6GT2815-0BH30 with a length of 3 m and 1 dB cable loss is used.
- The alignment of the transponder and antenna needs to be optimum (see section "Configurations of antenna and transponder (Page 275)").
- The optimum mounting surface for the transponder has been selected (see section "Effects of the materials of the mounting surfaces on the range (Page 277)")
- The maximum range shown in the section "Maximum read/write ranges of transponders (Page 278)" applies only to read operations.

  With write operations, the range is reduced as described in the section.
- Effects that reduce read/write ranges have been avoided (see section "Antenna configurations (Page 40)").

7.1.5.1 Configurations of antenna and transponder

Below, you will find several possible antenna-transponder configurations that are necessary to achieve the maximum range. With the RF620A and RF642A antennas, the polarization axes of the antenna and of the transponder must be aligned parallel to each other.

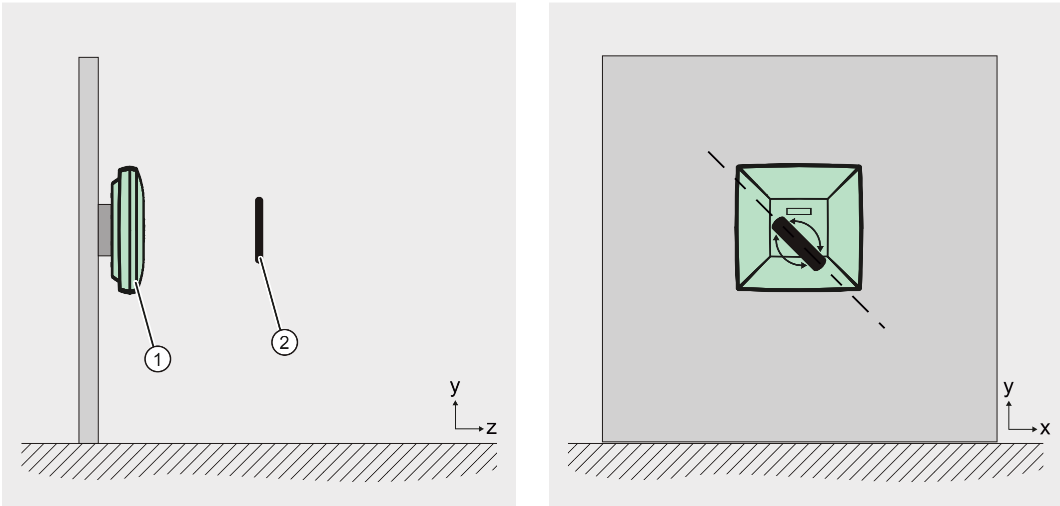
Note

Reduction of the maximum read/write range when using RF620A or RF642A antennas

If the alignment of the polarization axes between the RF620A or RF642A antennas and transponders is not parallel, this reduces the read/write range. The reduction in the range depends on the angular deviation between the polarization axes of the RF620A or RF642A antenna and the polarization axis of the transponder. You will find further details in the section "Alignment of transponders to the antenna (Page 196)" or "Alignment of transponders to the antenna (Page 236)".

Possible transponder alignments depending on the antenna type

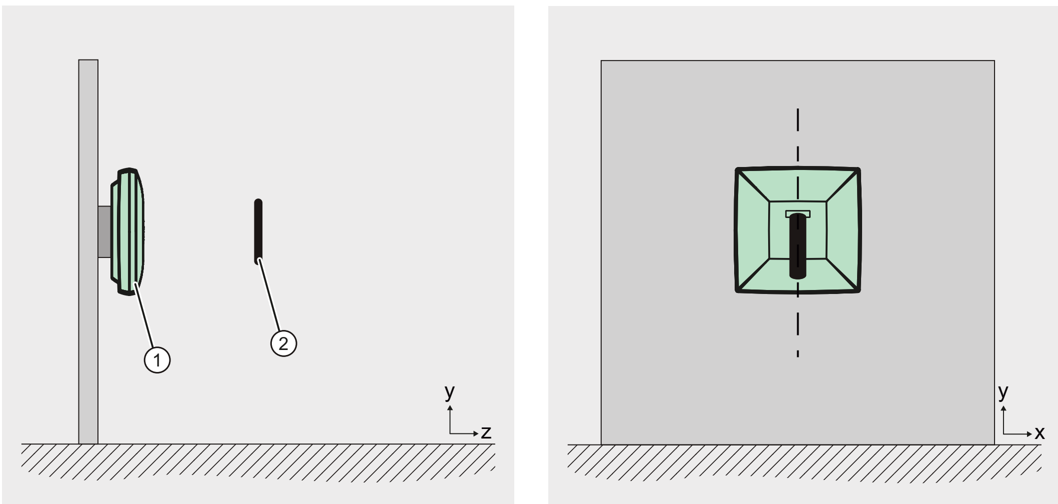
To achieve the maximum read/write range with RF640A or RF660A antennas, make sure that the planes of the polarization axes have the same alignment. Changing the transponder angle within the x-y plane has no effect on the range.



① Antenna RF640A or RF660A
② Transponder

Figure 7-4 Possible transponder alignment with RF640A or RF660A

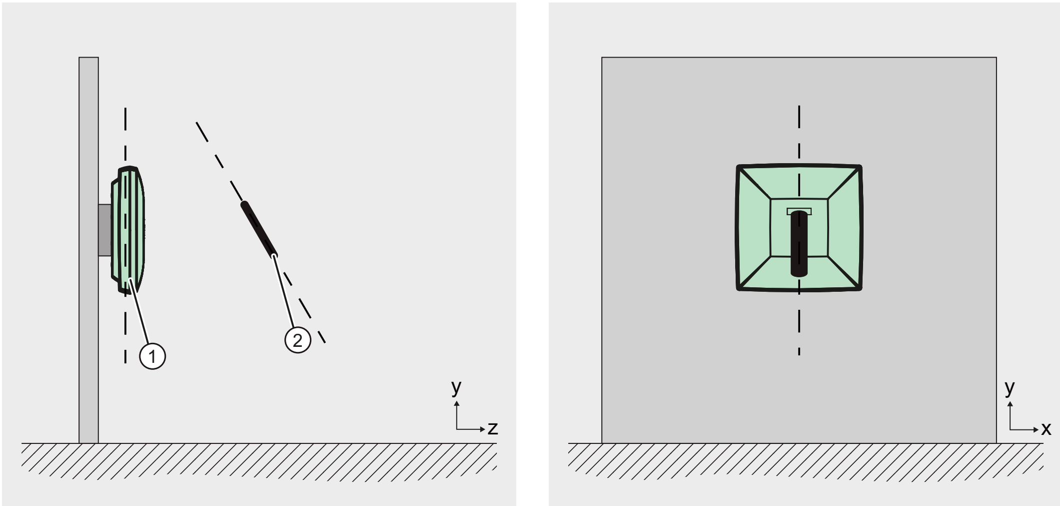
To achieve the maximum range with RF620A or RF642A antennas, make sure that the polarization axes of the antenna and transponder are parallel to each other. Changing the transponder angle within the x-y plane leads to a reduction of the range.



① Antenna RF620A or RF642A
② Transponder

Figure 7-5 Possible transponder alignment with RF620A or RF642A

If the angle is changed within the y-z plane, this causes a reduction in range for all antenna types.



① Antenna RF620A, RF640A, RF642A or RF660A
② Transponder

Figure 7-6 Transponder alignment not allowed

Note

Optimum transponder position/alignment

Depending on the electromagnetic properties of the environment, the optimum transponder position and alignment may differ from those shown above.

7.1.5.2 Effects of the materials of the mounting surfaces on the range

Effects due to antenna mounting

For the RF640A, RF642A and RF660A antennas, the antenna gain and therefore the maximum read/write range does not depend on the selected material of the mounting surface. In contrast to this, the antenna gain of the RF620A antenna and therefore the maximum read/write range of transponders does depend on the mounting surface of the antenna. To achieve the maximum range with an RF620A antenna, the antenna needs to be mounted on a metallic surface of at least 150 x 150 mm.

You will find more detailed information on antenna gain in the subsections of the section "Antenna patterns (Page 199)".

Effects due to transponder mounting

The maximum read/write range of the transponders depends on the material of the mounting surface. The specified ranges apply when mounted on non-metallic surfaces, such as paper or card, with the RF625T, RF630T and RF640T when mounted on metal.

Mounting on plastic can reduce the maximum read/write range considerably depending on the type of plastic (up to 70%). When mounted on wood, the range is furhter reduced the more moisture the wood contains. Due to the attenuating properties of glass, direct mounting without a spacer can halve the range.

If the RF625T, RF630T, RF640T or RF680T transponders are mounted on metal, this metallic surface acts as a reflection surface. This surface should therefore be adequately large. To achieve the listed maximum ranges, transponders must be mounted on a metallic mounting surface with a minimum diameter of 150 mm, for the RF630T and RF680T 300 mm. If the metallic mounting surface only has a diameter of 65 mm instead of the required 150 mm, the range is reduced by 65%.

7.1.5.3 Maximum read/write ranges of transponders

Maximum read ranges

Table 7- 1 Read ranges of transponders at a room temperature of +25 °C (all ranges in m)

	SIMATIC RF630L 6GT2810-2AB00, 6GT2810-2AB01, 6GT2810-2AB02-0AX0	SIMATIC RF630L 6GT2810-2AB03	SIMATIC RF680L	SIMATIC RF610T	SIMATIC RF620T [1)]
SIMATIC RF620R with internal antenna	5	3	2.5	3	5
SIMATIC RF630R with RF620A	1,6	1	0,8	1	1,6
with RF640A	4,5	2,8	2,2	2,8	4,5
with RF642A	5,5	3,5	2,8	3,5	5,5
with RF660A	6	4	3	4	6
SIMATIC RF640R with internal antenna	7	4	3,5	4,5	7
with RF620A	2,2	1,4	1,1	1,4	2,2
with RF640A	6	4	3,1	4	6
with RF642A	8	5	4	5	8
with RF660A	8	5	4	5	8
SIMATIC RF670R with RF620A	2,2	1,4	1,1	1,4	2,2
with RF640A	6	4	3	4	6
with RF642A	8	5	4	5	8
with RF660A	8	5	4	5	8

	SIMATIC RF625T 2)	SIMATIC RF630T 2)	SIMATIC RF640T 2)	SIMATIC RF680T 2)
SIMATIC RF620R				
with internal antenna	1	0.8	2.5	5,5
SIMATIC RF630R				
with RF620A	0,3	0,3	0,8	1,3
with RF640A	0,8	0,7	2,2	3,5
with RF642A	1,1	0,8	2,8	5
with RF660A	1,2	0,9	3	5
SIMATIC RF640R				
with internal antenna	1,3	1	3,5	6
with RF620A	0,4	0,3	1,1	1,8
with RF640A	1,2	0,9	3	5
with RF642A	1,5	1,2	4	7
with RF660A	1,5	1,2	4	7
SIMATIC RF670R				
with RF620A	0,4	0,3	1,1	1,8
with RF640A	1,2	0,9	3	5
with RF642A	1,5	1,2	4	7
with RF660A	1,5	1,2	4	7

1) Mounting on a non-metallic surface. Mounting surface with a minimum diameter of 300 mm. Mounting on metal is not possible.

2) Mounting on metal Mounting surface with a minimum diameter of 150 mm, for the RF630T and RF680T 300 mm.

Maximum write ranges

Depending on the transponder type, the reader antenna requires more power for writing than for reading data. When writing, the maximum range reduces by approximately 30% compared with the read range.

7.1.5.4 Minimum distances between antennas and transponders

The antennas listed here are all far field antennas. For this reason, a minimum distance between antennas and transponders must be maintained to ensure reliable transponder data access:

Table 7- 2 Minimum distances to be maintained between antennas and transponders

RF600 antenna	Minimum distances to be maintained
RF620A	50 mm
RF640A	200 mm
RF642A	200 mm
RF660A	200 mm

7.2 SIMATIC RF630L Smartlabel

7.2.1 Features

SIMATIC RF630L smart labels are passive, maintenance-free data carriers based on UHF Class 1 Gen2 technology that are used to store the "Electronic Product Code" (EPC).

Smart labels offer numerous possible uses for a wide range of applications and support efficient logistics throughout the process chain.

SIMATIC RF630L transponder				
	6GT2810-2AB00	6GT2810-2AB01	6GT2810-2AB02-0AX0	6GT2810-2AB03
Design				
Area of application	Simple identification such as barcode replacement or supplementation, through warehouse and distribution logistics, right up to product identification.			
Memory	EPC 96 bits		EPC 96/128 bits	EPC 96/240 bits
Additional user memory	No		64 bytes	64 bytes
Range [1)]	max. 8 m		max. 5 m	
Mounting	Self-adhesive paper labels, for example for attaching to packaging units, paper or cartons		Self-adhesive plastic labels, for example for attaching to packaging units, paper or cartons	
	Not suitable for fixing straight onto metal or onto liquid containers			
[1)] The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".				

7.2.2 Ordering data

RF630L transponder	Order number	Type of delivery
RF630L transponder, smart label 101.6 mm x 152.4 mm (4" x 6")	6GT2810-2AB00	Minimum order amount 1600 items (800 on one roll)
RF630L transponder, smart label 101.6 mm x 50.8 mm (4" x 2")	6GT2810-2AB01	Minimum order amount 1000 items (1000 on one roll)
RF630L transponder, smart label 97 mm x 27 mm	6GT2810-2AB02-0AX0	Minimum order amount 5000 items (5000 on one roll)
RF630L transponder, smart label 54 mm x 34 mm	6GT2810-2AB03	Minimum order amount 2000 items (2000 on one roll)

7.2.3 Minimum spacing between labels

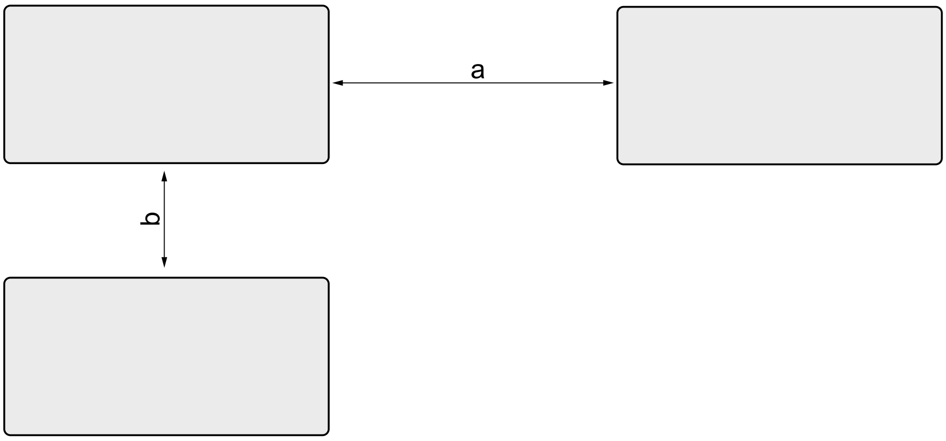


Figure 7-7 Minimum spacing between labels

The specified minimum spacing applies for the SIMATIC RF630L smart labels with the following order numbers:

- 6GT2810-2AB00
- 6GT2810-2AB01
- 6GT2810-2AB02-0AX0
- 6GT2810-2AB03

Table 7- 3 Minimum spacing

Name	Minimum spacing
a	50 mm
b	50 mm

Please note that smart labels can also be attached one above the other. The spacing between the labels attached one above the other depends on the damping characteristics of the carrier material.

7.2.4 Memory configuration of the smart label

The memory configuration of the smart label is described in the section SIMATIC memory configuration of the RF600 transponders and labels (Page 268).

7.2.5 Technical data

Table 7- 4 Mechanical data

	6GT2810-2AB00	6GT2810-2AB01	6GT2810-2AB02-0AX0	6GT2810-2AB03
Dimensions (L x W)	101.6 mm x 152.4 mm (ca. 4" x 6")	101.6 mm x 50.8 mm (ca. 4" x 2")	97 mm x 27 mm	54 mm x 34 mm
Design	Paper with integrated antenna		Plastic with integrated antenna	
Label type	Paper label		Inlay	
Antenna material	Aluminum			
Static pressure	10 N/mm^2			
Material surface	Paper		Plastic PET	
Type of antenna	Shortened dipole			
Color	white		Transparent	
Printing	Can be printed using heat transfer technique			
Mounting	Single-sided adhesive (self-adhesive label).		Single-sided adhesive (self-adhesive inlay).	
Degree of protection	None, the label must be protected against humidity.		IP65	
Weight	approx. 3 g	approx. 2 g	approx. 1 g	

Table 7- 5 Electrical data

	6GT2810-2AB00	6GT2810-2AB01	6GT2810-2AB02-0AX0	6GT2810-2AB03
Air interface	ISO 18 000-6 Type C			
Polarization type	Linear			
Polarization direction	The polarization direction is parallel with the short side of the paper label	The polarization direction is parallel with the long side of the paper label	The polarization direction is parallel with the long side of the inlay	
Frequency range	860 to 960 MHz			
Range [1)]	max. 8 m		max. 5 m	
Minimum spacing between labels • Vertically • Horizontally	 • 50 mm • 100 mm			
Energy source	Field energy via antenna, without battery			
Multitag capability	Yes			
[1)] The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)"				

Table 7- 6 Memory specifications

	6GT2810-2AB00	6GT2810-2AB01	6GT2810-2AB02-0AX0	6GT2810-2AB03
Type	EPC Class 1 Gen2			
Memory organization	EPC 96 bits		EPC 96/128 bits	EPC 96/240 bits
Additional user memory	No		64 bytes	64 bytes
Listing	ISO 18000-6C			
Data retention at +25 °C	10 years			
Read cycles	Unlimited			
Write cycles	100.000			
Anti collision	approx. 100 labels/sec			

Table 7- 7 Environmental conditions

	6GT2810-2AB00	6GT2810-2AB01	6GT2810-2AB02-0AX0	6GT2810-2AB03
Temperature range during operation	-40 °C … 65 °C, up to 80 °C (200 cycles)			
Temperature range during storage	The label should be stored in the range of +15°C and +25°C at a humidity of 40% to 60%.			
Storage duration	Two years, determined by the shelf life of the adhesive			
Torsion and bending load	Partially permissible			
Distance from metal	Not suitable for fixing straight onto metal			

Table 7- 8 Identification

	6GT2810-2AB00	6GT2810-2AB01	6GT2810-2AB02-0AX0	6GT2810-2AB03
CE	CE approval to R&TTE			
FCC	Passive labels or transponders comply with the valid regulations; certification is not required.			

7.2.6 Dimension drawings

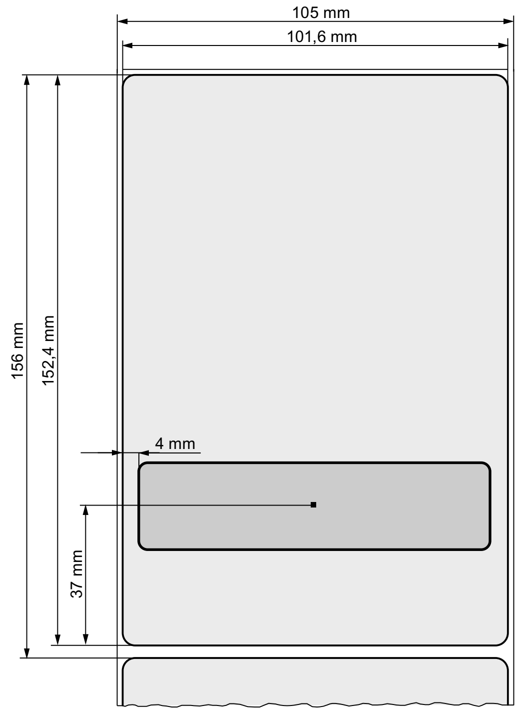


Figure 7-8 SIMATIC RF630L 6GT2810-2AB00 dimension drawing

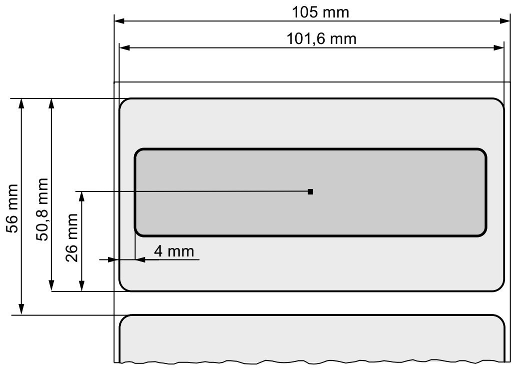


Figure 7-9 SIMATIC RF630L 6GT2810-2AB01 dimension drawing

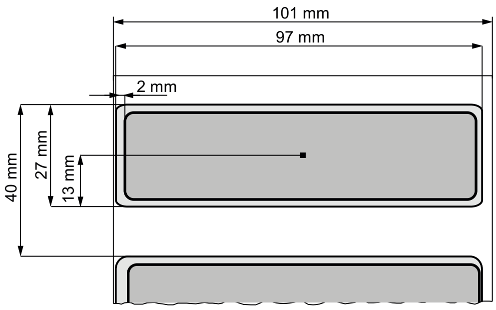


Figure 7-10 Dimension drawing SIMATIC RF630L 6GT2810-2AB02-0AX0

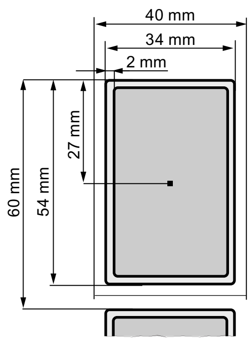


Figure 7-11 SIMATIC RF630L 6GT2810-2AB03 dimension drawing

7.3 SIMATIC RF680L Smartlabel

7.3.1 Features

The SIMATIC RF680L Smartlabel is passive and maintenance-free. It functions based on the UHF Class 1 Gen 2 technology and is used for saving the electronic product code (EPC) of 96 bits/240 bits. The label also has a 512 bit user memory.

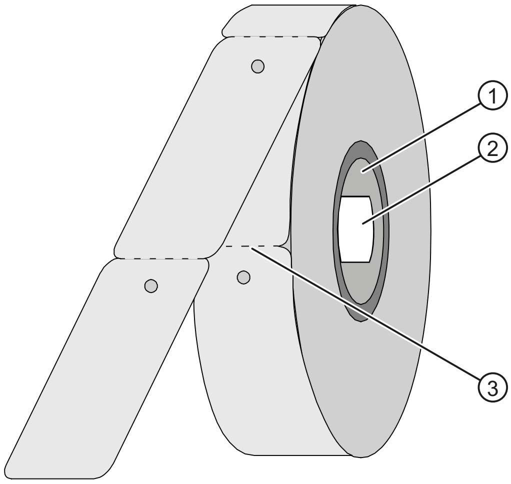
The SIMATIC RF680L is a heat-resistant Smartlabel with a limited service life. Its target use is the direct identification of objects in high-temperature applications.

Thanks to its antenna geometry, the transponder can be read from any direction. However, the range is reduced if it is not aligned in parallel with the antenna.

SIMATIC RF680L Smartlabel	Features	
	Area of application	Production logistics applications subject to high temperatures
	Air interface	according to ISO°18000-6C
	Memory	EPC 96 bit/240 bit Add-on-memory 64 bytes
	Range [1)]	max. 4 m
	Mounting	Via a hole on the narrow side. Can also be glued by customer.
[1)] The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".		

7.3.2 Delivery format

The SIMATIC RF680L is supplied on a roll. One roll always contains 1000 Smartlabels. You can tear off the Smartlabel from the roll at the perforation.



① Cardboard tube, inner dia 76 mm
② Roll label
③ Perforation

Figure 7-12 SIMATIC RF680L roll

7.3.3 Ordering data

Ordering data	Order no.	Delivery format
SIMATIC RF680L • Smartlabels 54 x 89 mm • heat-resistant	6GT2810-2AG80	1,000 units on a roll

7.3.4 Minimum spacing between labels

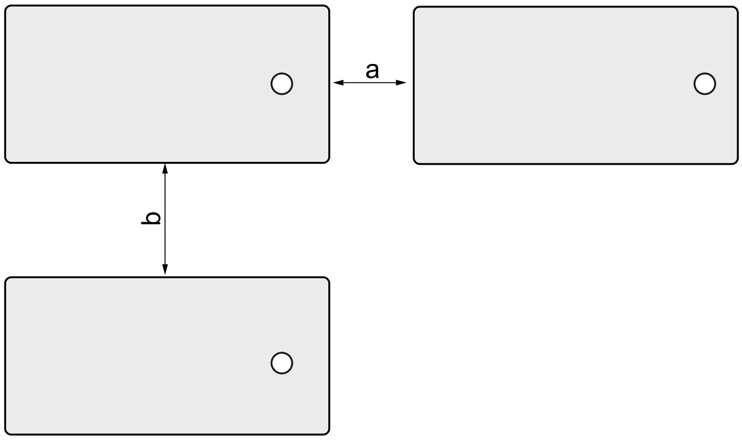


Figure 7-13 Minimum spacing between labels

Table 7- 9 Minimum spacing

Minimum spacing	
a	20 mm
b	50 mm

7.3.5 Memory configuration of the smart label

The memory configuration of the smart label is described in the section SIMATIC memory configuration of the RF600 transponders and labels (Page 268).

7.3.6 Mounting on metal

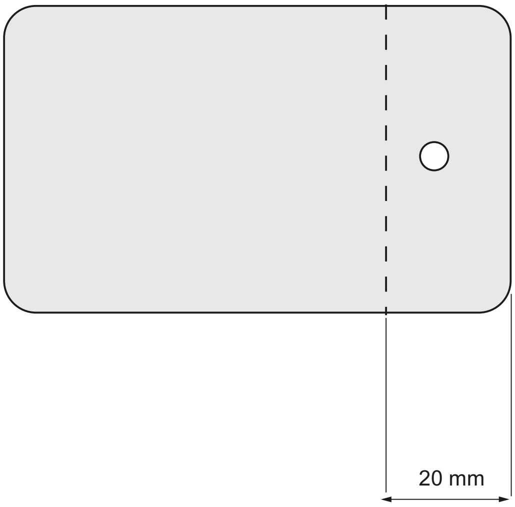


Figure 7-14 Metal mounting surface

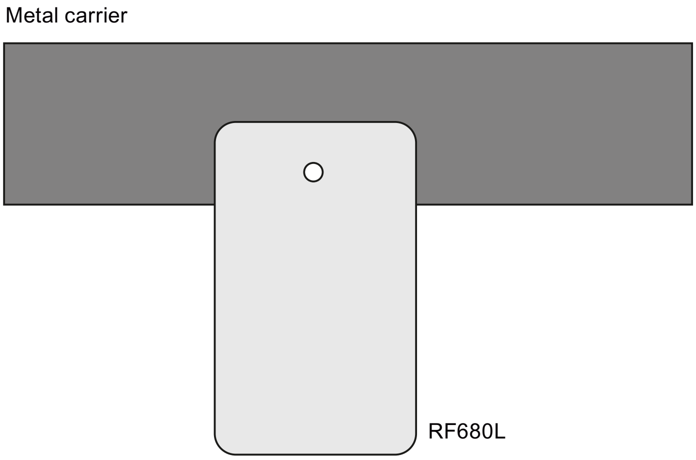


Figure 7-15 Mounting on metal

7.3.7 Technical data

7.3.7.1 Mechanical data

Feature	Description
Dimensions (L x W)	156 mm x 40 mm
Thickness of the label	0.4 mm (±25% incl.. chip)
Design	Synthetic paper
Antenna material	Aluminum
Static pressure	10 N/mm^2
Silicone-free	Yes
Type of antenna	Shortened dipole
Color	beige
Printing	Yes, customized
Mounting	Via a hole on the narrow side. Can also be glued by customer.
Weight	Approx. 3 g

7.3.7.2 Electrical data

Characteristic	Description
Air interface	According to ISO 18 000-6 C
Polarization type	Linear
Polarization direction	The polarization direction is parallel with the long side of the inlay
Frequency range	• Europe 865 to 868 MHz • USA 902 to 928 MHz
Range 1)	max. 4 m
Minimum spacing between labels • Vertically • Horizontally	 • 50 mm • 20 mm
Energy source	Field energy via antenna, without battery
Multitag capability	Yes
1) The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".	

7.3.7.3 Memory specifications

Property	Description	
Type	EPC Class 1 Gen 2	
Memory organization	EPC code	96 bits/240 bits
	User memory	64 bytes
	TID	64 bits
	Reserved (passwords)	64 bits
Protocol	ISO 18000-6C	
Data retention time	10 years	
Read cycles	Unlimited	
Write cycles	Minimum at +22 °C 100 000	

7.3.7.4 Environmental conditions

Property	Description
Temperature range during operation	-25 °C … +85 °C (permanent) +200 °C up to six hours +220 °C up to one hour +230 °C for a short time
Temperature range during storage	-40 °C … +85 °C
Torsion and bending load	Partially permissible
Distance from metal	Whole surface not suitable for fixing straight onto metal (see chapter Mounting on metal (Page 289))

7.3.8 Certificates and approvals

Certificate	Description
CE	Conformity with R&TTE directive
FCC Federal Communications Commission	Passive labels and transponders comply with the valid regulations; certification is not required.
RoHS	Compliant according to EU Directive 2002/95/EC

7.3.9 Dimension drawing

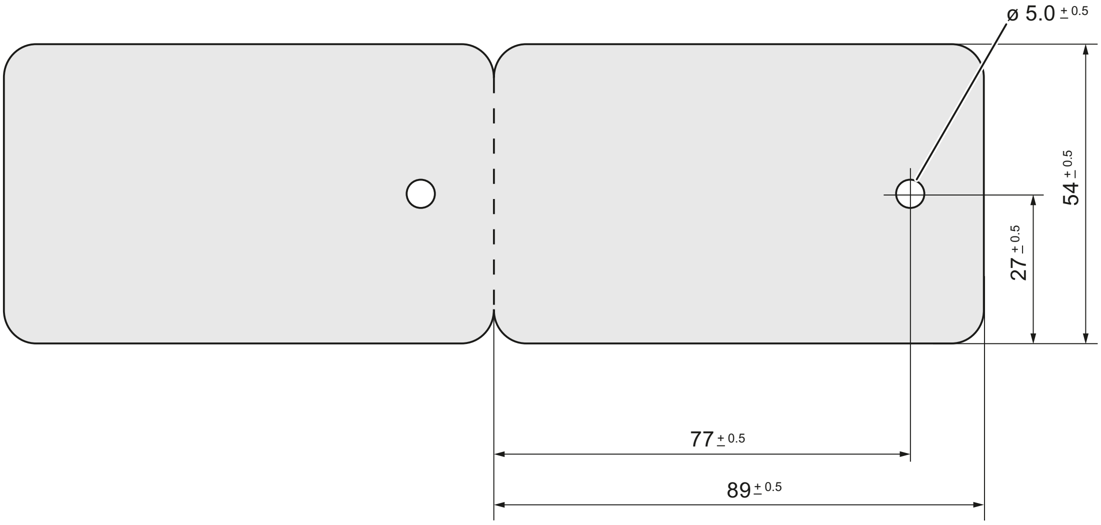


Figure 7-16 SIMATIC RF680L

7.4 SIMATIC RF610T

7.4.1 Features

The SIMATIC RF610T is passive and maintenance-free. It operates based on the UHF Class 1 Gen 2 technology and is used for saving the electronic product code (EPC) of 96 bits / 240 bits. The label also has a 512 bit user memory.

The SIMATIC RF610T offers a host of possible uses for a wide range of applications and supports efficient logistics throughout the entire process chain.

Thanks to its antenna geometry, the transponder can be read from any direction. However, the range is reduced if it is not aligned in parallel with the antenna.

SIMATIC RF610T	Features	
	Area of application	• Simple identification, such as barcode replacement or barcode supplement • Warehouse and distribution logistics • Product identification For the Food & Beverage sector, a special version can be supplied on request that is certified for use in contact with food.
	Air interface	according to ISO°18000-6C
	Memory	EPC 96 bit/240 bit Add-on-memory 64 bytes
	Range [1)]	max. 5 m
	Mounting	• Suspended by means of cable ties, or similar • Can also be fixed with screws or glued by customer. • Not suitable for mounting straight onto metal.

[1)] The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".

7.4.2 Ordering data

Ordering data	Order no.	Type of delivery
SIMATIC RF610T	6GT2810-2BB80	Min. order quantity 500 units

7.4.3 Safety instructions for the device/system

Note

This device/system may only be used for the applications described in the catalog and the technical documentation "System manual MOBY D, RF200, RF300, RF600 (http://support.automation.siemens.com/WW/view/en/10805817) and only in combination with third-party devices and components recommended and/or approved by Siemens.

7.4.4 Minimum spacing between labels

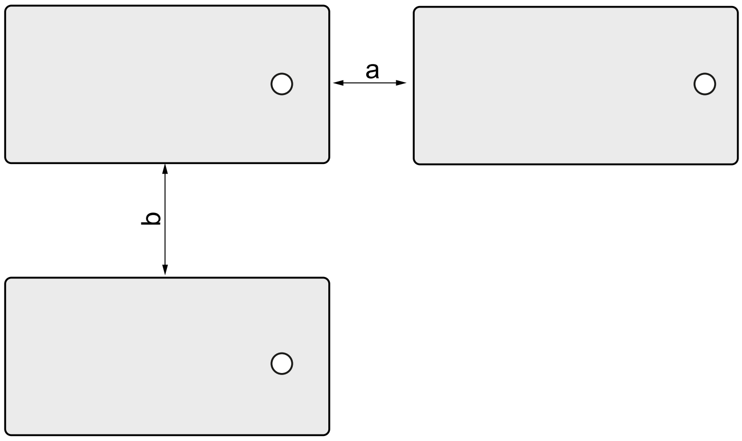


Figure 7-17 Minimum spacing between labels

Table 7- 10 Minimum spacing

Minimum spacing	
a	20 mm
b	50 mm

7.4.5 Memory configuration of the transponder

The memory configuration of the transponder is described in the section SIMATIC memory configuration of the RF600 transponders and labels (Page 268).

7.4.6 Technical data

7.4.6.1 Mechanical data

Feature	Description
Dimensions (L x W x H)	86 mm x 54 mm x 0.4 mm
Design	PVC (polyvinyl chloride)
Antenna material	Aluminum
Static pressure	10 N/m^2
Type of antenna	Shortened dipole
Color	white
Printing	Can be printed using heat transfer technique
Mounting	• Suspended by means of cable ties, or similar • Can also be fixed with screws or glued by customer. • Not suitable for mounting straight onto metal.
Weight	Approx. 3 g

7.4.6.2 Electrical data

Characteristic	Description
Air interface	According to ISO 18 000-6 C
Polarization type	Linear
Polarization direction	The polarization direction is parallel with the long side of the inlay
Frequency range	• Europe 865 … 868 MHz • USA 902 … 928 MHz
Range [1)]	max. 5 m
Energy source	Field energy via antenna, without battery
Multitag capability	Yes
[1)] The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".	

7.4.6.3 Memory specifications

Property	Description	
Type	EPC Class 1 Gen 2	
Memory organization	EPC code	96 bits/240 bits
	User memory	512 bits
	TID	64 bits
	Reserved (passwords)	64 bits
Protocol	ISO 18000-6C	
Data retention time	10 years	
Read cycles	Unlimited	
Write cycles	Minimum at +22 °C 100 000	

7.4.6.4 Environmental conditions

Feature	Description
Temperature range during operation	-25 °C … +85 °C
Temperature range during storage	-40 °C … +85 °C
Shock resistant acc. to EN 60068-2-27 Vibration acc. to EN 60068-2-6	100 g[1] 50 g[1]
Torsion and bending load	Partially permissible
Distance from metal	Not suitable for fixing straight onto metal
Degree of protection	IP67

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

Note

Note that in temperature ranges > 70 °C, the transponder can become slightly deformed. However, this has no effect on the transponder function.

7.4.7 Certificates and approvals

Certificate	Description
CE	Conformity with R&TTE directive
FCC Federal Communications Commission	Passive labels and transponders comply with the valid regulations; certification is not required.
c UL us	This product is UL-certified for the USA and Canada. It meets the following safety standard(s): • UL508 - Industrial Control Equipment • CSA C22.2 No. 142 - Process Control Equipment • UL Report E 120869

7.4.8 Dimension drawing

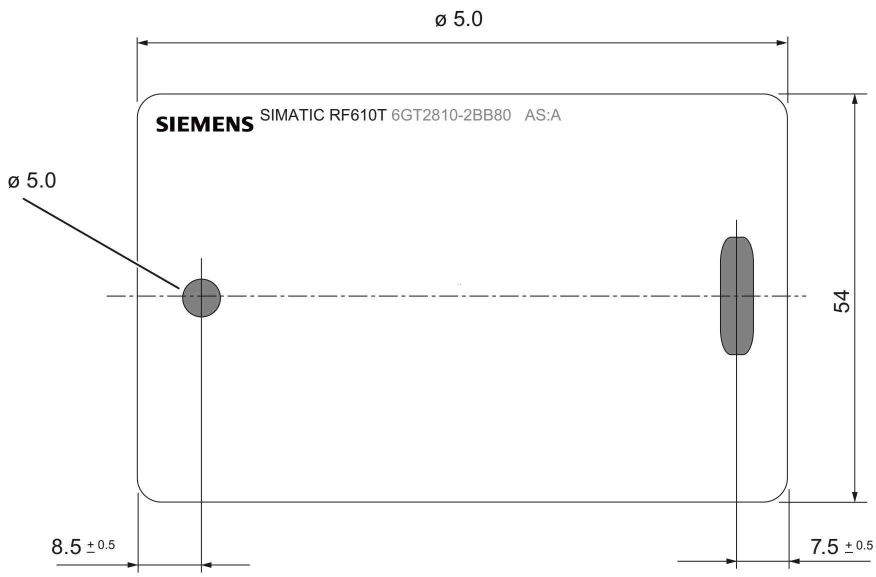


Figure 7-18 Dimensional drawing of SIMATIC RF610T

All dimensions in mm

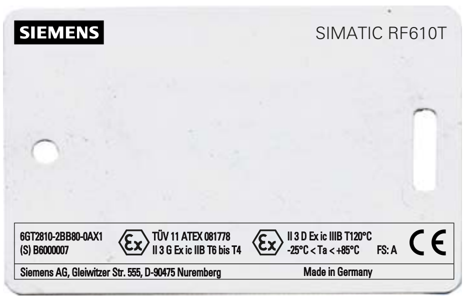
7.5 SIMATIC RF610T ATEX

7.5.1 Features

The SIMATIC RF610T special variant ATEX is passive and maintenance-free. It operates based on the UHF Class 1 Gen 2 technology and is used for saving the electronic product code (EPC) of 96 bits / 240 bits. The label also has a 512 bit user memory.

The SIMATIC RF610T special variant ATEX provides numerous possible uses for a wide range of applications and allows efficient logistics throughout the entire process chain.

Thanks to its antenna geometry, the transponder can be read from any direction. However, the range is reduced if it is not aligned in parallel with the antenna.

<table>
<tr><th>SIMATIC RF610T</th><th colspan="2">Features</th></tr>
<tr><td rowspan="5">
</td><td>Area of application</td><td>• Simple identification, such as barcode replacement or barcode supplement
• Warehouse and distribution logistics
• Product identification
For the Food & Beverage sector, a special version can be supplied on request that is certified for use in contact with food.</td></tr>
<tr><td>Air interface</td><td>according to ISO°18000-6C</td></tr>
<tr><td>Memory</td><td>EPC 96 bit/240 bit
Add-on-memory 64 bytes</td></tr>
<tr><td>Range 1)</td><td>max. 5 m</td></tr>
<tr><td>Mounting</td><td>• Suspended by means of cable ties, or similar
• Can also be fixed with screws or glued by customer.
• Not suitable for mounting straight onto metal.</td></tr>
<tr><td colspan="3">1) The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".</td></tr>
</table>

7.5.2 Ordering data

Ordering data	Order number	Type of delivery
SIMATIC RF610T special variant ATEX	6GT2810-2BB80-0AX1	Min. order quantity 500 units

7.5.3 Safety instructions for the device/system

NOTICE
Approved use This device/system may only be used for the applications described in the catalog and the technical documentation "System manual MOBY D, RF200, RF300, RF600 (http://support.automation.siemens.com/WW/view/en/10805817) and only in combination with third-party devices and components recommended and/or approved by Siemens.

7.5.4 Minimum spacing between labels

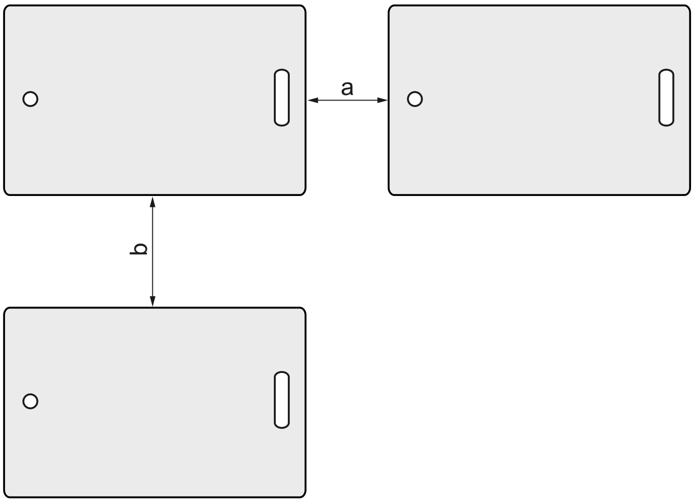


Figure 7-19 Minimum spacing between labels

Table 7- 11 Minimum spacing

Minimum spacing	
a (horizontal)	20 mm
b (vertical)	50 mm

7.5.5 Memory configuration

The memory configuration of the transponder is described in section SIMATIC memory configuration of the RF600 transponder and labels (Page 268).

7.5.6 Technical specifications

7.5.6.1 Mechanical data

Feature	Description
Dimensions (L x W x H)	86 mm x 54 mm x 0.4 mm
Design	PVC (polyvinyl chloride)
Antenna material	Aluminum
Static pressure	10 N/m²
Type of antenna	Shortened dipole
Color	white
Printing	Can be printed using heat transfer technique
Mounting	• Suspended by means of cable ties, or similar • Can also be fixed with screws or glued by customer. • Not suitable for mounting straight onto metal.
Weight	Approx. 3 g

7.5.6.2 Electrical data

Characteristic	Description
Air interface	According to ISO 18 000-6 C
Polarization type	Linear
Polarization direction	The polarization direction is parallel with the long side of the inlay
Frequency range	Europe: 865 ... 868 MHz USA: 902 to 928 MHz
Range [1)]	max. 5 m
Energy source	Field energy via antenna, without battery
Multitag capability	Yes
[1)] The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".	

7.5.6.3 Memory data

Feature	Description	
Type	EPC Class 1 Gen 2	
Memory organization	EPC code	96 bits/240 bits
	User memory	64 bytes
	TID	64 bits
	Reserved (passwords)	64 bits
Protocol	ISO 18000-6C	
Data retention time	10 years	
Read cycles	Unlimited	
Write cycles	Minimum 100 000 at +22 °C	

7.5.6.4 Environmental conditions

Feature	Description
Temperature range during operation	-25 °C … +85 °C
Temperature range during storage	-40 °C … +85 °C
Shock resistant acc. to EN 60068-2-27 Vibration acc. to EN 60068-2-6	100 g [1)] 50 g [1)]
Torsion and bending load	Partially permissible
Distance from metal	Not suitable for fixing straight onto metal
Degree of protection	IP67

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

Note

Note that in temperature ranges > 70 °C, the transponder can become slightly deformed. However, this has no effect on the transponder function.

7.5.6.5 Use of the transponder in the Ex protection area

In a conformity declaration, TÜV NORD CERT GmbH has confirmed compliance with the essential health and safety requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive areas as per Annex II of the directive 94/9/EG.

The essential health and safety requirements are satisfied in accordance with standards EN 60079-0: 2009, EN 60079-11: 2007 and EN 61241-11: 2006.

This allows the RF610T special variant ATEX transponder to be used in hazardous areas for gases, for the device category 3 G and gas group IIB, or alternatively in hazardous areas for dusts, for the device category 3 D and group IIIB.

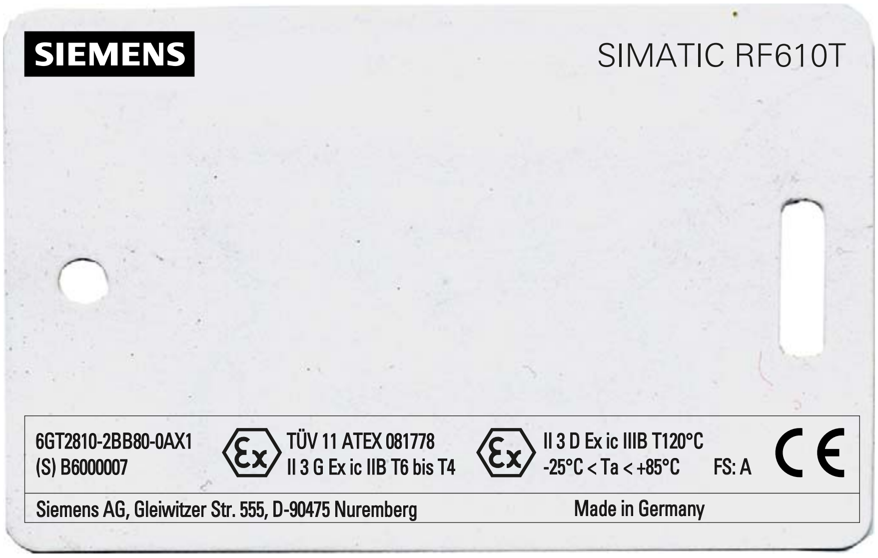
Identification

The identification is as follows:

II 3 G Ex ic IIB T6 to T4 or

II 3 D Ex ic IIIB T120°C,
-25 °C < Ta < +85 °C

7.5.6.6 Use of the transponder in hazardous areas for gases



Note

The labeling of the front of the transponder shown above is an example and can vary between batches produced at different times.

This does not affect the haradous area marking.

Temperature class delineation for gases

The temperature class of the transponder for hazardous areas depends on the ambient temperature range:

Ambient temperature range	Temperature class
-25 °C to +85 °C	T1 - T4
-25 °C to +65 °C	T5
-25 °C to +50 °C	T6

WARNING
Ignitions of gas-air mixtures
When using the RF610T transponder, check to make sure that the temperature class is adhered to in keeping with the requirements of the area of application
Non-compliance with the permitted temperature ranges while using the transponder can lead to ignitions of gas-air mixtures.

WARNING
Ignitions of gas-air mixtures
The maximum radiated power of the transmitter used to operate the transponder must not exceed 2000 mW ERP.
Non-compliance with the permitted radiated power can lead to ignitions of gas-air mixtures.

7.5.6.7 Use of the transponder in hazardous areas for dusts

The equipment is suitable for dusts whose ignition temperatures for a dust layer of 5 mm are higher than 190 °C (smoldering temperature). The ignition temperature specified here according to EN 60079-0 and EN 61241-11 for ignition protection type ic in this case references the smoldering temperature of a layer of combustible flyings (ic IIIA) or alternatively non-conductive dusts (ic IIIB).

Temperature class delineation for dusts

Ambient temperature range	Temperature value
-25 °C < Ta < +85 °C	T120 °C

WARNING
Ignitions of dust-air mixtures
When using the RF610T transponder, make sure that the temperature values are adhered to in keeping with the requirements of the area of application.
Non-compliance with the permitted temperature ranges while using the transponder can lead to ignitions of dust-air mixtures.

7.5.7 Certificates and approvals

Certificate	Description
CE	Compatible with R&TTE directive
	For directive 94/9/EC: conformity declaration no. TÜV 11 ATEX 081778
FCC Federal Communications Commission	Passive labels and transponders comply with the valid regulations; certification is not required.

7.5.8 Dimension drawing

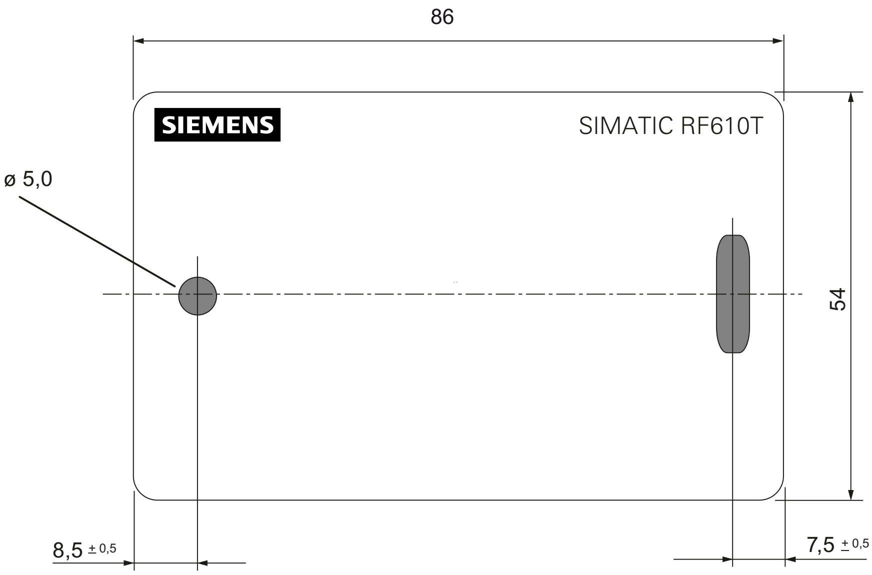


Figure 7-20 Dimension drawing SIMATIC RF610T (special variant ATEX)

All dimensions in mm

7.6 SIMATIC RF620T

7.6.1 Characteristics

The SIMATIC RF620T Transponder is passive and maintenance-free, based on the UHF Class 1 Gen2 technology for storing 96-bit/128-bit electronic product codes (EPC).

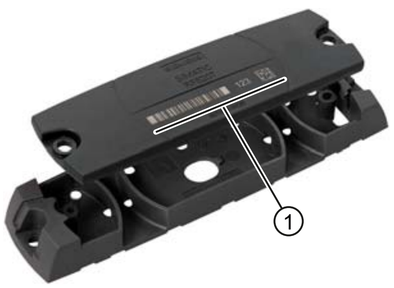
The transponder also has a 64-byte user memory.

The container tag for industrial applications is rugged and highly resistant to detergents. It is designed for easy attachment onto plastic, wood, glass, e.g. containers, palettes, and trolleys

The optimum functionality/range of the RF620T on metal is achieved by means of the spacer.

Since the plastic is food safe, it is also suitable for use in the food-processing industry.

This container tag is designed for the frequency bands of 860 MHz and 960 MHz and can be operated in combination with our UHF system RF660.

SIMATIC RF620T Transponder	Features	
	Area of application	Transponder for rugged, industrial requirements such as RF identification in warehouses and the logistics and transport area.
	Frequency range	860 to 960 MHz
	Polarization	Linear
	Memory	EPC 96 bit/128 bit
	Additional USER memory	64 bytes
	Range [1)]	max. 8 m
	Mounting	• Screw, bond • On metal by means of spacers
	① Labeling area	You can inscribe the transponder itself using laser, or adhere a label to position ①. Possible types of labeling: • Barcode • Inscription in plain text • Data matrix code
	Housing color	Anthracite

[1)] The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".

7.6.2 Ordering data

Ordering data	Order number
SIMATIC RF620T • Frequency 865 MHz to 928 MHz, • UHF Class 1 Gen2 technology (96 bit/128 bit) • -25 °C to +85 °C operating temperature • Dimensions (L x W x H) 127 x 38 x 6 mm • IP67 degree of protection	6GT2810-2HC81
Spacer for SIMATIC RF620T • For attaching to metal surfaces • Dimensions (L x W x H) 155 x 38 x 12 mm	6GT2898-2AA00

7.6.3 Planning the use

7.6.3.1 Range when mounted on non-metallic carrier materials

The transponder is generally designed for mounting on non-metallic objects which provide the conditions for the maximum reading ranges

Table 7- 12 Range with non-metallic carriers

Carrier material	Range
Transponder on wooden carrier (dry, degree of moisture < 15%)	typically 75 %
Transponder on plastic carrier	typically 75 %
Transponder on glass	typically 75 %
Transponder on plastic mineral water bottle	typically 15 %

The maximum range of 100% is achieved by mounting the transponder in a free space with low reflections on a metal-free carrier with a diameter of at least 300 mm.

You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 275)".

7.6.3.2 Directional radio pattern of the transponder on non-metallic surfaces

Preferably, align the data carrier parallel to the transmitting antenna. If, however, the data carrier including the metallic carrier plate is tilted, the reading range will be reduced.

Rotation about the polarization axis

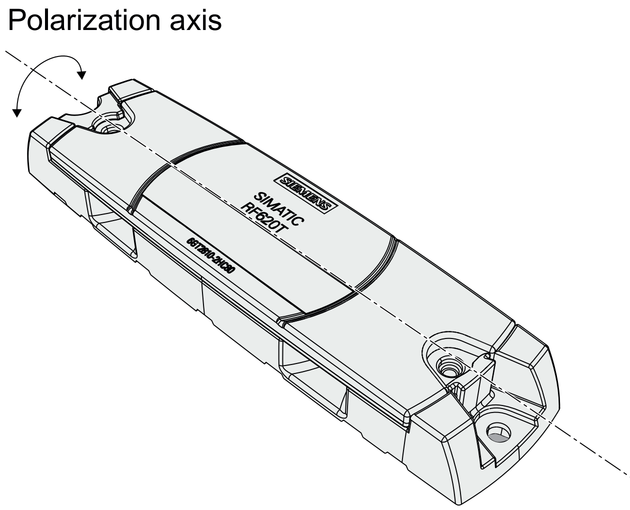


Figure 7-21 Rotation of the transponder about the polarization axis

Generally the range does not change when the transponder without carrier material is rotated about the polarization axis.

Rotation orthogonal to the polarization axis

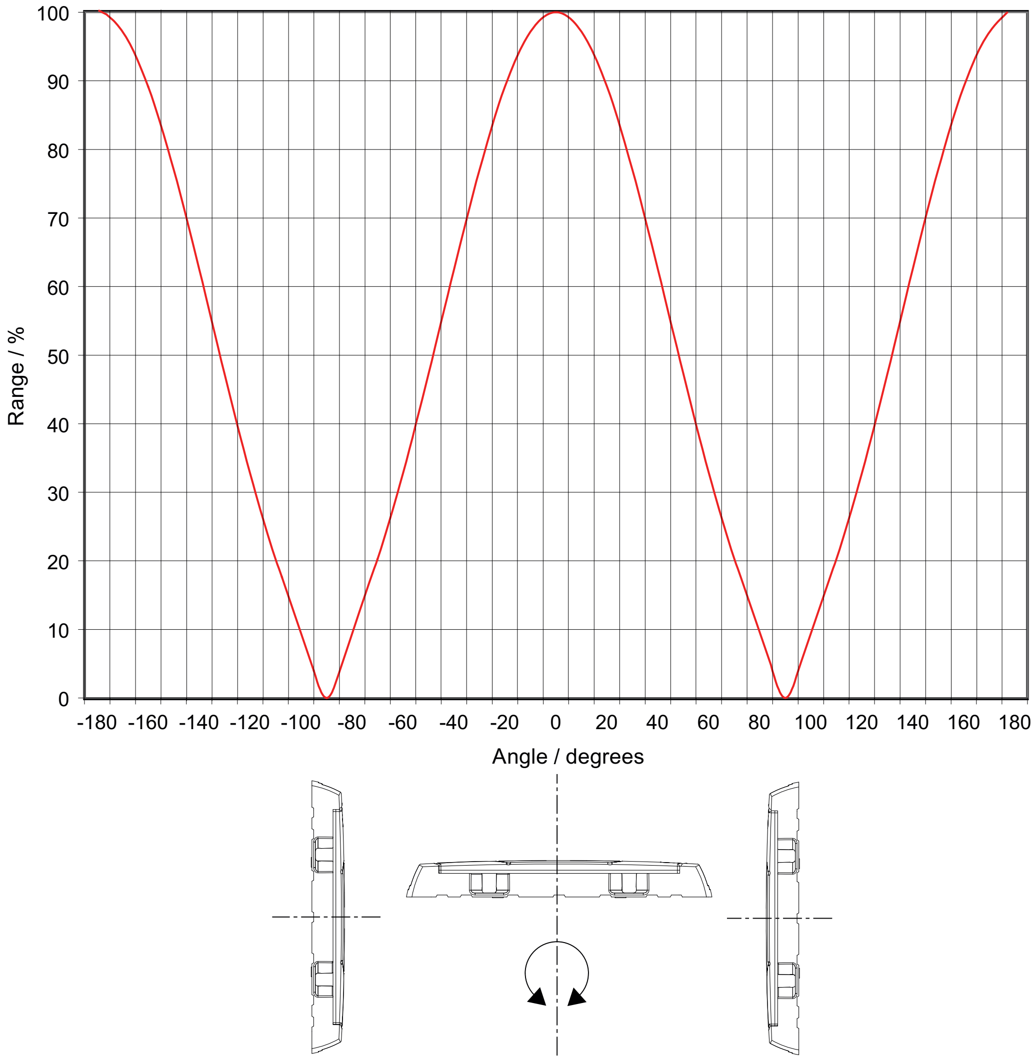


Figure 7-22 Transponder characteristics when rotated orthogonally to the polarization axis (within the tag plane)

If the transponder is positioned orthogonally to the transmitting antenna, it normally cannot be read. Therefore the data carrier is preferably to be aligned parallel to the transmitting antenna. The following figure illustrates this situation.

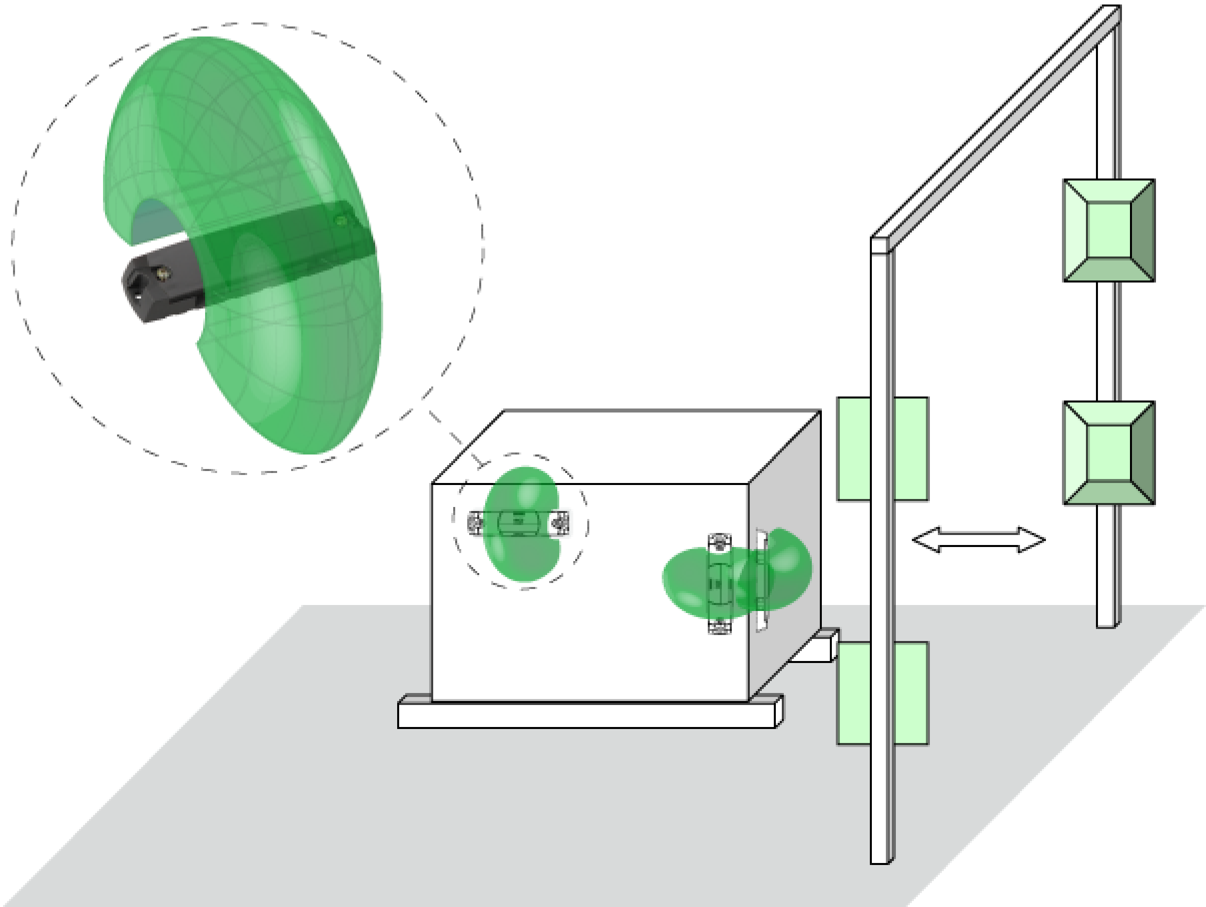


Figure 7-23 Application example for possible orientations of the transponder.

7.6.3.3 Optimum antenna/transponder positioning with planar mounting of the transponder on metal

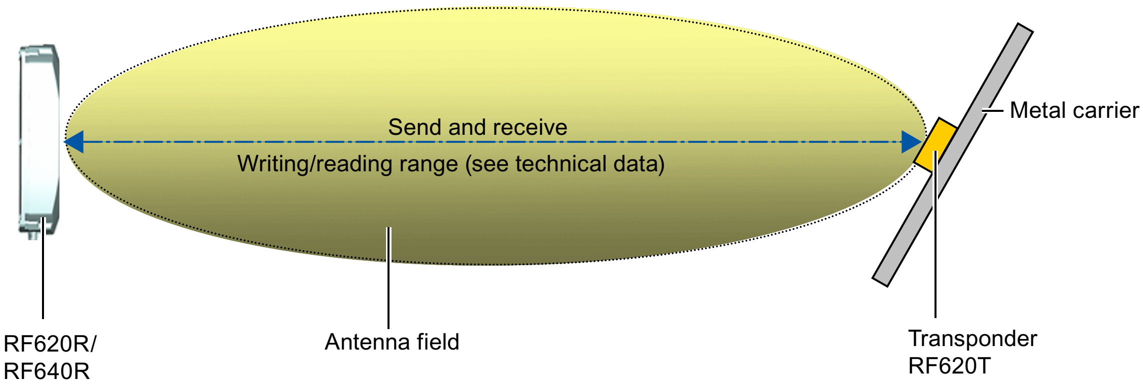


Figure 7-24 Example of optimum reader-transponder positioning with RF620R and RF640R via the internal reader antenna.

7.6.3.4 Range when mounted on flat metallic carrier plates

The transponder generally has linear polarization. The polarization axis runs as shown in the diagram below. If the tag is mounted in the center of a flat metal plate, which is either approximately square or circular, it can be aligned in any direction since the transmitting and receiving RF660A antennas operate with circular polarization.

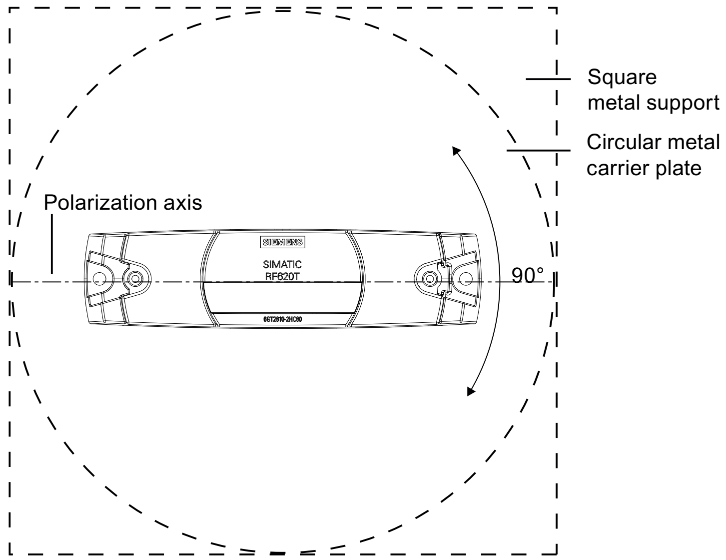


Figure 7-25 Optimum positioning of the transponder on a (square or circular) metal surface

Table 7- 13 Range with metallic, flat carriers without spacers

Carrier material	Range
Metal plate at least 300 x 300 mm	typically 38%

Table 7- 14 Range with flat metallic carriers with spacers

Carrier material	Range
Metal plate at least 300 x 300 mm	typically 87%

The use of spacers on metallic surfaces is recommended.

On rectangular carrier plates, the range depends on the mounting orientation of the transponder A 90° rotation of the transponder about the axis of symmetry may result in greater ranges.

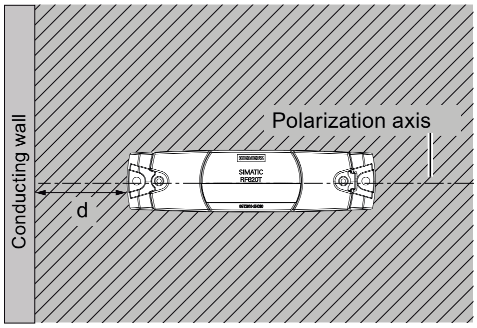
You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 275)".

7.6.3.5 Influence of conducting walls on the range

If there are conducting walls or restrictions in the vicinity that could affect the wireless field, a distance of approx. 10 cm is recommended. In principle, walls have least influence if the polarization axis is orthogonal to the wall. A spacer must be used in any case.

Range: One conducting wall

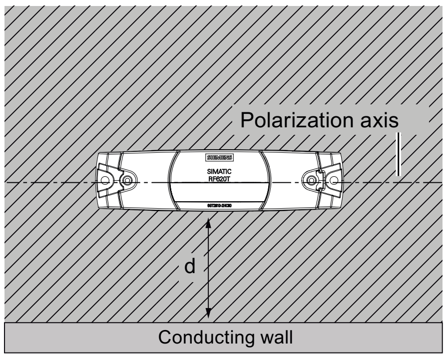
Influence on the range when positioned orthogonally to the conducting wall



View from above

Distance d	20 mm	50 mm	100 mm	
Range	approx. 100%	approx. 100%	approx. 100%	Wall height 20 mm
	approx. 100%	approx. 100%	approx. 100%	Wall height 50 mm
	approx. 80%	approx. 100%	approx. 100%	Wall height 100 mm

Influence on the range when positioned parallel to the conducting wall

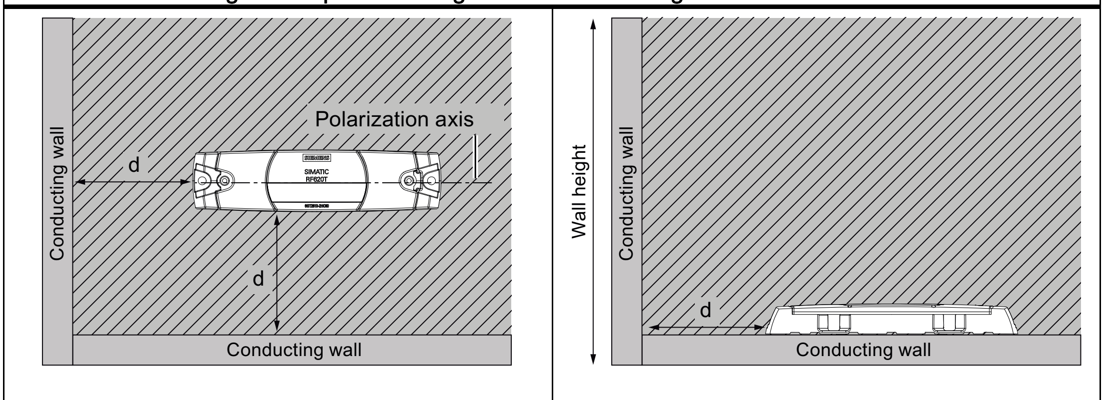


View from above

Distance d	20 mm	50 mm	100 mm	
Range	approx. 70%	approx. 100%	approx. 100%	Wall height 20 mm
	approx. 60%	approx. 90 %	approx. 100%	Wall height 50 mm
	approx. 30%	approx. 70%	approx. 100%	Wall height 100 mm

Range: Two conducting walls

Influence on the range when positioned against two conducting walls



View from above | Side view

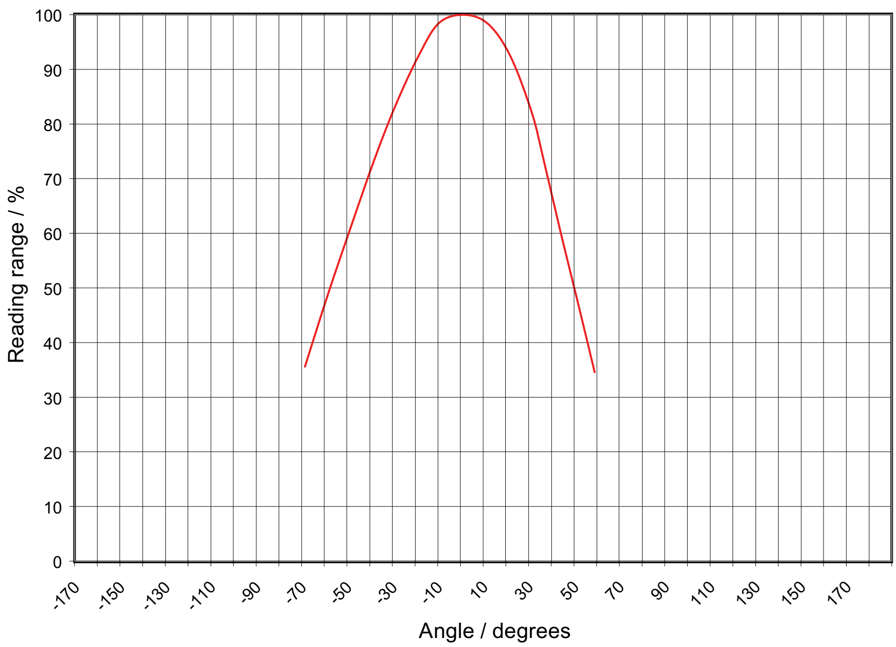
Distance d	20 mm	50 mm	100 mm	
Range	approx. 70%	approx. 100%	approx. 100%	Wall height 20 mm
	approx. 60%	approx. 90 %	approx. 100%	Wall height 50 mm
	approx. 30%	approx. 70%	approx. 100%	Wall height 100 mm

The values specified in the tables above are guide values.

7.6.3.6 Directional radio pattern of the transponder on metallic surfaces

Preferably, align the data carrier parallel to the transmitting antenna. If, however, the data carrier including the metallic carrier plate is tilted, the reading range will be reduced.

Rotation about the polarization axis or orthogonal to the polarization axis



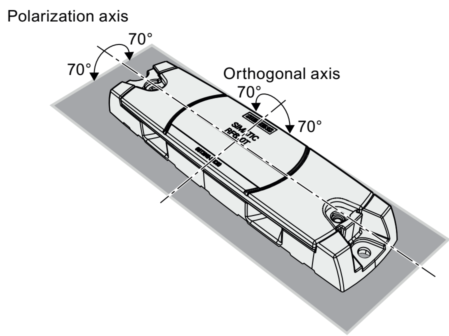


Figure 7-26 Characteristic of the transponder when rotated about the polarization axis or orthogonally to the polarization axis

7.6.3.7 Range when mounted on ESD carrier materials

The transponder is generally designed for mounting on non-conductive objects which provide the conditions for the maximum reading ranges The conductive or dissipative surface of ESD materials limits the range depending on the surface resistance. Generally, dissipative materials with a surface resistance of 1×10^5 to 1×10^{11} ohm and conductive materials with 1×10^3 to 1×10^5 ohm are available.

Table 7- 15 Limited range with ESD materials

Carrier material	Range
Transponder on electrostatic dissipative materials, dimensions 60°x°40 cm (surface resistance 2 x 10^9 ohm)	approx. 50%
Transponder on electrostatically conductive materials, dimensions 60 x 40 cm (surface resistance 1 x 10^4 ohm) Use of spacers	approx. 12% approx. 25 %

100% range is achieved when mounted in free space with low reflections. With multitag capability, the range may be limited further.

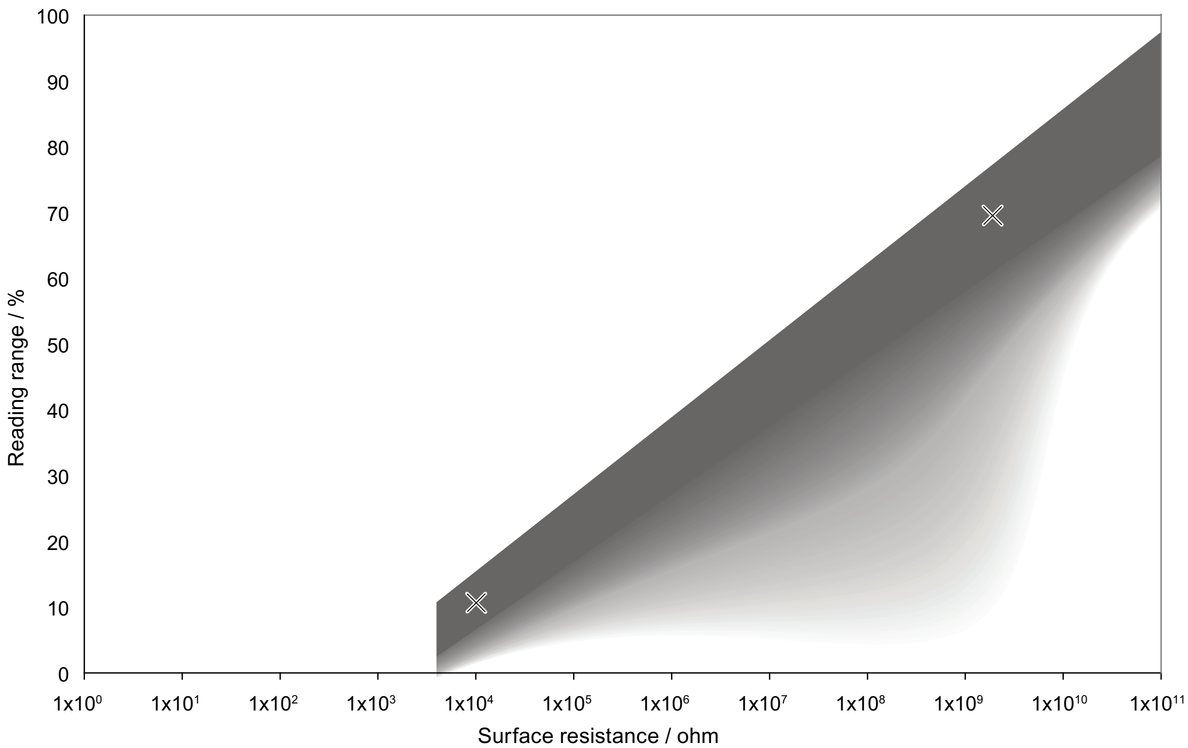


Figure 7-27 Schematic representation of how the range depends on the surface resistance of the ESD material

In the figure above, the two reading points are shown illustrating the range as a percentage dependent on the surface resistance. At the same time a linear dependence between the reading points is to be expected, however with measurement inaccuracies. The darker the hatching, the greater the probability that the reading point is found in the hatched area.

7.6.3.8 Communication with multiple transponders

The RF600 system is multitag-capable. This means that the reader can detect and write to several transponders almost simultaneously. The minimum distance between the transponders is ≥ 50 mm.

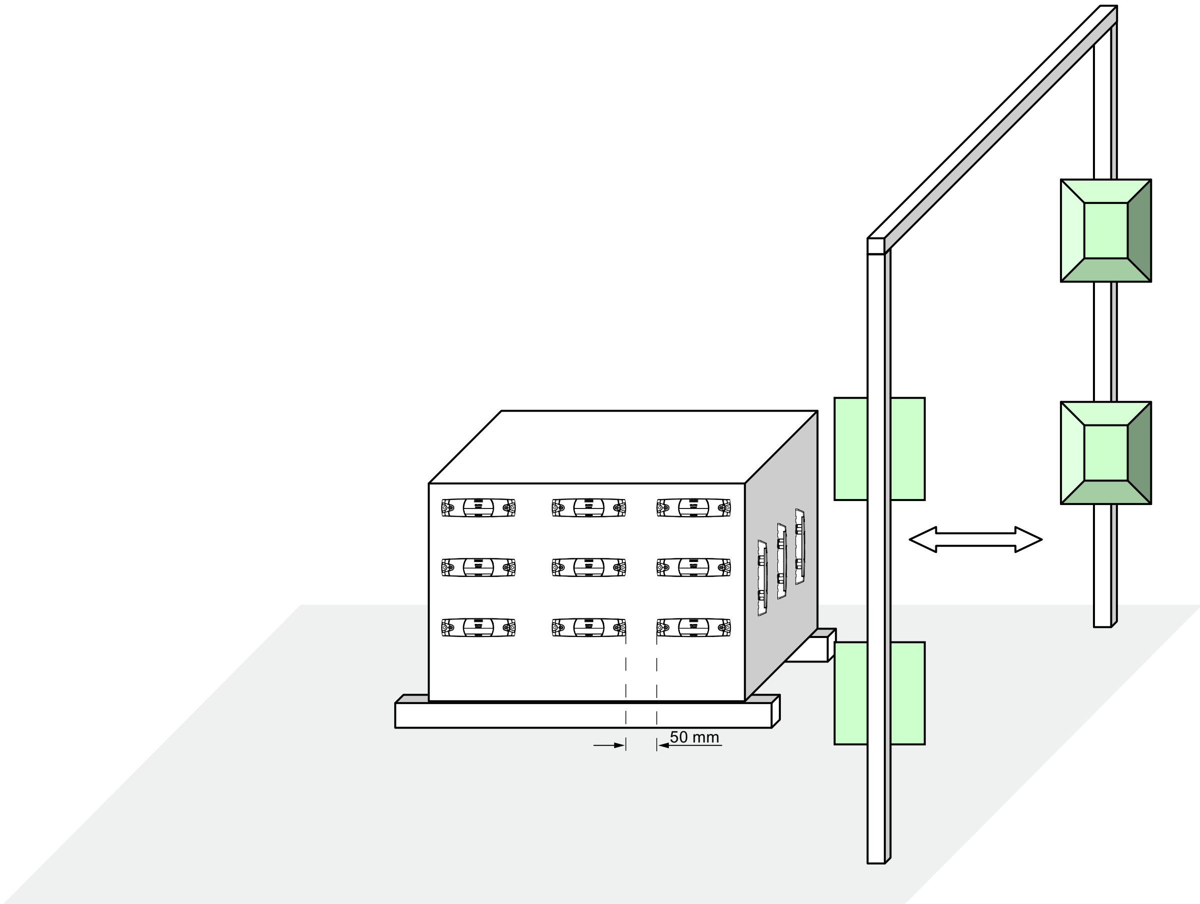


Figure 7-28 Multitag reading

7.6.4 Mounting instructions

NOTICE
Level mounting
Please note that both the transponder and the spacer must be mounted on a level surface.

NOTICE
The screw fixing element was tested with the types of screws, spring washers and plain washers indicated below. Depending on the application area, the user must use similar, correspondingly certified screws, spring washers and plain washers (e.g. for the food processing industry).

EJOT screws can be additionally etched and passivated in some areas of the food processing industry, e.g if they made of stainless steel A2. In other areas without special requirements, the screws can be, for example, zinc plated and blue passivated.

Note

In case of high mechanical loads (such as shocks or vibration), the transponder must be fixed onto the spacer by means of screws.

Properties		Description	Graphics
Mounting type	• Transponder	• Screw mounting (e.g. 2 x M4 hexagon socket head cap screws DIN 6912, spring lock and grommet DIN 433) or glued	
	• Transponder on spacer	• Clips or screw on the side of the clip, or 2°x° screws (e.g. EJOT PT ® WN 5411 35x10 VZ crosshead screw/torx)	
	• Spacer	• Screw mounting (e.g.°2 x M4 hexagon socket head cap screws DIN 6912, spring lock and grommet DIN 433) or glued or secured with tape	
Tightening torque		(at room temperature) < 1.2 Nm	

7.6.5 Memory configuration of the transponder

The memory configuration of the transponder is described in the section SIMATIC memory configuration of the RF600 transponders and labels (Page 268).

7.6.6 Technical Specifications

7.6.6.1 Mechanical data

Property	Description
Dimensions (L x W x H) • Transponder • Spacer	 • 127 x 38 x 6 mm • 157 x 39 x 12 mm
Design	Plastic enclosure (PP; food safe), silicon-free
Housing color	Anthracite
Weight • Transponder • Spacer • Transponder with spacer	 • Approx. 18 g • Approx. 22 g • Approx. 40 g
Mounting on metal	Preferably with spacer

7.6.6.2 Electrical data

Characteristic	Description
Air interface	According to ISO 18 000-6 C
Frequency range	860 ... 960 MHz
Range 1)	max. 8 m
Polarization type	Linear
Energy source	Magnetic energy via antenna, without battery
Multitag capability	Yes, minimum distance between data carriers ≥ 50 mm
1) Mounting on a flat metal-free carrier with a diameter of at least 300 mm and at room temperature. The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".	

7.6.6.3 Memory specifications

Characteristic	Description
Type	EPC Class 1 Gen2
Memory organization	EPC code 96/128 bit
User memory	64 byte
Protocol	ISO 18000-6C
Data retention time	10 years
Read cycles	Unlimited
Write cycles	100 000 min.

7.6.6.4 Environmental conditions

Property	Description
Temperature range during operation	-25 °C to +85 °C
Temperature range during storage	-40 °C to +85 °C
Shock Vibration compliant with EN 60721-3-7 Class 7 M3	100 g, 50 g
Torsion and bending load	Not permissible
Degree of protection	IP67

7.6.6.5 Chemical resistance of the transponder RF620T

The following table provides an overview of the chemical resistance of the data memory made of polypropylene.

	Concentration	20 °C	50 °C
Emissions alkaline/containing hydrogen fluoride /carbon dioxide	Low	oooo	oooo
Emissions containing hydrochloric acid		oooo	oooo
Emissions containing sulphuric acid		oooo	-
Battery acid	38	oooo	oooo
Aluminum acetate, w.		oooo	oooo
Aluminum chloride	10	oooo	oooo
Aluminum nitrate, w.		oooo	oooo
Aluminum salts		oooo	oooo
Formic acid	50	oooo	-
Aminoacetic acid (glycocoll, glycine)	10	oooo	oooo
Ammonia gas		oooo	oooo
Ammonia	25	oooo	oooo
Ammonia, w.	conc.	oooo	oooo

	Concentration	20 °C	50 °C
	10	oooo	oooo
Arsenic acid, w.		oooo	oooo
Ascorbic acid, w.		oooo	oooo
Petroleum spirit		-	-
Benzene		oo	-
Prussic acid, w.		oooo	oooo
Sodium hypochlorite solution	diluted / 20	oooo	oo
	50	oo	oo
Borax		oooo	oooo
Boric acid, w.	10	oooo	oooo
Brake fluid		oooo	oooo
Bromine		-	-
Butane, gas, liquid	techn. pure	oooo	oooo
Butyl acetate (acetic acid butyl ester)		oo	-
Calcium chloride, w./ alcoholic		oooo	ooo
Calcium chloride,		oooo	oooo
Calcium nitrate, w.		oooo	oooo
	50	oooo	oooo
Chlorine		–	–
Chloroacetic acid		oooo	oooo
Chloric acid	20	oooo	-
Chrome baths, tech.		–	–
Chromium salts		oooo	oooo
Chromic acid	10	oooo	oooo
	20 / 50	oo	oo
Chromic acid, w		oooo	oo
Chromosulphuric acid	conc.	-	-
Citric acid	10	oooo	oooo
Diesel fuel		oooo	
Diesel oil	100	oooo	
Diglycole acid	30	oooo	oooo
Iron salts, w.	k. g.	oooo	oooo
Vinegar		oooo	oooo
Acetic acid	5 / 50	oooo	oooo
Ethanol	50 / 96	oooo	oooo
Ethyl alcohol	96 / 40	oooo	oooo
Fluoride		oooo	oooo
Formaldehyde	10	oooo	oooo
	40	oooo	ooo
Formaldehyde solution	30	oooo	oooo
Glycerin	any	oooo	oooo

	Concentration	20 °C	50 °C
Glycol		○○○○	○○○○
Uric acid		○○○○	
HD oil, motor oil, without aromatic compounds		○○○○	
Fuel oil		○○○○	
Isopropanol	techn. pure	○○○○	○○○○
Potassium hydroxide, w.		○○○○	○○○○
Potassium hydroxide	10 / 50	○○○○	○○○○
Silicic acid	any	○○○○	○○○○
Common salt		○○○○	○○○○
Carbonic acid	saturated	○○○○	○○○○
Lysol		○○○○	○○
Magnesium salts, w.	k. g.	○○○○	○○○○
Magnesium salts	any	○○○○	○○○○
Machine oil	100	○○○○	
Sea water		○○○○	○○○○
Methanol		○○○○	○○○○
Methyl alcohol, w.	50	○○○○	○○○○
Lactic acid, w.		○○○○	○○○○
Lactic acid	3 / 85	○○○○	○○○
	80	○○○○	○○○○
Engine oil		○○○○	
Sodium carbonate, w. (soda)	k. g.	○○○○	○○○○
Sodium carbonate		○○○○	○○○○
Sodium chloride, w.	k. g.	○○○○	○○○○
Sodium hydroxide, w.		○○○○	○○○○
Sodium hydroxide solution, w.		○○○○	○○○○
Sodium hydroxide solution	30 / 45 / 60	○○○○	○○○○
Nickel salts, w.	k. g.	○○○○	○○○○
Nickel salts	saturated	○○○○	○○○○
Nitrobenzol		○○○	○○
Oxalic acid		○○○○	○○○○
Petroleum	techn. pure	○○○○	
Phosphoric acid	1-5 / 30	○○○○	○○○○
	85	○○○○	○○○
Phosphoric acid, w	20	○○○○	○○○○
Propane	liquid	○○○○	
Propane	gaseous	○○	
Mercury	pure	○○○○	○○○○
Crude oil	100	○○○○	○○
Ammonium chloride	100	○○○○	○○○○
Ammonium chloride, w.		○○○○	○○○○

	Concentration	20 °C	50 °C
Nitric acid		-	-
	50	○○	
	1-10	○○○○	○○○○
Hydrochloric acid	1-5 / 20	○○○○	○○○○
	35	○○○○	○○○
	conc.	○○○○	○○○○
Sulphur dioxide	Low	○○○○	○○○○
	moist	○○○○	○○
	liquid	-	-
Sulphuric acid	1-6 / 40 / 80	○○○○	○○○○
	20	○○○○	○○○
	60	○○○○	○○
	95	○○	-
	fuming	-	-
Hydrogen sulphide	Low/saturated	○○○○	○○○○
Detergent	High	○○○○	○○○○
Water		○○○○	○○○○
Hydrogen	techn. pure	○○○○	○○○○
Plasticizer		○○○○	○○

Abbreviations	
○○○○	Resistant
○○○	Virtually resistant
○○	Limited resistance
○	Less resistant
−	Not resistant
w.	Aqueous solution
k. g.	Cold saturated

7.6.7 Certificates and approvals

Table 7- 16 6GT2810-2HC00 - RF620T UHF container tag

Certificate	Description
	CE Approval to R&TTE

Table 7- 17 6GT2810-2HC80 - RF620T UHF container tag

Standard	
FCC Federal Communications Commission	Passive labels or transponders comply with the valid regulations; certification is not required.
C US	This product is UL-certified for the USA and Canada. It meets the following safety standard(s): • UL508 - Industrial Control Equipment • CSA C22.2 No. 142 - Process Control Equipment • UL Report E 120869

7.6.8 Dimension drawing

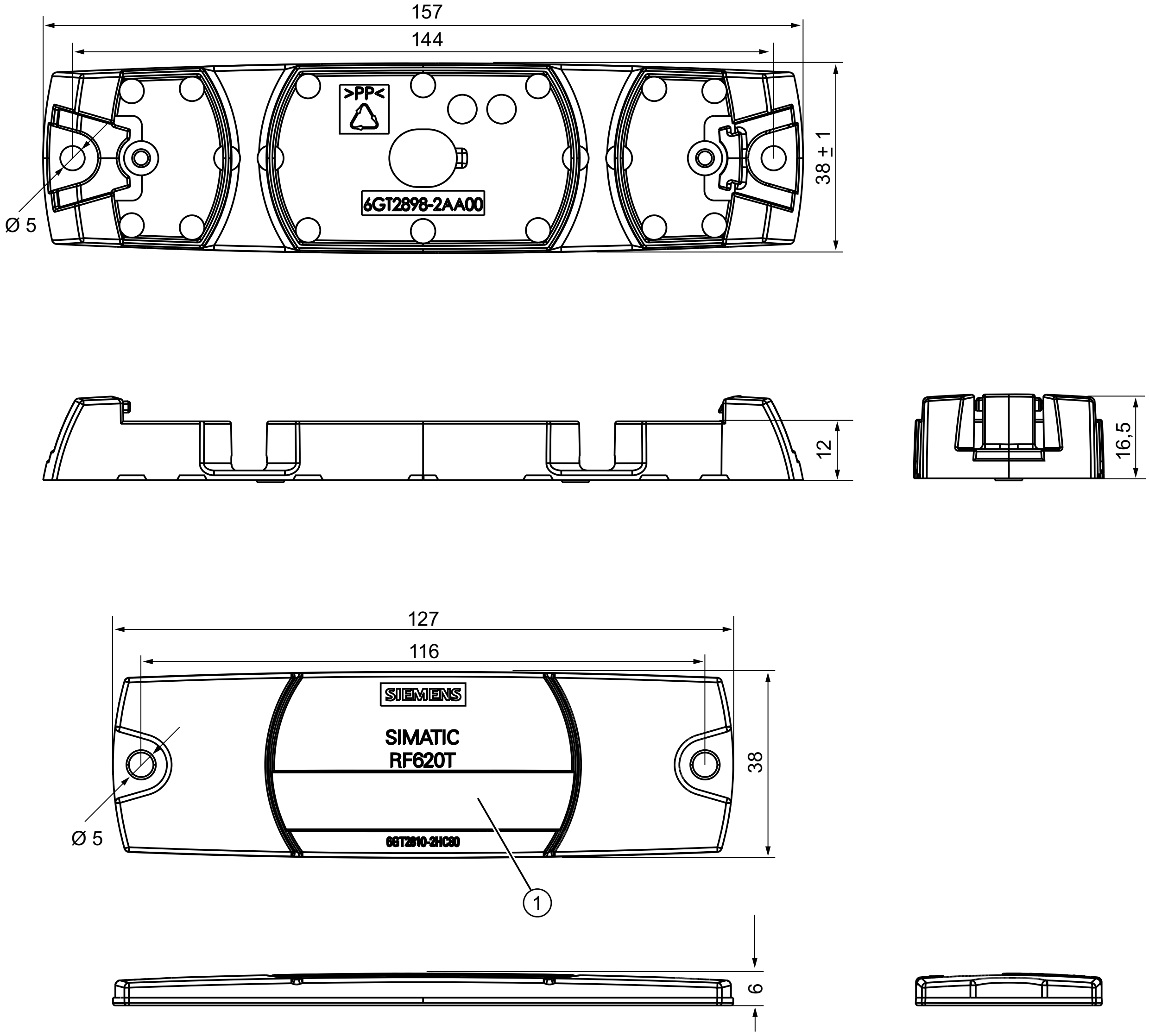


Figure 7-29 SIMATIC RF620T UHF container tag

Units of measurement: All dimensions in mm

Tolerances, unless indicated otherwise, are +-0.5 mm.

① Labeling area, see Section Characteristics (Page 305)

7.7 SIMATIC RF625T

7.7.1 Characteristics

The SIMATIC RF625T transponder is a passive, maintenance-free data carrier with a round design. It operates based on the UHF Class 1 Gen 2 technology and is used to save the "Electronic Product Code" (EPC) of 96 bits/128 bits. The transponder also has a 512-bit user memory.

The areas of application are industrial asset management, RF identification of tools, containers and metallic equipment.

The Disk Tag is small and rugged and suitable for industrial applications with degree of protection IP68. It is highly resistant to oil, grease and cleaning agents.

Ideally, the SIMATIC RF625T is mounted directly on a flat metal surface of at least 150 mm diameter where it achieves a typical sensing distance of 1.5 m.

<table>
<tr><th>SIMATIC RF625T</th><th colspan="3">Features</th></tr>
<tr><td rowspan="8">
</td><td>Area of application</td><td colspan="2">Identification tasks in rugged industrial environments</td></tr>
<tr><td rowspan="2">Frequency variants</td><td>Europe</td><td>USA/Canada</td></tr>
<tr><td>865 MHz ... 868 MHz</td><td>902 MHz ... 928 MHz</td></tr>
<tr><td>Air interface</td><td colspan="2">according to ISO°18000-6C</td></tr>
<tr><td>Polarization</td><td colspan="2">Linear</td></tr>
<tr><td>Memory</td><td colspan="2">EPC 96 bit/128 bit
Add-on-memory 64 bytes</td></tr>
<tr><td>Range [1)]</td><td colspan="2">max. 1.5 m</td></tr>
<tr><td>Mounting</td><td colspan="2">for direct mounting on conductive materials (preferably metal).</td></tr>
<tr><td colspan="4">[1)] The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".</td></tr>
</table>

7.7.2 Ordering data

Ordering data	Order no.
SIMATIC RF625T (Europe), frequency range 865 MHz ... 868 MHz	6GT2810-2EE00
SIMATIC RF625T (USA / Canada), frequency range 902 MHz ... 928 MHz	6GT2810-2EE01

7.7.3 Planning the use

7.7.3.1 Optimum antenna/transponder positioning with planar mounting of the transponder on metal

Example of optimum reader-transponder positioning with RF620R and RF640R

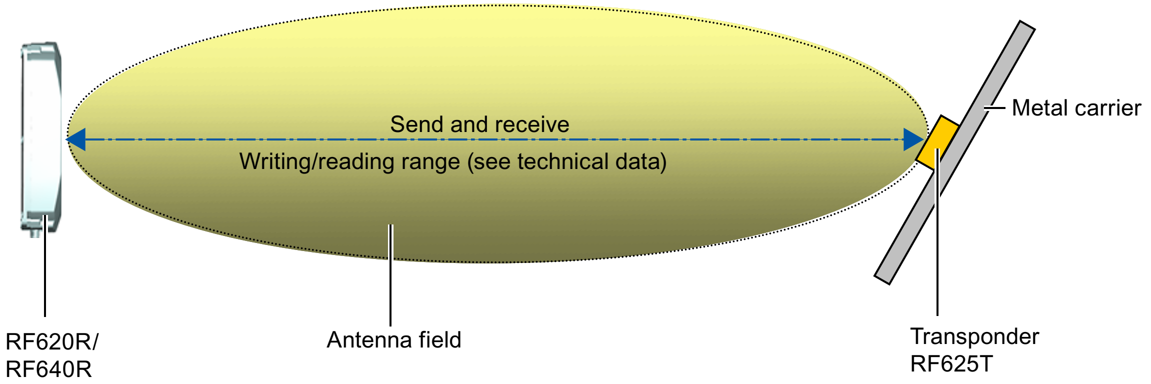


Figure 7-30 Example of optimum reader-transponder positioning with RF620R and RF640R via the internal reader antenna.

Example of optimum antenna-transponder positioning with RF620R, RF630R, RF640R and RF670R

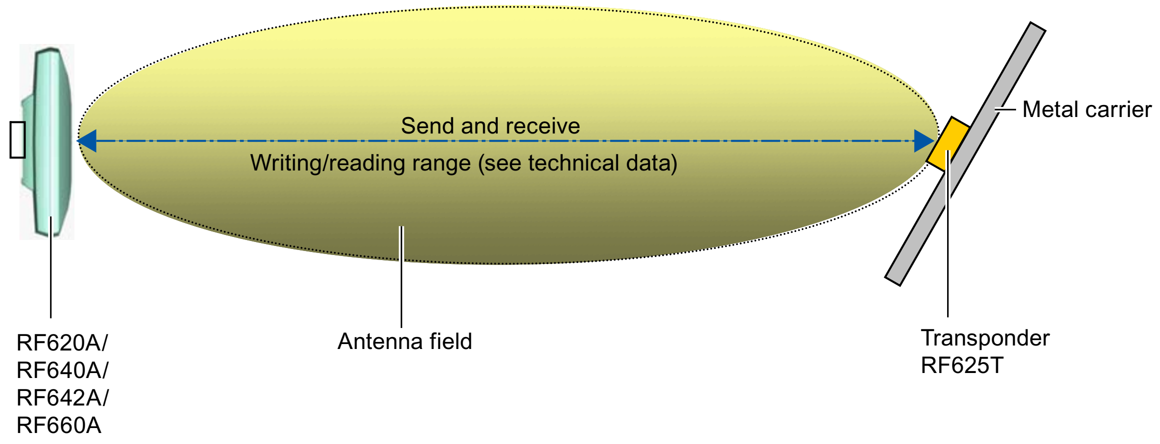


Figure 7-31 Example of optimum antenna-transponder positioning with the RF620R, RF630R, RF640R and RF670R readers in conjunction with the external antennas RF620A, RF640A, RF642A or RF660A.

7.7.3.2 Range when mounted on flat metallic carrier plates

The transponder generally has linear polarization. The polarization axis runs as shown in the diagram below. If the tag is mounted in the center of a flat metal plate, which is either approximately square or circular, it can be aligned in any direction since the transmitting and receiving RF660A antennas operate with circular polarization.

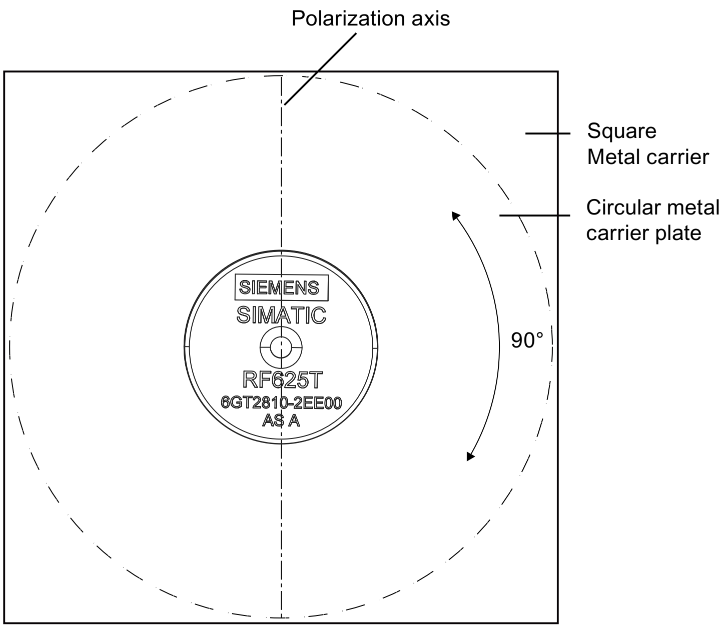


Figure 7-32 Optimum positioning of the transponder on a (square or circular) metal surface

Table 7- 18 Range on flat metallic carriers

Carrier material	Range
Metal plate of at least Ø 150 mm	100 %
Metal plate Ø 120 mm	approx. 70%
Metal plate Ø 85 mm	approx. 60%
Metal plate Ø 65 mm	approx. 60%

On rectangular carrier plates, the range depends on the mounting orientation of the transponder

You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 275)".

7.7.3.3 Range when mounted on non-metallic carrier materials

The transponder is generally designed for mounting on metallic objects which provide the conditions for the maximum reading ranges

Table 7- 19 Range with non-metallic carriers

Carrier material	Range
Transponder on wooden carrier	approx. 60%
Transponder on plastic carrier	approx. 65 %
Transponder on plastic mineral water bottle	approx. 70%
Transponder without base	approx. 50 %

The maximum range of 100% is achieved by mounting the transponder in a free space with low reflections on a flat metal carrier with a diameter of at least 150 mm.

You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 275)".

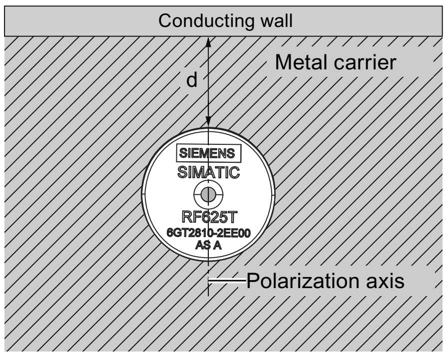
7.7.3.4 Influence of conducting walls on the range

If there are conducting walls or restrictions in the vicinity that could affect the wireless field, a distance of approx. 10 cm is recommended. In principle, walls have least influence if the polarization axis is orthogonal to the wall.

Range: One conducting wall

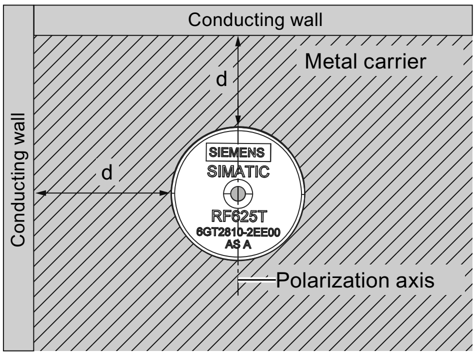
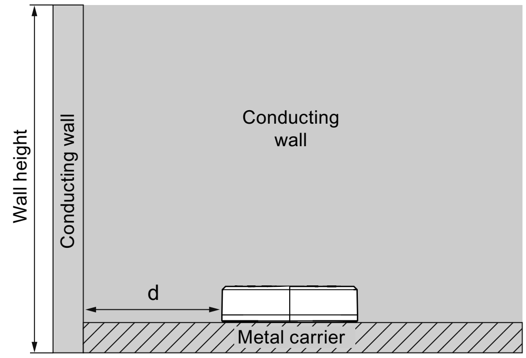
Influence on range when positioned against one conducting wall

View from above



Distance d	20 mm	50 mm	100 mm	
Range	approx. 100%	approx. 100%	approx. 100%	Wall height 20 mm
	approx. 100%	approx. 100%	approx. 100%	Wall height 50 mm
	approx. 80%	approx. 100%	approx. 100%	Wall height 100 mm

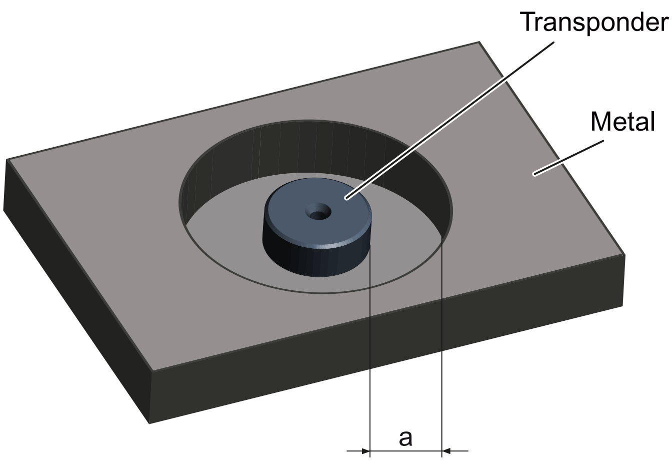
Range: Two conducting walls

<table>
<tr><th colspan="5">Influence on the range when positioned against two conducting walls</th></tr>
<tr><td colspan="2">View from above

</td><td colspan="3">Side view

</td></tr>
<tr><td>Distance d</td><td>20 mm</td><td>50 mm</td><td>100 mm</td><td></td></tr>
<tr><td>Range</td><td>approx. 70%</td><td>approx. 75 %</td><td>approx. 100%</td><td>Wall height 20 mm</td></tr>
<tr><td></td><td>approx. 70%</td><td>approx. 80%</td><td>approx. 100%</td><td>Wall height 50 mm</td></tr>
<tr><td></td><td>approx. 70%</td><td>approx. 40%</td><td>approx. 50 %</td><td>Wall height 100 mm</td></tr>
</table>

The values specified in the tables above are guide values.

7.7.3.5 Mounting in metal

It is possible to mount the transponder in metal. If there is not enough clearance to the surrounding metal, this reduces the reading range.



Clearance (all-round)	Reading range [1]
a = 5 mm	Approx. 50 %
a = 10 mm	Approx. 70%

[1] The read range information applies when the transponder is mounted on a metallic carrier with a diameter of at least 150 mm.

Figure 7-33 Flush-mounting of RF625T in metal

7.7.3.6 Directional radiation pattern of the transponder

Directional diagram in the ETSI frequency band (Europe)

The directional diagram is shown for nominal alignment and a center frequency of 866.3 MHz. The nominal transponder alignment is achieved when the transponder is viewed as shown in the following figure.

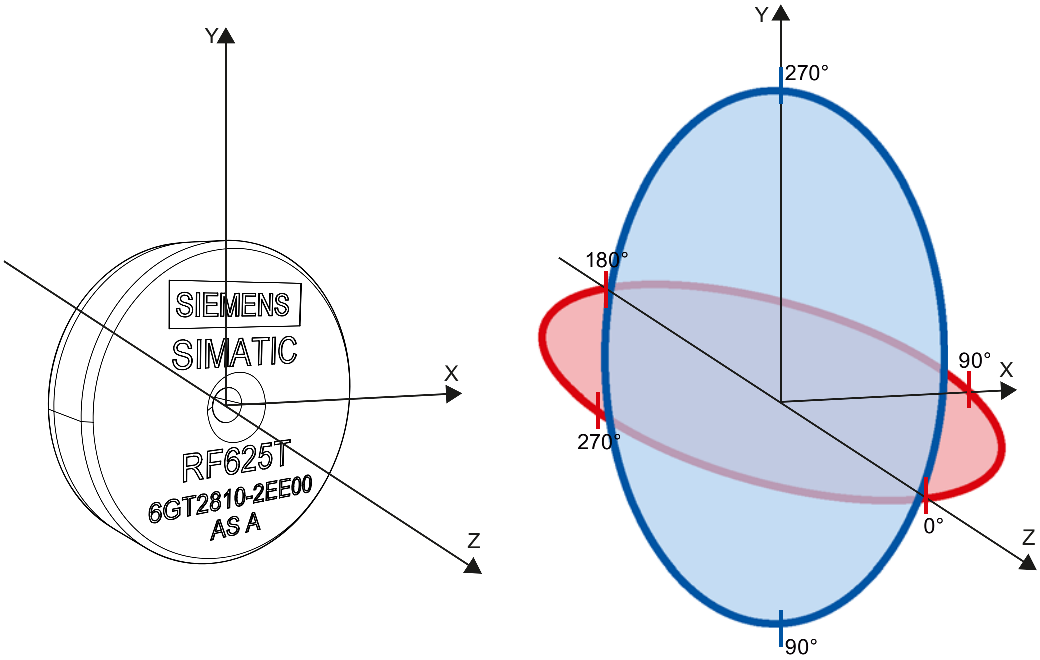


Figure 7-34 Reference system of the RF625T

Ideally, align the data carrier parallel with the transmitting antenna or the reader. If the data carrier including the (metallic) carrier plate is tilted, the reading range will be reduced. The following diagrams show the effects on the reading range depending on the carrier material and the angle of inclination of the transponder.

Directional characteristics of the transponder when mounted on a metallic carrier

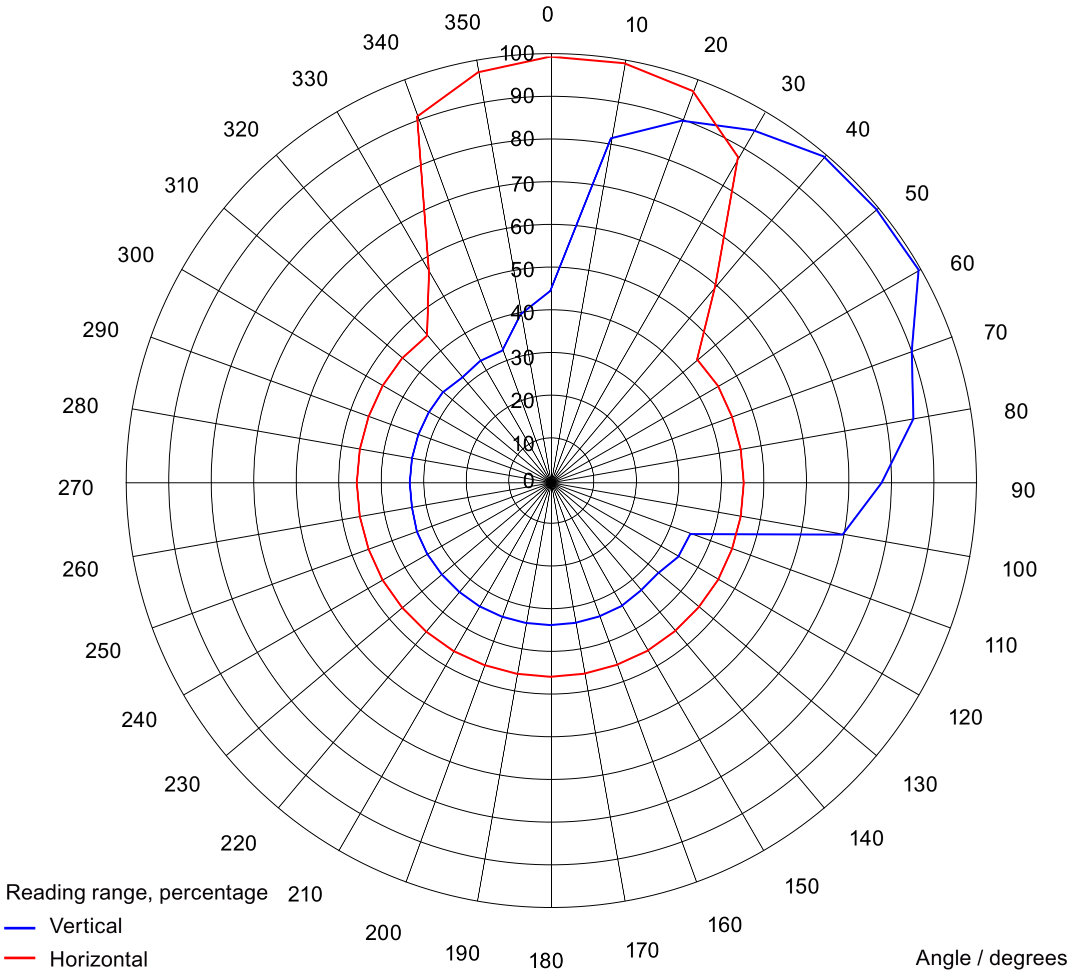


Figure 7-35 Directional characteristics of the RF625T on a metallic carrier depending on the angle of inclination in a vertical or horizontal direction

Directional characteristics of the transponder when mounted on a non-metallic carrier

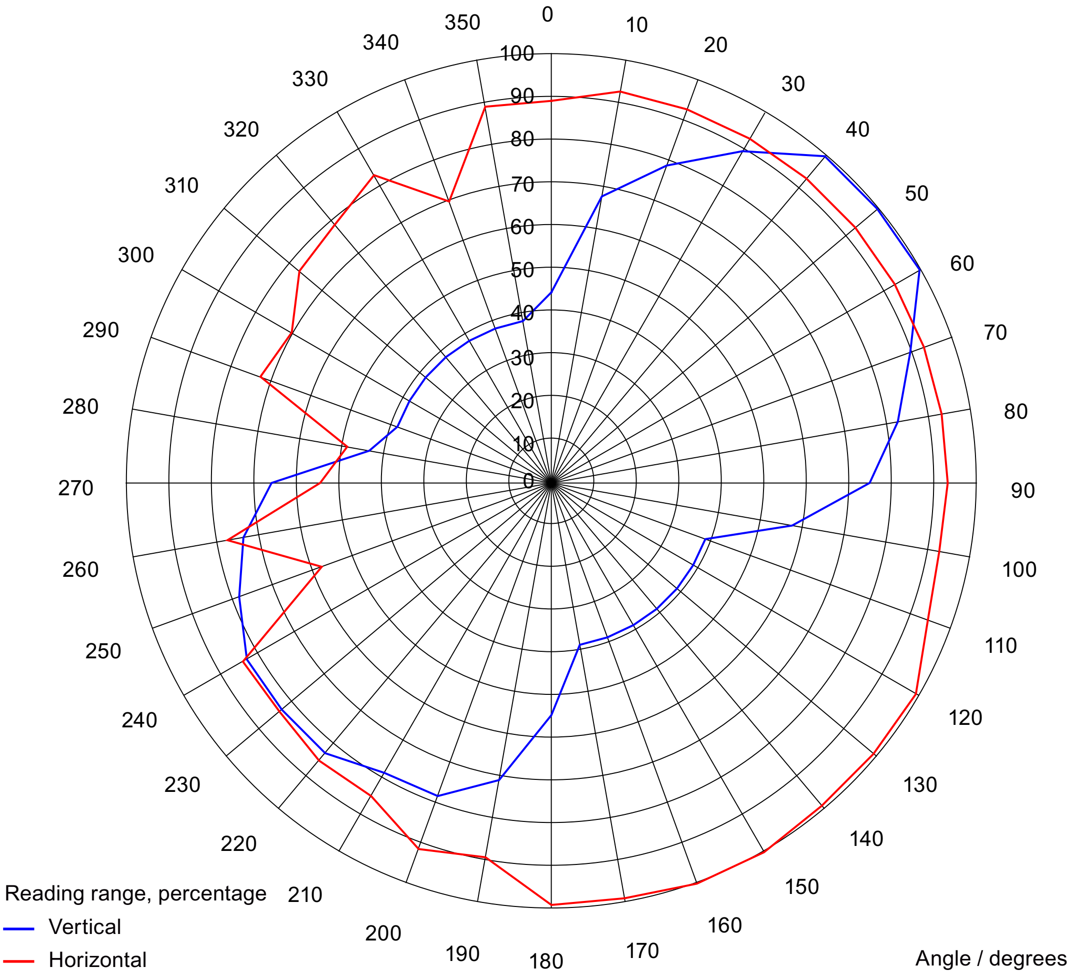


Figure 7-36 Directional characteristics of the RF625T on a non-metallic carrier depending on the angle of inclination in a vertical or horizontal direction

7.7.4 Mounting instructions

Properties	Description
Type of installation	Secured with screw ①, (M3 counter-sunk head screw)
Tightening torque (at room temperature)	≤ 1.0 Nm

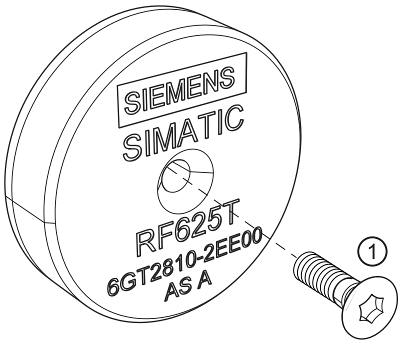


Figure 7-37 Screw mounting

Note

Make sure that the mounting surface is even when mounting the transponder.

7.7.5 Memory configuration of the transponder

The memory configuration of the transponder is described in the section SIMATIC memory configuration of the RF600 transponders and labels (Page 268).

7.7.6 Technical Specifications

7.7.6.1 Mechanical data

Property	Description
Dimensions (D x H)	30 (+0.5) mm x 8 (+0.5) mm
Design	Plastic housing (PA6.6), silicone-free
Weight	Approx. 6 g
Mounting on metal	directly on metal without spacing

7.7.6.2 Electrical data

Characteristic	Description	
	Europe	USA/Canada
Air interface	According to ISO 18 000-6 C	According to ISO 18 000-6 C
Frequency range	865 ... 868 MHz	902 ... 928 MHz [1)]
Necessary transmit power	2 W (ERP)	4 W (EIRP)
Range [2)]	max. 1.5 m	max. 1.5 m
Polarization type	Linear	Linear
Energy source	Field energy via antenna, without battery	Field energy via antenna, without battery
Multitag capability	yes, minimum distance between data carriers ≥ 50 mm [3)]	yes, minimum distance between data carriers ≥ 50 mm [3)]
[1)] Reduction of range to about 70% at the band limits 902 MHz or 928 MHz; acquisition is guaranteed at 915 MHz due to frequency hopping procedure. [2)] Mounting on a flat metal surface with a diameter of at least 150 mm and at room temperature. The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)". [3)] When these minimum distances are not reached, there is a reduction in the maximum possible read and write distances of the transponder.		

7.7.6.3 Information on memory

Property	Description	
Type	EPC Class 1 Gen 2	
Memory organization	EPC code	96 bits/128 bits
	User memory	64 bytes
	TID	96 bits
	Reserved (passwords)	64 bits
Protocol	ISO 18000-6C	
Data retention time	10 years	
Read cycles	Unlimited	
Write cycles	Minimum 100 000, at +22 °C	

7.7.6.4 Environmental conditions

Property	Description
Temperature range during operation	-25 °C … +85 °C
Temperature range during storage	-40 °C … +125 °C
Shock resistant to EN 60068-2-27 Vibration to EN 60068-2-6	50 g, [1)] 20 g, [1)]
Torsion and bending load	Not permissible

Property	Description
Degree of protection	IP68 according to EN 60529: (45 minutes. immersion in water; water depth 1 m from top edge of housing at +20 °C)
	IPx9K to EN 60529: • Steam blaster nozzle distance 150 mm • 10 ... 15 l water per minute • Pressure 100 bar • Temperature 75 °C • Test time 30 seconds
MTBF	2 x 10^5 hours

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

7.7.6.5 Chemical resistance of the RF625T transponder

The following table provides an overview of the chemical resistance of the data memory made of polyamide 6.6. It must be emphasized that the plastic housing is extremely resistant to chemicals in automobiles (e.g.: oil, grease, diesel fuel, gasoline) which are not listed separately.

Substance	Concentration
Mineral lubricants	■
Aliphatic hydrocarbons	■
Aromatic hydrocarbons	■
Petroleum spirit	■
Weak mineral acids	◪
Strong mineral acids	□
Weak organic acids	◪
Strong organic acids	□
Oxidizing acids	□
Weak alkalis	◪
Strong alkalis	□
Trichloroethylene	■
Perchloroethylene	■
Acetone	■
Alcohols	■
Hot water (hydrolysis resistance)	◪
Abbreviations:	
■	Resistant
◪	Limited resistance
□	Not resistant

7.7.7 Certificates and approvals

Table 7- 20 SIMATIC RF625T UHF Disk Tag (Europe), 6GT2810-2EE00

Certificate	Description
	Conforms to R&TTE directive

Table 7- 21 SIMATIC RF625T UHF Disk Tag (USA/Canada), 6GT2810-2EE01

Standard	
FCC Federal Communications Commission	Passive labels or transponders comply with the valid regulations; certification is not required
	This product is UL-certified for the USA and Canada. It meets the following safety standard(s): • UL508 - Industrial Control Equipment • CSA C22.2 No. 142 - Process Control Equipment • UL Report E 120869

7.7.8 Dimension drawing

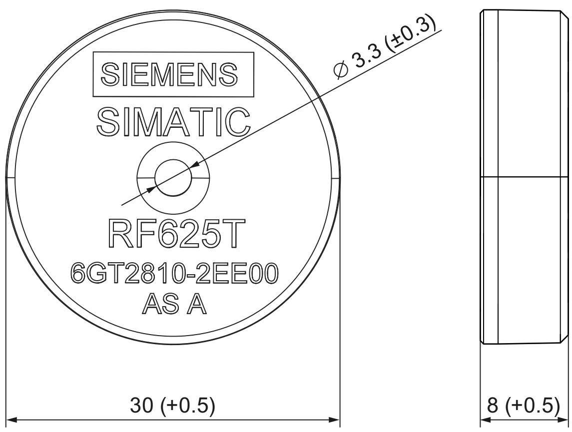


Figure 7-38 SIMATIC RF625T UHF Disk Tag

Units of measurement: All dimensions in mm

7.8 SIMATIC RF630T

7.8.1 Characteristics

The SIMATIC RF630T transponder is a passive (i.e. battery-free) and maintenance-free, cylindrical data carrier. It operates based on the UHF Class 1 Gen 2 technology and is used to save the "Electronic Product Code" (EPC) of 96 bits/240 bits. The transponder also has a 512-bit user memory.

Areas of application include the mounting of metallic components (e.g. engine assembly in the automobile industry) as well as RF identification of tools, containers and metal frames.

The RF630T is small and rugged and suitable for industrial applications with IP68/IPX9K degree of protection. It is highly resistant to oil, grease and cleaning agents.

The SIMATIC RF630T is mounted directly onto metal surfaces to ensure optimum functioning and its typical detection range is 1.2 m.

<table>
<tr><th>SIMATIC RF630T</th><th colspan="3">Features</th></tr>
<tr><td rowspan="8">
</td><td>Area of application</td><td colspan="2">Identification tasks in rugged industrial environments</td></tr>
<tr><td rowspan="2">Frequency variants</td><td>Europe</td><td>USA/Canada</td></tr>
<tr><td>868 MHz</td><td>915 MHz</td></tr>
<tr><td>Air interface</td><td colspan="2">according to ISO°18000-6C</td></tr>
<tr><td>Polarization</td><td colspan="2">Linear</td></tr>
<tr><td>Memory</td><td colspan="2">EPC 96 bit/240 bit
Add-on-memory 64 bytes</td></tr>
<tr><td>Range 1)</td><td colspan="2">max. 1.2 m</td></tr>
<tr><td>Mounting</td><td colspan="2">for direct mounting on conductive materials (preferably metal).</td></tr>
<tr><td colspan="4">1) The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".</td></tr>
</table>

7.8.2 Ordering data

Ordering data	Order no.
SIMATIC RF630T (Europe) • For attaching to metal surfaces • Frequency 865 MHz to 868 MHz	6GT2810-2EC00
SIMATIC RF630T (USA / Canada) • For attaching to metal surfaces • Frequency 902 MHz to 928 MHz	6GT2810-2EC10

7.8.3 Planning application

7.8.3.1 Optimum antenna/transponder positioning with plane mounting of the transponder on metal

The maximum reading range is achieved when the reader antenna is positioned at right angles to the mounting surface. In the case of parallel mounting directly above the transponder, detection is not possible.

Positioning of the RF660A antenna in combination with the RF670R/RF630R reader

The RF670R and RF630R reader can operate with an RF660A antenna which can be positioned as shown.

RF630T application example

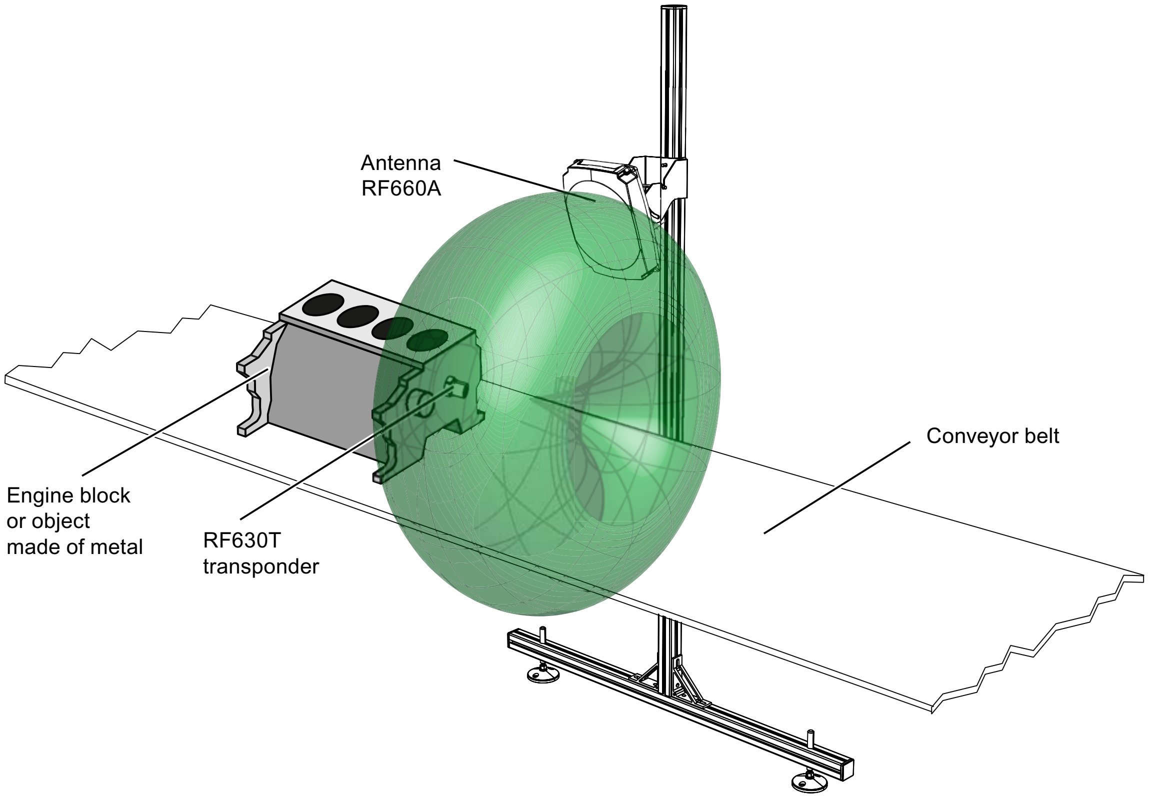


Figure 7-39 RF630T application example

Positioning of two RF660A antennas

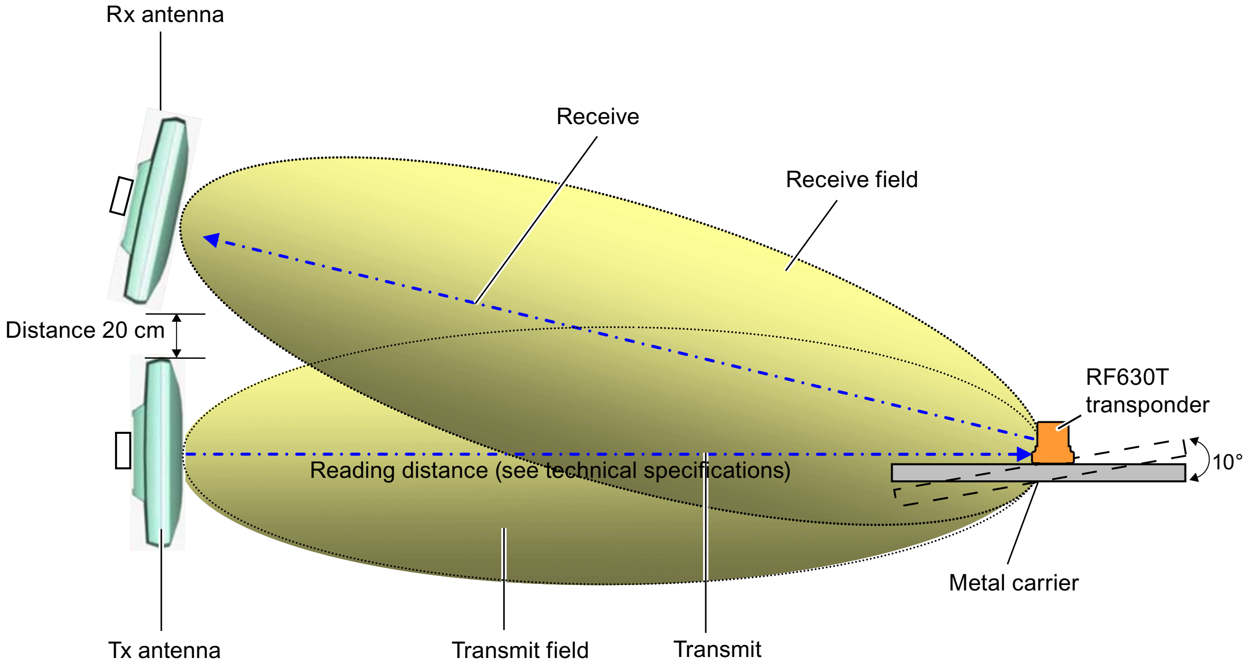


Figure 7-40 Example of optimum antenna/transponder positioning

Depending on the design of the metal bracket (surface parallel to the transmitting antenna), an angle of 10° will have a favorable effect.

Positioning of the RF620R reader

The RF620R reader with an integrated circular polarized antenna can be placed in the same position as the RF660A antennas with reference to the RF630T transponder.

Please note the different reading ranges for the RF600 readers in the section Electrical data (Page 344)

7.8.3.2 Range when mounted on flat metallic carrier plates

The transponder generally has linear polarization. The polarization axis runs as shown in the diagram below. If the tag is mounted in the center of a flat metal plate, which is either approximately square or circular, it can be aligned in any direction since the transmitting and receiving RF660A antennas operate with circular polarization.

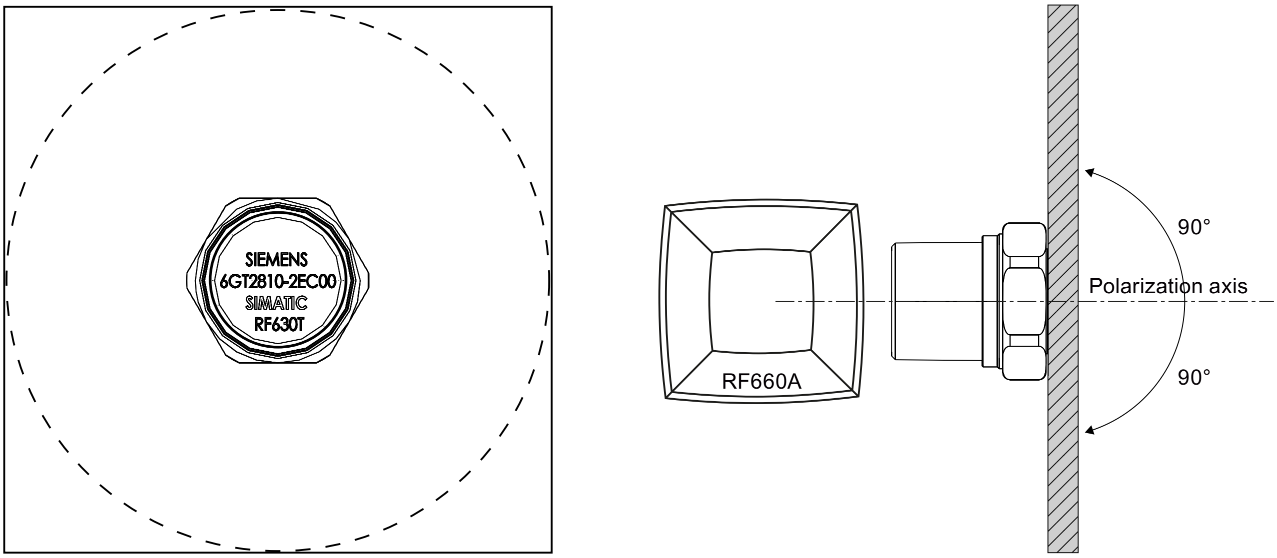


Figure 7-41 Optimum positioning of the transponder on a (square or circular) metal surface

Table 7- 22 Range on flat metallic carriers

Carrier material	Range
Metal plate of at least Ø 300 mm	100 %
Metal plate Ø 150 mm	approx. 75 %
Metal plate Ø 120 mm	approx. 50 %
Metal plate Ø 85 mm	approx. 40%

On rectangular carrier plates, the range depends on the mounting orientation of the transponder

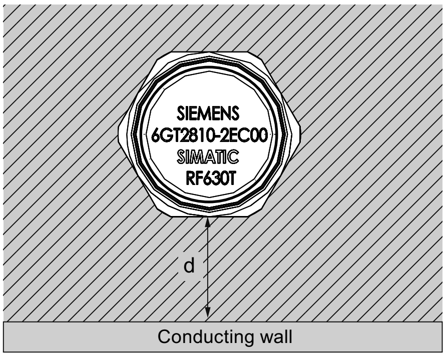
You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 275)".

7.8.3.3 Influence of conducting walls on the range

If there are conducting walls or restrictions in the vicinity that could affect the wireless field, a distance of approx. 10 cm is recommended. In principle, walls have least influence if the polarization axis is vertical to the conducting wall.

Range: One conducting wall

Influence on range when positioned against one conducting wall

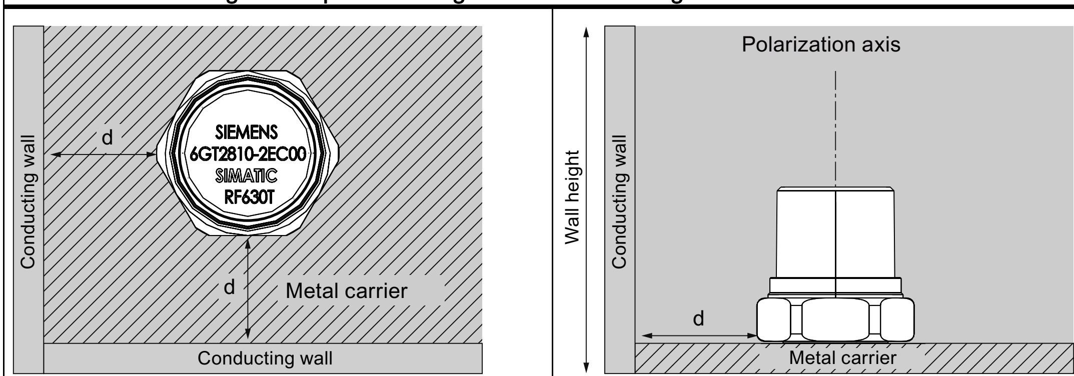


View from above

Distance d	20 mm	50 mm	100 mm	
Range	approx. 40%	approx. 40%	approx. 90 %	Wall height 20 mm
	approx. 40%	approx. 90 %	approx. 90 %	Wall height 50 mm
	approx. 40%	approx. 40%	approx. 90 %	Wall height 100 mm

Range: Two conducting walls

Influence on the range when positioned against two conducting walls



Side view

Distance d	20 mm	50 mm	100 mm	
Range	approx. 90 %	approx. 90 %	approx. 90 %	Wall height 20 mm
	approx. 25 %	approx. 90 %	approx. 90 %	Wall height 50 mm
	approx. 25 %	approx. 90 %	approx. 90 %	Wall height 100 mm

The values specified in the tables above are guide values.

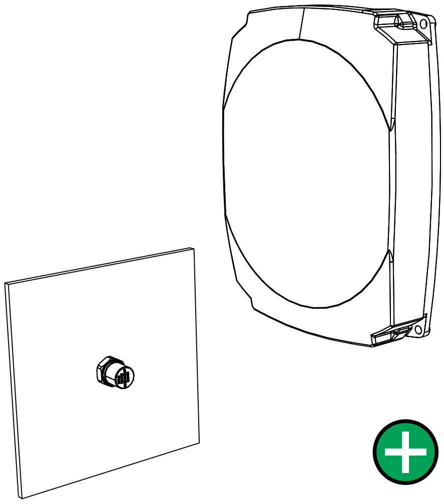
7.8.3.4 Directional radiation pattern of the transponder

Preferably, align the data carrier orthogonal to the transmitting antenna. If, however, the tag including the metallic carrier plate is tilted, the reading range will be reduced.

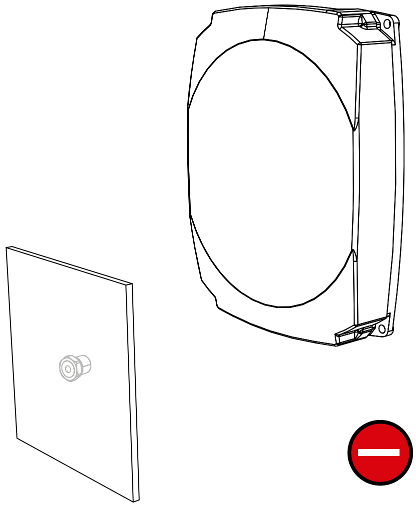
Note

Incorrect alignment of the transponder

When you align the transponder in parallel with the transmitting antenna, it cannot be read!

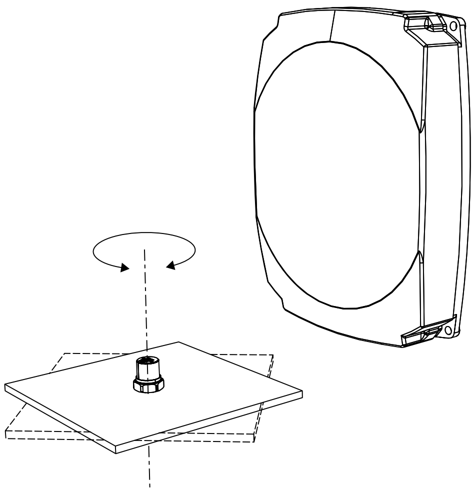


Optimum alignment of the transponder to the transmitting antenna



Incorrect alignment of the transponder to the transmitting antenna

Rotation about the polarization axis



If the transponder mounting surface is circular there is almost no change in the reading range.

Rotation of the mounting plane

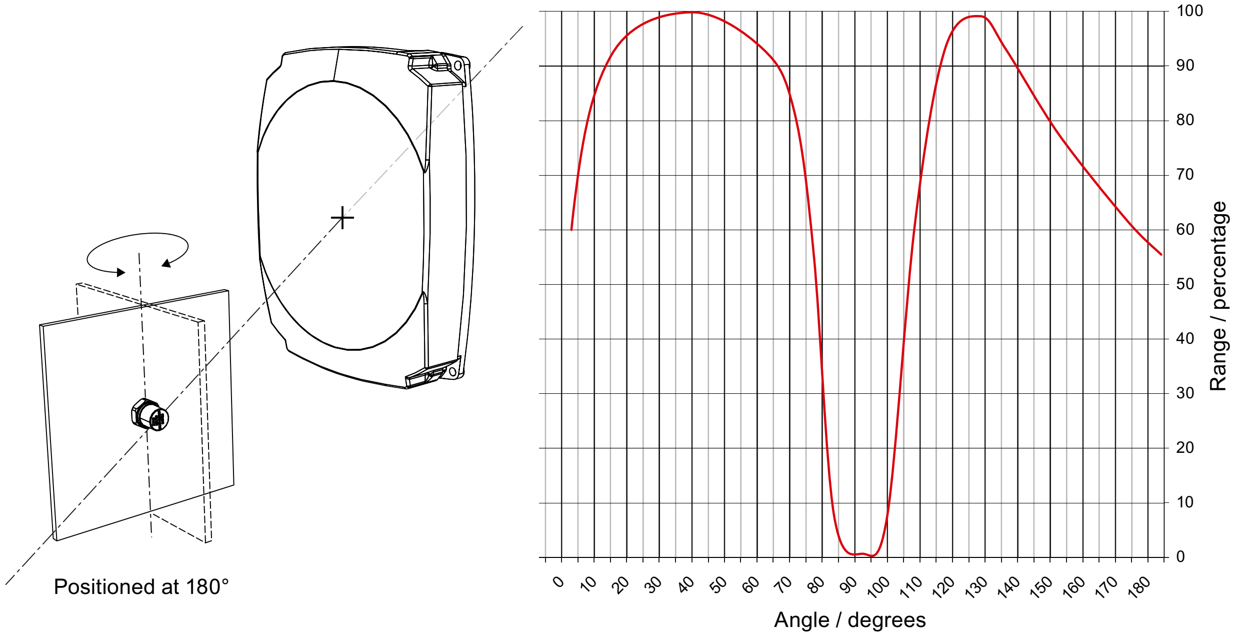


Figure 7-42 Characteristics of the transponder on rotation of the mounting plane

7.8.4 Mounting instructions

Properties	Description
Type of installation	M6 bolt fixing, spanner size 19 mm
Tightening torque	(at room temperature) ≤ 6 Nm

Note

Make sure that the mounting surface is even when mounting the transponder. Electrical contact between the mounting surface and the transponder is necessary.

Without a metal surface the transponder does not function.

7.8.5 Memory configuration of the transponder

The memory configuration of the transponder is described in the section SIMATIC memory configuration of the RF600 transponders and labels (Page 268).

7.8.6 Technical specifications

7.8.6.1 Mechanical data

Property	Description
Dimensions (D x H)	21 mm x 21 mm (without thread), tolerance 1 mm spanner size 19 mm
Design	Plastic enclosure: PA 6.6 GF, silicone-free Thread: Stainless steel
Weight	approx. 22 g
Installation	directly on metal without spacing

7.8.6.2 Electrical data

Characteristic	Description	
	Europe	USA/Canada
Air interface	According to ISO 18 000-6 C	According to ISO 18 000-6 C
Frequency range	865 ... 868 MHz	902 ... 928 MHz [1)]
Necessary transmit power	2 W (ERP)	4 W (EIRP)
Range [2)]	max. 1.5 m	max. 1.5 m
Polarization type	Linear	Linear
Energy source	Field energy via antenna, without battery	Field energy via antenna, without battery
Multitag capability	yes, minimum distance between data carriers ≥ 50 mm [3)]	yes, minimum distance between data carriers ≥ 50 mm [3)]

[1)] Reduction of range to about 70% at the band limits 902 MHz or 928 MHz; detection is guaranteed at 915 MHz due to frequency hopping procedure.

[2)] Mounting on a flat metal surface with a diameter of at least 300 mm and at room temperature. The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".

[3)] When these minimum distances are not reached, there is a reduction in the maximum possible read and write distances of the transponder.

7.8.6.3 Memory specifications

Property	Description	
Type	EPC Class 1 Gen 2	
Memory organization	EPC code	96 bits/240 bits
	User memory	64 bytes
	TID	64 bits
	Reserved (passwords)	64 bits
Protocol	ISO 18000-6C	
Data retention time	10 years	
Read cycles	Unlimited	
Write cycles	Minimum at +22 °C 100 000	

7.8.6.4 Environmental conditions

Property	Description
Temperature range during operation	-25 °C to +85 °C
Temperature range during storage	-40 °C to +125 °C
Shock Vibration compliant with EN 60721-3-7 Class 7 M3	100 g, [1)] 20 g, [1)]
Torsion and bending load	Not permissible
Degree of protection	IP68 according to EN 60529: (45 minutes. Immersion in water; water depth 1 m from top edge of enclosure at +20 °C) IPx9K according to DIN 40005-9 (steam jet-air ejector: 150 mm; 10 to 15 l/min; 100 bar; 75 °C)

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

7.8.6.5 Chemical resistance of the transponder

The following table provides an overview of the chemical resistance of the plastic cap of the transponder made of PA 6.6 GF. Different values apply to the stainless steel bolt head. It must be emphasized that the plastic enclosure is extremely resistant to chemicals in automobiles (e.g.: oil, grease, diesel fuel, gasoline) which are not listed separately.

	Concentration	20 °C	60 °C
Ammonia, w.	conc.	+	+
	20	+	+
Benzol		+	+
Bleach solution (12.5 % effective chlorine)		-	–
Butane, gas, liquid		+ 1)	Nothing specified
Butyl acetate (acetic acid butyl ester)		+ 1)	Nothing specified
Calcium chloride, saturated 10% solution		+	○
Chlorine		–	–
Chrome baths, tech.		–	–
Iron salts, w.	k. g.	-	-
Acetic acid, w.	10	○	–
Ethyl alcohol, w., undenaturated	40	+	Nothing specified
Formaldehyde	30	+	Nothing specified
Formalin		+	Nothing specified
Glycerine		+	Nothing specified
Isopropanol		+	+
Potassium hydroxide, w.	10-15 %	○	Nothing specified
Magnesium salts, w.		+ 1)	Nothing specified
Methyl alcohol, w.	50	+	Nothing specified
Lactic acid, w.		+	–
Sodium carbonate, w. (soda)		+	Nothing specified
Sodium chloride, w.		○	Nothing specified
Sodium hydroxide	10 %	+	Nothing specified
Nitrobenzol		○ 1)	Nothing specified
Phosphoric acid	10	-	-

	Concentration	20 °C	60 °C
Propane		+	Nothing specified
Nitric acid	10	-	–
Hydrochloric acid	10	-	–
Sulphur dioxide	Low	○	Nothing specified
Sulphuric acid	25	-	–
	10	-	–
Hydrogen sulphide	Dry	+	-
Carbon tetrachloride	1-4 %	+	Nothing specified

1) Nothing specified for stainless steel

Abbreviations	
+	Resistant
○	Limited resistance
–	Not resistant
w.	Aqueous solution
k. g.	Cold saturated

7.8.7 Certificates and approvals

Table 7- 23 6GT2810-2EC00 - RF630T UHF Tool Tag - Europe

Certificate	Description
CE	Conformity with R&TTE directive

Table 7- 24 6GT2810-2EC10 - RF630T Gen 2 UHF Tool Tag - USA / Canada

Standard	
FCC Federal Communications Commission	Passive labels and transponders comply with the valid regulations; certification is not required.
C UL US	This product is UL-certified for the USA and Canada. It meets the following safety standard(s): • UL508 - Industrial Control Equipment • CSA C22.2 No. 142 - Process Control Equipment • UL Report E 120869

7.8.8 Dimension drawing

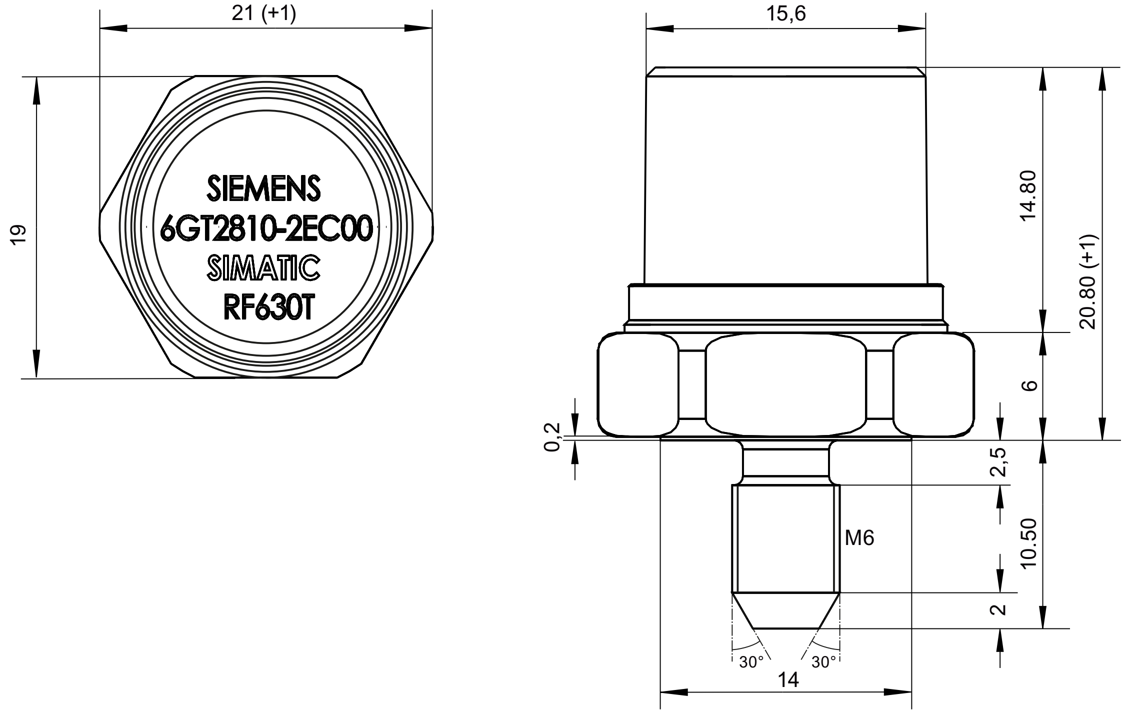


Figure 7-43 SIMATIC RF630T

Units of measurement: All dimensions in mm

General tolerances in accordance with DIN ISO 2768f.

7.9 SIMATIC RF640T Gen 2

7.9.1 Characteristics

The SIMATIC RF640T Gen 2 transponder is a passive (i.e. battery-free) and maintenance-free, round-shaped data carrier. It operates based on UHF Class 1 Gen 2 technology and is used to save the electronic product code (EPC) of 96 bits/240 bits. The transponder also has a 512-bit user memory.

The areas of application are industrial asset management, RF identification of tools, containers and metallic equipment.

The tool tag is small and rugged and suitable for industrial applications with degree of protection IP68. It is highly resistant to oil, grease and cleaning agents.

Preferably the SIMATIC RF640T is to be mounted direct on a flat metal surface of at least 150 mm diameter where it achieves a typical sensing distance of 4 m.

<table>
<tr><th>SIMATIC RF640T Gen 2</th><th colspan="3">Features</th></tr>
<tr><td rowspan="8">
</td><td>Area of application</td><td colspan="2">Identification tasks in rugged industrial environments Suitable for use in hazardous areas.</td></tr>
<tr><td rowspan="2">Frequency variants</td><td>Europe</td><td>USA/Canada</td></tr>
<tr><td>868 MHz</td><td>915 MHz</td></tr>
<tr><td>Air interface</td><td colspan="2">according to ISO°18000-6C</td></tr>
<tr><td>Polarization</td><td colspan="2">Linear</td></tr>
<tr><td>Memory</td><td colspan="2">EPC 96 bit/240 bit
Add-on-memory 64 bytes</td></tr>
<tr><td>Range 1)</td><td colspan="2">max. 4.0 m</td></tr>
<tr><td>Mounting</td><td colspan="2">for direct mounting on conductive materials (preferably metal).</td></tr>
<tr><td colspan="4">1) The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".</td></tr>
</table>

7.9.2 Ordering data

Ordering data	Order number
SIMATIC RF640T Gen 2 (Europe) • Frequency 865 MHz to 868 MHz • EPC 96 bits/240 bits • 64-byte user memory • -25 °C to +85 °C operating temperature • Dimensions (D x H) 50 mm x 8 mm	6GT2810-2DC00
SIMATIC RF640T Gen 2 (USA/Canada) • Frequency 902 MHz to 928 MHz • EPC 96 bits/240 bits • 64-byte user memory • -25 °C to +85 °C operating temperature • Dimensions (D x H) 50 mm x 8 mm	6GT2810-2DC10

7.9.3 Planning the use

7.9.3.1 Optimum antenna/transponder positioning with plane mounting of the transponder on metal

Example of optimum antenna/transponder positioning

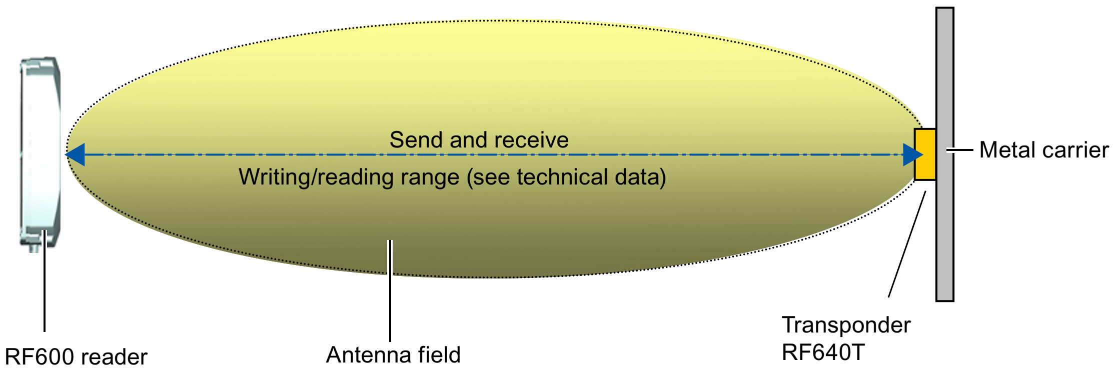


Figure 7-44 Example of optimum antenna/transponder positioning with RF600 readers and an RF600 antenna

7.9.3.2 Range when mounted on flat metallic carrier plates

The transponder generally has linear polarization. The polarization axis runs as shown in the diagram below. If the tag is mounted in the center of a flat metal plate, which is either approximately square or circular, it can be aligned in any direction since the transmitting and receiving RF660A antennas operate with circular polarization.

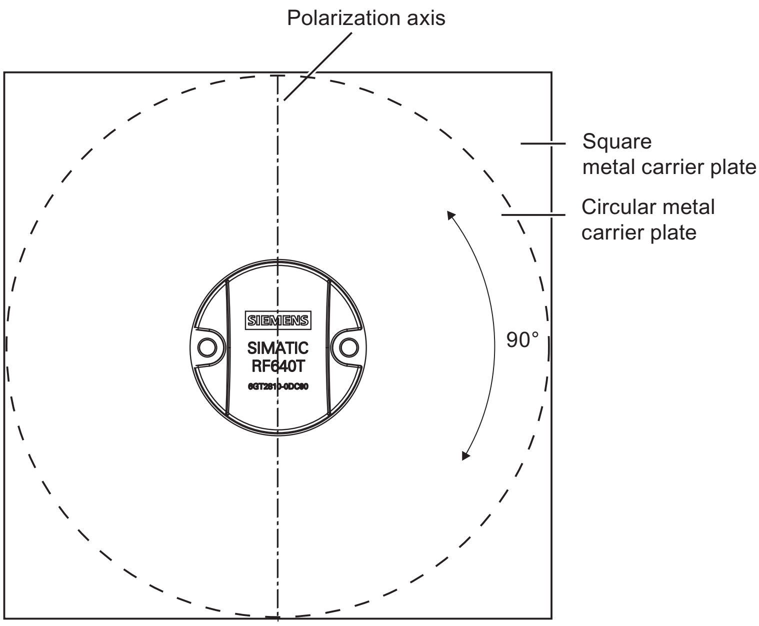


Figure 7-45 Optimum positioning of the transponder on a (square or circular) metal surface

Table 7- 25 Range on flat metallic carriers

Carrier material	Range
Metal plate of at least Ø 150 mm	100 %
Metal plate Ø 120 mm	approx. 80%
Metal plate Ø 85 mm	approx. 55%
Metal plate Ø 65 mm	approx. 40%

On rectangular carrier plates, the range depends on the mounting orientation of the transponder

You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 275)".

7.9.3.3 Range when mounted on non-metallic carrier materials

The transponder is generally designed for mounting on metallic objects which provide the conditions for the maximum reading ranges

Table 7- 26 Range with non-metallic carriers

Carrier material	Range
Transponder on wooden carrier	approx. 40%
Transponder on plastic carrier	approx. 35%
Transponder on plastic mineral water bottle	approx. 55%
Transponder without base	approx. 30%

The maximum range of 100% is achieved by mounting the transponder in a free space with low reflections on a flat metal carrier with a diameter of at least 150 mm.

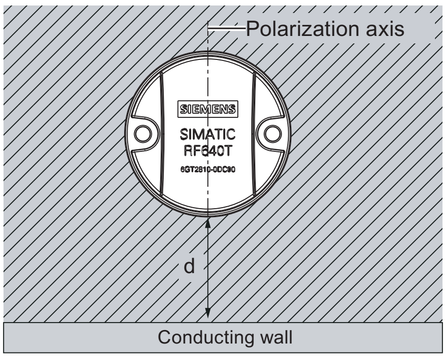
You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 275)".

7.9.3.4 Influence of conducting walls on the range

If there are conducting walls or restrictions in the vicinity that could affect the wireless field, a distance of approx. 10 cm is recommended. In principle, walls have least influence if the polarization axis is orthogonal to the wall.

Range: One conducting wall

Influence on range when positioned against one conducting wall

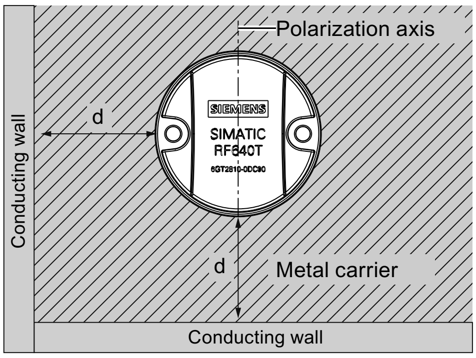


View from above

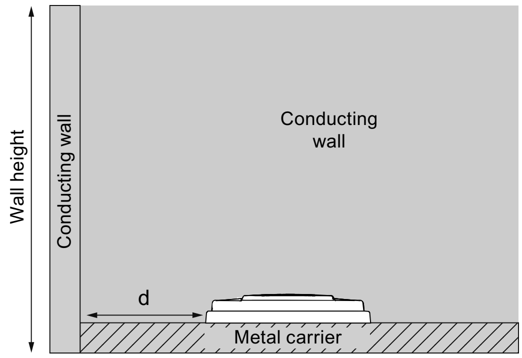
Distance d	20 mm	50 mm	100 mm	
Range	approx. 90 %	approx. 90 %	approx. 95 %	Wall height 20 mm
	approx. 80%	approx. 90 %	approx. 90 %	Wall height 50 mm
	approx. 70%	approx. 75 %	approx. 90 %	Wall height 100 mm

Range: Two conducting walls

Influence on the range when positioned against two conducting walls



View from above



Side view

Distance d	20 mm	50 mm	100 mm	
Range	approx. 75 %	approx. 90 %	approx. 90 %	Wall height 20 mm
	approx. 50 %	approx. 45 %	approx. 80%	Wall height 50 mm
	approx. 40%	approx. 45 %	approx. 75 %	Wall height 100 mm

The values specified in the tables above are guide values.

7.9.3.5 Directional radiation pattern of the transponder

Preferably, align the tag parallel to the transmitting antenna. If, however, the tag including the metallic carrier plate is tilted, the reading range will be reduced.

Rotation about the polarization axis

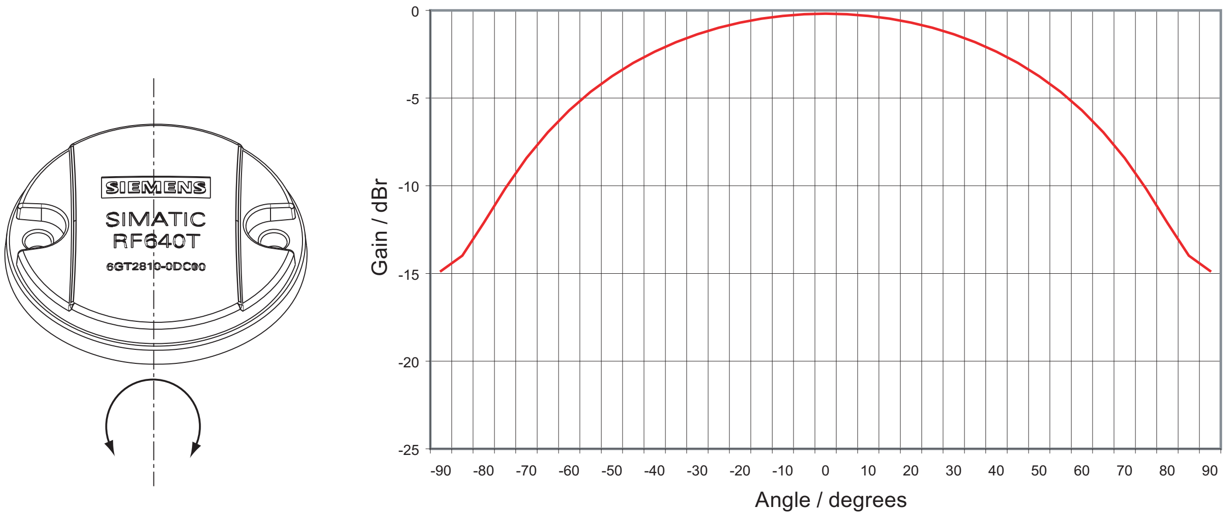


Figure 7-46 Transponder characteristics when rotated about the polarization axis

Rotation orthogonal to the polarization axis

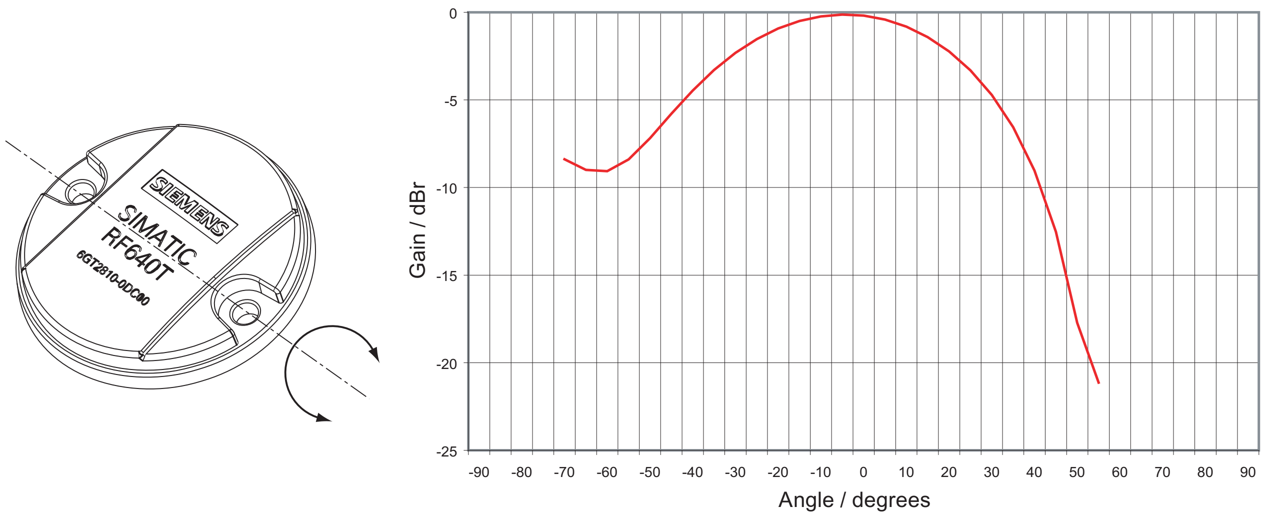


Figure 7-47 Transponder characteristics when rotated orthogonally to the polarization axis (within the tag plane)

7.9.3.6 Use of the transponder in the Ex protection area

TÜV NORD CERT GmbH, appointed center no. 0044 as per Article 9 of the Directive 94/9/EC of the European Council of 23 March 1994, has confirmed the compliance with the essential health and safety requirements relating to the design and construction of equipment and protective systems intended for use in hazardous areas as per Annex II of the Directive.

The essential health and safety requirements are satisfied in accordance with standards IEC 60079-0: 2011 and EN 60079-11: 2012.

This allows the RF640T transponder to be used in hazardous areas for gases, for the device category 2G and gas group IIC, or alternatively in hazardous areas for dusts, for the device category 2D and group IIIB.

Note

Readability of the serial number on the type plate

When using the transponder, make sure that the serial number can be read. The serial number is lasered and can be hidden by paint or other materials making it illegible.

The customer is responsible for making sure that the serial number of a transponder for the hazardous area can be read at all times.

Identification

The identification is as follows:

II 2 G Ex ib IIC T6 to T3 GB or II 2 D Ex ib IIIB T135°C DB

7.9.3.7 Use of the transponder in hazardous areas for gases

Note

Transponder labeling

The labeling of the front of the transponder shown above is an example and can vary between batches produced at different times.

This does not affect the hazardous area marking.

Temperature class delineation for gases

The temperature class of the transponder for hazardous atmospheres (gases) depends on the ambient temperature and the radiated power of an antenna in the 865 - 868 MHz frequency band within the hazardous area.

> **WARNING**
>
> **Ignitions of gas-air mixtures**
>
> When using the RF640T transponder, check to ensure that the temperature class is observed in respect of the requirements of the area of application
>
> Non-compliance with the permitted temperature ranges while using the transponder can lead to ignitions of gas-air mixtures.

WARNING

Ignitions of gas-air mixtures

The maximum transmitting power of the transmitter used to operate the transponder must not exceed 2 W.

Non-compliance with the permissible transmitting power can lead to ignitions of gas-air mixtures.

Temperature class assignment for gases and a radiated power less than 100 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 100 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature class
-25 °C to +85 °C	T5
-25 °C to +76 °C	T6

Temperature class assignment for gases and a radiated power less than 500 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 500 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature class
-25 °C to +85 °C	T4
-25 °C to +77 °C	T5
-25 °C to +62 °C	T6

Temperature class assignment for gases and radiated power for 2000 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 2000 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature class
-25 °C to +85 °C	T3
-25 °C to +65 °C	T4
-25 °C to +25 °C	T5
-25 °C to +10 °C	T6

Temperature class assignment for gases and a radiated power of 10 mW to 2000 mW ERP

If the radiated power of an antenna radiating into the hazardous area or of an antenna located in the hazardous area in the 865 - 868 MHz frequency band cannot exceed the radiated power selected in the following diagram, the maximum permitted ambient temperature range can be found in the corresponding temperature function of the diagram. This makes the following temperature class assignment valid:

Ambient temperature range	Temperature class
-25 °C to +85 °C	T2
-25 °C to +85 °C	T3
-25 °C to T_{max} (T4) °C	T4
-25 °C to T_{max} (T5) °C	T5
-25 °C to T_{max} (T6) °C	T6

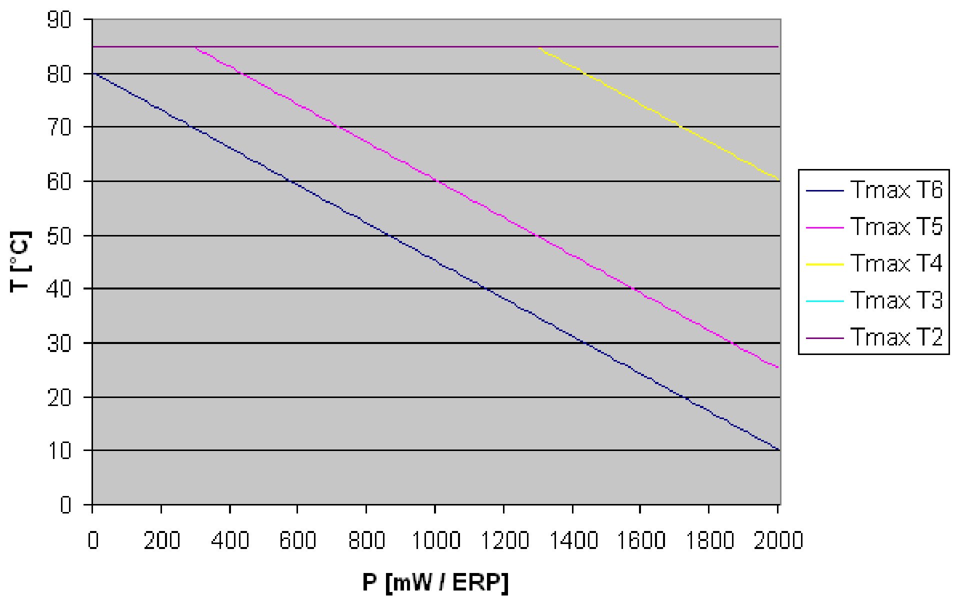


Figure 7-48 Maximum permitted ambient temperature depending on the radiated power

7.9.3.8 Use of the transponder in hazardous areas for dusts

The equipment is suitable for dusts whose ignition temperatures for a dust layer of 5 mm are higher than 210 °C (smoldering temperature). The ignition temperature specified here according to IEC 60079-0: 2011 for ignition protection type ib in this case references the smoldering temperature of a layer of combustible flyings (ib IIIA) or alternatively non-conductive dusts (ib IIIB).

Temperature class delineation for dusts

WARNING

Ignitions of dust-air mixtures

When using the RF640T transponder, check to ensure that the temperature values are complied with in connection with the requirements of the application area.

Non-compliance with the permitted temperature ranges while using the transponder can lead to ignitions of dust-air mixtures.

Temperature class assignment for dusts and a radiated power less than 100 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 100 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature value
-25 °C ≤ Ta ≤ +85 °C	T94 °C

Temperature class assignment for dusts and a radiated power less than 500 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 500 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature value
-25 °C ≤ Ta ≤ +85 °C	T108 °C

Temperature class assignment for dusts and a radiated power less than 1280 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 1280 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature value
-25 °C ≤ Ta ≤ +85 °C	T135 °C

Ambient temperature range for dust and radiated power of 2000 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 2000 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature value
-25 °C ≤ Ta ≤ +60 °C	T135 °C

Temperature class assignment for dusts and a radiated power of 10 mW ERP to 2000 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band can be between the values 10 mW ERP and 1280 mW ERP, the temperature class assignment is as follows:

Ambient temperature range	Temperature value
-25 °C ≤ Ta ≤ +85 °C	T_{value} °C [1)]

[1)] See diagram, blue line

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band can be between the values 1280 mW ERP and 2000 mW ERP, the temperature class assignment is as follows:

Ambient temperature range	Temperature value
-25 °C ≤ Ta ≤ $T_{max. ambient}$ °C [1)]	135°C

[1)] See diagram, orange line

WARNING

Ignitions of dust-air mixtures

Using the RF640T transponder with radiant power greater than 1280 mW ERP, requires compliance with the reduced maximum ambient temperature (see diagram) for maintaining the temperature value to a maximum of 135 °C.

Non-compliance with the permitted temperature ranges while using the transponder can lead to ignitions of dust-air mixtures.

The respective temperature value and the maximum allowed ambient temperature in relation to the radiated power of the antenna is shown in the diagram below:

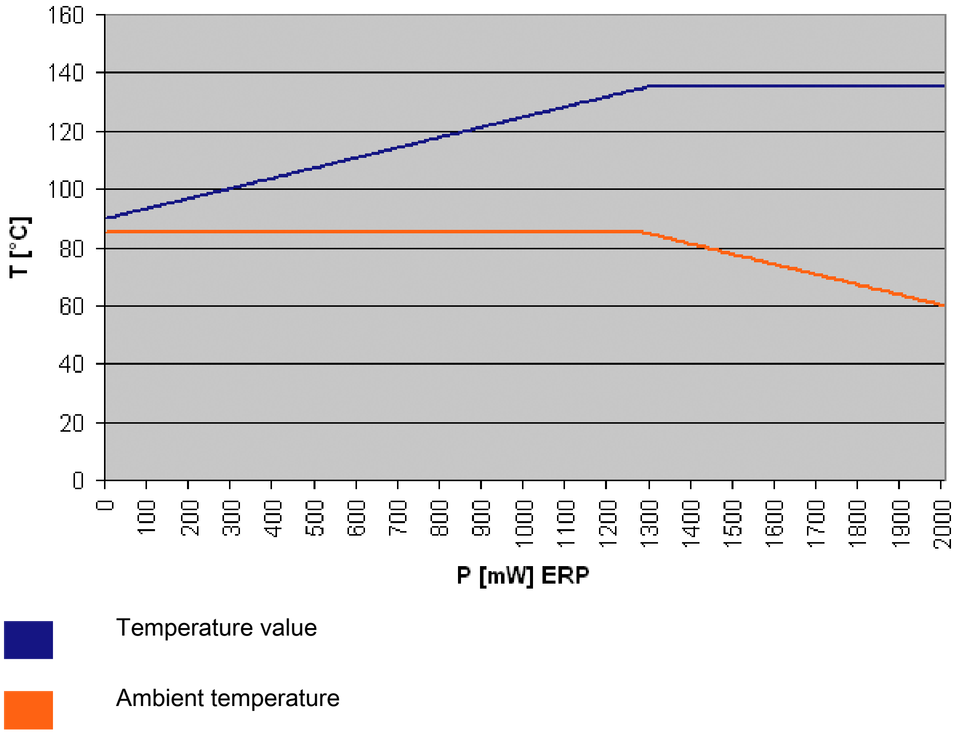


Figure 7-49 Temperature value and maximum permitted ambient temperature in relation to the radiated power

7.9.4 Mounting instructions

Properties	Description
Type of installation	Screw mounting ①, (M4 screws) (two DIN 433 washers and two M4 hexagon socket head cap screws DIN 6912)
Tightening torque	(at room temperature) < 1.2 Nm

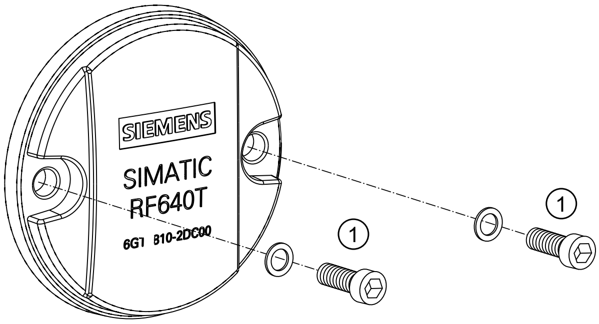
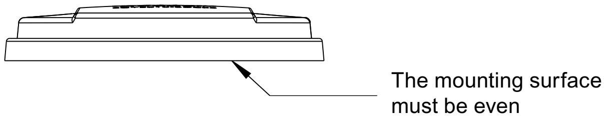


Figure 7-50 Screw mounting

Note

Make sure that the mounting surface is even when mounting the transponder.



7.9.5 Memory configuration of the transponder

The memory configuration of the transponder is described in the section SIMATIC memory configuration of the RF600 transponders and labels (Page 268).

7.9.6 Technical Specifications

7.9.6.1 Mechanical data

Property	Description
Dimensions (D x H)	50 mm x 8 mm (+1 mm)
Design	PCB with integrated antenna
Design	Plastic enclosure (PA12), silicone-free
Weight	approx. 13 g
Mounting on metal	directly on metal without spacing

7.9.6.2 Electrical data

Characteristic	Description	
	Europe	USA/Canada
Air interface	According to ISO 18 000-6 C	According to ISO 18 000-6 C
Frequency range	865 ... 868 MHz	902 ... 928 MHz [1)]
Necessary transmit power	2 W (ERP)	4 W (EIRP)
Range [2)]	max. 4.0 m	max. 4.0 m
Polarization type	Linear	Linear
Energy source	Field energy via antenna, without battery	Field energy via antenna, without battery
Multitag capability	yes, minimum distance between data carriers ≥ 50 mm [3)]	yes, minimum distance between data carriers ≥ 50 mm [3)]

[1)] Reduction of range to about 70% at the band limits 902 MHz or 928 MHz; acquisition is guaranteed at 915 MHz due to frequency hopping procedure.

[2)] Mounting on a flat metal surface with a diameter of at least 150 mm and at room temperature. The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".

[3)] When these minimum distances are not reached, there is a reduction in the maximum possible read and write distances of the transponder.

7.9.6.3 Memory specifications

Property	Description	
Type	EPC Class 1 Gen 2	
Memory organization	EPC code	96 bits/240 bits
	User memory	64 bytes
	TID	64 bits
	Reserved (passwords)	64 bits
Protocol	ISO 18000-6C	
Data retention time	10 years	
Read cycles	Unlimited	
Write cycles	Minimum at +22 °C 100 000	

7.9.6.4 Environmental conditions

Property	Description
Temperature range when operating in non-hazardous areas	-25 °C … 85 °C[1)]
Temperature range when operating in areas at risk of a gas explosion with temperature class T3-T6	See alsoUse of the transponder in hazardous areas for gases (Page 356) [2)]
Temperature range when operating in areas at risk of dust explosions with temperature value ≤ T135 °C	See alsoUse of the transponder in hazardous areas for dusts (Page 359) [2)]

Property	Description
Temperature range during storage	-40 °C … 125 °C[1)]
Shock Vibration compliant with EN 60721-3-7 Class 7 M3	100 g, [3)] 20 g, [3)]
Torsion and bending load	Not permissible
Degree of protection	IP68 according to EN 60529: (45 minutes. immersion in water; water depth 1 m from top edge of housing at +20 °C)
	IP x9K according to EN 60529: • Steam blaster nozzle distance 150 mm • 10 ... 15 l of water per minute • Pressure 100 bar • Temperature 75 °C • Test time 30 seconds

[1)] At temperatures above 70 °C the casing may distort slightly; this does not however cause any impairment of function (mechanical or electrical).

[2)] Directive 94/9/EC of the European Council of 23 March 1994 must be complied with, see also Chapter "Using the transponder in hazardous areas".

[3)] The values for shock and vibration are maximum values and must not be applied continuously.

WARNING

Ignitions of gas-air or dust-air mixtures

When using the RF640T transponder, check to ensure that the temperature values are observed in respect of the requirements of the hazardous area of application.

Non-compliance with the permitted temperature ranges while using the transponder can lead to ignitions of gas-air or dust-air mixtures.

Note

Damage to the surface of the housing

The values specified for the IP x9K test are maximum values and must not be applied continuously.

Protracted loading of the transponder can lead to damage to the surface of the housing due to high pressures.

7.9.6.5 Chemical resistance of the RF640T transponder

The following table gives an overview of the chemical composition of the data memory made from polyamide 12. The plastic housing has a notably high resistance to chemicals used in automobiles (e.g.: oil, grease, diesel fuel, gasoline) which are not listed separately.

	Concentration	20 °C	60 °C
Battery acid	30	○○	–
Ammonia gas		○○○○	○○○○
Ammonia, w.	conc.	○○○○	○○○○
	10	○○○○	○○○○
Benzol		○○○○	○○○
Bleach solution (12.5 % effective chlorine)		○○	–
Butane, gas, liquid		○○○○	○○○○
Butyl acetate (acetic acid butyl ester)		○○○○	○○○○
Calcium chloride, w.		○○○○	○○○
Calcium nitrate, w.	k. g.	○○○○	○○○
Chlorine		–	–
Chrome baths, tech.		–	–
Iron salts, w.	k. g.	○○○○	○○○○
Acetic acid, w.	50	–	–
Ethyl alcohol, w., undenaturated	96	○○○○	○○○
	50	○○○○	○○○○
Formaldehyde, w.	30	○○○	–
	10	○○○○	○○○
Formalin		○○○	–
Glycerine		○○○○	○○○○
Isopropanol		○○○○	○○○
Potassium hydroxide, w.	50	○○○○	○○○○
Lysol		○○	–
Magnesium salts, w.	k. g.	○○○○	○○○○
Methyl alcohol, w.	50	○○○○	○○○○
Lactic acid, w.	50	○○	–
	10	○○○	○○
Sodium carbonate, w. (soda)	k. g.	○○○○	○○○○
Sodium chloride, w.	k. g.	○○○○	○○○○
Sodium hydroxide		○○○○	○○○○
Nickel salts, w.	k. g.	○○○○	○○○○
Nitrobenzol		○○○	○○
Phosphoric acid	10	○	V
Propane		○○○○	○○○○
Mercury		○○○○	○○○○
Nitric acid	10	○	–
Hydrochloric acid	10	○	–

	Concentration	20 °C	60 °C
Sulphur dioxide	Low	○○○○	○○○○
Sulphuric acid	25	○○	–
	10	○○○	–
Hydrogen sulphide	Low	○○○○	○○○○
Carbon tetrachloride		○○○○	○○○○
Toluene		○○○○	○○○
Detergent	High	○○○○	○○○○
Plasticizer		○○○○	○○○○

Abbreviations	
○○○○	Resistant
○○○	Virtually resistant
○○	Limited resistance
○	Less resistant
–	Not resistant
w.	Aqueous solution
k. g.	Cold saturated

7.9.7 Certificates and approvals

Table 7- 27 6GT2810-2DC00 - RF640T Gen 2 UHF Tool Tag - Europe

Certificate	Description
	CE approval according to R&TTE guideline
	For Directive 94/9/EC: EC type test certification no. TÜV 07 ATEX 346241 Recognition of the quality assurance BVS 11 ATEX ZQS/E111

Table 7- 28 6GT2810-2DC10 - RF640T Gen 2 UHF Tool Tag - USA/Canada

Standard	
FCC Federal Communications Commission	Passive labels or transponders comply with the valid regulations; certification is not required.
	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

7.9.7.1 EC Declaration of Conformity according to directive 94/9EC RF640T Gen 2 UHF Tool Tag Version 1

The type test certification for the RF640T Gen 2 UHF Tool Tag Version 1 is stored by TÜV 07 ATEX 346241. On the basis of this certification, the CE declaration by the manufacturer has been made according to directive 94/9/EC.
The producing factory of the RF640T Gen 2 UHF Tool Tag Version 1 has an ATEX quality assurance system recognized by the DEKRA EXAM GmbH with certificate number BVS 11 ATEX ZQS/E111.

Manufacturer's address - distributor

Siemens Aktiengesellschaft
Industry Sector (I)
Industry Automation Division (IA)
Sensors and Communication (SC)
Communication and Identification (CI)
Gleiwitzer Str. 555
D-90475 Nürnberg, Germany

Manufacturer's address - factory

Siemens Aktiengesellschaft
Industry Sector (I)
Industry Automation Division (IA)
Control Components and System Engineering (CE)
Würzburger Straße 121
D-90766 Fürth, Germany

7.9.8 Dimension drawing

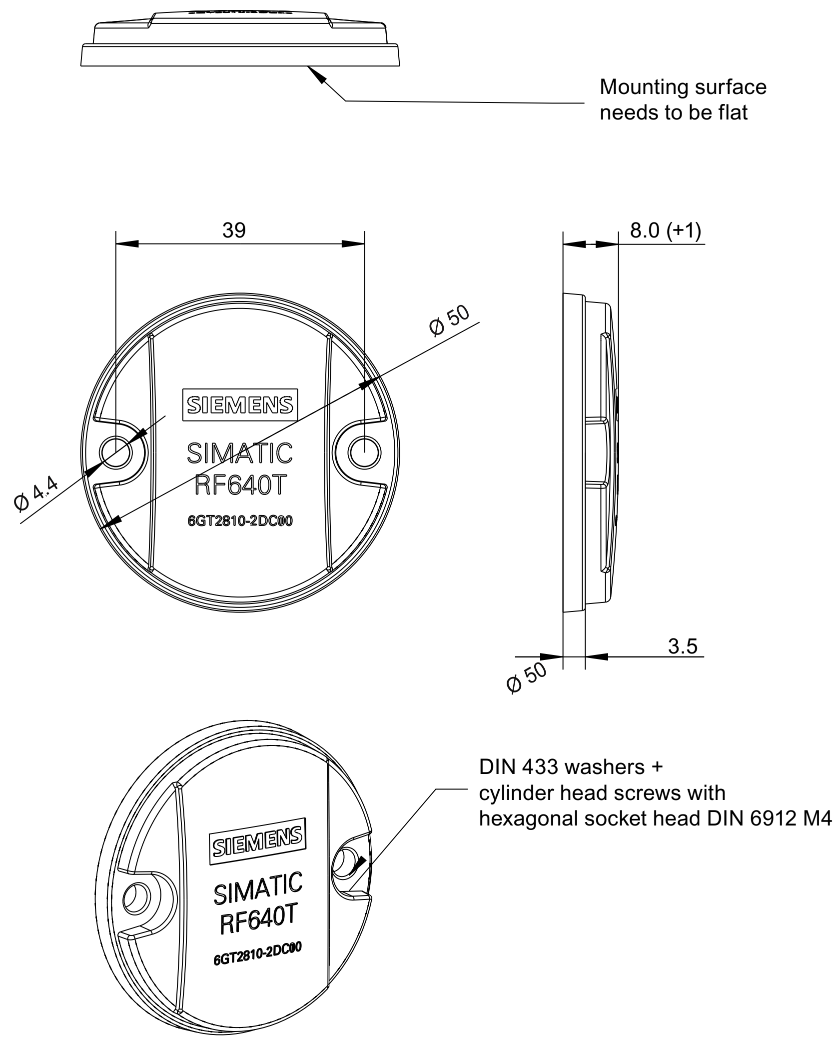


Figure 7-51 SIMATIC RF640T Gen 2 UHF Tool Tag Version 1

Units of measurement: All dimensions in mm

7.10 SIMATIC RF680T

7.10.1 Characteristics

The heat-resistant SIMATIC RF680T transponder is a passive, maintenance-free data carrier. It operates based on UHF Class 1 Gen 2 technology and is used to save the "Electronic Product Code" (EPC) of 96 bits/240 bits. The transponder also has a 512-bit user memory.

These transponders with limited service life are ideally suited to high-temperature applications
(e.g. the painting of vehicle bodies) as well as applications in production logistics.

The RF680T is rugged and suitable for industrial applications with IP68/IPX9K degree of protection. It is highly resistant to oil, grease and cleaning agents.

The SIMATIC RF680T is mounted directly onto metal and non-metal carrier plates to ensure optimum operation and has a typical detection range of 6.7 m.

SIMATIC RF680T	Features	
	Area of application	Applications with high temperatures (up to +220 °C). Suitable for use in hazardous areas. Typical application areas: • Paint shops and their preparatory treatments, incl. drying ovens • Electrophoretic deposition area • Primer coat incl. drying oven • Top coat area incl. drying oven • Washing areas at temperatures > 85 °C
	Frequency range	865 ... 928 MHz (ETSI and FCC)
	Air interface	according to ISO°18000-6C
	Polarization	Linear
	Temperature range	up to 220 °C
	Memory	EPC 96 bit/240 bit Add-on-memory 64 bytes
	Range [1)]	max. 7 m
	Mounting	Suitable for direct mounting on conductive and non-conductive materials.
	Material	Plastic PPS; silicone-free
	Dimensions	130 x 32 x 15 mm
[1)] The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".		

7.10.2 Ordering data

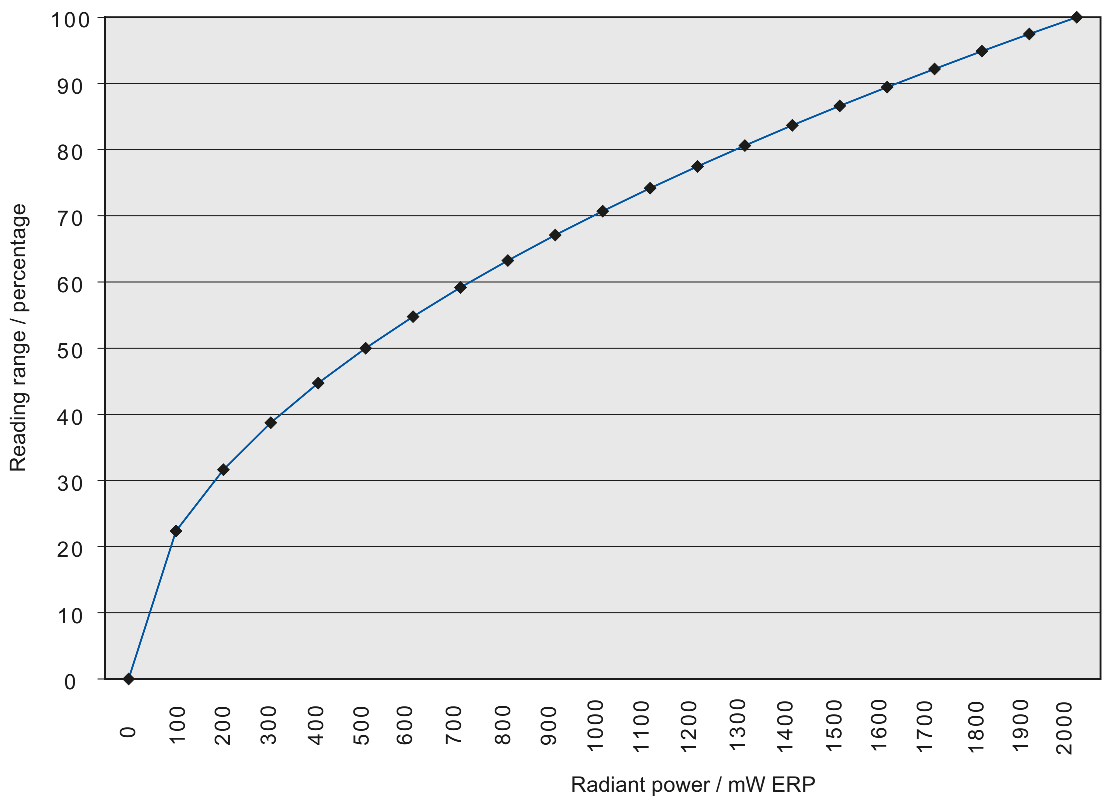
Ordering data	Order no.
SIMATIC RF680T • Frequency 865 MHz to 928 MHz • EPC 96 bit/240 bit (64 bytes user memory) • -25 ... +220 °C • 130 x 32 x 15 mm	6GT2810-2HG80

7.10.3 Planning the use

The absolute values of the reading ranges specified below refer to a transmit power of 2 W ERP.

When the power is reduced (e.g. when a different reader is used), you will find the corresponding reduced reading ranges in the following table:

Relationship between radiant power and reading range



7.10.3.1 Range when mounted on non-metallic carrier materials

The RF680T transponder is a universal transponder for mounting on many different types of carrier materials.

Table 7- 29 Range for non-metal carriers (RF670R = 2 W ERP;)

Carrier material	Range
Transponder on wooden carrier (dry, degree of moisture < 15%)	typically 50 %
Transponder on plastic carrier	typically 50 %
Transponder on glass	typically 50 %

The maximum range of 100% is achieved by mounting the transponder in a free space with low reflections on a flat metal carrier with a diameter of at least 300 mm.

You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 275)".

7.10.3.2 Directional radiation pattern of the transponder on non-metallic surfaces

It is recommendable to align the transponder parallel to the transmitting antenna. If, however, the transponder including the metallic carrier plate is tilted, the reading range will be reduced.

Rotation about the polarization axis

Polarization axis

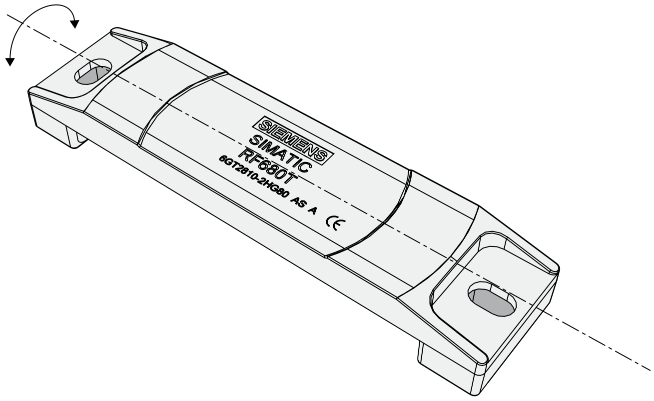


Figure 7-52 Rotation of the transponder about the polarization axis

Generally the range does not change when the transponder without carrier material is rotated about the polarization axis.

Rotation orthogonal to the polarization axis

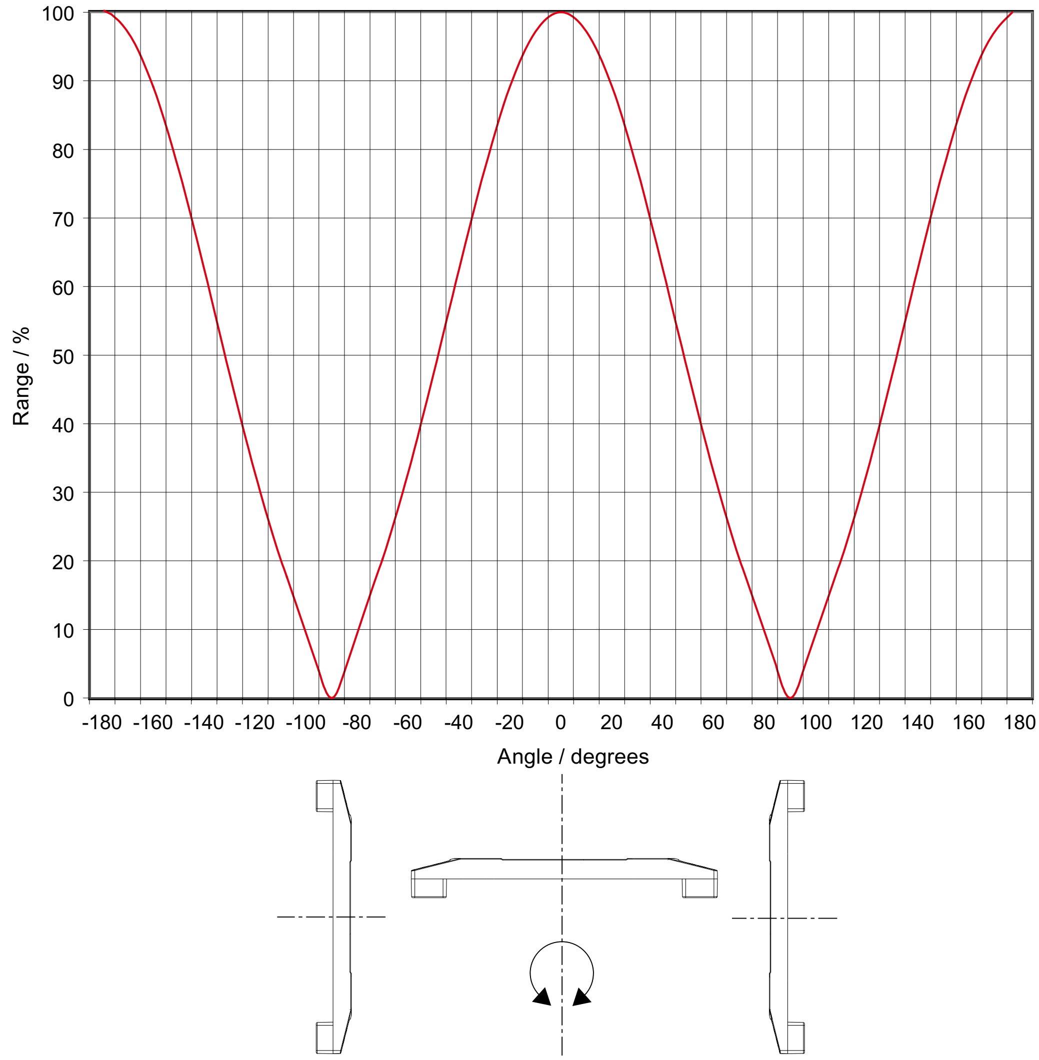


Figure 7-53 Transponder characteristics when rotated orthogonally to the polarization axis (within the tag plane)

If the transponder is positioned orthogonally to the transmitting antenna, it normally cannot be read. Therefore the transponder is preferably to be aligned parallel to the transmitting antenna. The following figure illustrates this situation.

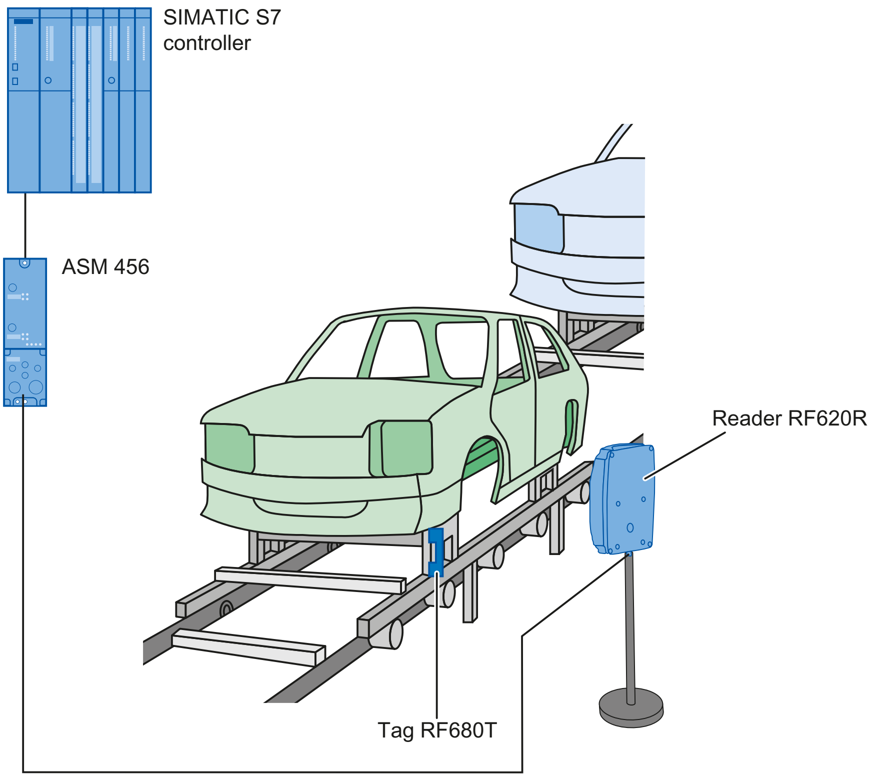


Figure 7-54 Application example

7.10.3.3 Optimum antenna/transponder positioning with plane mounting of the transponder on metal

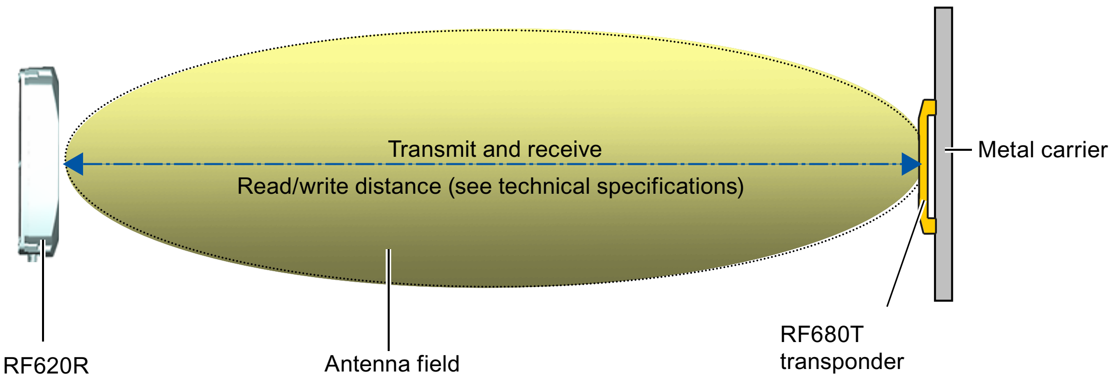


Figure 7-55 Example of optimum antenna/transponder positioning

7.10.3.4 Range when mounted on flat metallic carrier plates

The transponder generally has linear polarization. The polarization axis runs as shown in the diagram below. If the transponder is centrally mounted on a plane metal plate, which may either be almost square or circular, it can be aligned in any direction if the transmitting and receiving antennas operate with circular polarization (such as RF660A and RF620R).

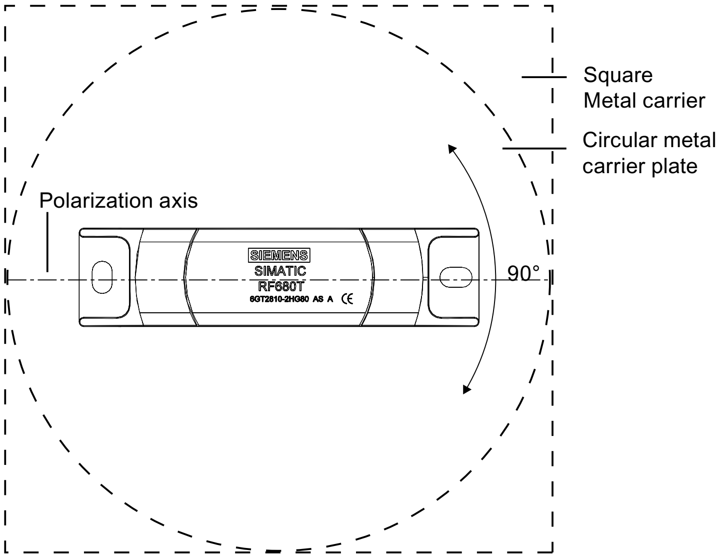


Figure 7-56 Optimum positioning of the transponder on a (square or circular) metal surface

Table 7- 30 Range on flat metallic carriers

Carrier material	Range Europe	Range USA
Metal plate 150 x 150 mm	typically 50 %	typically 50 %
Metal plate 300 x 300 mm	typically 100 %	typically 100 %

On rectangular carrier plates, the range depends on the mounting orientation of the transponder A 90° rotation of the transponder about the axis of symmetry may result in greater ranges.

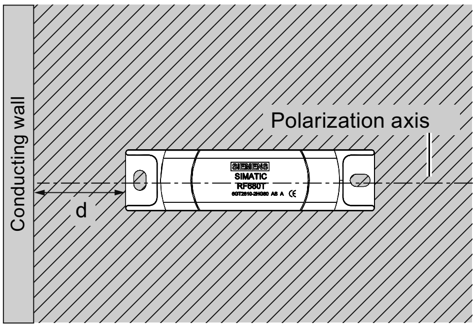
You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 275)".

7.10.3.5 Influence of conducting walls on the range

If there are conducting walls or restrictions in the vicinity that shade the radio field, a distance of approx. 10 cm is recommended between the transponder and the wall. In principle, walls have least influence if the polarization axis is orthogonal to the wall.

Range: One conducting wall

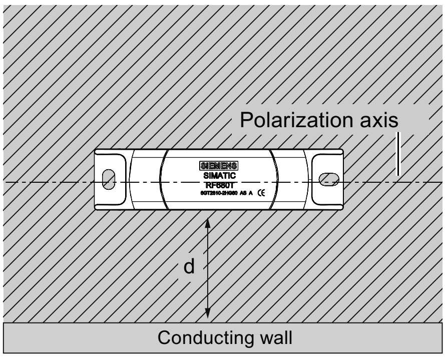
Influence on the range when positioned orthogonally to the conducting wall



View from above

Distance d	20 mm	50 mm	100 mm	
Range	approx. 100%	approx. 100%	approx. 100%	Wall height 20 mm
	approx. 100%	approx. 100%	approx. 100%	Wall height 50 mm
	approx. 80%	approx. 100%	approx. 100%	Wall height 100 mm

Influence on the range when positioned parallel to the conducting wall

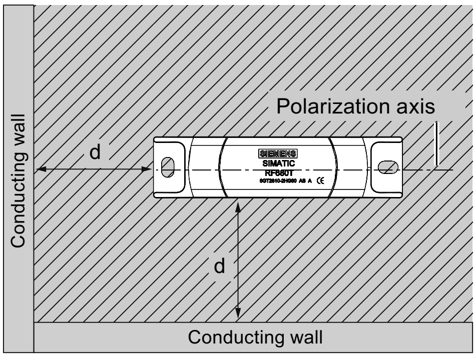


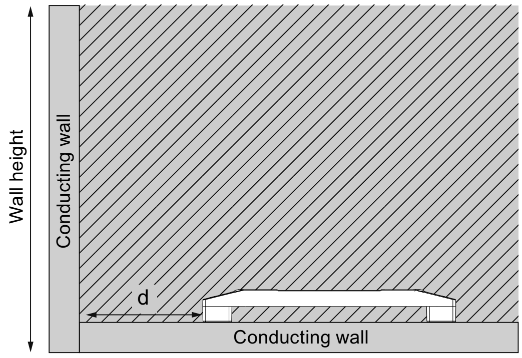
View from above

Distance d	20 mm	50 mm	100 mm	
Range	approx. 50%	approx. 70%	approx. 90%	Wall height 20 mm
	approx. 40%	approx. 70%	approx. 90%	Wall height 50 mm
	approx. 30%	approx. 50%	approx. 90%	Wall height 100 mm

Range: Two conducting walls

Influence on the range when positioned against two conducting walls





Side view

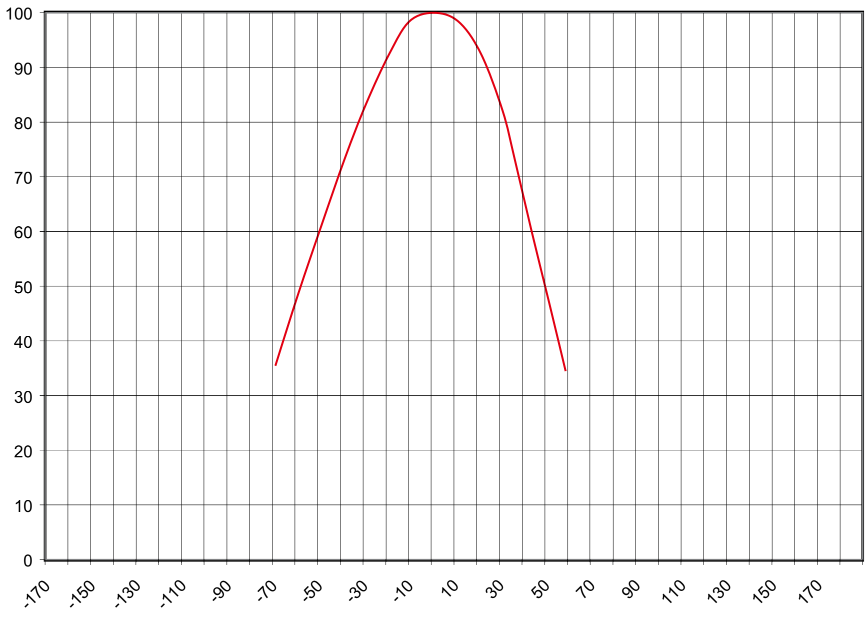
Distance d	20 mm	50 mm	100 mm	
Range	approx. 50%	approx. 70%	approx. 90%	Wall height 20 mm
	approx. 30%	approx. 60%	approx. 90%	Wall height 50 mm
	approx. 25%	approx. 50%	approx. 90%	Wall height 100 mm

The values specified in the tables above are guide values.

7.10.3.6 Directional radiation pattern of the transponder on metallic surfaces

It is recommendable to align the transponder parallel to the transmitting antenna. If, however, the transponder including the metallic carrier plate is tilted, the reading range will be reduced.

Rotation about the polarization axis or orthogonal to the polarization axis



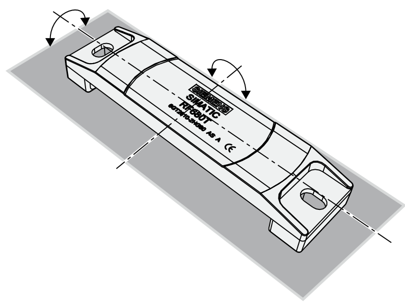


Figure 7-57 Characteristic of the transponder when rotated about the polarization axis or orthogonally to the polarization axis

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Note

Please note that the directional effect is dependent on the size of the metal surface. The larger the metal surface, the larger the directional effect.

7.10.3.7 Use of the transponder in hazardous areas

TÜV NORD CERT GmbH, appointed center no. 0044 as per Article 9 of the Directive 94/9/EC of the European Council of 23 March 1994, has confirmed the compliance with the essential health and safety requirements relating to the design and construction of equipment and protective systems intended for use in hazardous areas as per Annex II of the Directive.

The essential health and safety requirements are satisfied in accordance with standards IEC 60079-0:2011 and EN 60079-11:2012.

This allows the RF680T transponder to be used in hazardous areas for gases, for the device category 2G and gas group IIB, or alternatively in hazardous areas for dusts, for the device category 2D and group IIIB.

Note

Readability of the serial number on the type plate

When using the transponder, make sure that the serial number can be read. The serial number is lasered and can be hidden by paint or other materials making it illegible.

The customer is responsible for making sure that the serial number of a transponder for the hazardous area can be read at all times.

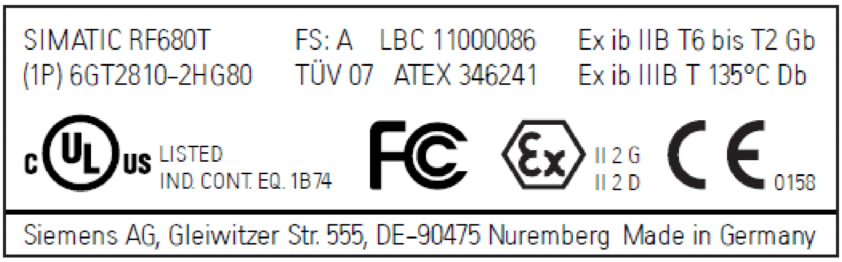
Identification

The identification is as follows:

II 2G Ex ib IIB T6 to T2 Gb or

II 2D Ex ib IIIB T135 °C Db

7.10.3.8 Use of the transponder in hazardous areas for gases



Note

Transponder labeling

The labeling of the front of the transponder shown above is an example and can vary between batches produced at different times.

This does not affect the hazardous area marking.

Temperature class delineation for gases

The temperature class of the transponder for hazardous atmospheres (gases) depends on the ambient temperature and the radiated power of an antenna in the 865 - 868 MHz frequency band within the hazardous area.

WARNING

Ignitions of gas-air mixtures

When using the RF680T transponder, check to make sure that the temperature class is adhered to in keeping with the requirements of the area of application Non-compliance with the permitted temperature ranges while using the transponder can lead to ignitions of gas-air mixtures.

WARNING

Ignitions of gas-air mixtures

The maximum transmitting power of the transmitter used to operate the transponder must not exceed 2 W. Non-compliance with the permissible transmitting power can lead to ignitions of gas-air mixtures.

Temperature class assignment for gases and a radiated power less than 100 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 100 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature class
-25 °C ... +200 °C	T2
-25 °C ... +190 °C	T3
-25 °C ... +125 °C	T4
-25 °C ... +90 °C	T5
-25 °C ... +75 °C	T6

Temperature class assignment for gases and a radiated power less than 500 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 500 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature class
-25 °C ... +220 °C	T2
-25 °C ... +173 °C	T3
-25 °C ... +108 °C	T4
-25 °C ... +73 °C	T5
-25 °C ... +58 °C	T6

Temperature class assignment for gases and radiated power for 1000 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 1000 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature class
-25 °C ... +220 °C	T2
-25 °C ... +151 °C	T3
-25 °C ... +86 °C	T4
-25 °C ... +51 °C	T5
-25 °C ... +36 °C	T6

Temperature class assignment for gases and radiated power for 2000 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 2000 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature class
-25 °C ... +208 °C	T2
-25 °C ... +108 °C	T3
-25 °C ... +43 °C	T4
-25 °C ... +8 °C	T5

Temperature class assignment for gases and a radiated power of 10 mW to 2000 mW ERP

If the radiated power of an antenna radiating into the hazardous area or of an antenna located in the hazardous area in the 865 - 868 MHz frequency band cannot exceed the radiated power selected in the following diagram, the maximum permitted ambient temperature range can be found in the corresponding temperature function of the diagram. This makes the following temperature class assignment valid:

Ambient temperature range	Temperature class
-25 °C ... T_{max} (T2) °C	T2
-25 °C ... T_{max} (T3) °C	T3
-25 °C ... T_{max} (T4) °C	T4
-25 °C ... T_{max} (T5) °C	T5
-25 °C ... T_{max} (T6) °C	T6

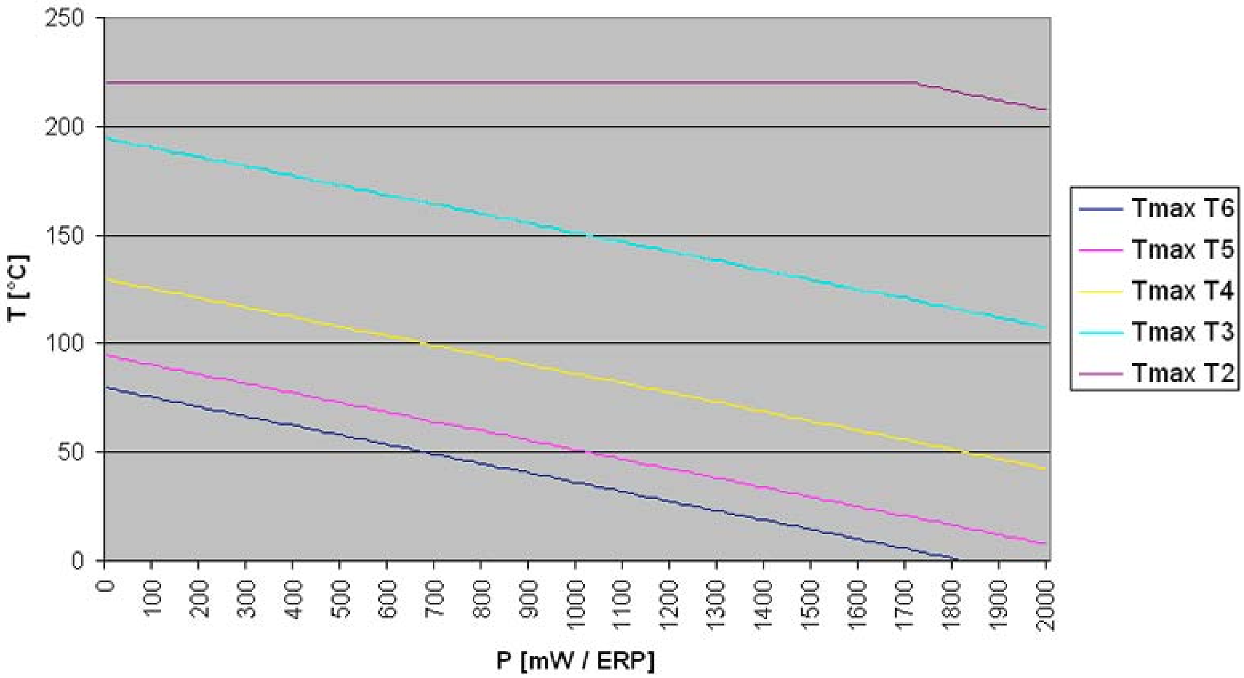


Figure 7-58 Maximum permitted ambient temperature depending on the radiated power

7.10.3.9 Use of the transponder in hazardous areas for dusts

The equipment is suitable for dusts whose ignition temperatures for a dust layer of 5 mm are higher than 210 °C (smoldering temperature). The ignition temperature specified here according to IEC 60079-0:2011 for ignition protection type ib in this case references the smoldering temperature of a layer of combustible flyings (ib IIIA) or alternatively non-conductive dusts (ib IIIB).

Temperature class delineation for dusts

WARNING
Ignitions of dust-air mixtures
When using the RF680T transponder, check to make sure that the temperature values are adhered to in keeping with the requirements of the area of application Non-compliance with the permitted temperature ranges while using the transponder can lead to ignitions of dust-air mixtures.

Temperature class assignment for dusts and a radiated power less than 100 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 100 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature value
-25 °C ≤ Ta ≤ +125 °C	T135 °C

Temperature class assignment for dusts and a radiated power less than 500 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 500 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature value
-25 °C ≤ Ta ≤ +108 °C	T135 °C

Temperature class assignment for dusts and a radiated power less than 1000 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 1000 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature value
-25 °C ≤ Ta ≤ +86 °C	T135 °C

Ambient temperature range for dust and radiated power of 2000 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band cannot exceed the value 2000 mW, the temperature class assignment is as follows:

Ambient temperature range	Temperature value
-25 °C ≤ Ta ≤ +43 °C	T135 °C

Temperature class assignment for dusts and a radiated power of 10 mW ERP to 2000 mW ERP

If the radiated power of an antenna radiating into the hazardous area or located in the hazardous area and operating in the 865 - 868 MHz frequency band can be between the values 10 mW ERP and 2000 mW ERP, the temperature class assignment is as follows:

Ambient temperature range	Temperature value
-25 °C ≤ Ta ≤ $T_{max. ambient}$ °C [1]	135°C [2]

[1] See diagram, orange line

[2] See diagram, blue line

WARNING

Ignitions of dust-air mixtures

Using the RF680T transponder with radiant power greater than 1280 mW ERP, requires compliance with the reduced maximum ambient temperature (see diagram) for maintaining the temperature value to a maximum of 135 °C. Non-compliance with the permitted temperature ranges while using the transponder can lead to ignitions of dust-air mixtures.

The respective temperature value and the maximum allowed ambient temperature in relation to the radiated power of the antenna is shown in the diagram below:

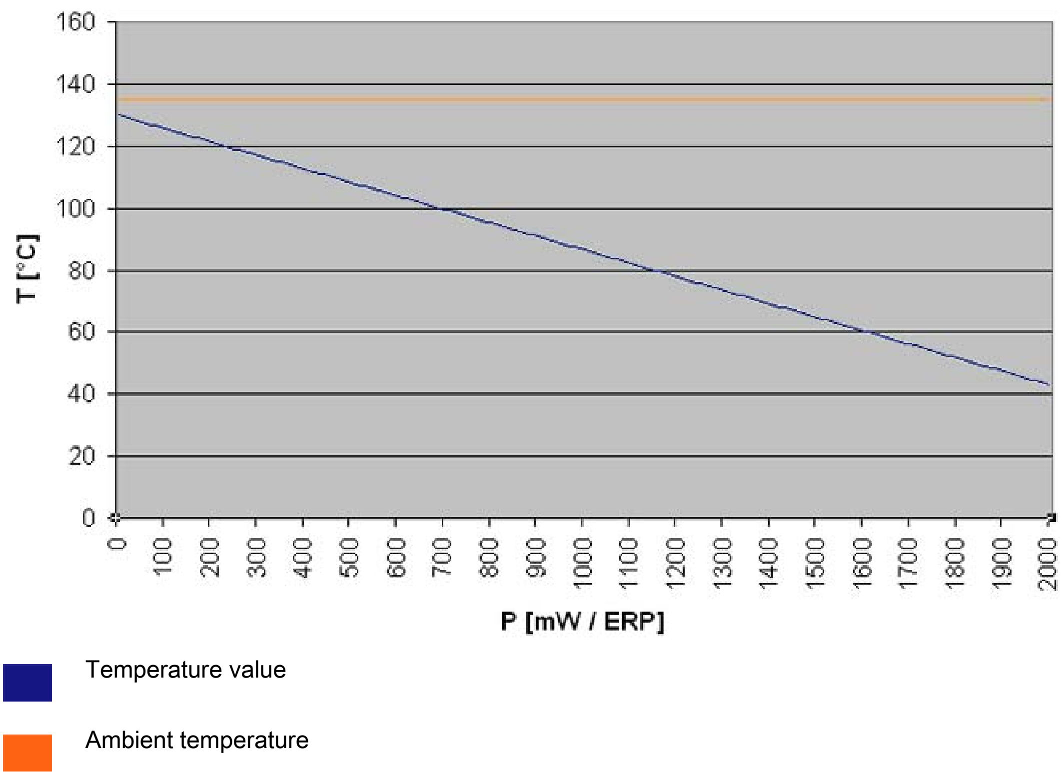


Figure 7-59 Temperature value and maximum permitted ambient temperature in relation to the radiated power

7.10.4 Mounting instructions

Mount the SIMATIC RF680T transponder on the base using two M6 screws.

Figure 7-60 Mounting SIMATIC RF680T

Properties	Description
Type of mounting	M6 screw mounting
Tightening torque (at room temperature)	≤ 1 Nm (Note the expansion coefficients of the materials used at high temperatures!)

Note

Reduction of the read/write distance

When mounting on metal or conductive material, ensure that the space below the transponder remains empty.

7.10.5 Memory configuration of the transponder

The memory configuration of the transponder is described in the section SIMATIC memory configuration of the RF600 transponders and labels (Page 268).

7.10.6 Technical specifications

7.10.6.1 Mechanical data

Property	Description
Dimensions (L x W x H)	130 x 32 x 15 mm
Design	Plastic housing (PPS)
Housing color	Black
Weight	Approx. 50 g
Mounting on metal	Yes

7.10.6.2 Electrical data

Characteristic	Description	
	Europe	USA/Canada
Air interface	According to ISO 18 000-6 C	
Frequency range	865 ... 868 MHz	915 ... 928 MHz [1)]
Necessary transmit power	2 W (ERP)	4 W (EIRP)
Range [2)]	max. 7 m	
Polarization type	Linear	
Energy source	Magnetic energy via antenna, without battery	
Multitag capability	yes, minimum distance between data carriers ≥ 50 mm [3)]	

[1)] Reduction of range to about 70% at the band limit 928 MHz on metal surfaces; acquisition is guaranteed at 921 MHz due to the frequency hopping procedure.

[2)] Mounting on a flat metal surface with a diameter of at least 300 mm and at room temperature. The information relates to the maximum read range. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 275)".

[3)] When these minimum distances are not reached, there is a reduction in the maximum possible read and write distances of the transponder.

7.10.6.3 Memory specifications

Property	Description
Type	EPC Class 1 Gen2
Memory organization	96 bits/240 bits EPC code
User memory	64 bytes
Protocol	ISO 18000-6C
Data retention time	10 years
Read cycles	Unlimited
Write cycles	Typ. 1 000 000 (at +40 °C)

7.10.6.4 Environmental conditions

Property		Description	
Ambient temperature	• Operation	-25 °C ... +100 °C	Permanent
		from 100 °C ... +140 °C	20% reduction in the limit distance
		+200 °C [2]	Tested up to 5000 hours or 3000 cycles
		+220 °C	Tested up to 2000 hours or 1500 cycles
		Temperature range when operating in areas at risk of a gas explosion with temperature class T2-T6	See also Use of the transponder in hazardous areas for gases (Page 378) [3]
		Temperature range when operating in areas at risk of dust explosions with T135 °C	See also Use of the transponder in hazardous areas for dusts (Page 381) [3]
	• Transport and storage	-40 °C ... +100 °C	
Shock Vibration compliant with EN 60721-3-7 Class 7 M3		50 g, [1] 20 g [1]	
Torsion and bending load		Not permissible	
Degree of protection		• IP68 according to EN 60529: (60 minutes. Immersion in cleaning fluids, fluid depth 5 m top edge of housing) • Dipping lacquer • IPx9K (steam jet: 150 mm; 10 to 15 l/min; 100 bar; 75 °C)	
Silicone-free		Yes	
MTBF		$1,6 \cdot 10^7$ h	

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

2) Note that no processing is possible at temperatures of +140 °C or higher.

3) Directive 94/9/EC of the European Council of 23 March 1994 must be complied with, see also Chapter "Using the transponder in hazardous areas (Page 378)".

7.10.6.5 Chemical resistance of the RF680T transponder

The following table provides an overview of the chemical resistance of the data memory made of polypropylene sulfide.

	20 °C	65 °C
Ammonia, w. conc.	○	-
Butane gas	+	+
Butyl acetate (acetic acid butyl ester)	+	+
Calcium chloride	+	+
Chlorine	-	-
Chrome baths, tech.	-	-
Acetic acid, w. 10%	+	+
Ethyl alcohol, w., undenaturated	+	+
Formaldehyde	+	+
Isopropanol	+	+
Methyl alcohol	+	+
Lactic acid, w.	+	+
Sodium carbonate, w. (soda)	+	+
Sodium chloride, w.	+	+
Sodium hydroxide 10%	+	+
Nitrobenzol	○	-
Phosphoric acid	-	-
Propane	+	+
Nitric acid 10%	-	-
Hydrochloric acid 10%	-	-
Sulfur dioxide, minimal	+	+
Sulfuric acid 25%	-	-
Hydrogen sulfide, dry	+	+
Carbon tetrachloride	○	-

Abbreviations	
+	Resistant
○	Limited resistance
−	Not resistant

7.10.7 Certificates and approvals

Table 7- 31 6GT2810-2HG80 - RF680T - Europe

Certificate	Description
	Conformity with R&TTE directive For Directive 94/9/EC: EC type test certification no. TÜV 07 ATEX 346241 Recognition of the quality assurance BVS 11 ATEX ZQS/E111

Table 7- 32 6GT2810-2HG80- RF680T - USA / Canada

Standard	
FCC Federal Communications Commission	Passive labels or transponders comply with the valid regulations; certification is not required.
C US	This product is UL-certified for the USA and Canada. It meets the following safety standard(s): • UL508 - Industrial Control Equipment • CSA C22.2 No. 142 - Process Control Equipment • UL Report E 120869

7.10.7.1 EC Declaration of Conformity according to directive 94/9/EG RF680T Version 1

The type test certification for the RF680T Version 1 is stored by TÜV 07 ATEX 346241. On the basis of this certification, the CE declaration by the manufacturer has been made according to directive 94/9/EC.
The producing factory of the RF680T Version 1 has an ATEX quality assurance system recognized by the DEKRA EXAM GmbH with certificate number BVS 11 ATEX ZQS/E111.

Manufacturer's address - distributor

Siemens Aktiengesellschaft
Industry Sector (I)
Industry Automation Division (IA)
Sensors and Communication (SC)
Communication and Identification (CI)
Gleiwitzer Str. 555
D-90475 Nürnberg, Germany

Manufacturer's address - factory

Siemens Aktiengesellschaft
Industry Sector (I)
Industry Automation Division (IA)
Control Components and System Engineering (CE)
Würzburger Straße 121
D-90766 Fürth, Germany

7.10.8 Dimension drawing

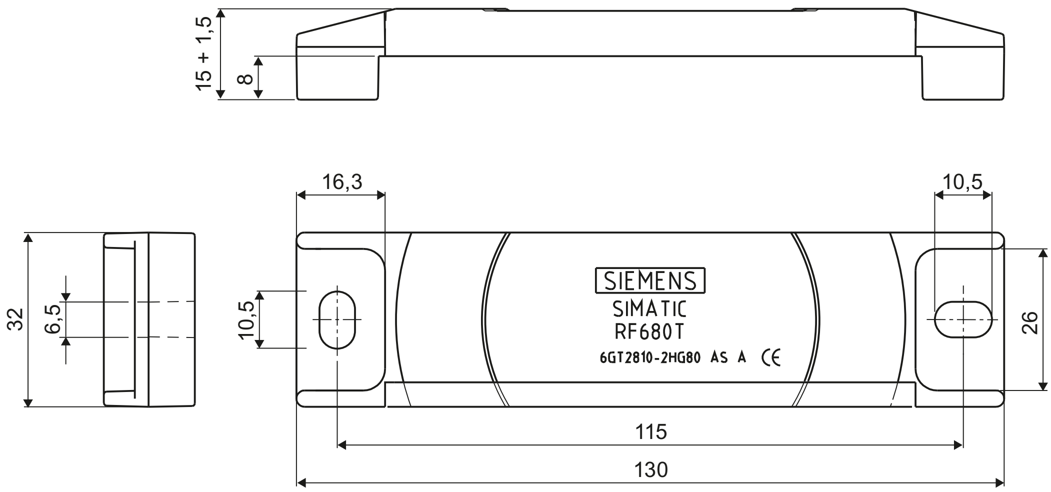


Figure 7-61 Dimension drawing of SIMATIC RF680T

Units of measurement: All dimensions in mm

Tolerances, unless indicated otherwise, are +-0.5 mm.

Integration into networks 8

8.1 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	SIMATIC command messages	RF-MANAGER Basic	XML commands	RFID reader interface
RF670R		Online help > chapter "Working with RFID objects"	SIMATIC RF Function Manual, Chapter "Standard Configuration Messages"	
RF640R		Online help > chapter "Working with RFID objects"	SIMATIC RF Function Manual, Chapter "Standard Configuration Messages"	
RF630R	"Configuration Manual RF620R/RF630R", chapter "Overview of commands"			
RF620R	"Configuration Manual RF620R/RF630R", chapter "Overview of commands"			
RF680M				Function Manual Mobile Reader, section "RFID Reader Interface Reference"

8.2 Integration in IT networks via the user application

Connecting the readers RF640R/RF670R using XML

If you want to create your own applications for the RF640R/RF670R reader, you can do this using the XML-based interface of the reader. For detailed information on configuring the reader using RF-MANAGER Basic V2, refer to the online help. For information about XML commands, refer to the "SIMATIC RF Function Manual" .

8.3 Integration in SIMATIC networks

Connecting the readers RF620R/RF630R

RF620R and RF630R readers are connected to the controller via the following adapter/communication modules:

- SIMATIC RF170C
- SIMATIC RF180C
- ASM 456

The RF182C communication module is connected with the PC directly over Ethernet.

Function blocks, interface modules/communication modules and readers

Table 8- 1 Table of reader/interface modules

Function blocks	Interface modules/communication modules						
	ASM 456	RF170C 1)	RF180C	ASM 475	RF182C	RF160C	RFID 181EIP
FB 45	1 - 2 readers	1 - 2 readers	1 - 2 readers	1 - 2 readers	N/A	N/A	N/A
FB 55	1 - 2 readers	1 - 2 readers	1 - 2 readers	1 - 2 readers	N/A	N/A	N/A
XML	N/A	N/A	N/A	N/A	1 - 2 readers	N/A	N/A
FC 44	N/A	N/A	N/A	N/A	N/A	1 - 2 readers	N/A
Ethernet/IP	N/A	N/A	N/A	N/A	N/A	N/A	1 - 2 readers
With all possible combinations, the input voltage at the communications module must not be below 21.6 V.							
1) If 2 readers are used with an RF170C, the CM/ASM can only be operated with a ambient temperature of max. 55 °C.							

Interface modules/communication modules and function blocks

Table 8- 2 Overview of interface modules/communication modules

ASM/CM	Interfaces to the application (PLC)	Interfaces to the reader	Function blocks	Reader connections	Dimensions (W x H x D) in mm	Temperature range	Degree of protection
ASM 456	PROFIBUS DP-V1	2 x 8-pin connection socket, M12	FB 45 FC 55	2 (parallel)	60 x 210 x 54 or 79	0 ... +55 °C	IP67
SIMATIC RF170C	PROFIBUS DP-V1 PROFINET IO	2 x 8-pin connection socket, M12	FB 45 FC 55	2 (parallel)	90 x 130 x 60	-25 ... 55° C	IP67
SIMATIC RF180C	PROFINET IO	2 x 8-pin connection socket, M12	FB 45	2 (parallel)	60 x 210 54	0 ... +60° C	IP67
SIMATIC RF182C	TCP/IP	2 x 8-pin connection socket, M12	-	2 (parallel)	60 x 210 x 54	0 ... +60° C	IP67

The following table shows which readers can be connected to which interface modules/communication modules.

Configuration with SIMATIC RF170C

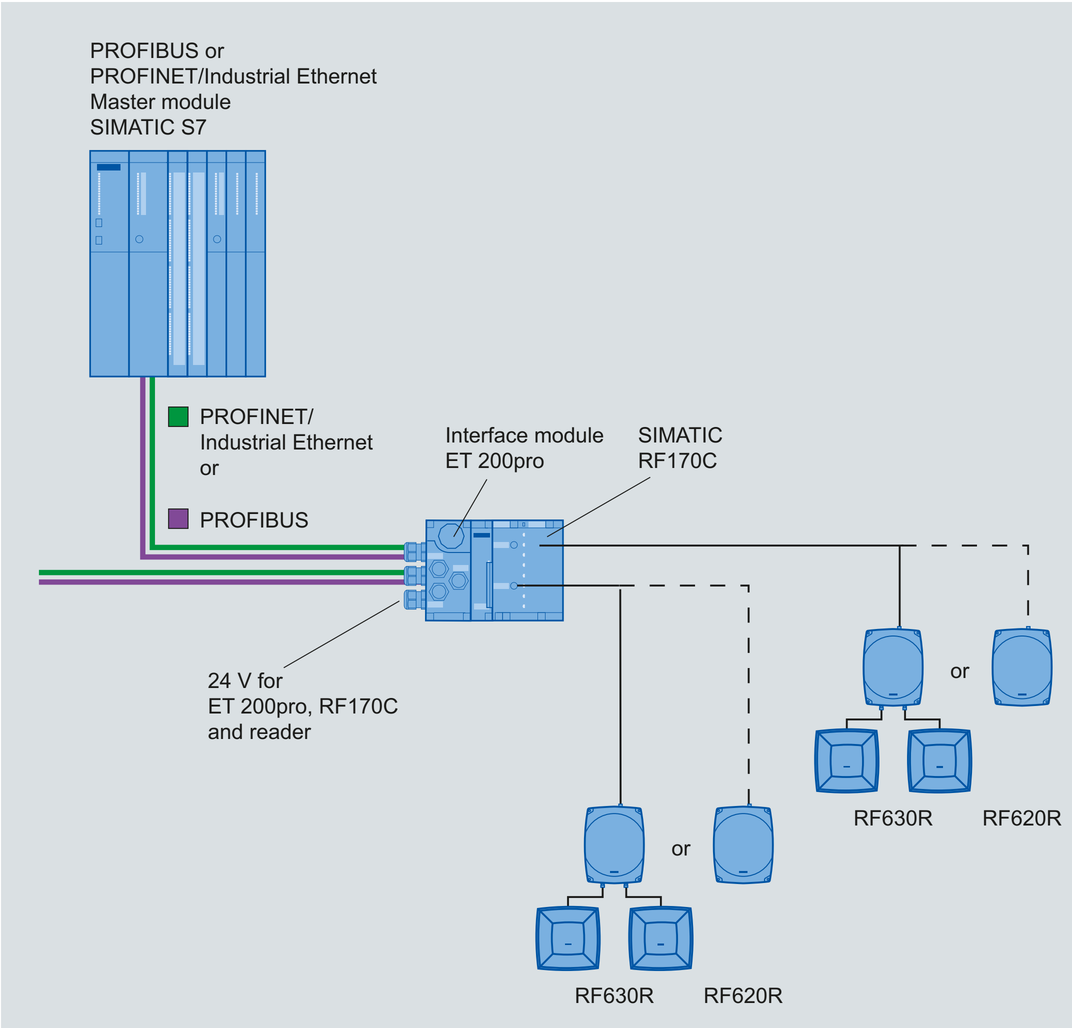


Figure 8-1 Configuration with SIMATIC RF170C

For more detailed information, please refer to SIMATIC RF170C Operating Instructions (http://support.automation.siemens.com/WW/view/en/32622825).

Configuration with SIMATIC RF180C

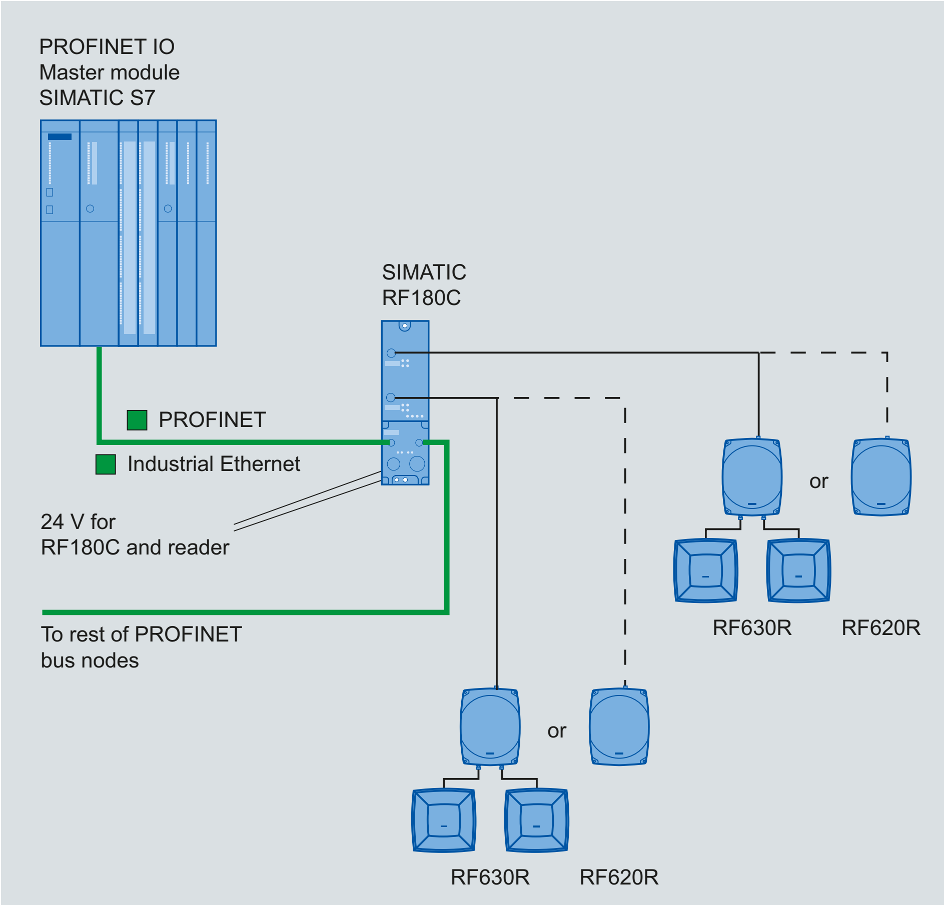


Figure 8-2 Configuration with SIMATIC RF180C

For more detailed information, please refer to SIMATIC RF180C Operating Instructions (http://support.automation.siemens.com/WW/view/en/30012157).

Configured with ASM 456

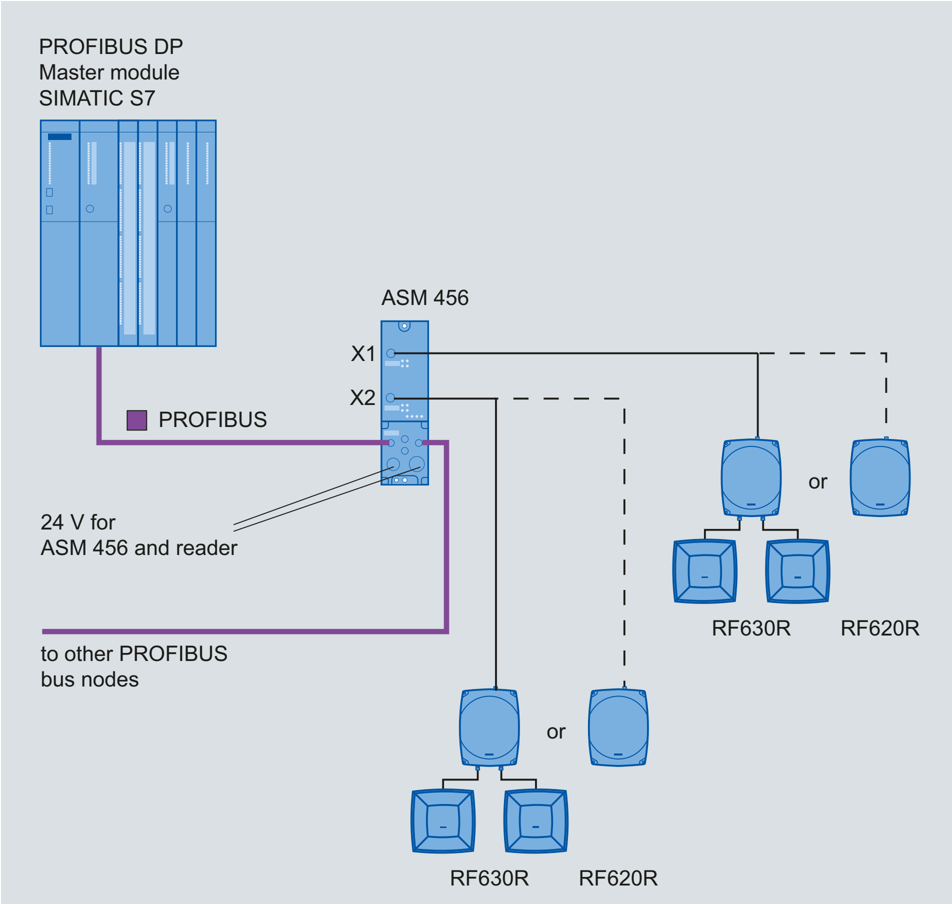


Figure 8-3 Configured with ASM 456

For more detailed information, please refer to ASM 456 Operating Instructions (http://support.automation.siemens.com/WW/view/en/32629442).

Configuration with RF182C

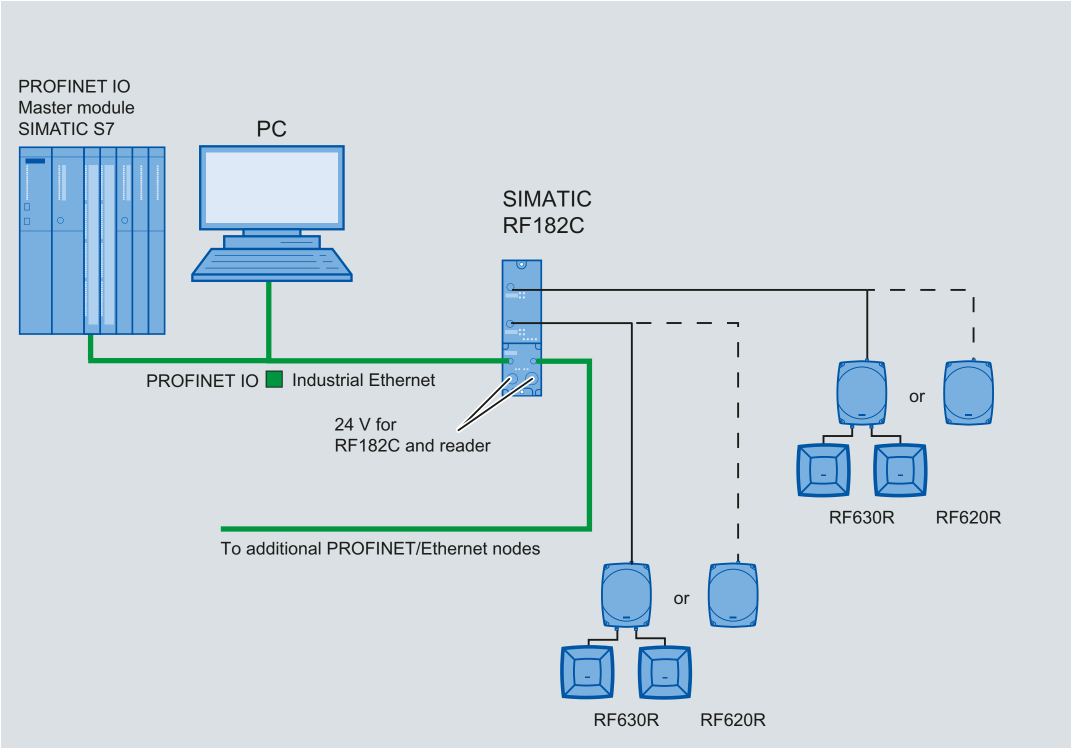


Figure 8-4 Configuration with SIMATIC RF182C

For more information, see SIMATIC RF182C Operating Instructions (http://support.automation.siemens.com/WW/view/en/38507897)

System diagnostics 9

9.1 Flashing codes of the RF600 readers with Ethernet interface

Error description	Flashing of ERR LED	
	Number	Repetitions
Reader inactive, no configuration data	Lit constantly	Permanent
Antenna 1 not connected or defective	3	Permanent
Antenna 2 not connected or defective	4	Permanent
Antenna 3 not connected or defective	5	Permanent
Antenna 4 not connected or defective	6	Permanent
Reading of user-defined memory has failed	11	3 times
Writing of user-defined memory has failed	12	3 times
The "SendCommand" function has failed	13	3 times
Wrong or missing password	14	3 times
Writing of the tag ID has failed	15	3 times
LOCK has failed	16	3 times
KILL has failed	17	3 times
Access to impermissible memory areas	18	3 times
Too many tags in the field	19	3 times
General software errors	20	Permanent
Impermissible message frame; Impermissible message frame parameter	29	3 times
Incorrect message frame format	30	3 times
The "SetReadProtect" NXP function has failed	31	3 times
The "ResetReadProtect" NXP function has failed	32	3 times
General error during detection of tags (inventory)	33	3 times

The LED states are described in chapter Status display (Page 168).

9.2 Error messages RF600 reader

A description of the RF640R/RF670R error codes can be found in the "SIMATIC RF Function Manual".

9.3 Error messages and flashing codes

error_MOBY

The ERR LED of the reader flashes when there are error messages. Some errors are also indicated by the flashing ERR LED of the CM.

Table 9- 1 Error messages of the communications module via the "error_MOBY" variable

Error code (B#16#..)	Flashing of ERR LED	Description
00	–	No error Default value if everything is ok
	1x	Boot message
01	2x	Presence error, possible causes: • The active command was not carried out completely • The transponder left the field while the command was being processed • Communication problem between reader and transponder The next command is automatically executed on the next transponder. A read or write command is possible. If the write command is aborted with error code 01, inconsistencies between the expected and actual data may occur on the data carrier. Repeat the read/write command.
03	3x	Problem on the connection to the reader or antenna problem. • The cable between the communications module and reader is wired incorrectly or there is a cable break • Antenna error: (Cable is defective), cable is no longer connected • The 24 V supply voltage is not connected or is not on or has failed briefly • Automatic fuse on the CM has blown • Hardware defect • Another reader is in the vicinity and is active • Interference on reader - or PROFIBUS line • Execute "init_run" after eliminating the problem

Error code (B#16#..)	Flashing of ERR LED	Description
05	5x	Command/parameter assignment error, possible causes: • Unknown command • Incorrect parameter • Function not allowed • Mode in "SET-ANT" command unknown FB 45 / FB 55 is sending an uninterpretable command to the communications module. • "command_DB" contains invalid command parameters • The "command_DB" was overwritten by the user • The transponder has signaled an address error
06	6x	Field disturbance on reader The reader is receiving interference pulses from the environment. • The distance between two readers is too small and does not correspond to the configuration guidelines • The connecting cable to the reader is defective or too long or does not comply with the specification
07	7x	No free ETSI transmit channel
09	9x	Wrong communications standard selected in the "init_run" command (e.g. FCC for ETSI reader)
0B	11x	Transponder memory cannot be read correctly or cannot be written to. The transponder signals an error. Options for troubleshooting: • Increase power • Change antenna alignment • Avoid field interference
0C	12x	Memory of the transponder cannot be written to • Transponder memory is defective • Memory is write-protected (Memory Locked: 000000100B) (The transponder memory is PERMA-locked and cannot be overwritten or the reader password has to be reset)
0D	13x	Error in specified address (address error) • The specified address does not exist on the transponder • The command must be checked and corrected. • This is not the correct transponder type. • Access attempted to non-existent or non-accessible memory areas (Memoryoverrun: 00000011B)
0E	14x	Password error • Incorrect transponder password (the reader password must be set again so that it matches the password).

Error code (B#16#..)	Flashing of ERR LED	Description
0F	1x	Start-up message from CM. The CM was off and has not yet received an "init_run" command • "init_run" needs to be executed • The same physical CM channel is used in two (or more) UDT 10 structures. Check "ASM_address" and "ASM_channel" in all UDT 10 structures.
10	16x	"NEXT" not possible or not permitted • CM is operating without MDS control ("MDS_control = 0,1") • CM has already received a "NEXT" command • CM/reader does not recognize a "NEXT" command "REPEAT" after forbidden commands: • "REPEAT" for "SET-ANT" • "REPEAT" for "SLG-STATUS"
11	–	Short circuit or overload of the 24 V outputs (DQ, error code, presence) • The affected output is turned off • All outputs are turned off when total overload occurs • A reset can only be performed by turning the 24 V voltage off and on again • Then start "init_run"
12	18x	Internal CM communication error. • Connector contact problem on the CM • Defective CM hardware – Return CM for repair • Start the "init_run" command after eliminating the problem
13	19x	• CM/reader does not have enough buffer space to store the command temporarily. • Maximum allowable number of 150 commands in a command chain was ignored. If "REPEAT" is used in conjunction with a command chain, the maximum number of commands is also 150 (including the number of commands from a command repetition). If a command chain contains more than 150 commands, after the 150th command is called, it will be stopped and the above error message will be sent without processing the complete chain. Commands in the command chain that have already been executed can still be sent later after the error message "0x13" is sent.
14	20x	Internal CM/reader error. • Program sequence error on the CM • Cycle power to the CM • Start the "init_run" command after eliminating the problem • Watchdog error on reader

Error code (B#16#..)	Flashing of ERR LED	Description
15	21x	Bad parameter assignment of the CM/reader • Check INPUT parameters in UDT 10 • Check parameters in HW Config • Transmit power set too high • Unused parameter bits are not 0. • "init_run" command has incorrect parameters • After a start-up, the CM has still not received an "init_run". • "scanning_time = 0x00" parameter was set (no standard selected).
16	22x	The FB command cannot be executed with the CM parameter assignment on PROFIBUS. • Length of the input/output areas too small for the cyclic I/O word. Did you use the right GSD file? • FB command (e.g. read) has too much user data (data length > 233 bytes)
17	23x	Communication error between FB 45 / FB 55 and communications module. Handshake error • "Params_DB" (UDT 10) of this CM station is overwritten by other parts of the program • Check parameter assignment of communications module in UDT 10 • Check FB 45/FB 55 command that caused this error • Start the "init_run" command after eliminating the problem
18	–	An error has occurred that must be acknowledged with an "init_run". • A temporary short circuit has occurred on PROFIBUS • The "init_run" command is incorrect • Start the "init_run" command after eliminating the problem • Check the parameters "ASM_address", "ASM_channel" and "MOBY_mode".
19	25x	Previous command is active or buffer overflow The user sent a new command to the CM although the last command was still active. • Active command can only be terminated with an "init_run" • Before a new command can be started "READY-Bit = 1 must be set; exception: "init_run" • Two FB 45/FC 55 calls were set with the same "ASM_address" and "ASM_channel" parameters • Two FB 45/FC 55 calls are using the same "Params_DB" pointer • Start the "init_run" command after eliminating the problem • When command repetition (e.g. read-only MDS) is used, no data is fetched from the transponder. The data buffer on the CM has overflowed. Transponder data has been lost.

Error code (B#16#..)	Flashing of ERR LED	Description
1A	–	PROFIBUS DP error occurred. • The PROFIBUS DP bus connection was interrupted – Wire break on the bus – Bus connector on CM was removed briefly • PROFIBUS DP master does not address CM anymore • "init_run" needs to be executed • The CM has detected a frame interruption on the bus. PROFIBUS may have been reconfigured (e.g. with HW Config). This error is only indicated when access monitoring has been enabled in the PROFIBUS configuration.
1B	27x	There is an inconsistency in the parameter assignment of the reader. Parameters were probably set in the Advanced User Parameter parameter with which the reader cannot work. • ETSI performance testing faulty
1C	28x	• Antenna is already switched off • Antenna is already switched on • Mode in "SET-ANT" unknown.
1D	–	More transponders are located in the antenna field than can be processed simultaneously by the reader. A read or write command was sent to a transponder (UID) and one of the following conditions was met at the same time: • Only 1 transponder at a time can be processed with FB 45. • With FB 45 and FB 55: there is more than one transponder with the same EPC-ID in the antenna field of the reader. Countermeasures: • with FB 55: Increase the value in multitag or decrease the number of transponders in the field. • with FB 55 (with MOBY_mode = 7): There is one or more transponder in the antenna field for which the content of the "FF00 – FF03" addresses of the EPC-ID does not match (uniqueness when accessing transponders using a UID with the length of 8 bytes). • Power supply of the transponder in the limit range: Due to short-term power shortage, a transponder loses its communication status (session) and the identical EPC-ID is sent a second time as soon as power is above the limit value again. Increase the reader's radiated power and/or reduce the distance between antenna and transponder until this effect no longer occurs.

Error code (B#16#..)	Flashing of ERR LED	Description
1E	30x	Wrong number of characters in the command message frame.
1F	31	Active command canceled by "RESET ("init_run" or "cancel") or bus connector removed • Communication with the transponder was aborted by "init_run" • This error can only be reported if there is an "init_run" or "cancel"

*) You will find the meaning of the error numbers in the EPC Global Class 1 Gen 2 document, Annex I.

error_FB

Table 9- 2 Error variable "error_FB"

Error code (B#16#...)	Description
00	No error; default value if everything is ok
01	"Params_DB" is not available in SIMATIC
02	"Params_DB" is too small • UDT 10/11 was not used during definition • "Params_DB" must be 300 bytes in length (for each channel) • "Params_DB", "Params_ADDR" - check that they are correct
03	The DB after the "command_DB_number" pointer is not available in the SIMATIC controller.
04	The "command_DB" on the SIMATIC controller is too small • UDT 20/21 was not used during command definition • The last command in the "command_DB" is a chained command; reset the chaining bit • Check the "command_DB_number/command_DB_address" command pointer
05	Invalid command type. The valid commands are described in the section "Auto-Hotspot" or "Auto-Hotspot". • Check the "command_DB_number/command_DB_address" command pointer • Check the actual values in the "command_DB" – "init_run" needs to be executed
06	Unexpected acknowledgement received. The parameters of the command and acknowledgement frame do not match ("command", "length", "address_MDS"). • The user changed the "command_DB_number/-_address" pointer during command execution. • The user changed the command parameters in the MOBY CMD data block (UDT 20) during command execution. • Check the parameter assignment of "ASM_address" and "ASM_channel". "ASM_address" and "ASM_channel" have the same parameter assignment for different channels. • The acknowledgement counter and command counter between the CM and FB are no longer synchronized – "init_run" needs to be executed
07	The "MOBY_mode" or "MDS_control" parameter (defined in UDT 10) has an invalid value
08	A bus error has occurred that is signaled by system functions SFB 52/53. More information on this error is available in the "error_BUS" variable. • "ASM_address" or "ASM_channel" not available • "init_run" needs to be executed

Error code (B#16#...)	Description
09	The CM has failed. • Loss of power on CM • PROFIBUS connector removed or PROFIBUS cable interrupted • "ASM_address" or "ASM_channel" not available This error is indicated if the "ASM_failure" bit was set in OB 122. OB 122 is called if FB 45 can no longer access the cyclic word for the CM.
0A	Another "init_run" was started while "init_run" was executing without waiting for "ready" • "init_run" must not be not set cyclically • The same physical channel/reader is used in two (or more) UDT 10 structures. Check "ASM_address" and "ASM_channel" in all UDT 10 structures.
0B	"init_run" cannot be executed; cyclic process image for the CM is disrupted; FB 45 reports a timeout of the process image for the CM The timeout time can be adapted in DBB 47 of UDT 10 if required. The default value is 50 (dec.) = 2 seconds. Greater values (255 max.) increase the timeout time. • "ASM_address" in UDT 10 has bad parameter settings. The "ASM_address" may be on the wrong module. • "ASM_channel" setting is ≥16 or ≤0 • CM hardware/firmware is faulty. • The same physical channel/reader is used in two (or more) UDT 10 structures. Check "ASM_address" and "ASM_channel" in all UDT 10 structures.
0C	Area length error on block move for FB 45. • "DAT_DB" does not exist or is set too small. "DAT_DB_number" and "DAT_DB_address" in UDT 20 need to be checked • Write command with length = 0 was sent • "init_run" needs to be executed
0D	An "init_run" was not completed correctly. The process image is inconsistent. This message is equivalent to a timeout. A timeout is reported 15s after starting "init_run". This time can be adjusted when necessary in DBW 44. • Execute "init_run" again • Turn CM off and on again • The "RUN-STOP" switch on the CPU was pressed rapidly several times in succession (particularly with slow PROFIBUS baud rates) • The same physical channel/reader is used in two (or more) UDT 10 structures. Check "ASM_address" and "ASM_channel" in all UDT 10 structures.

error_BUS

Note

The following table of bus errors does not claim to be complete. If you receive any messages that are not documented here, you will find them in "Auto-Hotspot".

Table 9- 3 Error variable "error_BUS" when operating via PROFIBUS/PROFINET

Error code (W#16#...)	Description
800A	CM is not ready (temporary message) • This message is received by a user who is not using FB 45 and is querying the CM acyclically in very quick succession.
8x7F	Internal error in parameter x. Cannot be remedied by the user.
8x22 8x23	Area length error when reading a parameter. Area length error when writing a parameter. This error code indicates that parameter x is partially or completely outside the operand range or the length of a bit array for an "ANY" parameter is not divisible by 8.
8x24 8x25	Area error when reading a parameter. Area error when writing parameter. This error code indicates that parameter x is in an area not allowed for the system function.
8x26	Parameter contains a time cell number that is too high.
8x27	Parameter contains a counter cell number that is too high.
8x28 8x29	Alignment error when reading a parameter. Alignment error when writing a parameter. The reference to parameter x is an operand whose bit address is not equal to 0.
8x30 8x31	The parameter is located in the write-protected global DB. The parameter is located in the write-protected instance DB.
8x32 8x34 8x35	The parameter contains a DB number that is too high. The parameter contains an FC number that is too high. The parameter contains an FB number that is too high.
8x3A 8x3C 8x3E	The parameter contains a DB number that is not loaded. The parameter contains an FC number that is not loaded. The parameter contains an FB number that is not loaded.
8x42 8x43	An access error occurred while the system was attempting to read a parameter from the I/O area of the inputs. An access error occurred while the system was attempting to write a parameter to the I/O area of the outputs.
8x44 8x45	Error on nth (n > 1) read access after an error occurred. Error on nth (n > 1) write access after an error occurred.
8090	Specified logical base address is invalid: There is no assignment in SDB1/SDB2x, or it is not a base address.
8092	A type other than "BYTE" has been specified in an "ANY" reference.

Error code (W#16#...)	Description
8093	The area identifier contained in the configuration (SDB1, SDB2x) of the logical address is not permitted for these SFCs. Permitted: • 0 = S7-400 • 1 = S7-300 • 2, 7 = DP modules
80A0	Negative acknowledgment when reading from module; FB fetches acknowledgment although no acknowledgment is ready. A user who is not using the FB 45 would like to fetch DS 101 (or DS 102 to 104) although no acknowledgment is available. • Execute an "init_run" for resynchronization between CM and application
80A1	Negative acknowledgment while writing to the module. FB sends command although a CM is unable to receive a command
80A2	DP protocol error with layer 2 • DP-V1 mode must be set in the header module for distributed I/O. • Possible hardware defect
80A3	DP protocol error in Direct-Data-Link-Mapper or User-Interface/User. Could be a hardware defect.
80B0	• SFC not possible for module type. • Data record unknown to module. • Data record number ≥ 241 is not allowed. • Data records 0 and 1 are not permitted for SFB 52/53 "WR_REC".
80B1	The length specified in the "RECORD" parameter is wrong.
80B2	The configured slot is not occupied.
80B3	Actual module type is not the expected module type specified in "SDB1"
80C0	• RDREC: The module has the record, but there is no read data there yet. • WRREC: CM is not ready to receive new data – Wait until the cyclic counter has been incremented
80C1	The data of the preceding write job on the module for the same data record have not yet been processed by the module.
80C2	The module is currently processing the maximum possible number of jobs for a CPU.
80C3	Required resources (memory, etc.) are currently in use. This error is not reported by the FB 45. If this error occurs, the FB 45 waits until the system is able to provide resources again.

Error code (W#16#...)	Description
80C4	Communication error • Parity error • SW ready not set • Error in block length management • Checksum error on CPU side • Checksum error on module side
80C5	Distributed I/O not available.

Accessories 10

10.1 Wide-range power supply unit for SIMATIC RF systems

10.1.1 Features

<table>
<tr><th>Wide-range power supply unit for SIMATIC RF systems</th><th></th></tr>
<tr><td>
</td><td>(1) DC output 1
(2) DC output 2
(3) Mains connection</td></tr>
<tr><td colspan="2">Features</td></tr>
<tr><td colspan="2">

- Wide-range input (3) for use worldwide
- Dimensions without mains cable: 175 x 85 x 35 mm
- Dimensions including mains cable: 250 x 85 x 35 mm
- CE-compliant (EU and UK versions)
- UL-certified for US and Canada (US version)
- Mechanically and electrically rugged design
- Secondary side (1), (2): 24 V DC / 3 A
- Short-circuit and no-load stability
- Suitable for frame mounting
- 3 versions for use in the EU, UK, US

</td></tr>
</table>

Description

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

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

The device is vacuum-cast and prepared for Safety Class 2 applications. The EU and UK versions satisfy the low-voltage guideline as well as the current EU standards for CE conformity. Furthermore, the US version has been UL-certified for the US and Canada.

10.1.2 Scope of supply

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

10.1.3 Ordering data

Wide-range power supply unit for SIMATIC RF-systems (100 - 240 VAC / 24 VDC / 3 A) with 2 m connecting cable with country-specific plug	EU: 6GT2898-0AA00 UK: 6GT2898-0AA10 US: 6GT2898-0AA20
24 V connecting cable for SIMATIC RF640R/RF670R, length 5 m	6GT2891-0NH50

Note

Risk of confusion

Note that you cannot use the 24 V connecting cables of the discontinued RF660R reader for the RF640R and RF670R readers.

10.1.4 Safety Information

WARNING

Danger to life

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

The following must also be taken into account:

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

Note

The wide-range power supply unit must only be used for SIMATIC products in the specifically described operating range and for the documented intended use.

If the wide input range power supply for SIMATIC RF systems is used for an end product other than the SIMATIC RF600 system, the following must be taken into account:

- The electric strength test of the end product is to be based upon a maximum working voltage of: Transition from primary to SELV: 353 VDC, 620 Vpk
- The following secondary output circuits are SELV (low voltage; SELV = Safety Extra Low Voltage): all
- The following secondary output circuits are at non-hazardous energy levels: all
- The power supply terminals and/or connectors are suitable for field wiring if terminals are provided.

- The maximum investigated branch circuit rating is: 20 A
- The investigated pollution degree is: 2

> **WARNING**
>
> If the wide input range power supply for SIMATIC RF systems is connected to an end product other than end products of the RF600 family, the end user is responsible and liable for operation of the system or end product that includes the wide input range power supply for SIMATIC RF systems.

> **WARNING**
>
> Alterations to the SIMATIC RF600 components and devices as well as the use of SIMATIC RF600 components with third-party RFID devices are not permitted.
>
> Failure to observe this requirement shall constitute a revocation of the radio equipment approvals, CE approval and manufacturer's warranty. Furthermore, the compliance to any salient safety specifications of VDE/DIN, IEC, EN, UL and CSA will not be guaranteed.

Safety notes for the US and Canada

The SIMATIC RF640R/RF670R reader may only be operated with the wide range power supply unit for SIMATIC RF systems - as an optional component – or with power supply units that are UL-listed according to the safety standards specified below:

- UL 60950-1 - Information Technology Equipment Safety - Part 1: General Requirements
- CSA C22.2 No. 60950 -1 - Safety of Information Technology Equipment.

> **WARNING**
>
> The compliance of the SIMATIC RF600 system to the safety standards mentioned above will not be guaranteed if neither the wide-range power supply unit for SIMATIC RF systems°nor power supplies listed according to the safety standards above are used.

Safety information for Korea

WARNING

The SIMATIC RF640R/RF670R Reader may only be operated with power supplies that have received KETI approval. There is currently no KETI approval for the wide-range power supply (6GT2898-0AAx0). This is why the wide-range power supply may not be operated in South Korea.

To use the SIMATIC RF640R/RF670R Reader in South Korea, you need a power supply (24 V DC / 3 A). This power supply must meet the requirements of the application field and have a KETI approval. You also need the connection cable for the SIMATIC RF640R/RF670R (6GT2891-0NH50).

For the required pin assignments of the DC output for connecting the power supply, see section Pin assignment of DC outputs and mains connection (Page 416). You can find the pin assignment of the DC inputs for the reader in sections Pin assignment for power supply (Page 145) and Pin assignment for power supply (Page 174).

10.1.5 Connecting

- There are three different (country-specific) mains cables for the EU, UK and US.
  The appropriate mains cable must be connected to the primary input of the power supply.

Note

It is only permissible to insert or remove the mains cable when the power supply is de-energized.

- The wide-range power supply unit has total insulation (Safety Class 2), IP65
- It can be mounted using four fixing holes.

10.1.6 Technical specifications

Table 10- 1 General technical specifications

Insulation stability (prim./sec.) $U_{ins\ p/s}$		3.3 kV_{AC}
Insulation resistance R_{ins}		>1 GΩ
Leakage current I_{leak}	U_{in} = 230 V_{AC}, f = 50 Hz	< 200 µA
Safety class (SELV)	Designed for installation in devices of Safety Class 2	
Mains buffering t_h	U_{in} = 230 V_{AC}	≥ 50 ms
Ambient temperature		-25 °C to +55 °C
Surface temperature	Module top, center	Max. 96 °C
Storage temperature		-40 °C to +85 °C
Self-heating on full-load		max. 45 K
Interference immunity ESD HF fields Burst Surge HF injection Mains quality test	EN 61000-4-2, 4-3 up to 4-6, 4-11	 Air discharge: 15 kV 10 V/m symmetrical: 2 Symmetrical: 1 10 V_{rms}
Cooler		Free convection
Dimensions L x W x H		175 mm x 85 mm x 35 mm
Weight		720 g
Housing / casting		UL 94-V0
Power supply class	according to CSA	Level 3
Degree of protection	IP65	
MTBF in years		255

Table 10- 2 Technical specifications for the input

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

Table 10- 3 Technical specifications of the output

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

Table 10- 4 Output configurations

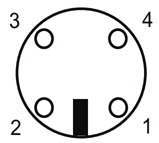
Input	Outputs U1 = U2	ILoad = I1 + I2	Efficiency (%)	Remarks
110 VAC	24 VDC	0 A		No-load stability
110 VAC	24 VDC	3 A	≥ 88	
220 VAC	24 VDC	0 A		No-load stability
220 VAC	24 VDC	3 A	≥ 90	

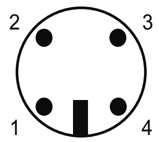
Table 10- 5 Compliance with standards

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

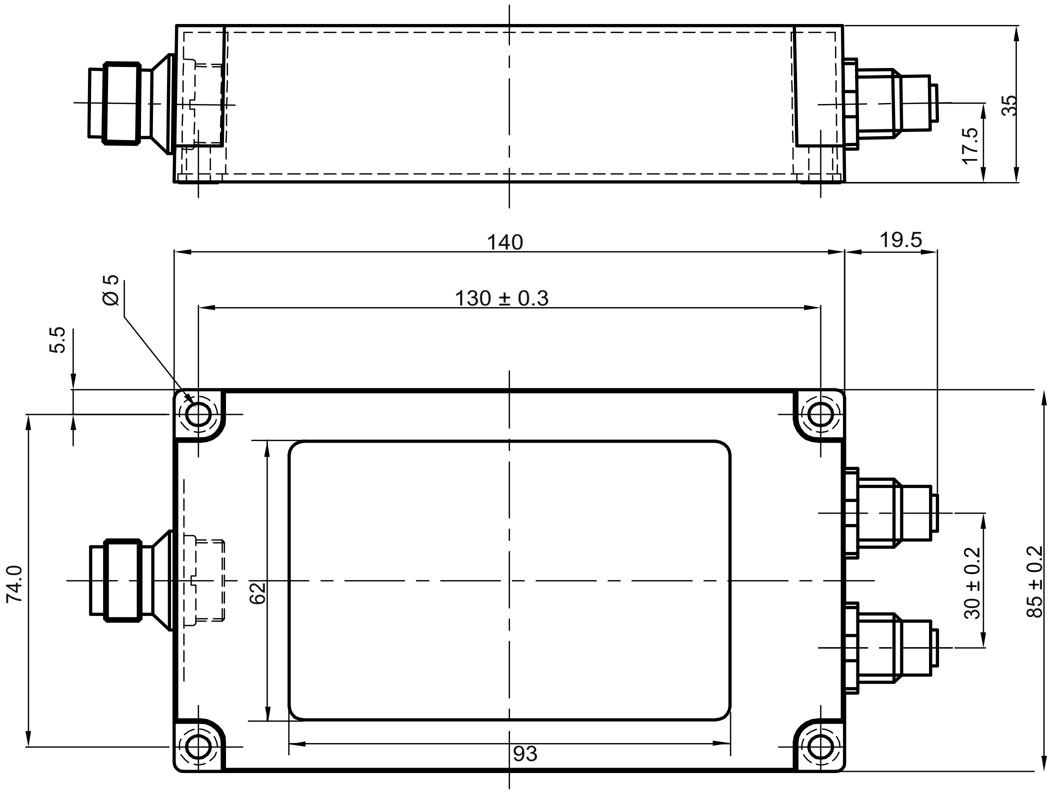
All values are measured at full-load and at an ambient temperature of 25 °C (unless specified otherwise).

10.1.7 Pin assignment of DC outputs and mains connection

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

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

10.1.8 Dimension drawing



Units of measurement:

All dimensions in mm

10.1.9 Certificates and approvals

Table 10- 6 Wide-range power supply unit for SIMATIC RF systems 6GT2898-0AA00 - Europe, 6GT2898-0AA10 - UK

Certificate	Description
CE	CE approval to 2004/108/EC EMC 73/23/EEC LVD

Table 10- 7 Wide-range power supply unit for SIMATIC RF systems 6GT2898-0AA20 - USA

Standard	
c UL US	This product is UL-certified for the US and Canada. It meets the following safety standards: 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

10.2 The PC adapter for SIMATIC RF-DIAG

10.2.1 Description

PC adapter for SIMATIC RF-DIAG	
	① USB interface ② RS-422 – CM / wide-range power supply unit ③ RS-422 – RF reader

The SIMATIC RF-DIAG product consists of a CD with software and documentation and a hardware packet. The hardware packet consists of a PC adapter for SIMATIC RF-DIAG, a USB connecting cable and an RS-422 cable.

The PC adapter for SIMATIC RF-DIAG is a converter from USB to RS-422. Communication between the PC and reader can be established using the PC adapter.

Characteristics

- RS-422 to USB converter for communication with the RF620R and RF630R
- Dimensions without connecting cables: 101 x 63 x 35 mm
- CE-compliant (EU and UK versions)
- FCC-compliant for use in the USA and Canada
- Mechanically and electrically rugged design
- RS-422 interface
  - With 24 VDC / 3 A for CM or wide-range power supply unit
  - With 24 VDC / 3 A for reader
- Short-circuit proof

Highlights

- Diagnostics via a PC with the reader supplied with power from the system
- IP65 degree of protection
- Can be used in high temperature ranges
- Use in productive operation possible
- Switchover to diagnostics mode "on the fly" (parallel to regular operation)

Note

Protection from environmental influences

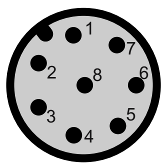
The IP65 degree of protection of the PC adapter is only valid if the USB protective cap is fitted and the corresponding RS-422 cable is connected. During diagnostics, this degree of protection is not present.

10.2.2 Pin assignment of the RS-422 interface

Pin assignment for connection to the CM or wide-range power supply unit

Pin assignment of the connector for PC adapter and CM or wide-range power supply unit

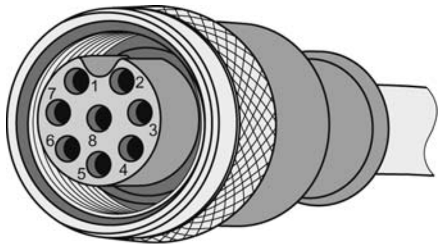
Table 10- 8 RS-422 interface of the PC adapter (male connector)

Pin	Pin Device end 8-pin M12	Assignment for CM	Assignment for wide-range power supply unit
	1	+ 24 V	+ 24 V
	2	- Transmit	Free
	3	0 V	0 V
	4	+ Transmit	Free
	5	+ Receive	Free
	6	- Receive	Free
	7	Free	Free
	8	Ground (shield)	Ground (shield)

The knurled bolt of the M12 plug does not contact the shield (reader end).

Pin assignment of the connecting cable between PC adapter and CM or wide-range power supply unit

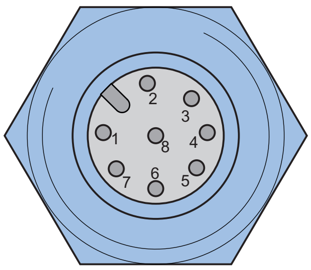
Table 10- 9 RS-422 connecting cable

View of M12 socket	M12 pin	Core color	Pin assignment for CM	Pin assignment for wide-range power supply unit
	1	White	24 VDC	24 VDC
	2	Brown	TX neg	Not used
	3	green	GND	GND
	4	Yellow	TX pos	Not used
	5	gray	RX pos	Not used
	6	pink	RX neg	Not used
	7	Blue	Not used	Not used
	8	Red	Ground (shield)	Ground (shield)

Pin assignment for connecting to the RF readers

Pin assignment of the connector for PC adapter and UHF reader

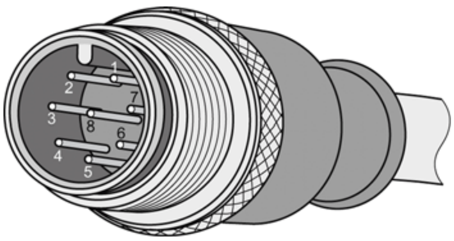
Table 10- 10 RS-422 interface of the PC adapter (female connector)

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

The knurled bolt of the M12 plug does not contact the shield (reader end).

Pin assignment of the connecting cable between PC adapter and UHF reader

Table 10- 11 RS-422 connecting cable

View of M12 plug	M12 pin	Wire color	Pin assignment
	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 used
	8	Red	Ground (shield)

Pin assignment for connection to the PC

Table 10- 12 USB 2.0 mini-B connector socket of the PC adapter

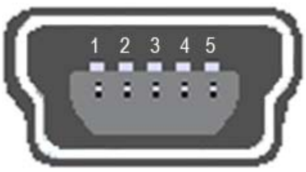
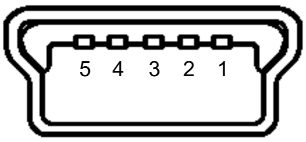
View of connection socket	Pin Device side	Assignment
	1	+ 5 V
	2	Data -
	3	Data +
	4	ID (not used)
	5	GND

Table 10- 13 USB 2.0 mini-B plug of the connecting cable

View of mini-B plug	Pin Device side	Wire color	Assignment
	1	Red	+ 5 V
	2	White	Data -
	3	green	Data +
	4	-	ID (not used)
	5	Black	GND

10.2.3 Technical specifications

Table 10- 14 Mechanical data

Property		Description
Weight		310 g
Dimensions (L x W x H)		101 × 63 × 35 mm
Enclosure material		Aluminum (painted)
Housing color		Black
Installation		No securing aids
Interfaces		
	RS422	• 1 x pin (8-pin M12, connection to CM/wide-range power supply) • 1 x socket (8-pin M12, connection to the reader)
	USB	USB 2.0 Mini-B
MTBF in years		1.1×10^3

Table 10- 15 Software interfaces

Property	Description
Software – RS-422	SIMATIC S7 / TIA
Software – USB • RF600	 • 3964R & RF-DIAG

Table 10- 16 Electrical data

Property	Description
Power supply of the PC adapter via USB (during operation) • Nominal value • Permitted range	 • 5 V DC • 4.0 to 5.25 VDC
Power supply of the RF readers via RS-422 • Nominal value • Permitted range	 • 24 VDC • 20 to 30 VDC
Current consumption • Connection via USB and RS-422 • No connection via USB	 • Via 5 VDC, approx. 30 mA; 24 VDC, approx. 15 mA • Via 24 VDC, ≤ 5 mA
Transmission rates USB / RS-422	• 19.2 Kbps • 57.6 Kbps • 115.2 Kbps

Table 10- 17 Ambient conditions

Property	Description
Temperature range during operation	-25 °C to +70 °C
Temperature range during storage	-40 °C to +85 °C
Shock resistant to EN 60068-2-27 Vibration resistant to EN 60068-2-6	50 g, [1] 20 g, [1]
Degree of protection in accordance with EN 60529	IP65 [2]

[1] The values for shock and vibration are maximum values and must not be applied continuously nor when the USB plug is plugged in.

[2] Only when the USB protective cap is fitted and the corresponding RS-422 cables are connected.

10.2.4 Dimension drawing

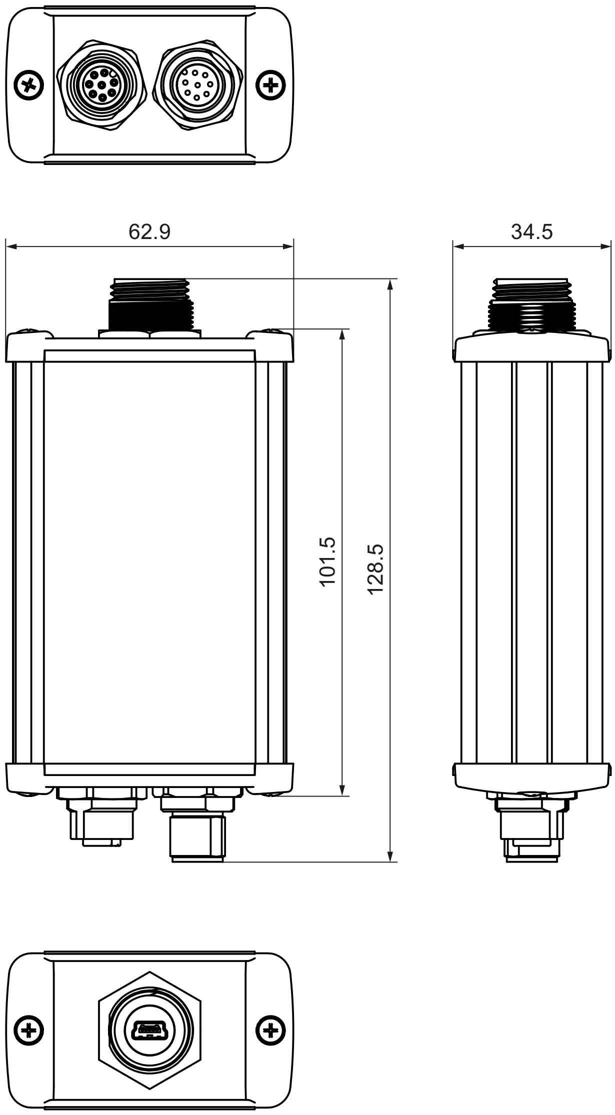


Figure 10-1 Dimension drawing of the PC adapter for SIMATIC RF-DIAG (all dimensions in mm)

When the USB protective cap is screwed on, the length of the adapter is 134 mm. The tolerances are +/- 1 mm.

10.2.5 Certificates and approvals

Table 10- 18 Certificates and approvals for the PC adapter

Certificate	Description
	CE approval complying with 2004/108/EC EMC
	FCC Rules, Part 15, Subpart B, Sections 15.107 and 15.109
Industry Canada Radio Standards Specifications	CAN/CSA-CISPR 22-10 - Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement

Appendix A

A.1 Certificates and approvals

Notes on CE marking

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

DIN ISO 9001 certificate

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

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

EQ-Net certificate no.: 1323-01

Table A- 1 FCC IDs: NXW-RF660, NXW-RF620R, NXW-RF630R, IC: 267X-RF620R, IC: 267X-RF630

Standards	
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 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

Certification for the USA, Canada and Australia

Safety

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

EMC

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

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

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

A.2 Service & support

Technical Support

You can contact Technical Support for SIPLUS HCS systems as follows:

- Phone: + 49 (0) 911 895 5900
- E-mail (mailto:technical-assistance@siemens.com)
- Internet: Online support request form: (http://www.siemens.com/automation/support-request)

Contacts

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

The addresses are found on the following pages:

- On the Internet (http://www.siemens.com/automation/partner)
- In Catalog CA 01
- In Catalog ID 10 specifically for industrial communication / industrial identification systems

Service & support for industrial automation and drive technologies

You can find various services on the Support homepage (http://www.siemens.com/automation/service&support) of IA/DT on the Internet.

There you will find the following information, for example:

- Our newsletter containing up-to-date information on your products.
- Relevant documentation for your application, which you can access via the search function in "Product Support".
- A forum for global information exchange by users and specialists.
- Your local contact for IA/DT on site.
- Information about on-site service, repairs, and spare parts. Much more can be found under "Our service offer".

RFID homepage

For general information about our identification systems, visit RFID homepage (http://www.siemens.com/ident/rfid).

Technical documentation on the Internet

A guide to the technical documentation for the various products and systems is available on the Internet:

SIMATIC Guide manuals (http://www.siemens.com/simatic-tech-doku-portal)

Online catalog and ordering system

The online catalog and the online ordering system can also be found on the Industry Mall Homepage (http://www.siemens.com/industrymall).

Training center

We offer appropriate courses to get you started. Please contact your local training center or the central training center in

D-90327 Nuremberg.

Phone: +49 (0) 180 523 56 11
(€ 0.14 /min. from the German landline network, deviating mobile communications prices are possible)

For information about courses, see the SITRAIN homepage (http://www.sitrain.com).

Glossary

Active field

Area with minimum field strength containing the sensing range. Within this sensing range, data can be read from the tag or written to the tag.

Active surface

See active field

Active surface

See active field

Active tag/transponder

Active transponders are battery-operated, i.e. they obtain the energy required to save data on the microchip from a built-in battery. They are usually in an idle state and do not transmit data in order to increase the energy source's service life. The transmitter is only activated when it receives a special activation signal.

AM

Amplitude modulation; data are present in the changes in carrier frequency amplitude.

Amplitude modulation

See AM

AS

See Automation system

ASM

Interface module, see Communication modules

Automation system (AS)

A programmable logical controller (PLC) of the SIMATIC S7 system, comprising a central controller, a CPU and various I/O modules.

Battery-free data storage unit

Mobile data storage units which operate without batteries. (See transponder). Power is supplied to the data storage unit across an electromagnetic alternating field.

Baud

Unit (digits per second).

Baud rate

The baud rate describes the data transmission's digit rate.

Byte

A group of eight bits

CE guidelines

See CE Label

CE Label

Communauté Européenne (product mark of the European Union)

Communication modules

Communication modules are used to integrate the identification systems in SIMATIC or SINUMERIK systems, or to connect them to PROFIBUS, PROFINET, PC or any other system. Once supplied with the corresponding parameters and data, they handle data communication. They then make the corresponding results and data available. Suitable software blocks (FB/FC for SIMATIC; C libraries for PCs with Windows) ensure easy and fast integration in the application.

Continuous Wave

See CW

CW

Continuous Wave; data are present in the carrier frequency which is switched on and off.

Data rate

The rate at which data are exchanged between the tag and reader. Typical units are bits per second or bytes per second.

Data transfer rate

Number of characters which can be transmitted from a tag to a reader within a defined time. Baud rates are also used to specify how fast a reader can read information.

Data transmission rate

Unit of measurement for the volume of data transmitted within a unit of time, e.g. bytes/s, see also Baud

dB

See Decibel

dBm

Dimensional unit for the transmitted power in the logarithmic relation to 1 mW (Milliwatt).

0dBm = 1mW, +23dBm = 200mW, +30dBm = 1W.

dBr

dB(relative); a relative difference to a reference value

Decibel (dB)

Unit of measurement for the logarithmic relationship between two variables.

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.

Detuning

UHF antennas are tuned to receive a particular electromagnetic wavelength from the reader. If the antenna is too close to metal or a metallic material, it can be detuned, making the performance deteriorate.

Distant field communication

RFID antennas emit electromagnetic waves. If a tag is more than a full wavelength away from the reader's transmitting antenna, it is in a "distant field". If it is within a full wavelength, this is known as the "near field".

The wavelength of UHF-RFID systems is approx. 33 cm.

The distant field signal is attenuated with the square of the distance from the antenna, whereas the near field signal is attenuated with the cube of the distance from the antenna. Passive RFID systems based on distant field communication (UHF and microwave systems) have a greater read range than systems based on near field communication (typically low-frequency and high-frequency systems).

Dwell time

The dwell time is the time in which the transponder dwells within the sensing range of a reader. The reader can exchange data with the transponder during this time.

Dynamic mode

In dynamic mode, the data carrier moves past the reader at a traversing rate which depends on the configuration. Various checking mechanisms ensure error-free data transfer even under extreme environmental conditions.

EAN

European article number. Standardized barcode used in Europe, Asia and South America. Is administered by EAN International.

EBS

Equipotential Bonding Strip

Effective Isotropic Radiated Power

See EIRP

Effective Radiated Power

See ERP.

EIRP

Effective Isotropic Radiated Power; unit of measurement for the transmission power of antennas (referred to an isotropic radiator) mainly used in the USA. EIRP is specified in Watt, and is not equal to ERP. (0dbi = - 2.14 dBm)

Electromagnetic compatibility (EMC)

Electromagnetic compatibility 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

See Electromagnetic compatibility

EMC directive

Guidelines for electromagnetic compatibility This guideline relates to any electrical or electronic equipment, plant or system containing electric or electronic components.

EPC

See EPC global

EPC global

Electronic Product Code. Standardized number system for identifying articles with a data width of either 64, 96 or 256 bits.

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. It is necessary to compensate for these differences by equipotential bonding: this is done by combining the equipotential bonding conductors of power components and
non-power components on a centralized equalizing conductor (EBS = **E**quipotential **B**onding **S**trip).

ERP

Effective Radiated Power; unit of measurement for the transmission power of antennas (referred to an ideal dipole) mainly used in Europe. ERP is specified in Watt, and is not equal to EIRP. (0dbm = + 2.14 dBi)

ESD directive

Directive for handling **E**lectrostatic **S**ensitive **D**evices

ETSI

European Telecommunications Standard Institute

European Article Numbering

See EAN.

eXtensible markup language

See XML.

FCC

Federal Communications Commission (USA)

FHSS

Frequency Hopping Spread Spectrum; frequency change procedure.

FM

Frequency modulation; data are present in the changes in the frequency of the carrier frequency.

Frequency hopping

Frequency hopping technique Automatic search for free channels.

In frequency hopping, data packets are transferred between the communication partners on constantly changing carrier frequencies. This makes it possible to react to interference from devices transmitting signals in the same frequency range (channel). If an attempt to send a data packet is unsuccessful, the packet can be transmitted again on a different carrier frequency. By default the RF600 uses this procedure (FCC) only in the USA and Canada.

Frequency modulation

See FM.

Frequency Shift Keying

See FSK

FSK

Modulation, Frequency Shift Keying; data are present in the changes between two frequencies.

ICNIRP

International Commission of Non Ionizing Radiological Protection

ICRP

International Commission of Radiological Protection

Interface modules

See communication modules

Interrogator

See readers

ISO

International Standard Organization

ISO 18000

Standard for data exchange of RFID systems between reader and transponder. There are various subdefinitions of this standard for the various approved frequency ranges for RFID. For example, the range 865 ... 868 MHz is described in ISO 18000-6.

LAN

Local Area Network

LBT

Listen Before Talk; the reader only transmits when the channel is free.

License plate

10-digit code that is saved on every RFID tag. The code of the license plate establishes a connection between the item of baggage and the baggage processing system of the airport. As soon as the license plate has been read by the reader, a message is automatically sent to the baggage processing system. This message contains important data regarding the flight and destination of the item of baggage. Using this data, the item of baggage can be successfully sorted by the baggage processing system of the airport.

Limit distance

The limit distance is the maximum clear distance between reader antenna and transponder at which the transmission can still function under normal conditions.

Mass recording

The capability of a reader to record several or many transponders quasi-simultaneously and to read the code. Contrary to the multi-tag capability, the reader is not able to specifically address individual tags.

MDS

Mobile data memory, see Transponder.

MES

Manufacturing Execution System

Metal-free area

Distance/area which must be maintained between the transponder and metal in order to prevent interference during data transfer between the transponder and reader.

Mobile Data Memory (MDS)

Mobile data memory, see Transponder

Modulation

Modulation is a procedure with which one or more characteristics (e.g. phase, amplitude, frequency) of a carrier oscillation are modified according to the response of a modulating oscillation.

Multi-tag capability

Multi-tag capability means that a reader can communicate simultaneously with different data carriers. Therefore the reader can specifically address a transponder with its UID (see also mass recording).

Near field communication

RFID antennas emit electromagnetic waves. If a tag is more than a full wavelength away from the reader's transmitting antenna, it is in a "distant field". If it is within a full wavelength, this is known as the "near field".

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The distant field signal is attenuated with the square of the distance from the antenna, whereas the near field signal is attenuated with the cube of the distance from the antenna. Passive RFID systems based on near field communication (typically low-frequency and high-frequency systems) have a greater read range than systems based on distant field communication (typically UHF and microwave systems).

Passive tag

If electromagnetic waves from the reader reach the tag antenna, the energy is converted by the antenna into electricity which provides the tag chip with current. The tag is able to return information stored on the chip. Passive tags do not usually have a battery. A battery is required if the tag has a RAM, but the battery is only used to save information in the RAM. In particular, the battery is not used for data exchange between reader and transponder.

Passive tag/transponder

A tag without its own power supply. Passive transponders obtain the energy required to supply the microchips from the radio waves they receive.

PDM

Pulse duration modulation; data are present in the pulse duration.

Phase modulation

See PM

PLC

Programmable Logic Controller, see PLC.

Programmable logic controller; electronic device used in automation engineering for open-loop and closed-loop control tasks. The typical modules of a PLC are the CPU, power supply (PS) and various input/output modules (I/O).

Programmable controller: The programmable logical controllers (PLC) of the SIMATIC S5 system consist of a central controller, one or more CPUs, and various other modules (e.g. I/O modules).

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PM

Phase modulation; data are present in the changes in carrier frequency phase.

Programmable Logic Controller

See PLC.

Programmable Logic Controllers

See PLC

Protocol

A combination of rules which manage communications systems.

Pulse duration modulation

See PDM

Radio Frequency Identification

See RFID.

Read rate

Number of tags which can be read within a defined time.
The read rate can also be used for the maximum rate at which data can be read from a tag. The unit is bits per second or bytes per second.

Reader (also interrogator)

Readers transfer data between mobile data memories (transponders) and the higher-level systems. The data, including the energy required for processing and sending back, are transmitted to the transponder across an electromagnetic alternating field. This principle enables contact-free data transmission, ensures high industrial compatibility and works reliably in the presence of contamination or through non-metallic materials.

Reader talks first

A passive tag communicates in the read field of a reader with the reader. The reader sends energy to the tags which only reply when they are explicitly requested. The reader is able to find tags with a specific serial number commencing with either 1 or 0.
If more than one tag responds, the reader can scan all tags commencing with 01 and subsequently with 010. This is referred to as "walking" on a binary tree, or "tree walking".

Reading range

The distance within which a reader can communicate with a tag. Active tags can cover a greater distance than passive tags because they use a battery to send signals.

Reciprocity

Reciprocity means that a two-way relationship exists between the transmit and receive case of a passive antenna.

RFID

Radio Frequency Identification; a method of identifying items using electromagnetic waves. The reader supplies energy to the tag and communicates with it.

RFID systems

SIMATIC RF identification systems control and optimize material flow and production sequences. They identify reliably, quickly and economically, use non-contact data communication technology, and store data directly on the product. They are also resistant to contamination.

RH circular

Right hand circular polarization

RSSI threshold value

The "Received Signal Strength Indication" (RSSI) is an indicator of the receive field strength of the transponders. When the field strength with which the transponder is received undershoots the set RSSI threshold, the reader ignores the signal of this transponder.

The RSSI threshold value can be activated to limit areas of the antenna fields to those in which transponders should still be accessed. This can be used to avoid undesirable effects, such as range overshoot when reading transponder data.

RTNC

Connector designation (Reverse TNC). Industrial coaxial connector with screw coupling, can be used for frequencies of up to 2 GHz. The mechanical design of the RTNC connector is not compatible with the TNC connector.

RTTE

Radio and Telecommunications Terminal Equipment

SCM

Supply Chain Management

Secondary fields

In addition to the main sensing range (antenna's main direction of transmission) there are secondary fields. These secondary fields are usually smaller than the main fields. The shape and characteristics of the secondary field depend on the metallic objects in the surroundings. Secondary fields should not be used in configuring.

SELV

Safety Extra Low Voltage

Sensing range

Area in which reliable data exchange between transponder and reader is possible due to a particular minimum field strength.

SSB

Single Sideband Modulation. SSB is similar to AM (amplitude modulation), however, only one sideband is sent instead of two sidebands. This saves 50% of the spectrum required in the HF channel without affecting the signal/data rate. For RFID applications, an HF carrier must also be sent to supply energy to the tag. Sending a carrier is many times not required for other SSB applications, since the HF carrier itself does not contain any data.

Static mode

In static mode the transponder is positioned at a fixed distance (maximum: limit distance) exactly above the reader.

Tag

See transponder

Tag talks first

A passive tag communicates in the read field of a reader with the reader. When a tag reaches the field of a reader, it immediately indicates its presence by reflecting a signal.

TARI

Abbreviation of Type A Reference Interval. Duration (period) for representation of a bit with content 0.

TCP/IP

Transmission Control Protocol/Internet Protocol

Telegram cycles

A passive tag communicates in the read field of a reader with the reader. When a tag reaches the field of a reader, it immediately indicates its presence by reflecting a signal. Transmission of a read or write command is implemented in three cycles. They are called "Telegram cycles". One or two bytes of user data can be transferred with each command. The acknowledgment or response transfer (status or read data) takes place in three further cycles.

TNC

Connector designation (Threaded Neill Concelman).

Industrial coaxial connector with screw coupling, can be used for frequencies of up to 2 GHz.

Transceiver (transmitter/receiver)

Combination of transmitter and receiver. A unit which can both send and receive electromagnetic waves.

Transmission distance

Distance between communication module and transponder

Transponder

An invented word from transmitter and responder. Transponders are used on the product, the product carrier, the object, or its transport or packaging unit, and contain production and manufacturing data, i.e. all application-specific data. They follow the product through assembly lines, transfer and production lines and are used to control material flow.

Because of their wireless design, transponders can be used, if necessary, at individual work locations or manufacturing stations, where their data can be read and updated.

Tree walking

See Reader talks first.

UHF

Ultra-high frequency; frequency range from 300 MHz to 3 GHz. UHF RFID tags usually operate between 866 MHz and 960 MHz. This corresponds to a wavelength of approx. 33 cm.

UID

User IDentifier; the UID is an unambiguous number in the transponder, assigned by the manufacturer. The UID is unambiguous, and can usually also be used as a fixed code. The UID is used to specifically address a transponder

Ultra High Frequency

See UHF.

User IDentifier

See UID

VESA

Video Electronics Standards Association (authority that defines standards for the PC industry)

Walking

See Reader talks first.

WLAN

Wireless LAN

writer

See readers

Writing/reading range

See transmission distance

XML

eXtensible markup language; XML is a language derived from SGML with which other languages (document types) can be described. In the meantime, XML is a widely used language for distributing information on the Internet. Data exchange between reader and read station is carried out using XML commands.

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