SIEMENS

SIMATIC Ident

RFID Systems

SIMATIC RF600

System Manual

Version 10/2015

Answers for industry.

SIEMENS

SIMATIC Ident

RFID systems SIMATIC RF600

System Manual

10/2015

J31069-D0171-U001-A17-7618

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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GERMANY

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Table of contents

1 Introduction

1.1 Preface

Purpose of this document

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

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

Scope of this documentation

This documentation is valid for all supplied versions of the SIMATIC RF600 system and describes the state of delivery as of 10/2015. If you are using older firmware versions, please refer to the 08/2011 edition of the documentation.

Registered trademarks

SIMATIC ®, SIMATIC RF ®, MOBY ®, RF MANAGER ® and SIMATIC Sensors ® are registered trademarks of Siemens AG.

History

Edition	Comment
11/2005	First edition
03/2006	2nd revised edition
04/2006	3rd revised and extended edition: Details in the technical descriptions were revised.
06/2006	4th revised and extended edition:
07/2008	5th revised and extended edition:
11/2008	6th revised and extended edition: New RF620R and RF630R readers
07/2009	7th revised and extended edition: FCC approval RF620R/RF630R
10/2009	8th revised and expanded edition for multitag mode
12/2009	9th revised and extended edition
06/2010	10th revised and extended edition
09/2010	11th revised edition
08/2011	12th revised and expanded edition: New reader RF640R, new antennas RF640A and RF642A
06/2012	13th revised and extended edition
03/2013	14th revised and extended edition
10/2014	15th revised and extended edition: New readers RF650R, RF680R and RF685R
07/2015	16th revised and extended edition
10/2015	17th revised and extended edition Approval for the readers RF650R, RF680R, and RF685R

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:

Write/read device (SLG)	Reader
Mobile data storage unit (MDS), data carrier,SmartLabel	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

Note

Heed the safety notices

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.

WARNING

Safety extra low voltage

The equipment is designed for operation with Safety Extra-Low Voltage (SELV) by a Limited Power Source (LPS). (This does not apply to 100 V ... 240 V devices.)

This means that only safety-extra low voltage (SELV) with a limited power source (LPS) complying with IEC 60950-1 / EN 60950-1 / VDE 0805-1 may be connected to the power supply terminals or the power supply unit for the equipment power supply must comply with NEC Class 2, according to the National Electrical Code (r) (ANSI / NFPA 70).

There is an additional requirement if devices are operated with a redundant power supply:

If the equipment is connected to a redundant power supply (two separate power supplies), both must meet these requirements.

WARNING

Opening the device

D not open the device when energized.

NOTICE

Alterations not permitted

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.

Operating temperature

CAUTION

Increased temperatures on the lower casing

Note that the lower casing of the readers is made of metal. This means that temperatures can occur on the lower casing that are higher than the maximum permitted operating temperature.

CAUTION

Do not expose the RF650R/RF680R/RF685R readers to direct sunlight

Note that the readers must not be exposed to direct sunlight. Direct sunlight can lead to the maximum permitted operating temperature being exceeded.

Overvoltage protection

NOTICE

Protection of the external 24 VDC voltage supply

If the module is supplied via extensive 24 V supply lines or networks, interference by strong electromagnetic pulses on the supply lines is possible, e.g. from lightning or the switching of large loads.

The connector for the 24 VDC external power supply is not protected against strong electromagnetic pulses. Make sure that any cables liable to lightning strikes are fitted with suitable overvoltage protection.

Repairs

WARNING

Repairs only by authorized qualified personnel

Repairs may only be carried out by authorized qualified personnel. Unauthorized opening of and improper repairs to the device may result in substantial damage to equipment or risk of personal injury to the user.

Lightning protection

⚠ CAUTION
Installation only in protected areas
The antennas and the RF680R/RF685R readers can be installed in the protected part of a building. When implementing your lightning protection concept, make sure you adhere to the VDE 0182 or IEC 62305 standards.
The RF650R reader must not be installed in the outdoor area.

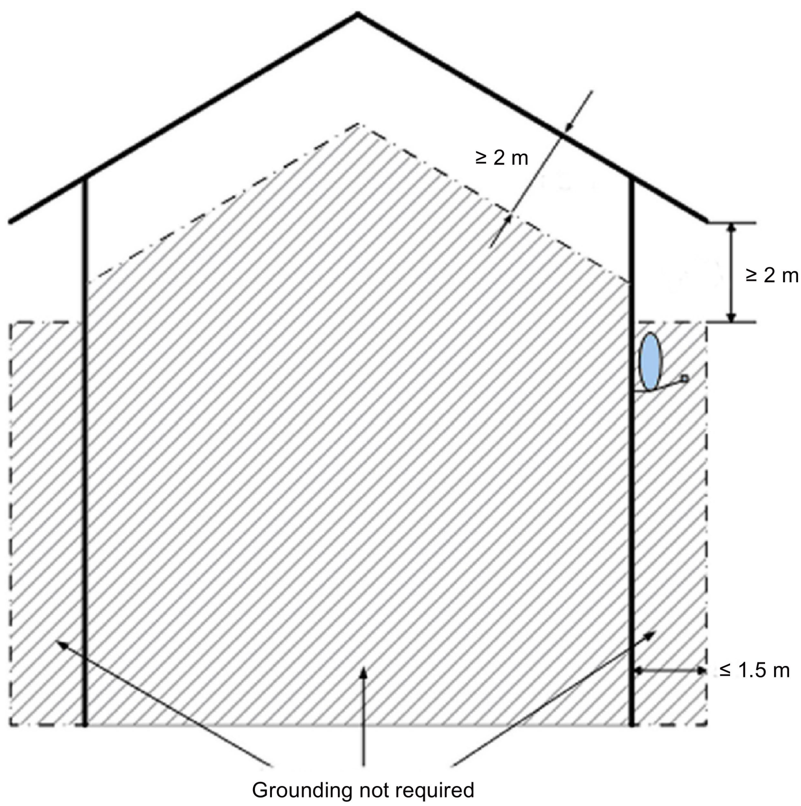


Figure 2-1 Mounting the reader in protected areas

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 customer service or where you purchased your device to find out which system expansions are suitable for installation.

Note

Warranty conditions

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

Alterations not permitted

Alterations to the devices are not permitted. If this is not adhered to, the radio approvals, the relevant country approvals (e.g. CE or FCC) and the manufacturer's guarantee are invalidated.

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 customer service or where you purchased your device to find out which system expansions are suitable for installation.

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 that do not belong to the RF600 range of products, all type tests as well as all certificates relevant to the RF600, such as CE, FCC, UL, CSA are invalidated.

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

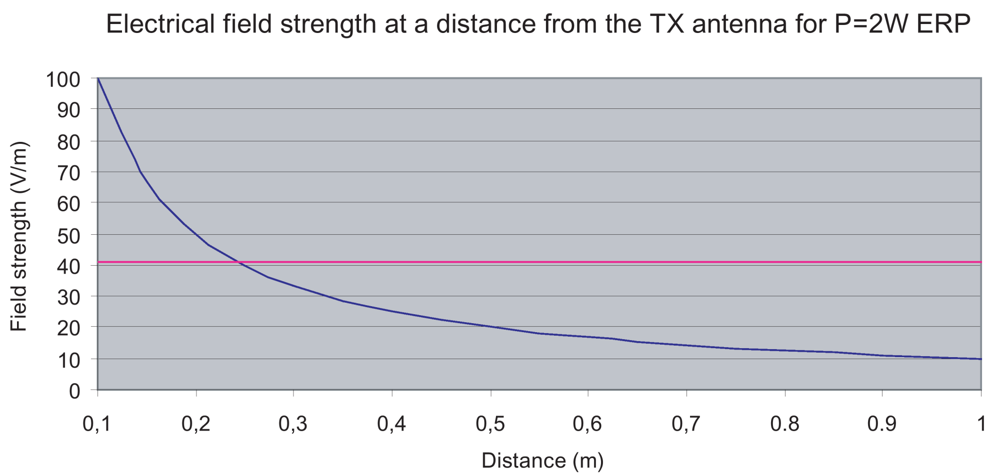
Magnetic field strength: H = 0.111 A/m

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 permitted transmit power ($1/r^2$) in accordance with ETSI (2 W ERP), the "safety distance" is d = 0.24 m. This means that personnel should not remain closer than 24 cm to the transmitter antenna for extended periods (for 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

RF620R/RF630R-specific notes

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 safety distance is therefore at least 0.12 m.

The SIMATIC RF630R (ETSI) 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 cannot exceed the 2 W ERP.

RF650R/RF680R/RF685R-specific notes

Note

Reduced maximum radiated power with RF650R/RF680R/RF685R readers

The SIMATIC RF650R (ETSI) reader has a maximum transmit power of 1 W. The radiated power therefore depends on the antenna cable and the type of antenna used, but cannot exceed 2 W ERP.

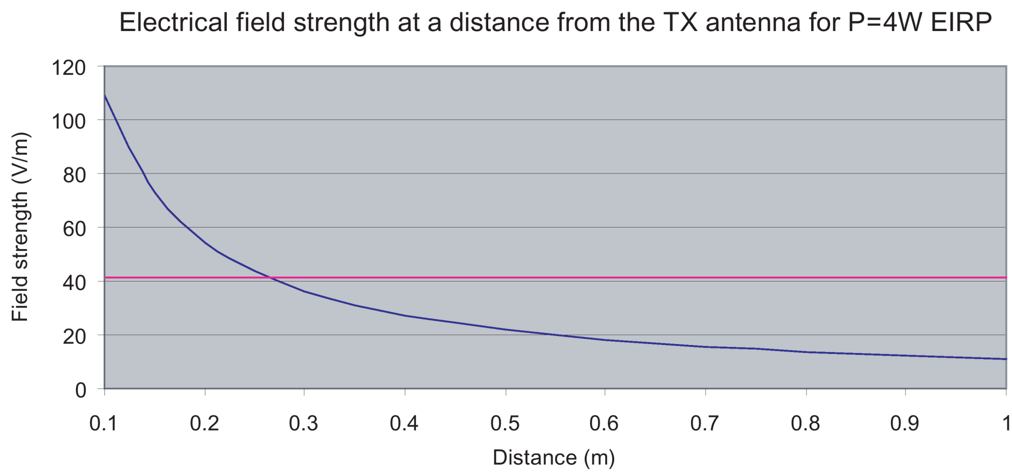
The SIMATIC RF680R (ETSI) reader has a maximum transmit power of 2 W. The radiated power therefore depends on the antenna cable and the type of antenna used, but cannot exceed 2 W ERP.

The SIMATIC RF685R (ETSI) reader has a maximum radiated power of 2 W ERP. The safety distance is therefore at least 0.12 m.

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

Minimum distance to antenna in accordance with FCC (USA)

For the maximum permitted radiated power in accordance with FCC (4 W EIRP), the "safety distance" is 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 permitted value (4 W 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 should be maintained.

RF620R/RF630R-specific notes

Note

Reduced maximum radiated power with RF620R/RF630R readers

The SIMATIC RF620R (FCC) reader has a maximum transmit power of 0.5 W. This means that 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 cannot exceed the 4 W EIRP.

RF650R/RF680R/RF685R-specific notes

Note

Reduced maximum radiated power with RF650R/RF680R/RF685R readers

The SIMATIC RF650R (FCC) reader has a maximum transmit power of 1 W. The radiated power therefore depends on the antenna cable and the type of antenna used, but cannot exceed 4 W EIRP.

The SIMATIC RF680R (FCC) reader has a maximum transmit power of 2 W. The radiated power therefore depends on the antenna cable and the type of antenna used, but cannot exceed 4 W EIRP.

The SIMATIC RF685R (CC) reader has a maximum transmit power of 2 W. This means that the safety distance is at least 0.12 m.

System overview of SIMATIC RF600

3

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

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.

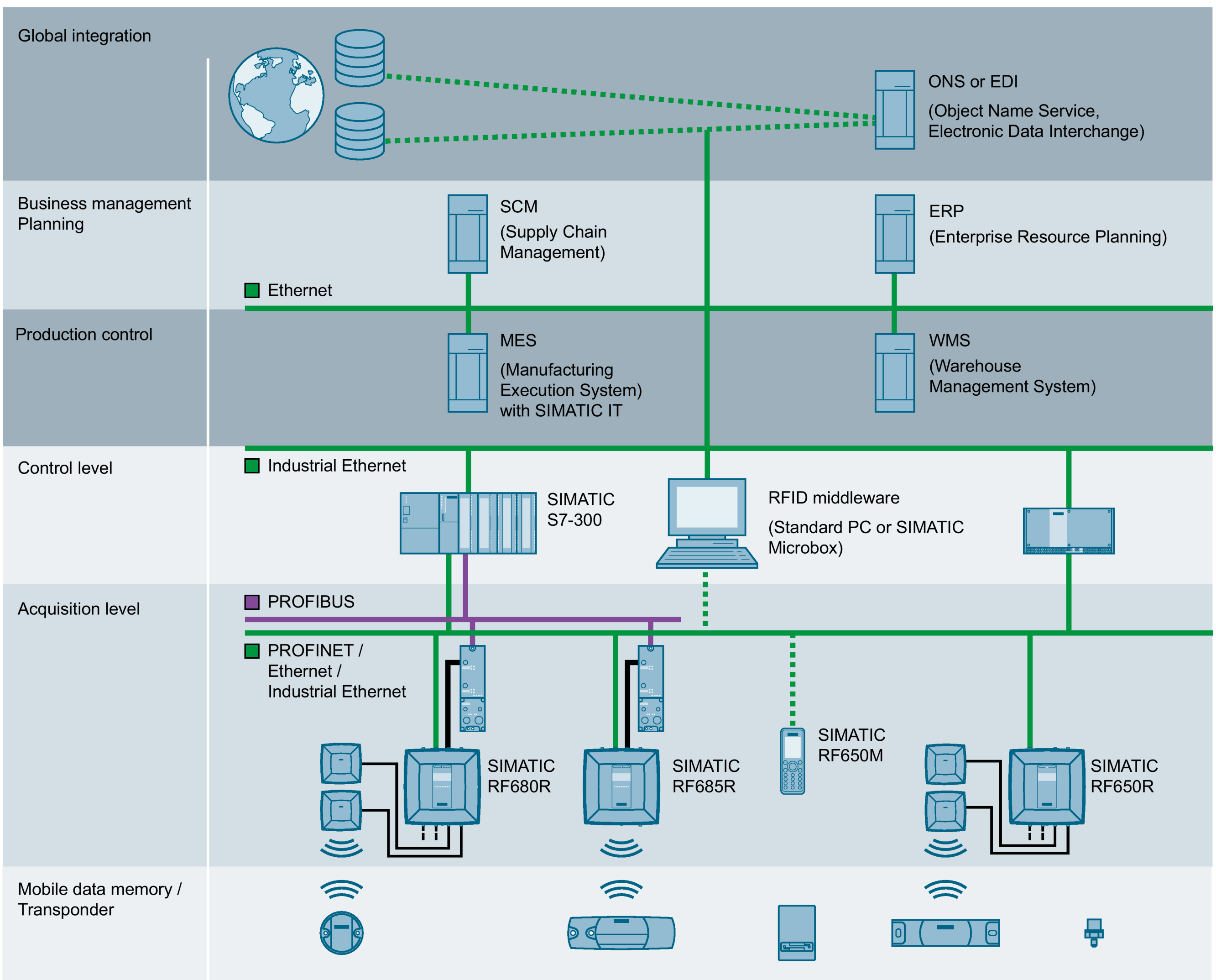


Figure 3-1 System overview SIMATIC RF600 with RF650R, RF680R, RF685R and RF680M

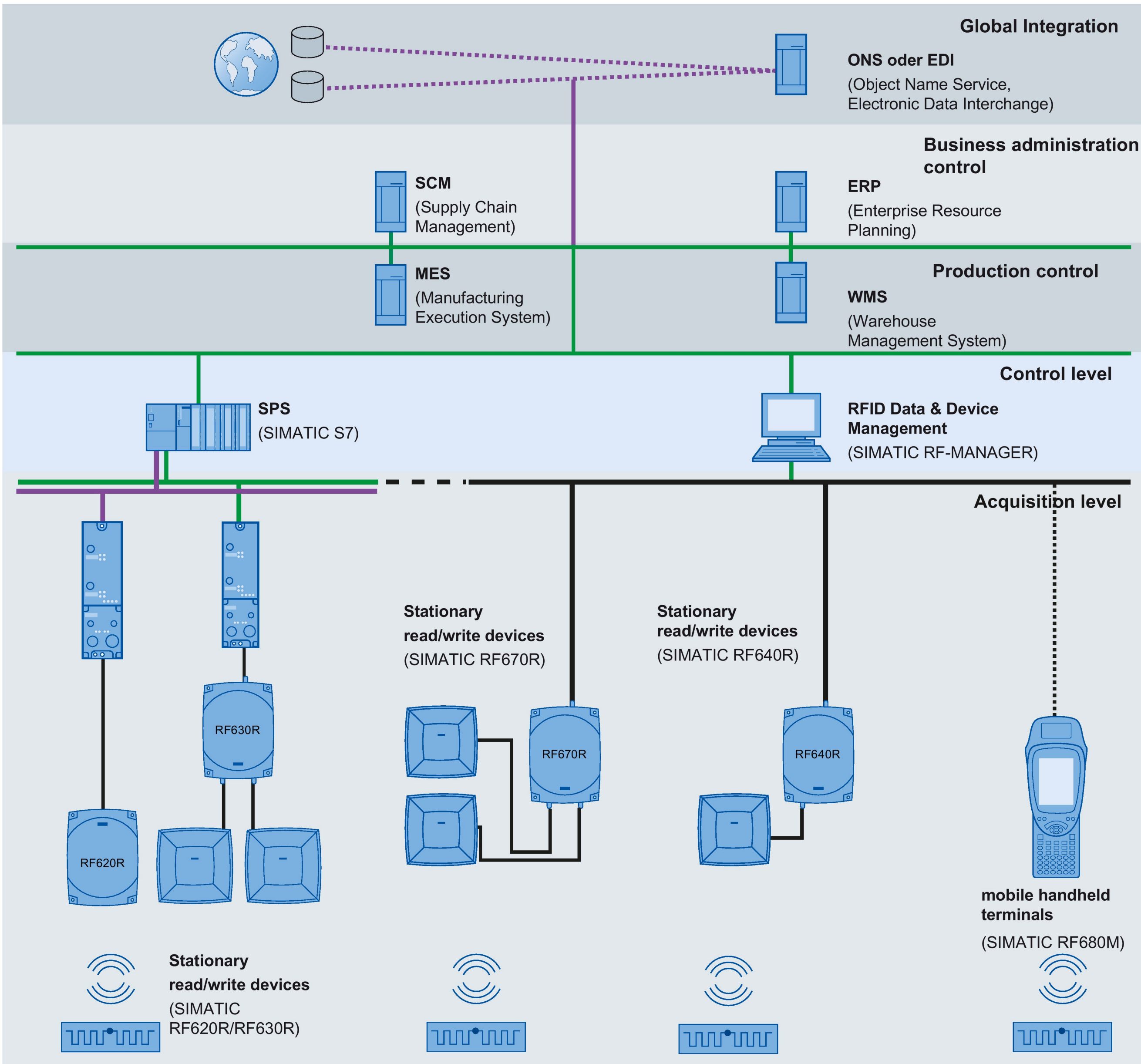


Figure 3-2 System overview SIMATIC RF600 with RF620R, RF630R, RF640R, RF670R and RF680M

- **Acquisition level**

  This level contains the RFID readers that read the appropriate transponder data and transfer it to the next higher level.

- **Control level**

  At the control level , the RFID data is collected, preprocessed and made available 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 arises in the automation environment (control level) and the logistic 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 the 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**

  At this level, product information can be exchanged at an inter-company level. This can be performed over the Internet with the help of special services.

3.1 Application areas of RF600

RFID (radio frequency identification) permits continuous identification, tracking and documentation of all delivered, stocked and shipped goods in the incoming goods, warehouse, production, 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.

3.2 System components (hardware/software)

RF600 products	Description
	The RF620R reader creates with its connection to a SIMATIC controller optimum preconditions for production-related application scenarios and/or production-related logistics applications by RFID. It is equipped with an integrated antenna with circular polarization and has a connector for an external antenna.
	The RF630R reader creates with its connection to a SIMATIC controller optimum preconditions for production-related application scenarios and/or production-related logistics applications by RFID. It has 2 connectors for external antennas.
	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 achieved using an XML protocol, TCP/IP and Ethernet. It is equipped with an integrated antenna with circular polarization and has a connector for an external antenna.

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 achieved using an XML protocol, TCP/IP and Ethernet. It has 4 connectors for external antennas.
	Due to its compact design the RF650R reader is suitable for applications in production logistics. Integration is achieved using an XML protocol, TCP/IP and Ethernet. It has 4 connectors for external antennas.
	Due to its compact design and high degree of protection, the RF680R reader is ideally suited to applications in production logistics and distribution. Integration is achieved using an XML protocol, TCP/IP and Ethernet or PROFINET. As an alternative, integration can also be via PROFIBUS via the serial interface. It has 4 connectors for external antennas.
	Due to its compact design and high degree of protection, the RF685R reader is ideally suited to applications in production logistics and distribution. Integration is achieved using an XML protocol, TCP/IP and Ethernet or PROFINET. As an alternative, integration can also be via PROFIBUS via the serial interface. It is equipped with an integrated antenna with switchable polarization and has a connector for an external antenna.

RF600 products	Description
	The mobile reader 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.
	SIMATIC RF660A is a circular antenna of medium size for production and logistics applications.
	The SIMATIC RF640A is a circular antenna of medium size for universal applications, for example material flow and logistics systems.
	SIMATIC RF642A is a linear antenna of medium size for environments where a lot of metal occurs.

RF600 products	Description
	The SIMATIC RF620A is a linear antenna with a compact design suitable for industry. It is suitable for UHF transponders with normal (far field) antenna characteristics.
	The RF600 transponder family provides the right solution for every application: RF610T ISO Card is a flexible card suitable for numerous applications. The transponders RF620T, RF625T, RF630T and RF640T are designed specially for industrial requirements. They are very rugged and highly resistant to detergents. The RF640T can also be mounted directly on metal. For storing larger amounts of data, the transponder RF622T with its 4 KB of FRAM memory is particularly suitable. The transponder RF680T was developed specially for use in high temperatures up to 220° C. In the area of Smartlabels, a comprehensive spectrum of competitively priced labels is available for the widest range of requirements. The heat-resistant smartlabels RF680L and RF690L can resist temperatures up to 230 °C and are therefore ideally suited for identification tasks in the paint shop/drying area.

3.3 Features

The RF600 identification system has the following performance features:

Table 3- 1 Features of the RF600 RFID system

Type	Contactless RFID (Radio Frequency IDentification) system in the UHF band
Transmission frequency	865-868 MHz (ETSI: EU, EFTA, Turkey) 902-928 MHz (FCC: USA) 920.125 - 924.875 MHz (CMIIT: CHINA)
Standards	EPCglobal Class 1, Gen 2

Table 3- 2 Features of the RF600 readers

Reader	Antennas	Read/write distance [1)]	Interface
RF620R	1 x internal antenna 1 x antenna connector for external antennas	Internal antenna: < 5 m External antenna < 6 m	PROFIBUS, PROFINET
RF630R	2 x antenna connectors for external antennas	< 6 m	PROFIBUS, PROFINET
RF640R	1 x internal antenna 1 x antenna connector for external antennas	Internal antenna: < 7 m External antenna < 8 m	Ethernet
RF670R	4 x antenna connectors for external antennas	< 8 m	Ethernet
RF650R	4 x antenna connectors for external antennas	< 8 m	Ethernet
RF680R	4 x antenna connectors for external antennas	< 8 m	Ethernet, PROFINET and PROFIBUS
RF685R	1 x internal antenna 1 x antenna connector for external antennas	Internal antenna: < 7 m External antenna < 8 m	Ethernet, PROFINET and PROFIBUS

[1)] Depends on the connected antenna and the transponder being used

Table 3- 3 RF680M mobile handheld terminal

Transmission frequency	865-868 MHz (EU) 902-928 MHz (USA)
Write/read distance	3 m
Standards	EPCglobal Class 1, Gen 2

Table 3- 4 RF680M mobile handheld terminal

Transmission frequency	865-868 MHz (EU, EFTA, Turkey) 902-928 MHz (USA)
Write/read distance	Europe < 2 m USA < 1 m
Standards	EPCglobal Class 1, Gen 2

Table 3- 5 Transponder

Version	**Tags / SmartLabels**	**Designation**	**Standards supported**
	SmartLabel	RF622L RF630L RF640L RF680L RF690L	EPCglobal Class 1, Gen 2
	ISO card Container tag Container tag Disc tag Powertrain tag Tool tag Heat-resistant tag	RF610T RF620T RF622T RF625T RF630T RF640T (Gen 2) RF680T	EPCglobal Class 1, Gen 2

Table 3- 6 Software

RF-MANAGER Basic V3	PC software for assigning parameters to the RF670R and RF640R readers System requirements: Windows XP SP2 and higher, Windows 7

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 section shows you how you can use the RF600 components on the basis of various example scenarios.

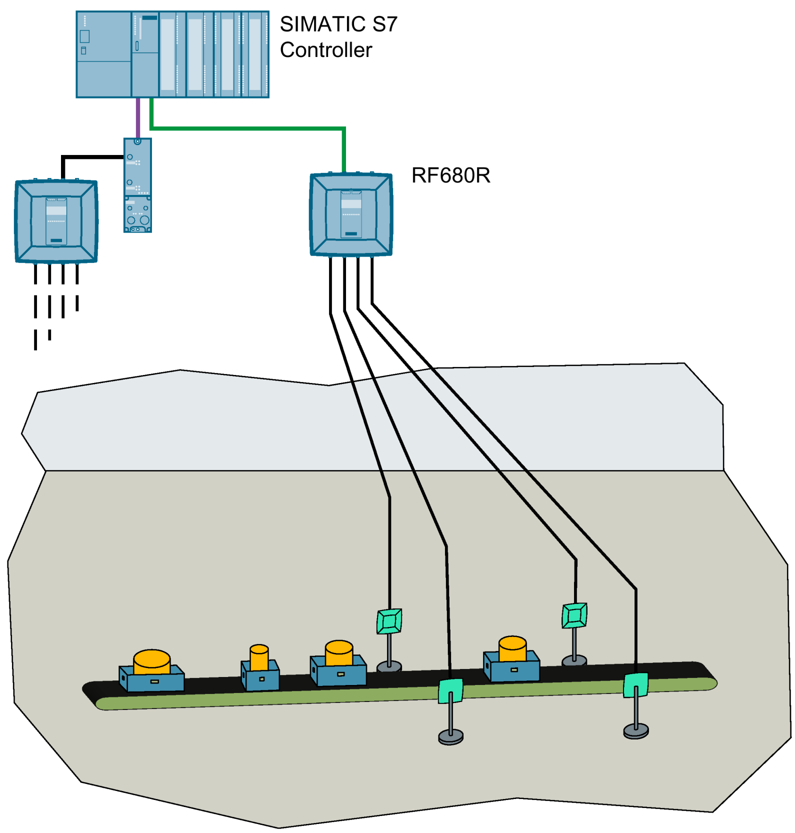
Note

Readers used in the following scenarios

The scenarios shown in the following sections are based on the RF650R, RF680R and RF685R readers. Remember that the individual scenarios can also be implemented with the RF620R, RF630R, RF640R or RF670R readers.

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

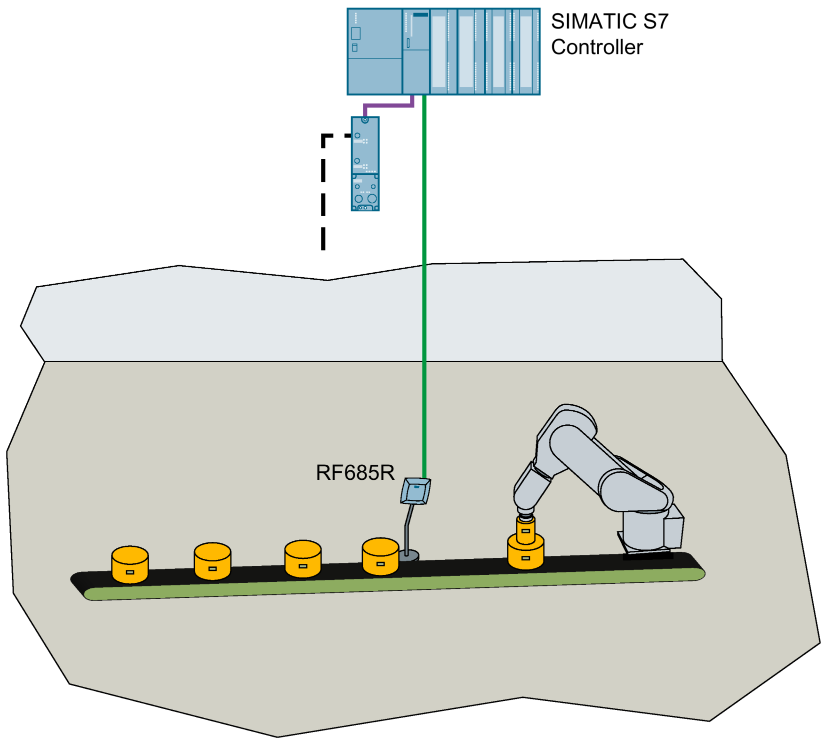
The conveyor transports different transport containers past the antennas. The RFID transponder is, however, always applied to the transport containers with the same alignment. The transponders in this scenario are transponders of the type SIMATIC RF680T.

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

In this scenario a SIMATIC RF680R is used as the reader. Optimum reading reliability is ensured by four external SIMATIC RF660A antennas in a portal arrangement. Where the distances to, or between, the material containers are extremely short the SIMATIC RF620A is an good alternative. The SIMATIC°RF680R reader reads the information from the transponder on the transport containers and transfers it to the SIMATIC S7 controller which controls the sequence to follow depending on the transponder information.

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 transponder of a tool holder 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

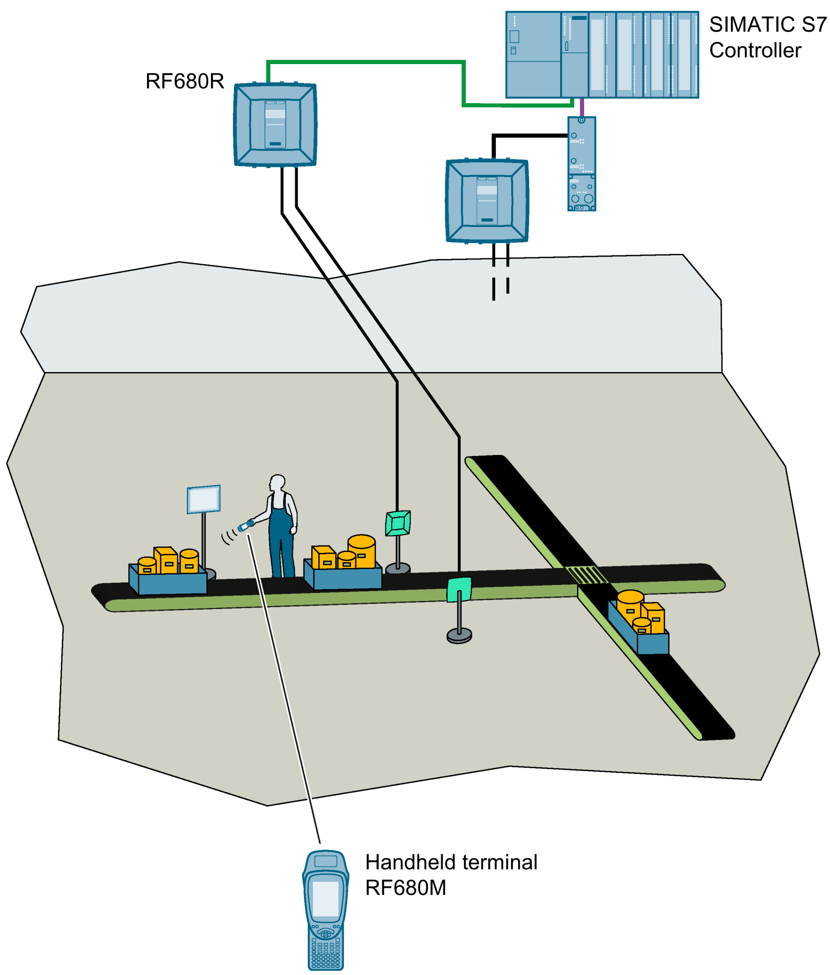
Transponders are attached to workpiece holders. Their spatial orientation is always identical. With this arrangement, only a single transponder needs to be detected each time (single-tag). The transponders in this scenario are transponders of the type SIMATIC RF640T.

The SIMATIC RF685R reader reads the information from the transponders with its integrated antenna and transfers it to the SIMATIC S7 controller. Depending on the stored transponder information, the SIMATIC S7 controller different control tasks, for example, automatically providing a suitable tool for an industrial robot at the correct time.

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 transponders of the type SIMATIC RF630L are directly attached to the item. The maximum transport speed of the conveyor belt is 2 m/s.

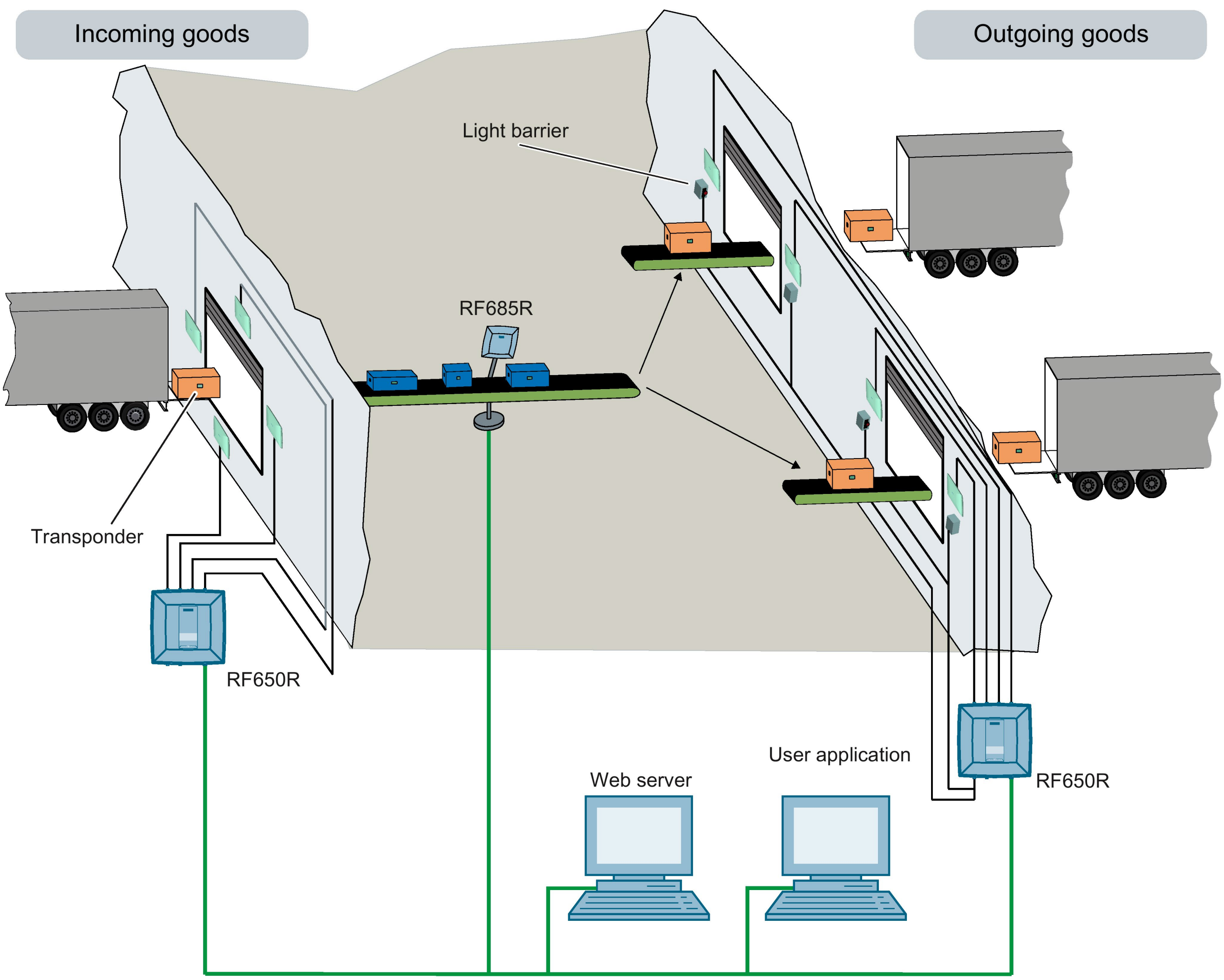
In this scenario, bulk acquisition is necessary because several objects must be detected at the same time.

The SIMATIC RF680R reader uses two external antennas in a portal arrangement to read the information from the transponders on the passing items and transfers it to the SIMATIC S7 controller via a communications module. The SIMATIC S7 controls the sorter of the conveyor system depending on the transponder information.

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

4.2.4 Scenario incoming goods, distribution of goods and outgoing goods

The scenario consists of an RFID system with three readers. The SIMATIC RF650R reader with its four antennas identifies the incoming/outgoing products at the incoming/outgoing goods gates of a factory building hall through which pallets are delivered. Each pallet is fitted with a transponder. The transponders 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.



Features of the scenario

in this example, the SIMATIC RF685R 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 transponder that is always fitted at the same position and with the same alignment on the item. These transponders 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 sorter, the goods are loaded onto pallets - each pallet is fitted with a transponder. These transponders also contain user data that provides information about the sender and receiver of the goods. Based on the data read by the SIMATIC RF650R 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.

4.3 Antenna configurations

Note

Validity of antenna configuration

The following information about the antenna configuration only applies to the antennas of the RF600 family. Refer to the Guidelines for selecting RFID UHF antennas (Page 59) for information on the configuration of third-party antennas.

4.3.1 Antenna configuration example

The following figure shows an example of an application with an antenna configuration of the RF650R. The antennas are positioned at the height at which the transponders to be identified are expected. The maximum width of the portal 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.

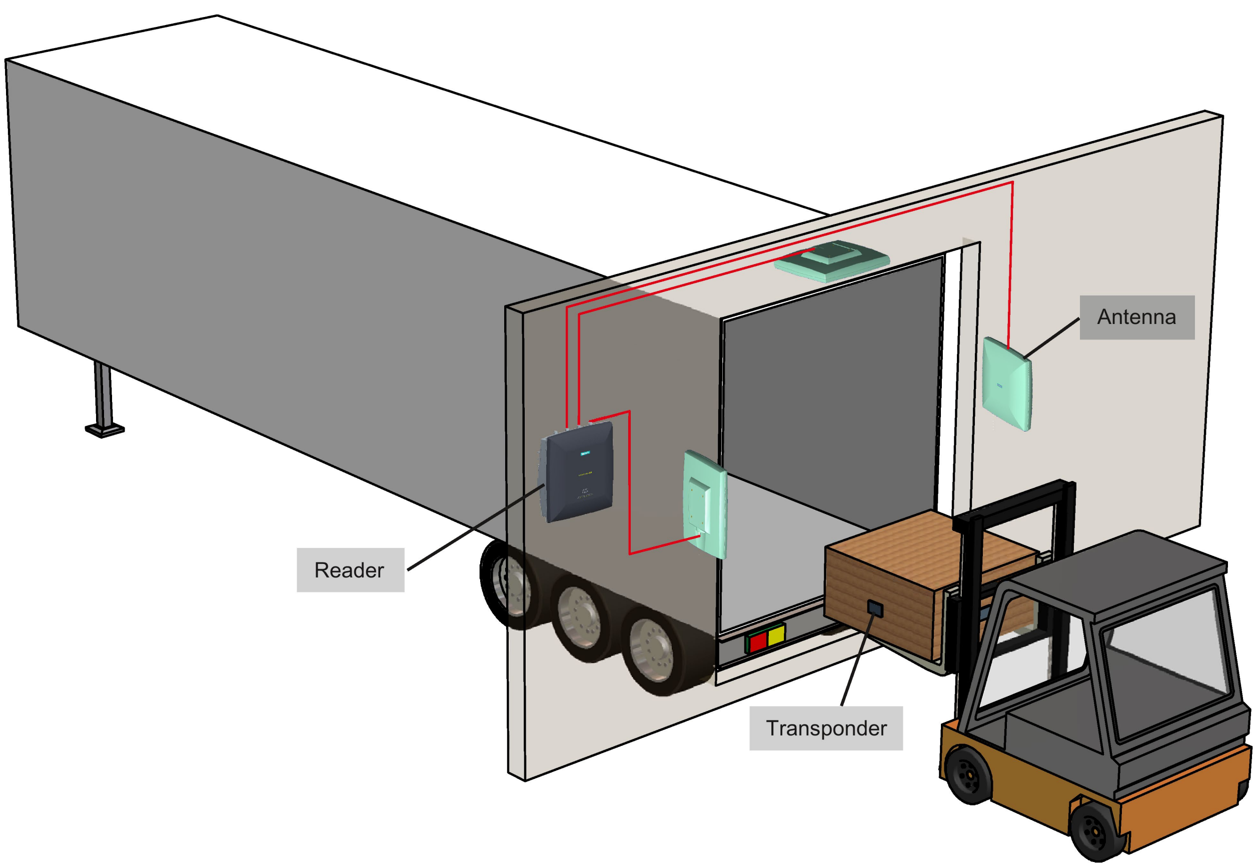
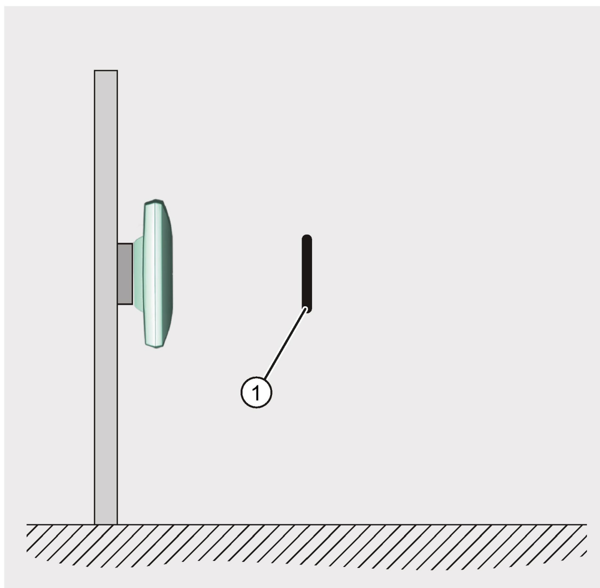


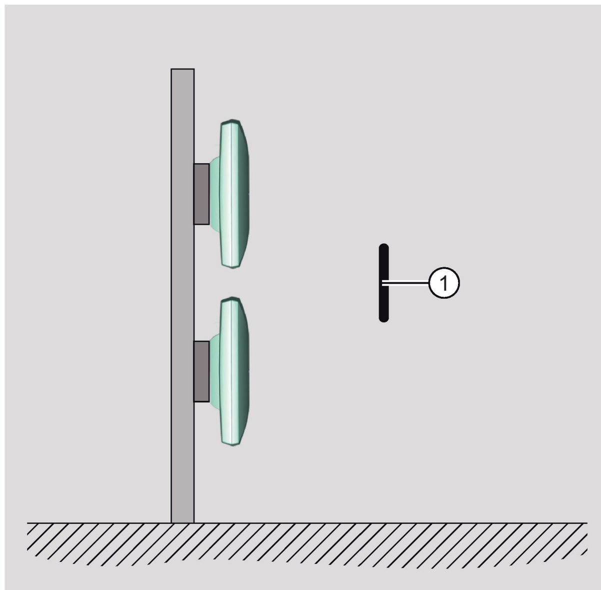
Figure 4-1 Example of an antenna configuration with three antennas

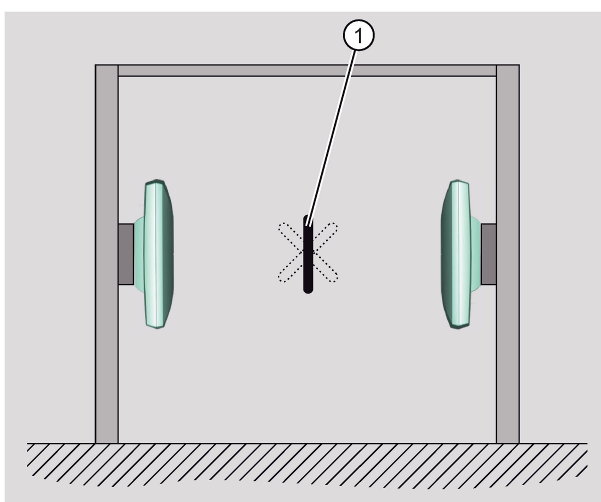
4.3.2 Possibilities and application areas for antenna configurations

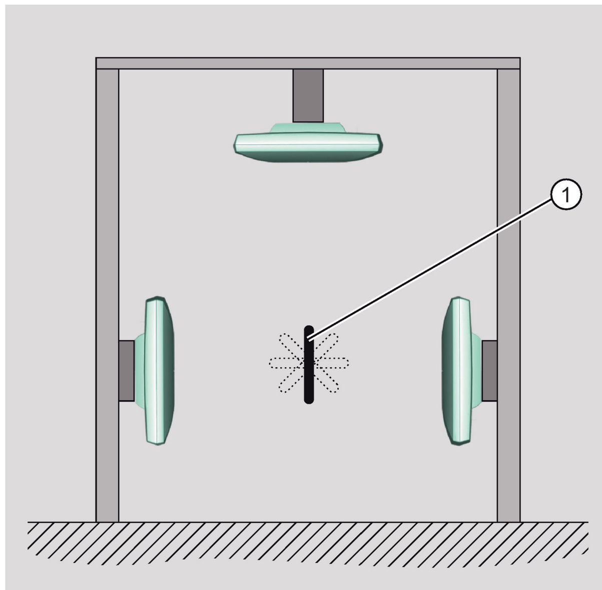
Some basic antenna configurations and possible fields of application are shown below.

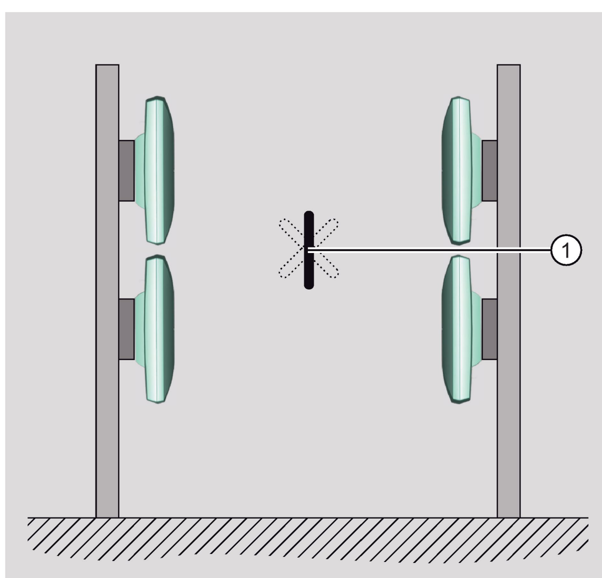
With the various configurations, please note that up to four external antennas can be connected to the RF650R, RF680R and RF670R readers, up to two can be connected to the RF630R reader and one external antenna can be connected to the RF620R, RF640R and RF685R readers. The RF620R, RF640R and RF685R readers also have an internal antenna.

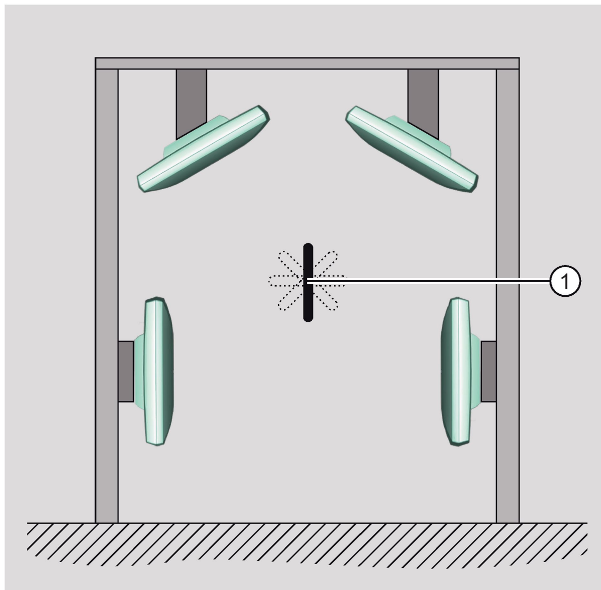
Antenna configuration 1	Description/ application areas
	This arrangement of antennas is appropriate when the transponders to be read are only located on one side of the goods to be acquired, for example, if a conveyor belt with passing goods has to be monitored during production and it is precisely defined on which side the transponders to be read are attached. ① Transponder

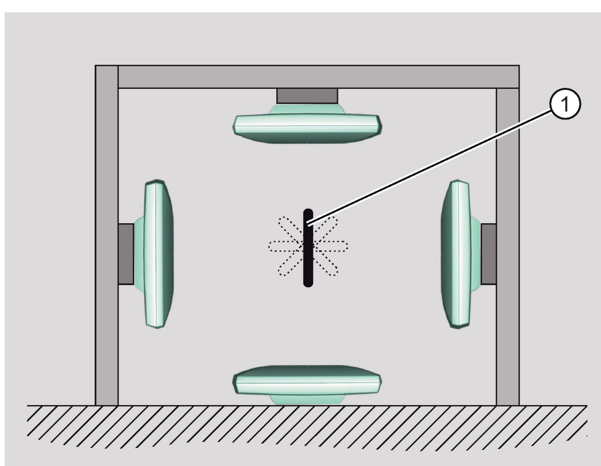
Antenna configuration 2	Description/ application areas
	This arrangement of antennas is appropriate when the transponders to be read are only located on one side of the items to be identified, e.g. when pallets are to be identified and it is known on which side the transponders to be read are located. ① Transponder

Antenna configuration 3	Description/ application areas
	Preferred for the identification of goods at loading gates: The transponder is located in the radiation field of two antennas; for reliable transponder reading, the height of the transponders above floor level must therefore be known with reasonable accuracy. ① Transponder

Antenna configuration 4	Description/ application areas
	Preferred for the identification of goods at loading gates: Similar to configuration 2, but with additional reading reliability when the transponder is at an angle to the vertical. ① Transponder

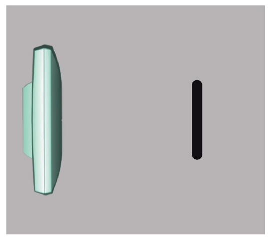
Antenna configuration 5	Description/ application areas
	Preferred for the identification of goods at loading gates: The transponder is located in the radiation field of all four antennas, so the transponder position for reliable tag identification is more flexible than in configuration 2. ① Transponder

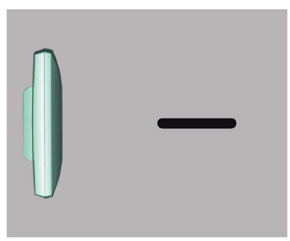
Antenna configuration 6	Description/ application areas
	Preferred for the identification of goods at loading gates: Similar to configuration 4, but the reliability of transponder identification is improved as a result of the four antennas at separate locations, so the transponder position is not critical. ① Transponder

Antenna configuration 7	Description/ application areas
	This tunnel configuration is suitable for conveyor belt applications. The goods with the transponders to be read are moving forwards on a conveyor belt but the alignment of the transponders 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 Transponder

4.3.3 Transponder orientation in space

The alignment of the transponder antenna to the antenna of the reader influences the reading range. For maximum performance and to achieve the maximum read range, the transponder antenna should therefore be aligned parallel to the reader antenna:

Parallel transponder alignment	Large reading range
	The probability of identification of the transponders is at a maximum.

Vertical transponder alignment	Minimal reading range
	The probability of identification of the transponders is at a minimum.

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:

Between the antenna and liquids or metals, a minimum distance of 50 cm should be kept to. The distance between the antenna and the floor should also be at least 50 cm.

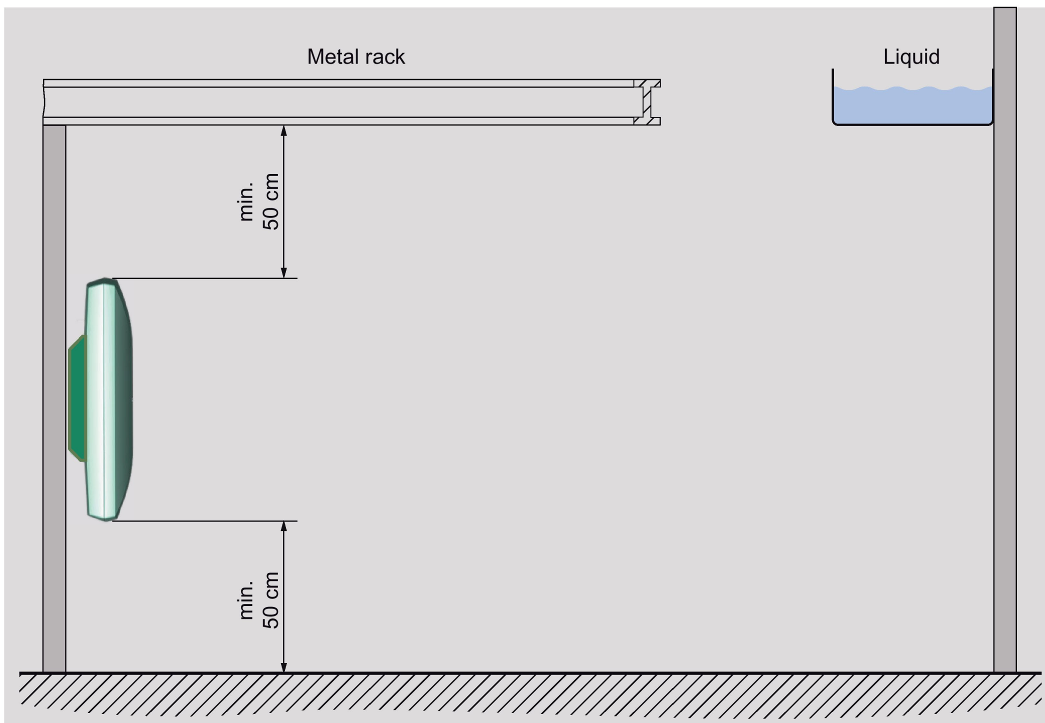


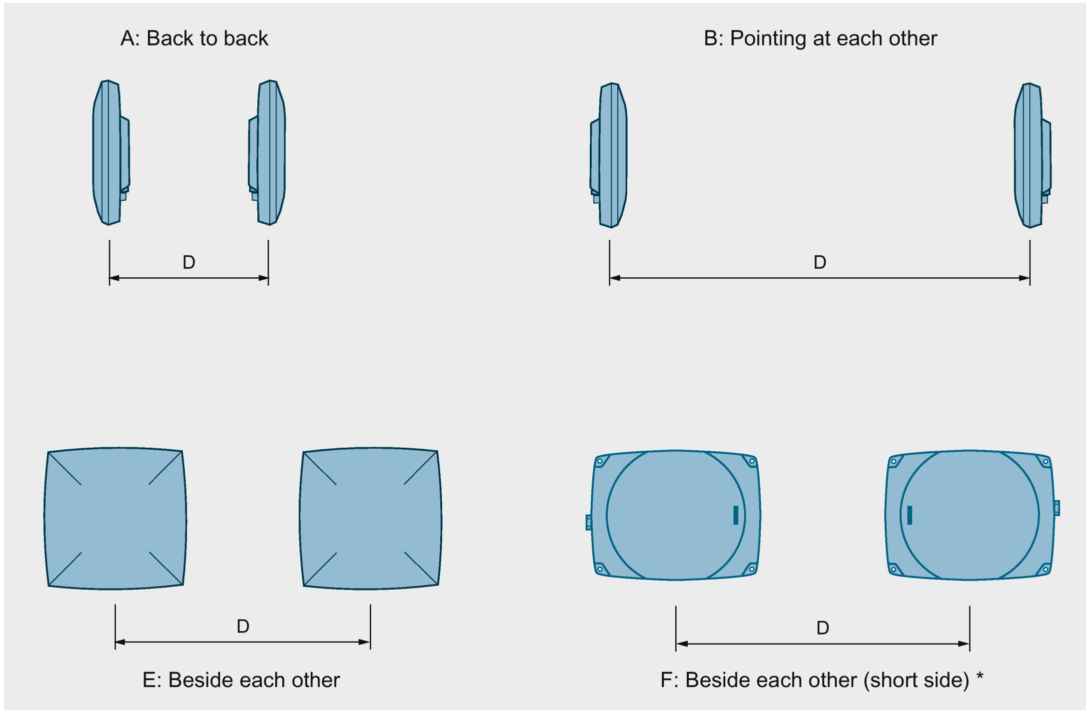
Figure 4-2 Minimum distance to the environment

4.3.5 Reciprocal influence of read points

Antenna alignment and antenna spacing with external antennas

The minimum distance required between antennas that use the same frequency and that are connected to different readers depends on the set maximum radiated power and the antenna alignment.

You will find an overview of the maximum radiated power of the readers in the section "Overview (Page 99)". In conjunction with the RF660A antennas, the readers achieve a maximum radiated power of 2 W.



* relevant when operating the RF620R and RF640R readers with the internal antenna

Figure 4-3 Antenna spacing for different readers/antennas and identical frequencies

Table 4- 1 Antenna alignment and minimum antenna spacing with external antennas

Antenna configuration	**Antenna alignment**	**Minimum distance required = D**		
		RF640R/RF670R with RF660A	**RF620R/RF630R with RF660A**	**RF650R/RF680R/RF685R with RF660A**
A	Back to back	0.5 m	0.3 m	0.5 m
B	Pointing at each other	6 m	6 m	2 m
E	Next to each other	1 m	0.8 m	0.8 m

Table 4- 2 Maximum antenna spacing of the external antennas with a portal configuration

Antenna configuration	**Antenna alignment**	**Maximum distance = D**		
		RF670R with RF660A	**RF630R with RF660A**	**RF650R/RF680R/RF685R with RF660A**
B	Pointing at each other	8 m [1)]	4 m	8 m

[1)] Portal spacing of up to 10 m is possible. The probability of a read must be checked.

Antenna alignment and antenna spacing with internal antennas (RF620R/RF640R/RF685R)

Table 4- 3 Antenna alignment and minimum antenna spacing with internal reader antennas

Antenna configuration	Antenna alignment	Minimum distance required = D		
		RF620R	RF640R	RF685R
A	Back to back	0.4 m	0.4 m	0.3 m
B	Pointing at each other	5.8 m	4.0 m	2 m
E	Side by side (long side)	1.4 m	1.4 m	0.5 m
F	Side by side (short side)	1.8 m	2 m	0.5 m

Optimization of the antenna arrangement

With the RF620R, RF640R, RF685R readers (with the internal antenna)

The RF620R and RF640R readers have an integrated, circular polarized antenna. This means that the type of antenna cannot be freely selected. The RF685R reader has an integrated switchable antenna (circular or linear polarization).

With the RF640A/RF642A/RF660A antennas

The electrical aperture angles (vertical and horizontal) of the RF660A antenna are identical, with the RF640A/RF642A antennas they are similar. Therefore, the robustness of the readers' access to transponder data cannot be optimized for the RF660A and with the RF640A/RF642A it can be optimized only to a limited extent by rotating around the antenna axis.

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.
Transponder size and design	The larger the transponder 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.
Manufacturing quality of the transponders	The better the transponder has been matched to the operating frequencies during manufacturing, the greater the reading range.

The reading range depends on	Description
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 are several transponders located in the antenna field, the distances to all other transponders must not exceed the maximum possible distance to be able to be detected from 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 of 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 Using more than one reader

When mounting the readers make sure that there is a minimum clearance of 0.5 m between the readers to avoid them influencing each other.

Avoiding problems

When several RFID readers are used, there is a danger that RFID transponders can also be read out by other readers. Care must therefore be taken to ensure that the transponder can only be identified by the intended 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 76)".

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

4.3.8.2 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 transponders are being used.

When mounting the readers, make sure that there is a minimum clearance of 0.5 m between the readers.

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 76))
- Type of transponder (see section Transponder/tags (Page 363))
- Number of transponders to be detected by an antenna at a time
- Type of antenna (see section Antennas (Page 275), section Guidelines for selecting RFID UHF antennas (Page 59), and section Planning application (Page 107))
- Transponders' distance from and orientation toward antennas (see section Transponder/tags (Page 363))

- 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

Frequency hopping is always active with FCC. With 50 available channels the probability is low that two readers will be operating on the same frequency. In China, one reader operates on at least 2 channels, e.g. sixteen 2 watt channels.

You will find more information on frequency bands in the section "Regulations applicable to frequency bands (Page 90)".

Procedure for ETSI

Frequency hopping is optional with ETSI. According to ETSI EN 203 208 V1.4.1, frequency hopping is used in multi-channel operation. Without frequency hopping, 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 24).

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 62) and Antenna cables (Page 74).

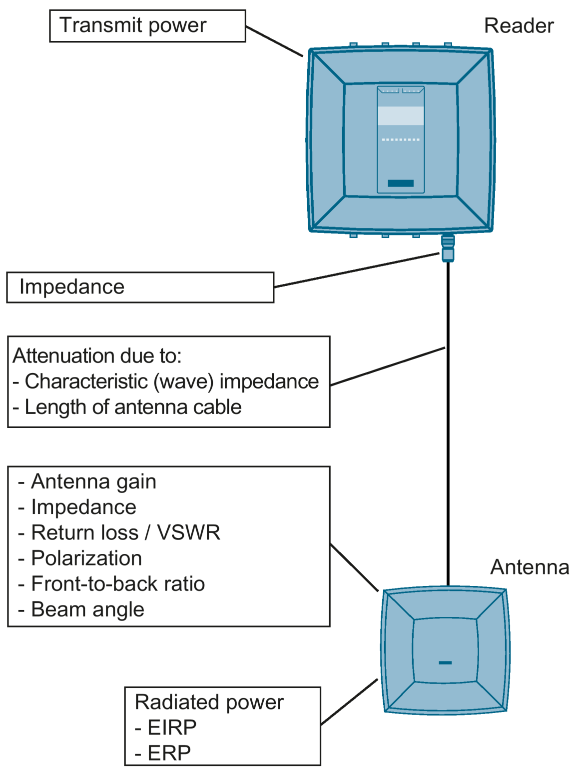


Figure 4-4 Overview of total system and influencing factors

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 and/or a third-party antenna cable with a reader, you need to select the suitable components. These instructions will help you to select the components and the settings of the important parameters. With the RF640R and RF670R readers, the parameters for the radiated power, antenna gain and cable loss are set using the RF-MANAGER Basic. With the RF650R, RF680R and RF685R readers, the parameters for the radiated power, antenna gain and cable loss (user-defined) are set using the WBM.

There are two different application cases:

- Selection of third-party components:
  You want to select suitable third-party components for the SIMATIC RF600 system and then configure the reader for these components.
- Configuration of existing third-party components:
  You already have third-party components (antennas, antenna cables or both) and want to 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 62) or section Antenna cables (Page 74) 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 or the WBM. 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 515).

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 element. 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?

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

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

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

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 66)). 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

There are country-specific upper limits for the transmit power of antennas. To adhere to these, you must know the antenna gain in the relevant frequency band or range. You can obtain the value of the antenna gain from the technical specifications of your antenna vendor.

Dependencies

- Frequency dependency:
  if a frequency dependency exists in the frequency band used, you must use the highest value 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 permitted radiated power will not be exceeded even in the most extreme case.
- Dependency on the plane
  If the values for the antenna gain are different in the horizontal and vertical planes, you must always use the higher value.

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

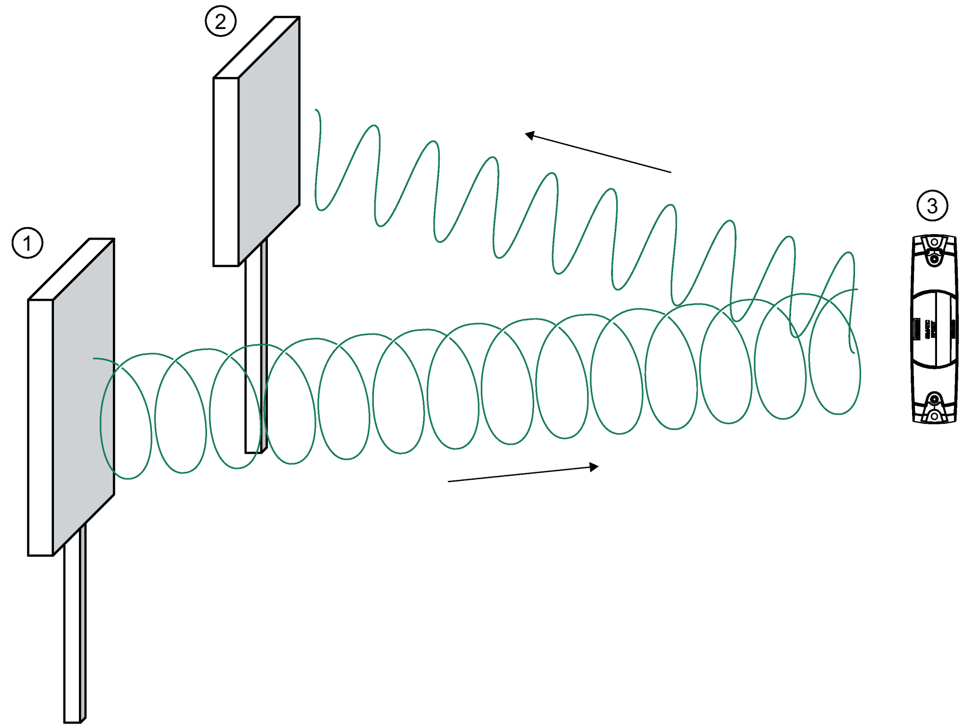
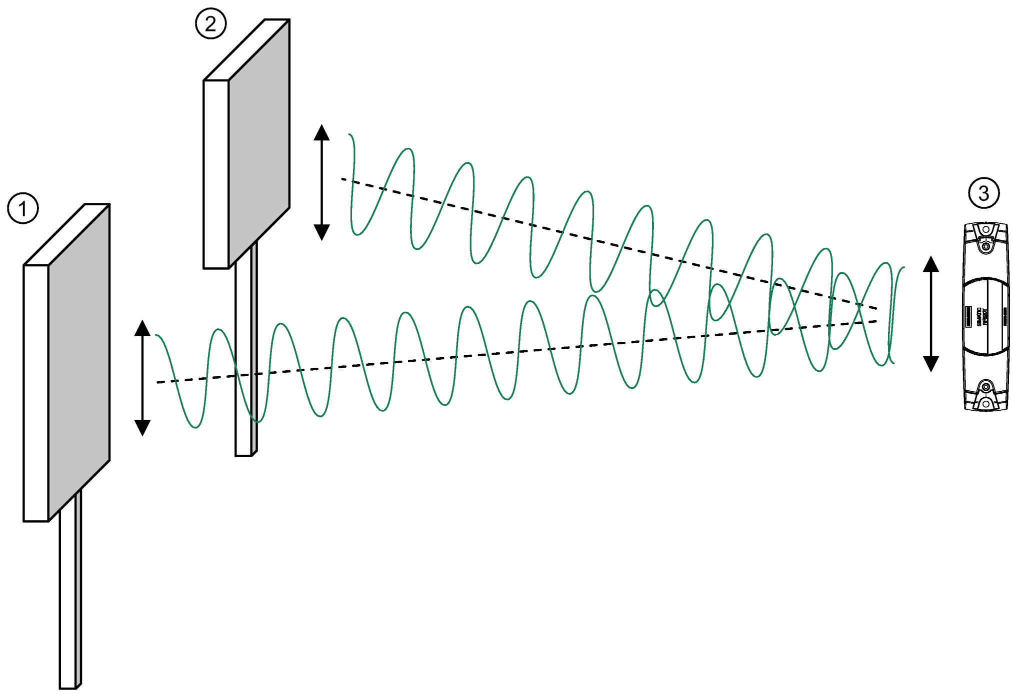


Figure 4-5 Circular polarization of antenna system and transponder

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 4-6 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 71).

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

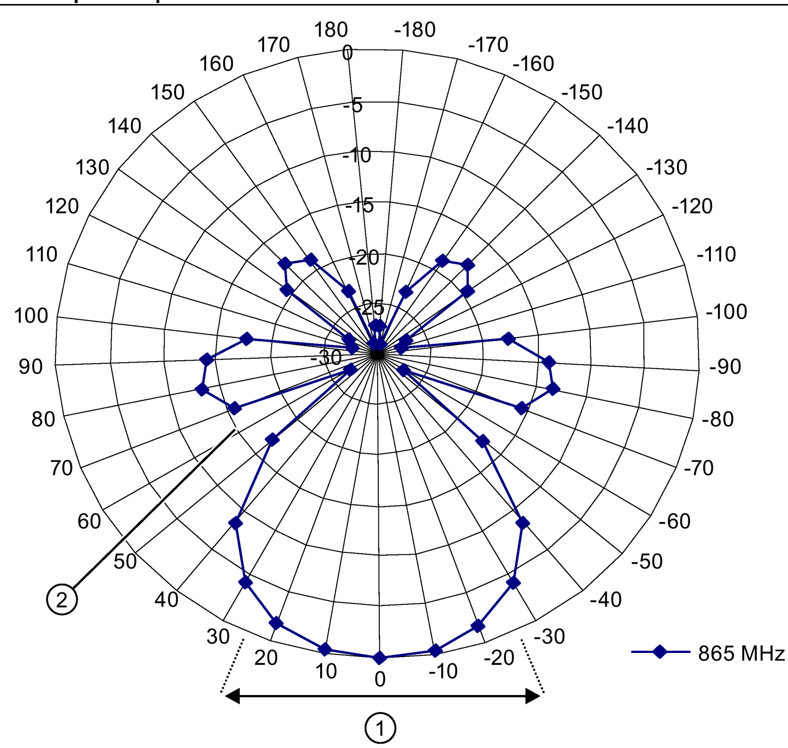
In ETSI EN 302 208, the radiated power is coupled to the beam width, i.e.

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

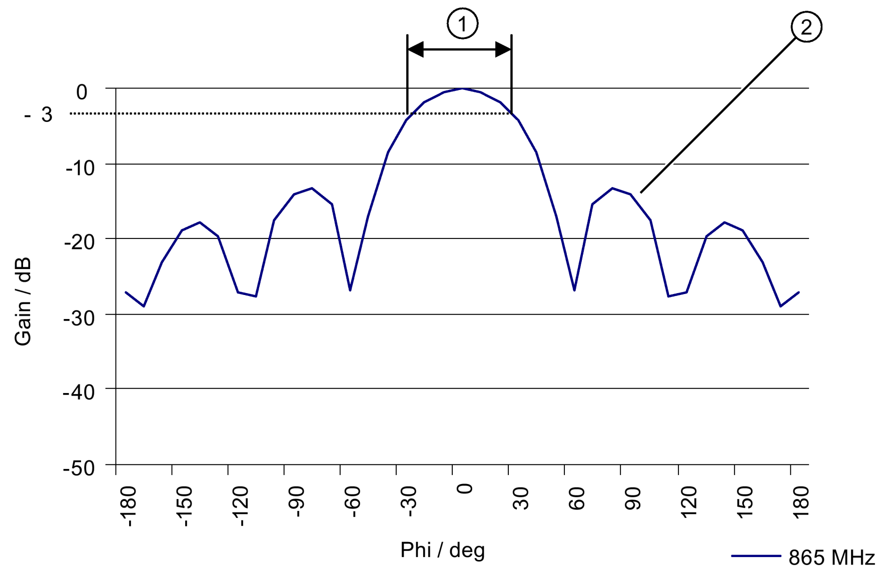
The beam width requirement applies to both the horizontal and vertical planes. The FCC directives do not envisage coupling with the beam width.

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

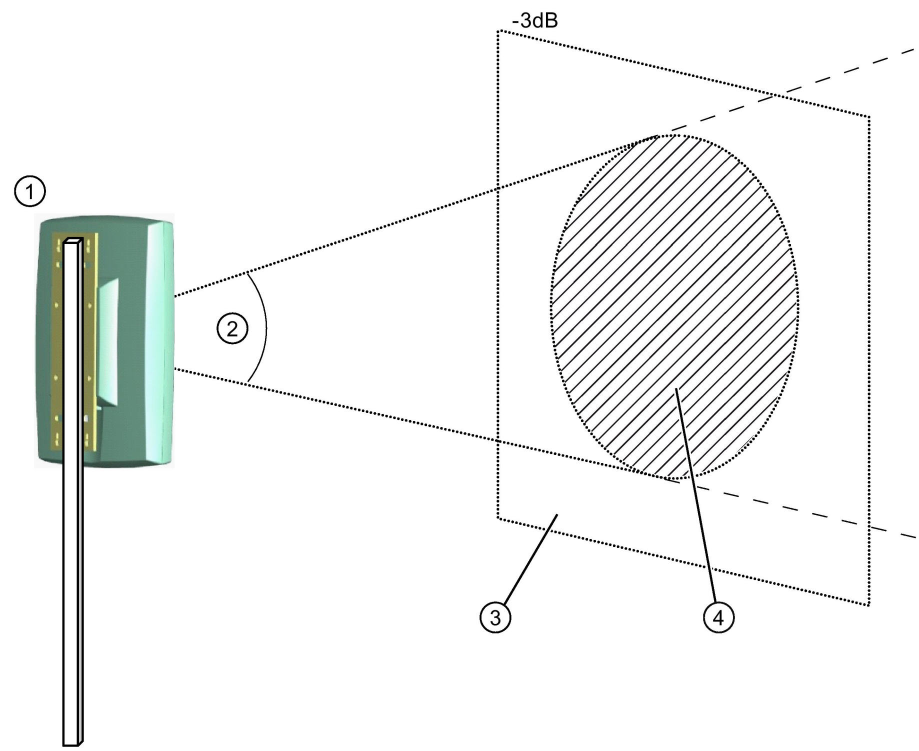
Example

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 70 % of the maximum range.

Specifications

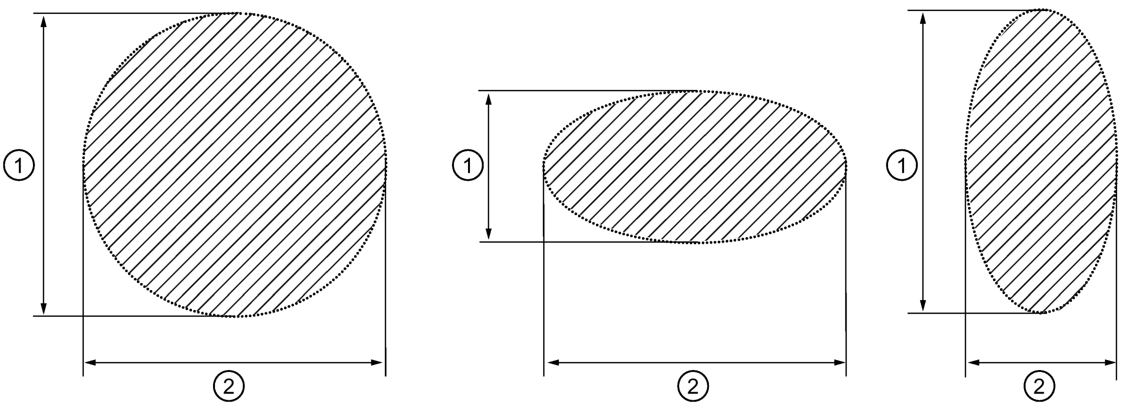
Selection of the beam angle within the approval directives also has effects on the field of application, since a larger beam angle allows a larger area to be covered by RFID transponders. The following graphic clarifies the cross-section of the beam cone with the acquisition level.

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



①	Third-party antenna
②	Beam angle
③	Acquisition level
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.

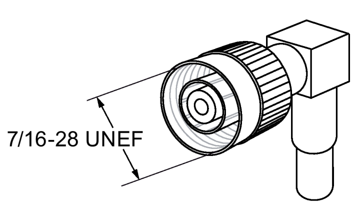
Bending radius of the antenna cable

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.

4.4 Environmental conditions for transponders

Basic rules

The transponder must not be placed directly on metal surfaces or on containers of liquid. The on-metal transponders designed specifically for use in metallic environments are an exception to this. For physical reasons, a minimum distance must be maintained between the transponder antenna and conductive material. A minimum distance of 5 cm is recommended. The transponder operates better when the distance is greater (between 5 and 20 cm).

- Transponder 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 transponder manufacturer.
- For more information, refer to the section "Transponder/tags (Page 363)" or ask the relevant transponder 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 transponders on metal.

  The on-metal transponders designed specifically for use in metallic environments are an exception to this.
- Do not place metallic or conducting objects in the propagation field of the antenna and transponder.

Transponder directly on metal

Fundamentally, transponders must not be mounted directly on metallic surfaces. Due to the nature of the electromagnetic field, a minimum distance must be maintained between the transponder antenna and conductive materials. For more detailed information on the special case of attaching transponders to electrically conducting materials, refer to section SIMATIC RF620T (Page 423) and sectionSIMATIC RF640T Gen 2 (Page 473) .

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 Planning and installation of UHF read points

RFID UHF systems (frequency band 865 - 928 MHz) have different requirements in terms of planning, commissioning and operation compared with the HF systems commonly used up to now in automation (frequency band 13.56 MHz). This section describes important rules for preparation and implementation of the RFID UHF systems.

4.6.1 Technical basics

General

In contrast to inductively coupled HF systems, in UHF technology, there is full propagation of the radio waves just as in other wireless systems (radio, TV etc). There are both magnetic and electrical field components present. The following graphic shows the structure of a UHF system. One characteristic is the design of the transponder that differs greatly from the structure used in HF systems, e.g. the use of a dipole or helix antenna.

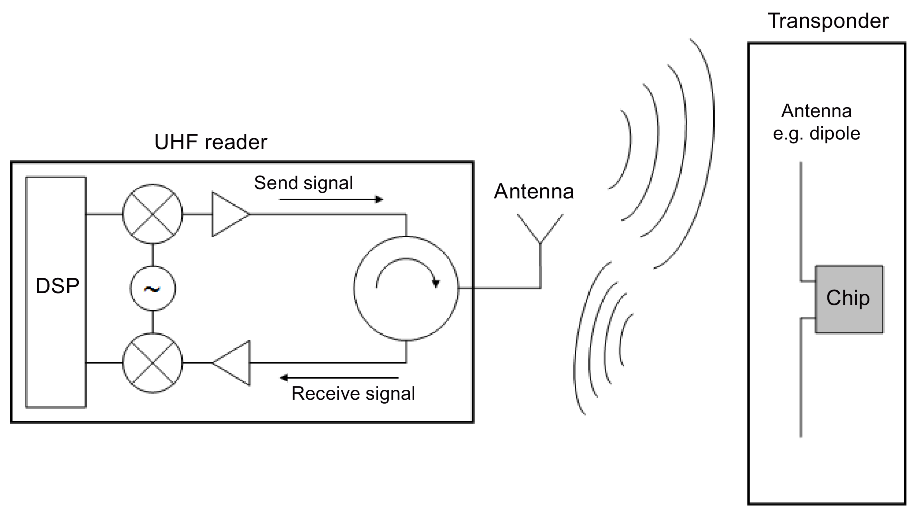


Figure 4-7 Structure of a UHF RFID system

RSSI value

The signal strength of the transponder reply is known as the RSSI value (Received Signal Strength Indication). The RSSI value is a one byte value (0 to 255), the higher the value the better the signal strength (according to the IEEE 802.11 standard).

The actual RSSI value depends on numerous parameters:

- transponder type used,
- chip used in the transponder,
- connected antenna,
- transmit power,

- distance between antenna and transponder,
- reflections,
- noise level in the channel used and in neighboring channels

With SIMATIC RF600 readers, you can achieve RSSI values of approximately 35 to >110.

The RSSI value is important for the automatic evaluation of the read point and for filtering. A simple comparison of the RSSI values of two transponders is nevertheless not possible because the values are influenced by the transponder tolerances and the non-homogeneous antenna field. This means that it is possible that a transponder positioned closer to the RFID antenna has a lower RSSI value than a transponder much further away.

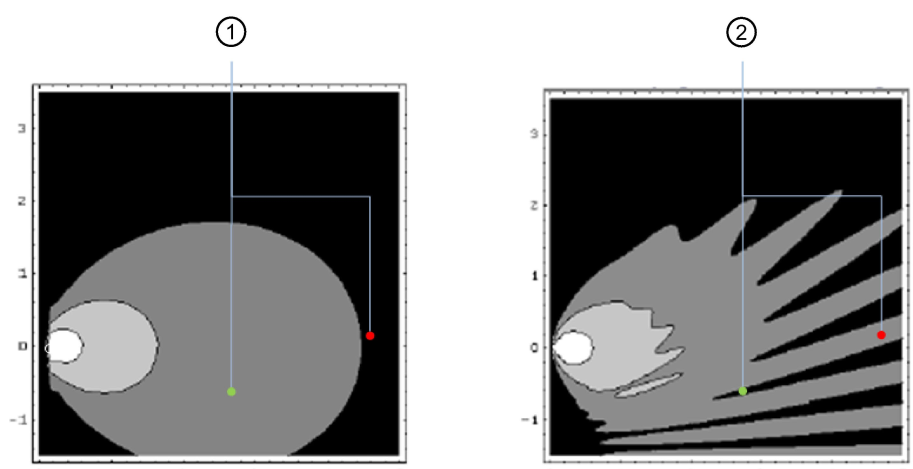
Propagation of the antenna field

The waves do not propagate as a homogeneous field, there is superposition of the waves that can cause the following effects:

- Overshoots and field gaps due to obliteration of two waves

  These are caused by reflection and the resulting propagation on different paths (comparable with fading effects on the car radio, e.g. noise when the vehicle is standing)
- Generation of overshoots due to reflecting objects and surfaces

This can be illustrated by comparing it with a "hall of mirrors". The signal transmitted by the reader is reflected (several times) by metallic objects such as housings, steel supports or grilles and this can lead to unwanted effects and read errors. Is also possible that a transponder is not identified although it is located in the identification range of the reader. It can also happen that a transponder moving outside the antenna field is read out due to overshoots.



① Identification situation with two transponders in an ideal radio/antenna field

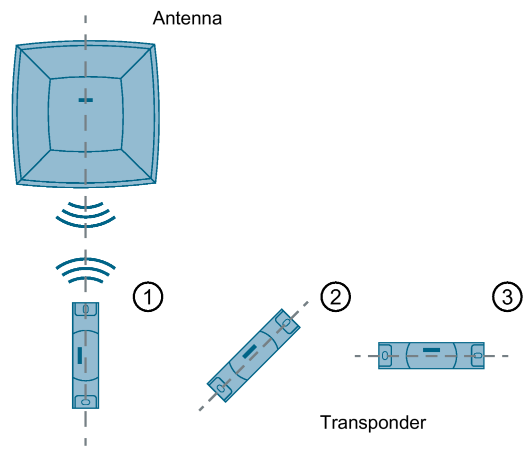
② Identification situation with two transponders in a real radio/antenna field with reflections that can lead to obliteration and overshoots

Figure 4-8 Propagation of UHF RFID antenna fields

Properties of the transmitting antenna

Depending on their design, UHF RFID antennas provide different properties. They differ in the polarization and antenna gain.

The direction of the electrical field component of an electromagnetic wave and the alignment of the antenna decide the polarization of the radiation. A distinction is made between linear and circular polarization of an antenna. With linear polarization you achieve the maximum write/read distances when the polarization axes of the antenna and transponder are parallel to each other. As the deviation increases, the received power deteriorates.



① Polarization axes parallel: approx. 100 % range
② Polarization axis turned through 45°: approx. 50% range
③ Polarization axis turned through 90°: approx. 10% range

Figure 4-9 Effect of the polarization axes on the write/read distance

This restriction does not apply with circular polarization. This means that linear antennas can only be used if the alignment of the transponder is defined. On the other hand, one advantage of linear antennas is that they react less sensitively to reflections. Circular antennas can also be used with differing alignments of the transponder and achieve constant results. It has been shown that with a defined transponder alignment, the linear antenna normally produces the best results.

The antenna gain is a factor for the directivity and the efficiency of an antenna. The directivity and degree of efficiency of antennas with a high antenna gain (e.g. RF642A) result in stronger signals. This means that you can also use a weaker transmit power or transponder replies. Here, however, there is a risk of overshoots. With an antenna with a weak or negative antenna gain, such as the RF620A antenna, a significantly higher transmit power needs to be used for a comparable distance. On the other hand, this antenna significantly reduces the risk of overshoots at the same transmit power.

4.6.2 Implementation of UHF RFID installations

The use of UHF RFID systems requires careful planning and preparation to avoid problems during commissioning and operation.

4.6.2.1 Preparation phase

Device selection

When selecting the suitable RFID hardware, remember the following minimum criteria:

- Integration in a control/IT environment
- Degree of protection
- Size of the identification range
- Type, number and position of the transponders in the antenna field
- Reflecting and absorbent materials in the vicinity of the antenna
- Distance between the antenna or the reader and the transponder

The following application examples illustrate the requirements for specific use cases and provide suitable solutions:

- RFID gate at the incoming goods / outgoing goods department:

  Several transponders are located on different packaging of products on a pallet. These need to be identified when passing through the RFID gate.

  Possible configuration: RF650R with four circular antennas (e.g. RF640A/RF660A depending on the required radiated power)
- Four read points along the production line:

  A product needs to be processed by different machines along the production line. The information for this is contained on a transponder attached to the product that must be read out at each machine.

  Possible configuration: RF680R with four antennas (e.g. RF620A)
- Read point on a production line with a predominantly metallic environment:

  A product needs to be processed by different machines along the production line. The information for this is contained on a transponder attached to the product that must be read out at each machine.

  Possible configuration: RF685R with integrated adaptive antenna

Dynamic identification

Dead spots cannot be excluded. To be able to compensate for dead spots, we recommend that you give preference to dynamic identification rather than static identification. Dynamic identification means that the transponders are read while they are moving (e.g. on the conveyor belt) or that the antenna field is made dynamic (e.g. by an integrated adaptive antenna RF685R).

Triggering

To read out all right transponder data, you can have the readers perform permanent write/read actions or have specific write/read actions triggered. For the following reasons, we recommend that you trigger specific write/read actions:

- The RFID system only performs write/read actions when an object to be identified enters the antenna field. This reduces the number of process errors and they can be identified more quickly.
- Due to the fact that the various RFID systems only perform write/read actions when necessary, this reduces the possibility of antenna fields disrupting each other. This increases process reliability in plants, particularly when there is a high reader density.

Decoupling third-party RFID systems

If you are using different RFID systems, make sure that no two systems are active at the same time or operate separately from each other. Ideally there should be no mixed usage.

Training

Make sure that the engineers commissioning the UHF RFID systems are adequately trained.

4.6.2.2 Test phase

Metals and absorbent materials have a major influence on the functioning of UHF RFID systems. Since every environment has different conditions, we recommend that you run a test with all the objects to be identified for each read point. Include neighboring readers in these tests as well as scenarios for overshoots. Run through the tests an adequate number of times to make sure that any sporadically occurring influences on the antenna fields are also tested.

The final position of the transponder should only be decided after an adequately intensive test phase so that suitable variations can be tried out if errors occur.

4.6.2.3 Setting up read points

The reader setup described in this section is performed using the Web Based Management (WBM) and applies to the RF650R, RF680R and RF685R readers. You will find a detailed description of the WBM in the configuration manual "SIMATIC RF650R/RF680R/RF685R (https://support.industry.siemens.com/cs/ww/en/ps/15081/man)".

Adjust antennas

Follow the steps below to optimize the antenna alignment:

1. Position the object fitted with a transponder and to be identified at the required read point.
2. Align the reader or the antenna so that its front points in the direction of the object (transponder) to be identified.

   When using linear antennas, make sure the polarization direction is correct.
3. In the "Settings - Adjust antenna" menu item, select the connected antenna and click the "Start adjustment" button.

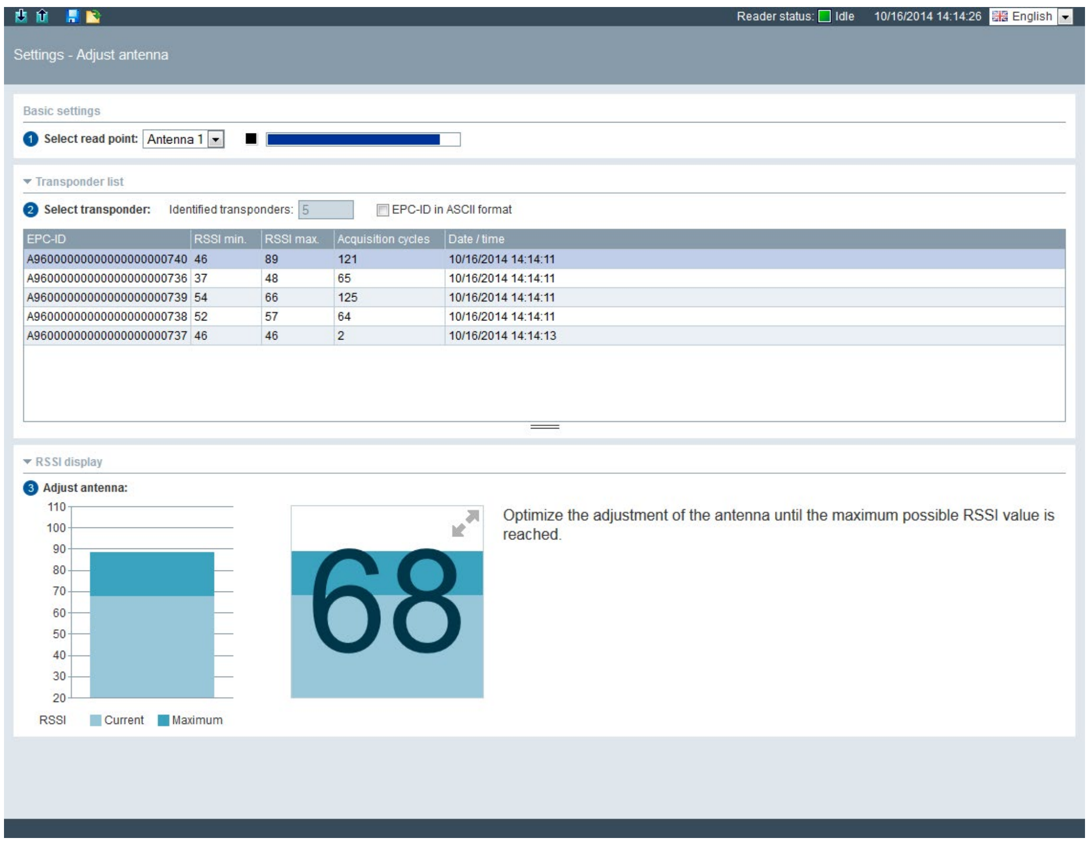


Figure 4-10 Optimizing the antenna alignment with the "Settings - Adjust antenna" menu item of the WBM

4. In the "RSSI display" area, you can see the current (light blue) and maximum reached (dark blue) RSSI values.

Note

Transponder is not identified

If no transponder is identified, first increase the radiated power as described in the following section. Then repeat the antenna adjustment.

---

5. Optimize the antenna adjustment until the maximum possible RSSI value is reached.
6. Secure the antenna.

Note that the RSSI value depends on the following components:

- transponder used,
- antenna used,
- reflecting and absorbent materials in the vicinity of the antenna.

Radiated power

Using the "Settings - Read points" menu item of the WBM, you can set the radiated power. Select the radiated power so that the required transponders can be identified reliably. In this case, the following applies: "as much as necessary, as little as possible".

In the "Settings - Activation power" menu item, you can find the optimum radiated power for reliable transponder access without creating overshoots.

Detect activation power

Follow the steps below to detect the activation power:

1. In the "Settings - Activation power" menu item, select the connected antenna and click the "Start measurement" button.
2. In the "Min. power" column of the transponder list, you can see the required activation power. The value "Min. power" of the transponder last selected in the transponder list is automatically transferred to the "Accept power" box with 2 dB added.

Note

Optimizing the radiated power

The value entered automatically in the "Accept power" box corresponds to the minimum value with which the transponder was identified by the antenna (Min. power) plus a power reserve of 2 dB. This value serves as a guideline and you can adapt it. To be sure that the antenna reliably detects the transponders regularly, we recommend that you accept the automatically adapted default value.

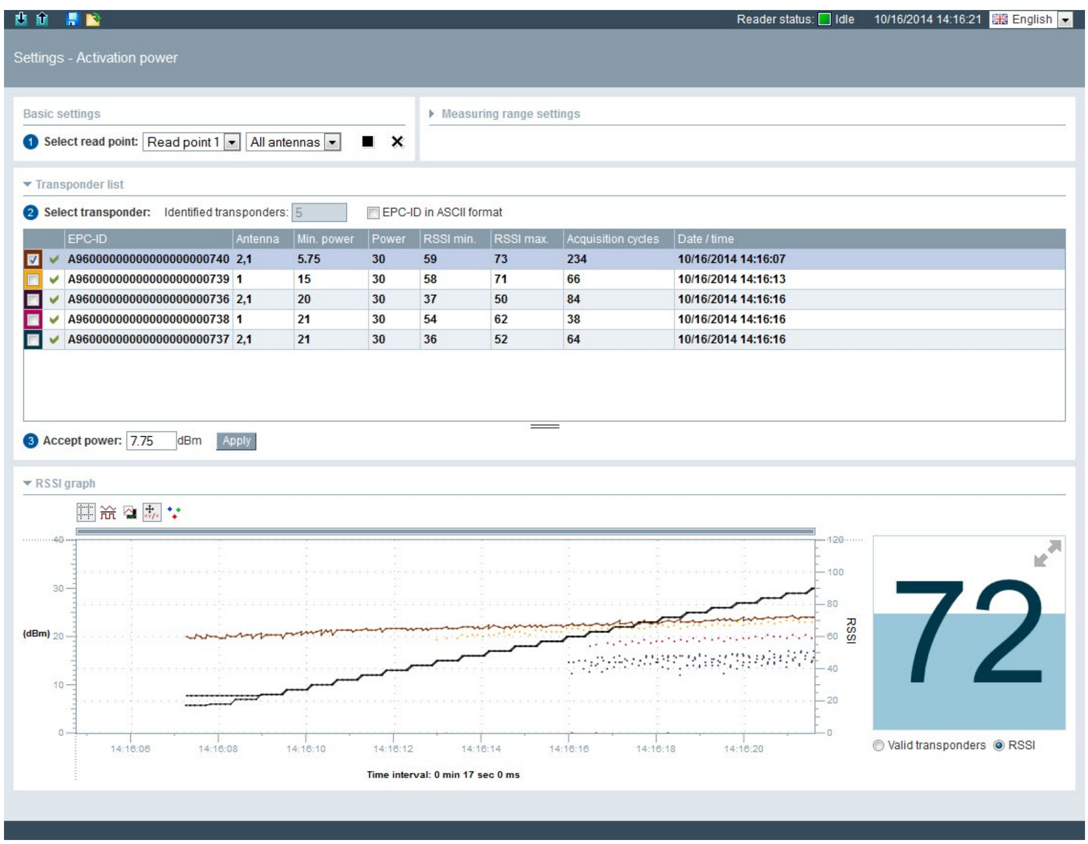


Figure 4-11 Determining the activation power using the "Settings - Activation power" menu item

3. Click the "Apply" button to transfer the value entered in the "Radiated power" input box of the "Settings - Read points" menu item.
4. Click the symbol to transfer the configuration to the reader.

Once the antenna has been adjusted to the optimum position, you can check whether or not the various transponders are identified consistently in the "Diagnostics - Tag monitor" menu item.

4.6.3 Dealing with field disturbances

4.6.3.1 Types and approaches to solutions

The superposition of radio waves and reflection by conductive materials (in particular metal) can lead to weakening or strengthening of the antenna field at certain points in space. These effects can lead to disruptions when identifying RFID transponders that can be distinguished as follows:

- Overshoots due to increasing field strength: Transponders are detected that are actually beyond the read distance.

  Approaches to solutions:

  - Reduction of the radiated power
  - Use of UHF algorithms
  - Changing the antenna position
  - Shielding measures
  - Varying the antenna polarization
  - Use antennas with a lower gain

- Lack of separation of transponders: Transponders positioned close together are detected together although the application logic requires individual detection (for example to determine the positioning order). All transponders are within the read distance.

  Approaches to solutions:

  - Reduction of the radiated power
  - Use of UHF algorithms
  - Changing the antenna position
  - Shielding measures
  - Use antennas with a lower gain

- Field obliteration: Due to the superposition of waves, obliteration effects occur within the read distance.

  Approaches to solutions:

  – Varying the antenna polarization
  – Using additional antennas
  – Use of UHF algorithms
  – Changing the antenna position
  – Shielding measures
  – Use antennas with a lower gain

- Reader ↔ reader influence: Several readers influence or disturb each other during transponder identification.

  Approaches to solutions:

  – "Interconnect" neighboring readers so that they do not send at the same time
  – Enable intermissions ("Settings - General" menu item)
  – Channel management

- Reader ↔ transponder influence: A reader communicates with a transponder that is also in the identification area of another reader.

  Solution approaches:

  – "Interconnect" neighboring readers so that they do not send at the same time

- Other sources of disturbances that can lead to restriction of transponder identification.

  Other sources of disturbances can occur if there are devices with similar frequency bands (for example 900 MHz) in the vicinity of the reader. The diagnostics corresponds to the influence of one reader on another. Mobile phones can also disturb identification. This is the case if a reader of the type FCC or CMIIT is operated in Europe.

  Solution approaches:

  – The disturbances can be eliminated by temporarily turning off the suspected source of interference or its shielding. Interference can also occur with devices in other frequency bands if these are located in the immediate vicinity of the RFID antenna (e.g. DECT telephone directly in front of the RFID antenna). Common industrial interference mechanisms, such as the harmonics of frequency converters or static discharge (ESD) can also cause disturbances.

Note

Occurrence of disturbances

Remember that these disturbances can also occur sporadically or in certain combinations.

4.6.3.2 Measures for eliminating field disturbances

Using shields

To avoid reflections, you can fit UHF absorbent material. To do this, the absorbent material is mounted at various suspected reflection points until the field disturbance no longer occurs. Where possible, avoid the use of metal structures (for example housings) and use plastic instead.

Even with reader-to-reader influence, you can use absorbent plates or shielding sheets.

Channel management

To operate the readers, depending on the country profile, you have between four and fifty send channels available. Ideally, you should make the channel assignments manually in STEP 7 Basic / Professional (TIA Portal) or in the WBM. This allows you to reduce reader-to reader influence and if applicable field obliteration.

Table 4- 4 Example of a channel plan according to ETSI

Reader	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	...
Transmission channel	4	10	7	13	4	...
Frequency (MHz)	865.7	866.9	866.3	867.5	865.7	...

Use of multiple antennas

If you do not find the ideal antenna position to be able to identify the transponders in the various positions and alignments, you have the option of using more antennas. Multiple antennas mounted at different positions enlarge the identification range.

Enabling send pauses

If too many neighboring readers send at the same time, this causes overload of the radio channels. In this case, enable the "Intermissions" function in the "Settings - General" menu item to improve read reliability.

Varying the antenna polarization

By using linear or circular antennas, you can reduce field obliteration. This improves the reader reliability in difficult radio conditions.

The RF685R reader also provides the option of operating the internal antenna both as a linear, vertical, linear horizontal and circular antenna. If more than one polarization is enabled, the polarization is changed automatically with each inventory. This increases the probability of identification in difficult radio conditions.

Changing the antenna position

In difficult radio conditions (e.g. where there is a lot of metal) it is possible that the communication between transponders and readers is impaired. You can counter this by changing the position of the antenna relative to the transponder. This also changes the multipath propagation of the radio waves and obliteration is reduced or shifted.

Use of UHF algorithms

In the "Settings - Read points" menu item of the WBM, you will find various "Tools" in the "Algorithms" area that you can use to improve the read/write reliability.

4.7 Regulations applicable to frequency bands

Overview of the frequency bands

The frequency bands are standardized by EPCglobal Inc. Since these are changed regularly, we recommend that you check the current country-specific frequency bands and approvals directly on the Internet page of EPCglobal®.

You will find the current country-specific frequency bands and approvals on the following Internet page:

EPCglobal (http://www.gs1.org/docs/epcglobal/UHF_Regulations.pdf)

You will find a list of all the country-specific approvals for SIMATIC RFID systems on the following Internet page:

Wireless approvals of SIMATIC RFID systems (http://www.siemens.com/rfid-approvals)

4.8 Guidelines for electromagnetic compatibility (EMC)

4.8.1 Overview

These EMC Guidelines answer the following questions:

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

The description is intended for "qualified personnel":

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

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.

4.8.2 What does EMC mean?

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

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

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

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

EMC can be broken down into three different areas:

- Internal immunity to interference:

  Immunity to internal (own) electrical disturbance
- External immunity to interference:

  Immunity to external electromagnetic disturbances
- 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 R&TTE directives. 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 directives 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 directives; the plant operator is responsible for radio interference suppression in the overall plant.

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

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

4.8.3 Basic rules

It is often sufficient to follow a few elementary rules in order to ensure electromagnetic compatiblity (EMC).

The following rules must be observed:

Shielding by enclosure

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

Wide-area ground connection

- 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.

4.8.4 Propagation of electromagnetic interference

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

- Interference source
- Coupling path
- Interference sink

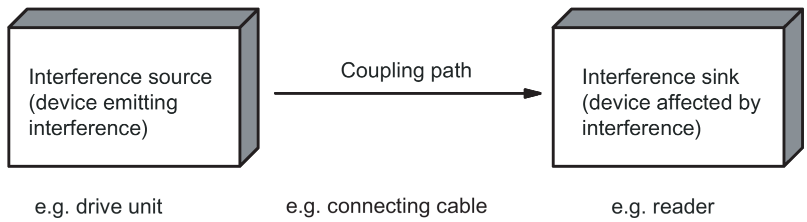


Figure 4-12 Propagation of interference

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- 5 Interference sources: origin and effect

Interference source	Interference results from	Effect on the interference sink
Contactor, 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

Interference source	Interference results from	Effect on the interference sink
Power supply unit, switched-mode	Circuit	Electrical and magnetic field, system disturbance
High-frequency appliances	Circuit	Electromagnetic field
Transmitter (e.g. professional mobile 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 shield-ed	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*

4.8.5 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.

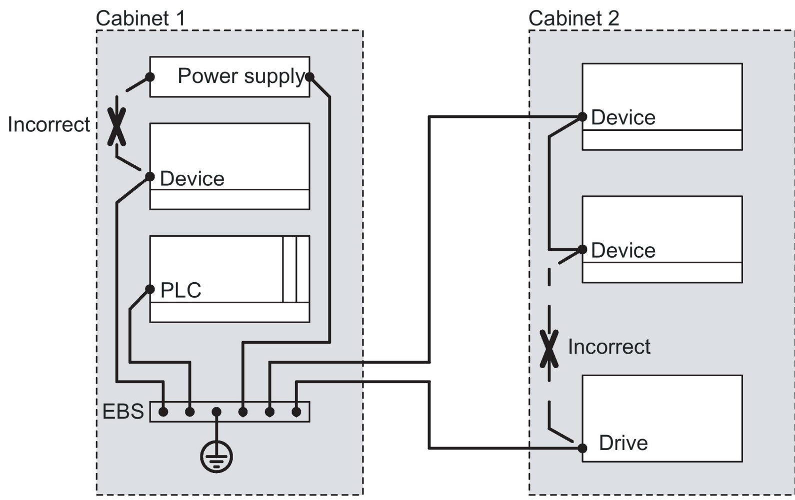


Figure 4-13 Equipotential bonding (EBS = Equipotential bonding strip)

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

4.8.6 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

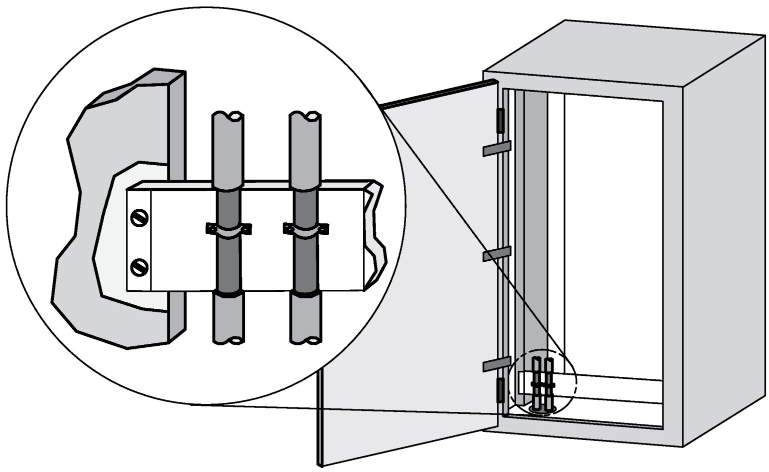


Figure 4-14 Cable shielding

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.

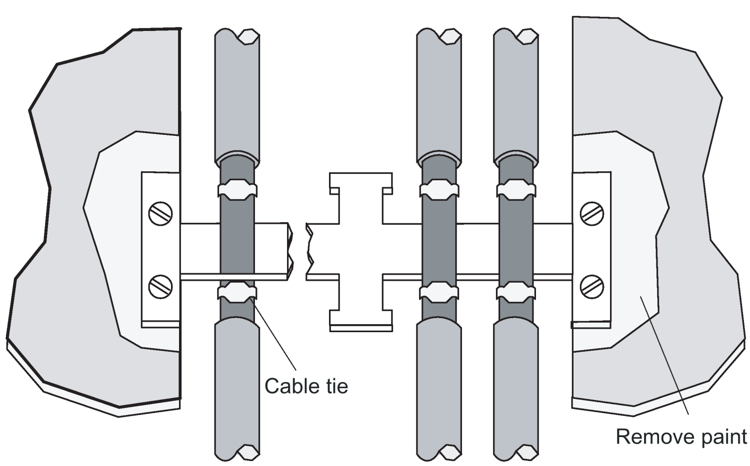


Figure 4-15 Connection of shielding bus

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.

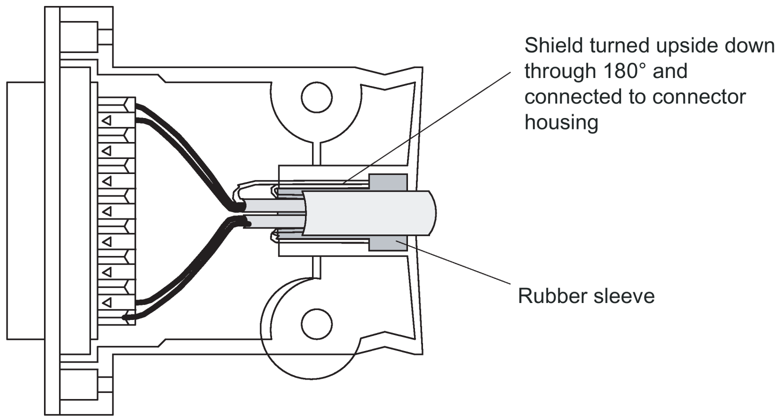


Figure 4-16 Interruption of shielded cables

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

5.1 Overview

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

Table 5- 1 Characteristics of the RF620R, RF630R, RF640R and RF670R readers

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 connector according to IEC PAS 61076-3-117	1 x RJ-45 connector according to IEC PAS 61076-3-117	-	-
	RS-422	-	-	1 x plug (M12, 8-pin)	1 x plug (M12, 8-pin)
	Digital inputs	4 (M12, 12-pin) log "0": 0…7 V log "1": 15…24 V	2 (M12, 8-pin) log "0": 0…7 V log "1": 15…24 V	-	-
	Digital outputs (short-circuit proof)	4 (M12, 12-pin) 24 V; 0.5 A each	2 (M12, 8-pin) 24 V; 0.5 A each	-	-
	Power supply	24 VDC (M12, 4-pin) 20 to 30 V (2.2 A) external	24 VDC (M12, 4-pin) 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 speed of the communications interface		10/100 Mbps	10/100 Mbps	115.2 kbps	115.2 kbps

Features	SIMATIC RF670R	SIMATIC RF640R	SIMATIC RF630R	SIMATIC RF620R
max. data speed reader to transponder	80 kbps (ETSI) 160 kbps (FCC)	80 kbps (ETSI) 160 kbps (FCC)	40 kbps	40 kbps
max. data speed transponder to reader	160 kbps (ETSI) 320 kbps (FCC)	160 kbps (ETSI) 320 kbps (FCC)	160 kbps	160 kbps

1) Internal antenna

Table 5- 2 Characteristics of the RF650R, RF680R and RF685R readers

Features		SIMATIC RF650R	SIMATIC RF680R	SIMATIC RF685R
Air interface / standards supported		EPCglobal Class 1 Gen 2	EPCglobal Class 1 Gen 2	EPCglobal Class 1 Gen 2
ETSI variant		Available	Available	Available
FCC variant		Available	Available	Available
CMIIT variant		Available	Available	Available
LEDs		6	17	17
Interfaces				
	Number of external antennas via RTNC	4	4	1
	Available internal antennas	-	-	1
	Ethernet	1 x RJ-45 connector (8-pin) according to IEC PAS 61076-3-117	2 x M12 connector (4-pin)	2 x M12 connector (4-pin)
	PROFINET	-	✓	✓
	RS-422	-	1 x plug (M12, 8-pin) 1)	1 x plug (M12, 8-pin) 1)
	Digital inputs	4 (M12, 12-pin) log "0": 0…7 V log "1": 15…24 V	4 (M12, 12-pin) log "0": 0…7 V log "1": 15…24 V	4 (M12, 12-pin) log "0": 0…7 V log "1": 15…24 V
	Digital outputs (short-circuit proof)	4 (M12, 12-pin)	4 (M12, 12-pin)	4 (M12, 12-pin)
	Power supply	24 VDC (M12, 8-pin) 20 to 30 V (2 A) external	24 VDC (M12, 8-pin) 20 to 30 V (2 A) external	24 VDC (M12, 8-pin) 20 to 30 V (2 A) external
Max. Radiated power ETSI and CMIIT in ERP		2 W ERP	2 W ERP	2 W ERP 2) 2 W ERP
Max. Radiated power FCC in EIRP		4 W EIRP	4 W EIRP	4 W EIRP 2) 4 W EIRP
max. transmit power ETSI and CMIIT		30 dBm 1 W	33 dBm 2 W	33 dBm 2 W
max. Transmit power FCC		30 dBm 1 W	33 dBm 2 W 3)	33 dBm 2 W 3)
max. Transmission speed of the communications interface 4)		100 Mbps	100 Mbps or 115.2 kbps	100 Mbps or 115.2 kbps

Features	SIMATIC RF650R	SIMATIC RF680R	SIMATIC RF685R
max. data speed reader to transponder	300 kbps	300 kbps	300 kbps
max. data speed transponder to reader	80 kbps	80 kbps	80 kbps

[1]) Connection of the readers to the ASM 456 communications module

[2)] Internal antenna

[3)] With a profile with a Tx data rate of 80 kbps (Tari = 12.5 us) the transmit power is 1 W.

[4)] A transmission speed of 10 Mbps is not supported.

5.2 RF620R reader

5.2.1 Description

The SIMATIC RF620R is a stationary reader in the UHF frequency band 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 operating display
	(3)	RS 422 interface (8-pin M12 connector)

5.2.1.1 Ordering data

Ordering data RF620R

Product	Article number
RF620R (ETSI) reader for EU, EFTA, Turkey	6GT2811-5BA00-0AA0
RF620R (FCC) reader for North America	6GT2811-5BA00-1AA0
RF620R (CMIIT) reader for China	6GT2811-5BA00-2AA1

Ordering data accessories

Product	Article 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 flash codes for RF620R/RF630R with FB45/FB55 (Page 523)

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

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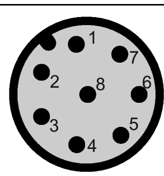
5.2.1.3 Pin assignment of the RS422 interface

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)

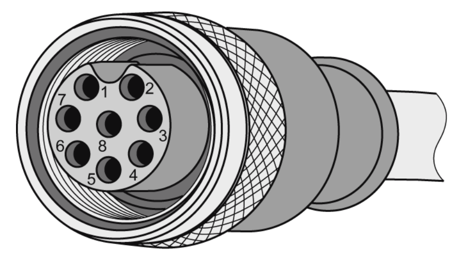
The knurled bolt of the M12 plug is not connected to the shield (on the reader side).

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- 3 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

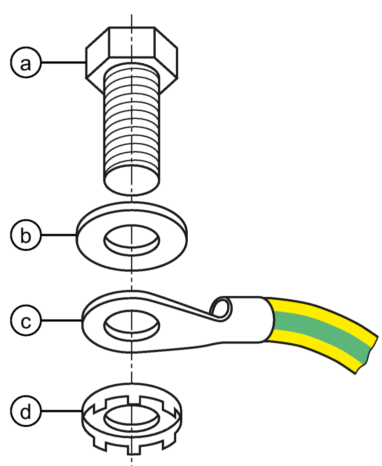
Note that with long cables in particular, the supply voltage of 24 V DC must always be applied. Note also that the data rate on the serial interface must, if necessary, be reduced. (See "Configuration Manual RF620R/RF630R")

5.2.1.5 Grounding connection

You can ground the RF620R reader using one of the mounting holes. Since the underside of the housing and therefore the mounting holes are varnished, a contact washer is required when securing the ground cable. The contact washer connects the housing to ground electrically. The tightening torque must be increased in this case from ≃ 1.5 Nm to 2.7 Nm to ensure that electrical contact is made.

When mounting the reader with the antenna mounting kit, you require a nut to ground the reader via one of the mounting holes.

> **⚠ 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)	Flat washer
	(c)	Cable lug
	(d)	Contact washer: To make ground contact, use contact wash-ers according to the Siemens standard: SN 70093-6-FSt-flNnnc-480h, Siemens item no.: H70093-A60-Z3

5.2.2 Planning application

5.2.2.1 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.

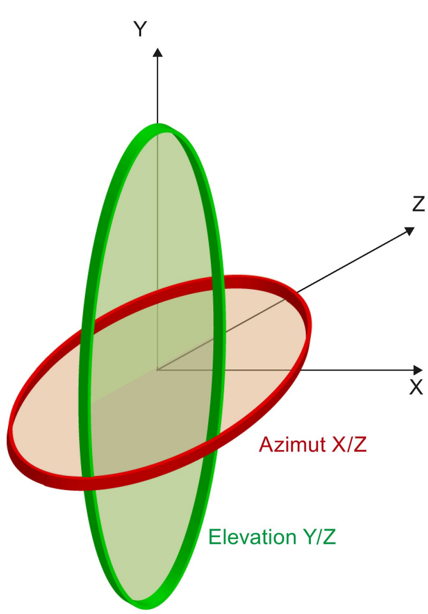
In order to avoid this, always keep a minimum distance of 3 m between two readers with the maximum radiated power of 500 mW ERP.

Dense Reader Mode (DRM)

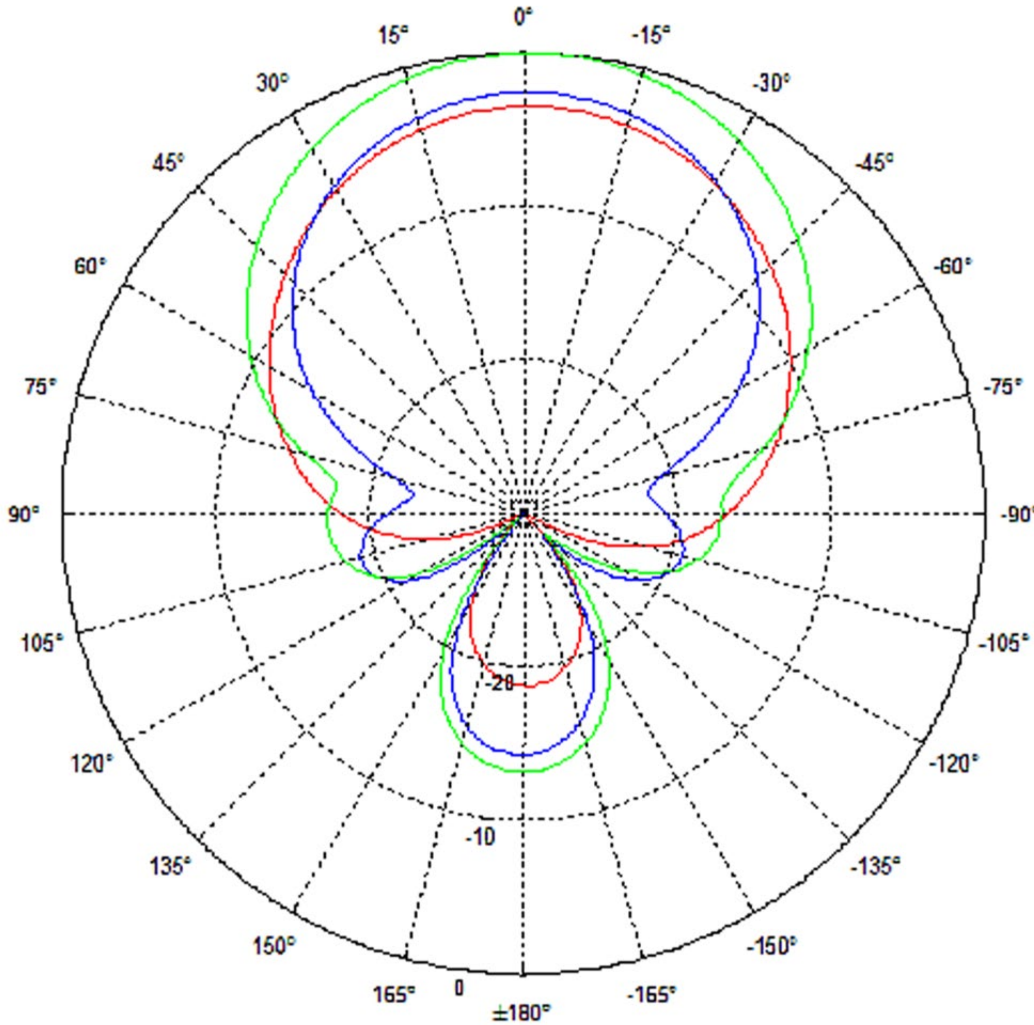
The readers can also interfere with each other (secondary fields), if the channels (Reader TX, Transponder TX) overlap. In order to prevent a transponder channel overlapping with a reader channel, we recommend that the Dense Reader Mode (DRM) is used.

5.2.2.2 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)



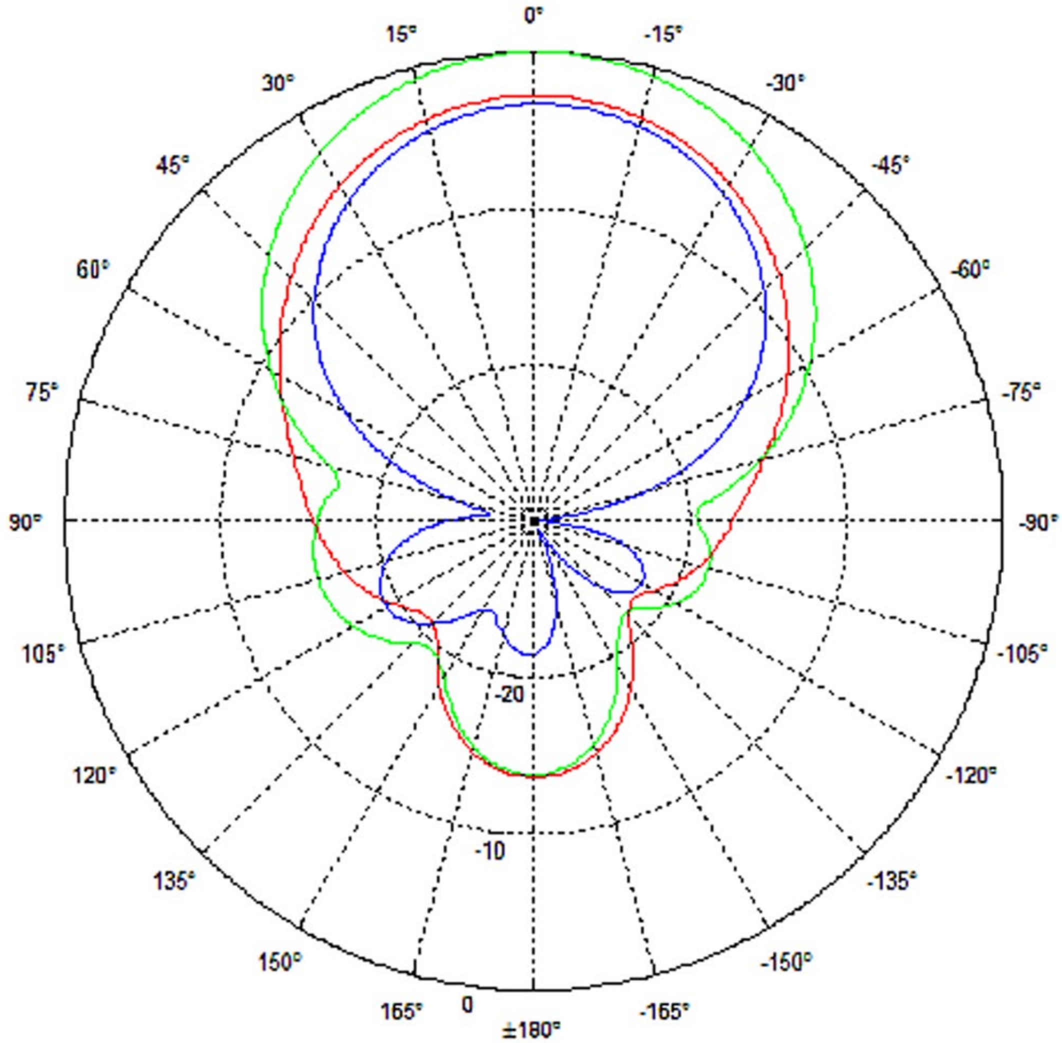
Vertical component of the polarization direction of the antenna

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

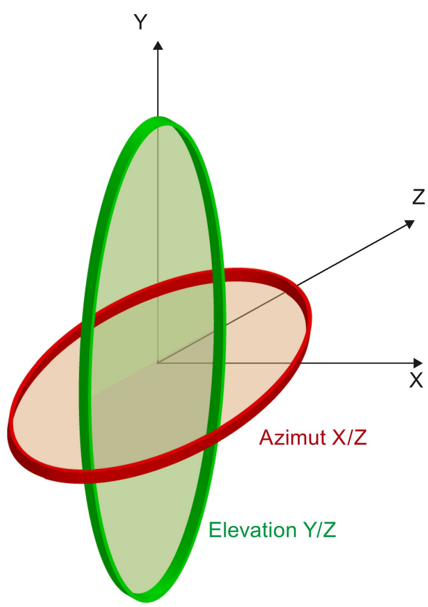
Table 5- 4 Maximum linear electrical aperture angle at 865 MHz:

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 59)

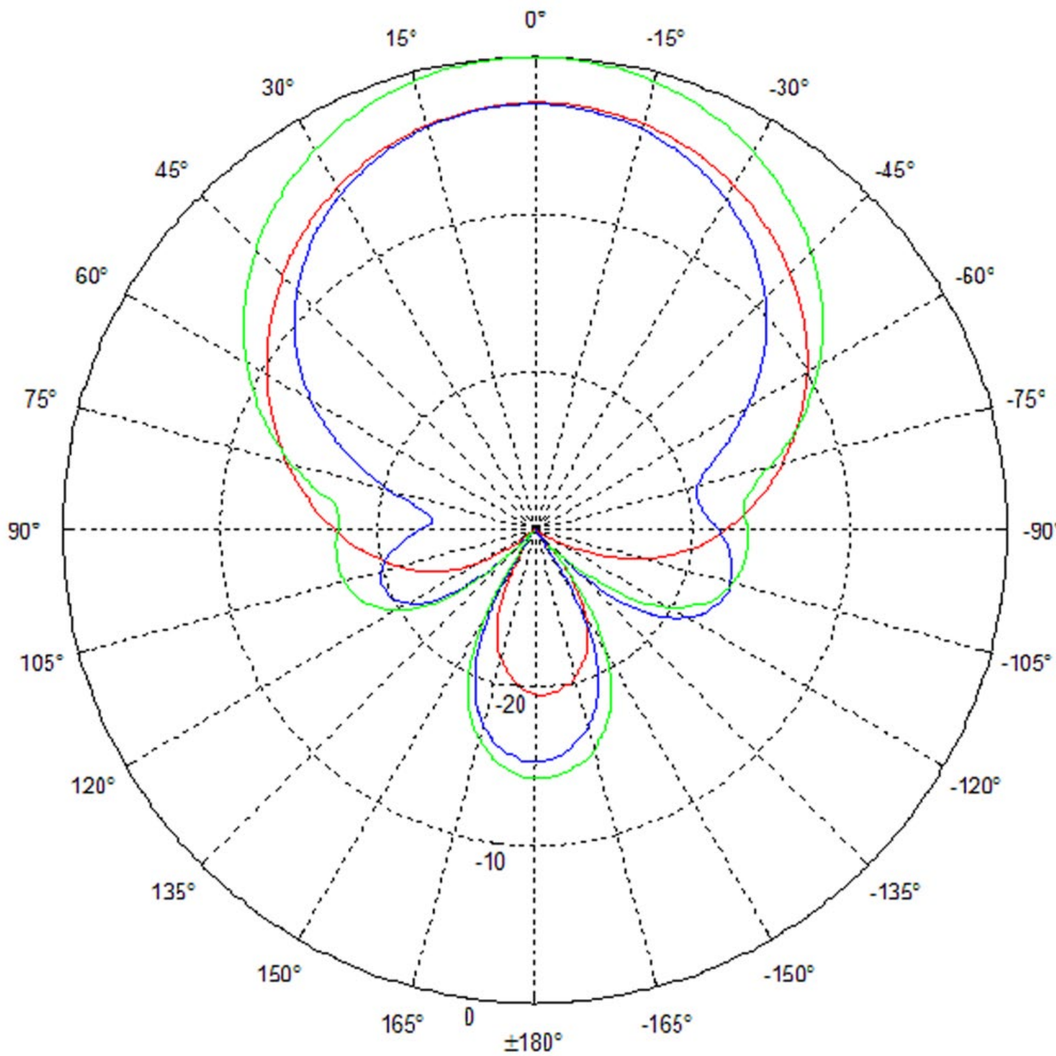
5.2.2.3 Antenna diagram for RF620R (FCC)

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)



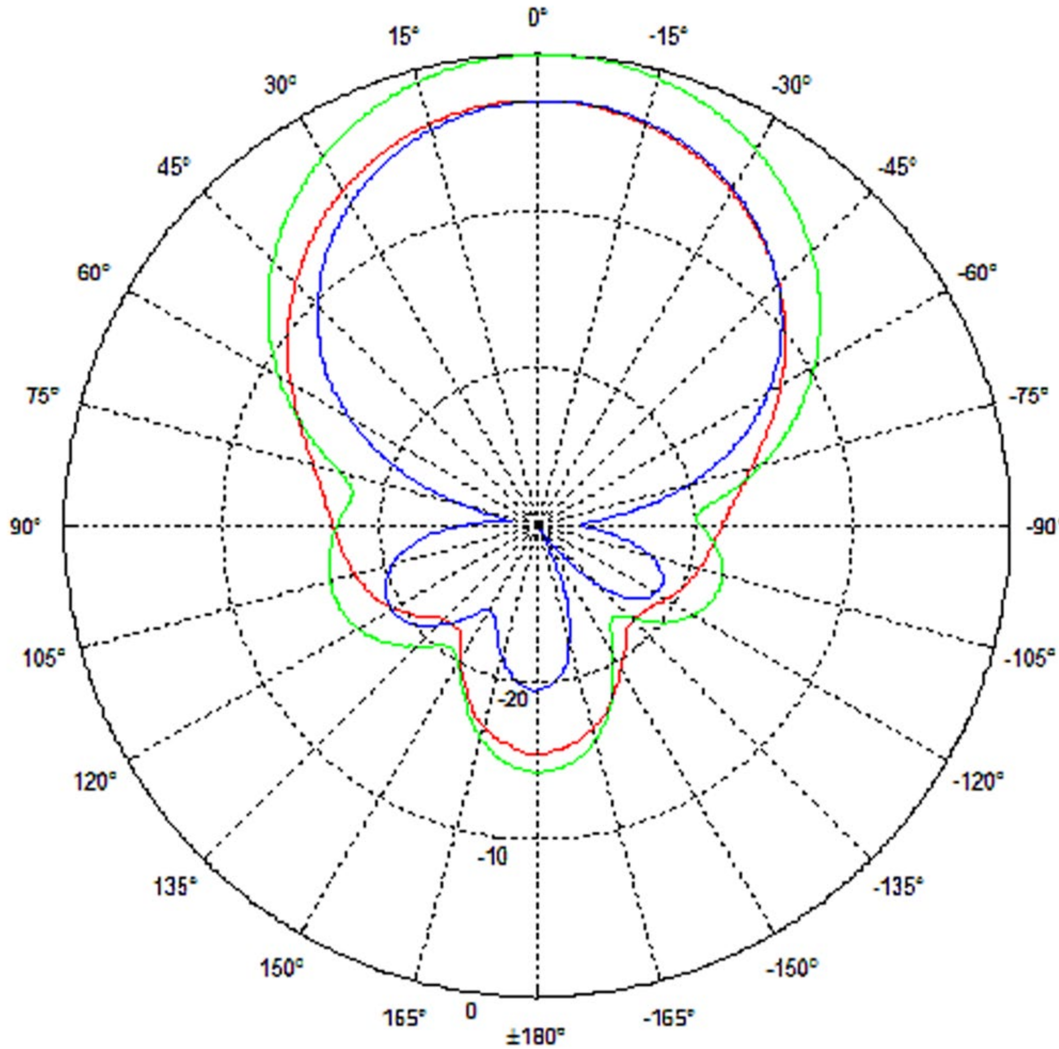
Vertical component of the polarization direction of the antenna

Horizontal component of the polarization direction of the antenna

Right circular component of the polarization direction of the antenna

Figure 5-3 Azimuth section

Radiation diagram (elevation section)



Vertical component of the polarization direction of the antenna

Horizontal component of the polarization direction of the antenna

Right circular component of the polarization direction of the antenna

Figure 5-4 Elevation section

Overview of the antenna parameters

Table 5- 5 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 59).

5.2.2.4 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 107), 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.

5.2.2.5 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.

5.2.3 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 122) RF620R or section FCC information (Page 139) RF630R.

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:

- Using a standardized VESA 100 mounting system using the Antenna Mounting Kit (refer to the section Mounting with antenna mounting kit (Page 360)).

  Tighten the M4 screws on the rear of the reader using a torque of ≤ 1.5 Nm.
- Directly on a flat surface (torque ≈ 1.5 Nm).

The positions of the mounting holes for the device are shown in the section Dimension drawings (Page 119).

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).

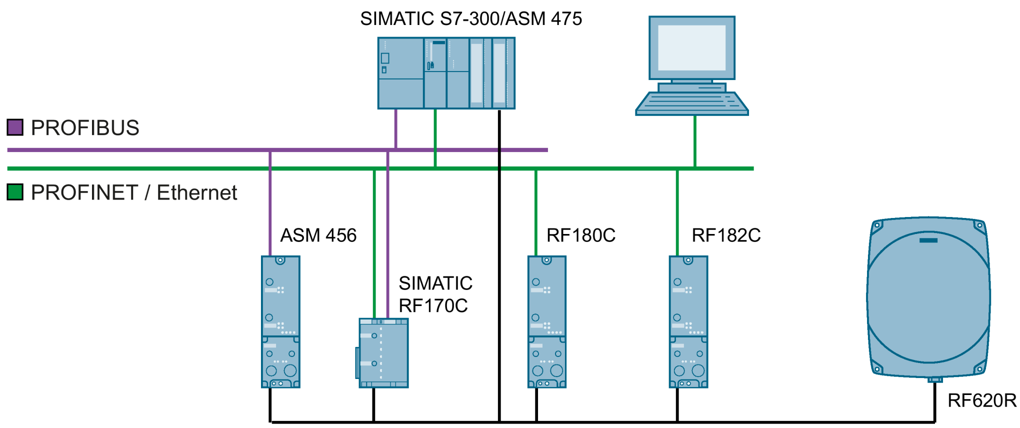


Figure 5-5 Overview of configuration of the RF620R reader

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 control networks (Page 516) .

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		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 trans-mit 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

5.2.5.2 Technical data according to EPC and ISO

Technical specifications	
Frequency accuracy	max.± 10 ppm
Channel spacing	EU, EFTA, Turkey: 600 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

Technical specifications	
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)

5.2.5.3 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 and 1 m in front)
- Max. 18 tags per second

5.2.6 Dimension drawings

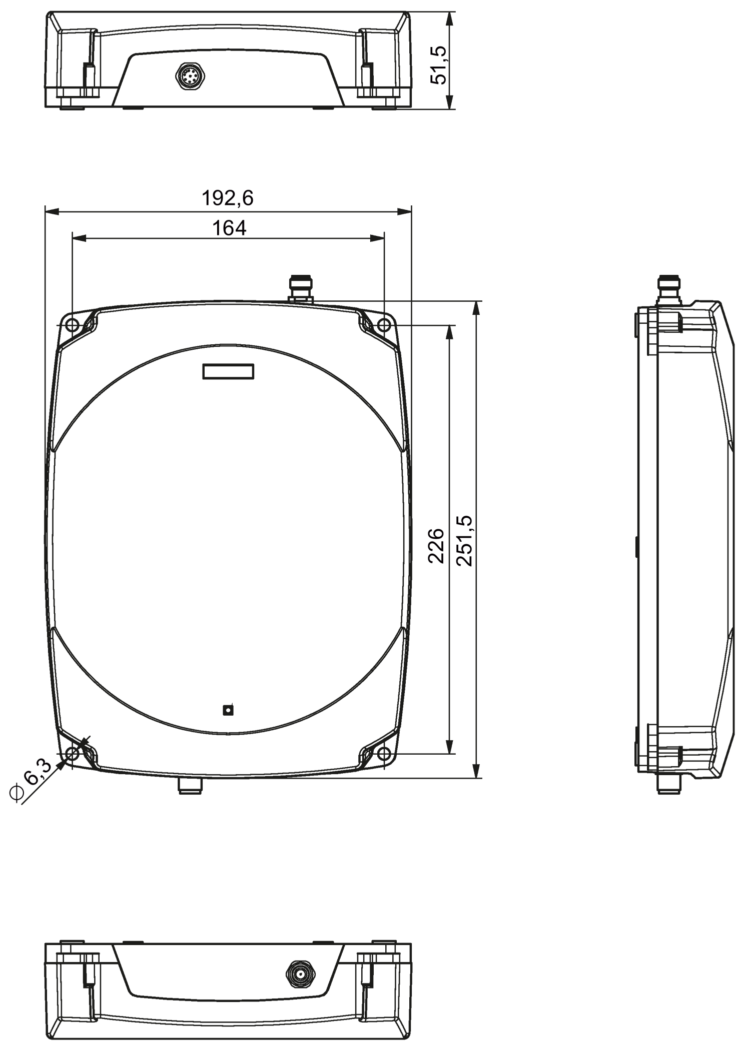


Figure 5-6 Dimension drawing for RF620R

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

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

5.2.7.1 Country-specific certifications

Table 5- 7 6GT2811-5BA00-1AA0, 6GT2811-5BA00-1AA1

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-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 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): ANATEL MODELO:RF620R 3377-12-4061 (01)07894607495719 Marking on the reader (6GT2811-5BA00-1AA1): ANATEL MODELO: RF620R 3377-12-4061 (01)07894607536610 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- 8 6GT2811-5BA00-2AA1

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

5.2.7.2 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 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.

5.2.7.3 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)

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) This device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d`Industrie Canada applicables aux appareils radio exempts de licence. L`exploitation est autorisée aux deux conditions suivantes :

(1) L`appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l`appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d`en compromettre le fonctionnement.

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 RF630R reader

5.3.1 Description

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

The maximum RF power output is 0.5°W at 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 operating display
	(3)	RS 422 interface (8-pin M12 connector)

5.3.1.1 Ordering data

Ordering data for RF630R

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

Ordering data accessories

Product	Article 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

5.3.1.2 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 flash codes for RF620R/RF630R with FB45/FB55 (Page 523)

Note

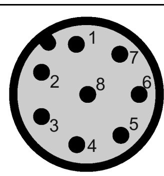
LED not lit yellow?

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

---

5.3.1.3 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)

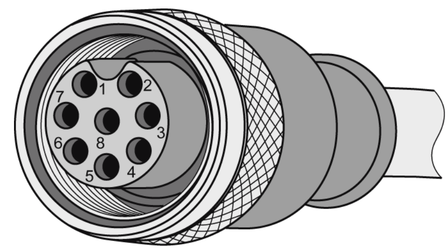
The knurled bolt of the M12 plug is not connected to the shield (on the reader side).

Note

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

5.3.1.4 Pin assignment of the connecting cable

Table 5- 9 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

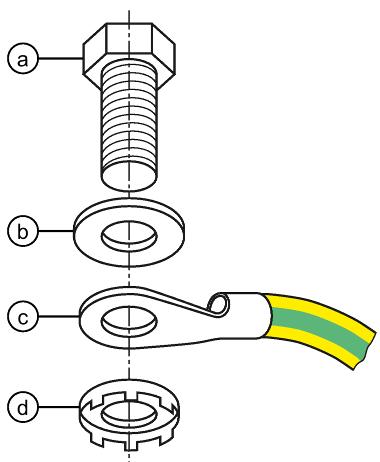
Note that with long cables in particular, the supply voltage of 24 V DC must always be applied. Note also that the data rate on the serial interface must, if necessary, be reduced. (See "Configuration Manual RF620R/RF630R")

5.3.1.5 Grounding connection

You can ground the RF630R reader using one of the mounting holes. Since the underside of the housing and therefore the mounting holes are varnished, a contact washer is required when securing the ground cable. The contact washer connects the housing to ground electrically. The tightening torque must be increased in this case from ≃ 1.5 Nm to 2.7 Nm to ensure that electrical contact is made.

When mounting the reader with the antenna mounting kit, you require a nut to ground the reader via one of the mounting holes.

> ⚠ **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)	Flat washer
	(c)	Cable lug
	(d)	Contact washer: To make ground contact, use contact wash-ers according to the Siemens standard: SN 70093-6-FSt-flNnnc-480h, Siemens item no.: H70093-A60-Z3

5.3.2 Planning application

5.3.2.1 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.

5.3.2.2 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 54) .

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 54) .

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.

5.3.3 Installing/Mounting

Requirement

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

NOTICE
Close unused connectors
Note that the readers only have the specified degree of protection when all connectors are in use or when unused connectors are closed with the protective caps. If you do not use reader connectors, close them 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:

- Using a standardized VESA 100 mounting system using the Antenna Mounting Kit (refer to the section Mounting with antenna mounting kit (Page 360)).

  Tighten the M4 screws on the rear of the reader using a torque of ≤ 1.5 Nm.
- Directly on a flat surface (torque ≃ 1.5 Nm).

The positions of the mounting holes for the device are shown in the section Dimension drawings (Page 136).

5.3.4 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).

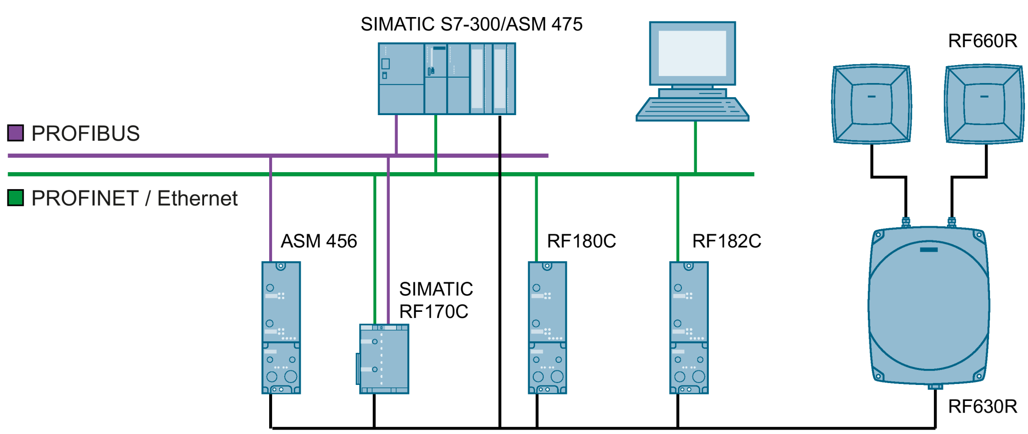


Figure 5-7 Overview of configuration of the RF630R reader

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 control networks (Page 516) .

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

5.3.4.1 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

5.3.5 Technical data

5.3.5.1 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 trans-mit power)	Current consumption (in standby mode, no trans-mit 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

5.3.5.2 Technical data according to EPC and ISO

Technical specifications	
Frequency accuracy	max.± 10 ppm
Channel spacing	EU, EFTA, Turkey: 600 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)

5.3.5.3 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).

5.3.6 Dimension drawings

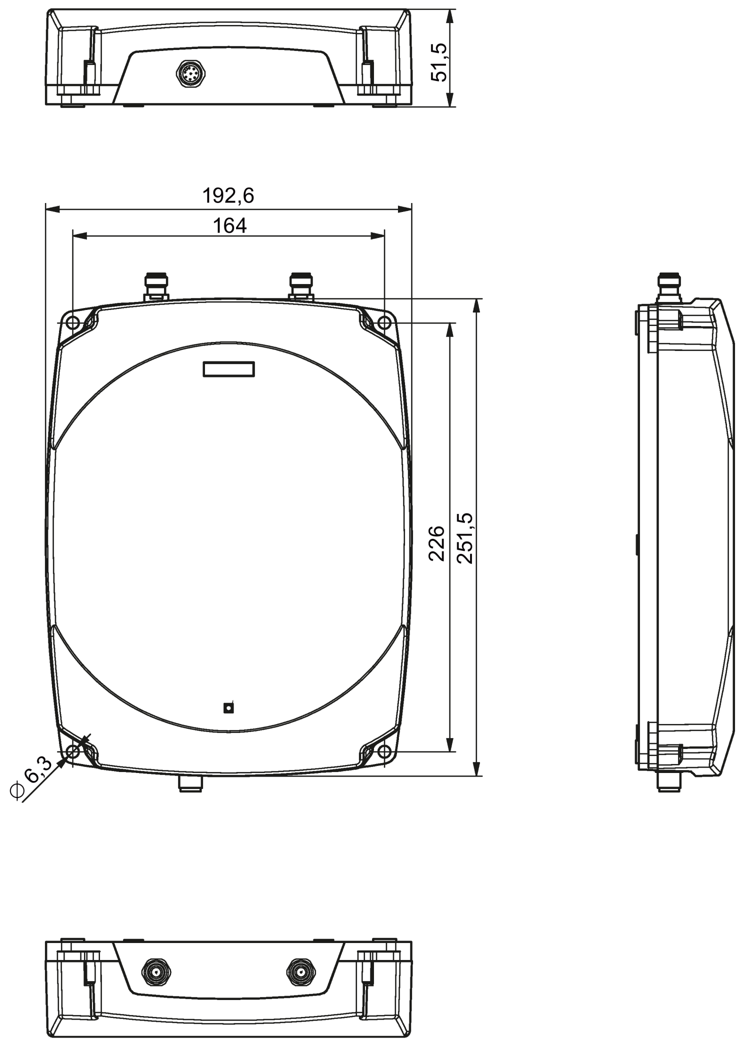


Figure 5-8 Dimension drawing for RF630R

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- 10 6GT2811-4AA00-0AA0, 6GT2811-4AA00-1AA1

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

Table 5- 11 6GT2811-4AA00-1AA0, 6GT2811-4AA00-1AA1

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-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 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

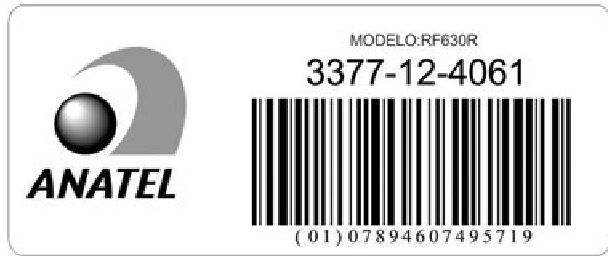
Standard	
ANATEL	Brazil wireless approval Marking on the reader (6GT2811-4AA00-1AA0):  Marking on the reader (6GT2811-4AA00-1AA1):  Statement about approval: Este equipamento opera em caráter secundário, isto é, não tem direito à proteção contra interferência prejudicial, mesmo de estações do mesmo tipo 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- 12 6GT2811-4AA00-2AA1

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

5.3.7.1 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.

5.3.7.2 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)

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) This device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d`Industrie Canada applicables aux appareils radio exempts de licence. L`exploitation est autorisée aux deux conditions suivantes :

(1) L`appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l`appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d`en compromettre le fonctionnement.

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 RF640R reader

5.4.1 Description

5.4.1.1 Overview

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

The maximum RF power output is 1000°mW at the external 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 front edge. These interfaces can be used to connect the reader to the power supply and the PC for parameter assignment.

The degree of protection is IP65.

	Pos.	Description
	(1)	TNC reverse interface for connecting an antenna
	(2)	LED operating display
	(3)	24 VDC power supply
	(4)	Ethernet interface (TCP/IP)
	(5)	Digital I/O interface

5.4.1.2 Ordering data

Ordering data RF640R

Product	Article 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 accessories

Product	Article number
Antenna mounting kit	6GT2890-0AA00
Connecting cable and connectors • Digital I/O, open cable ends, 5 m • Ethernet: 10 m (crossover cable) • Ethernet connector on reader according to IEC PAS 61076-3-117IE RJ-45 Plug PRO (IP67) • Ethernet connector, Standard IE FastConnect RJ-45 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
24 V connecting cable 5 m between reader and power supply (for RF640R only, pin assignment is PNO-compliant)	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

5.4.1.3 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 RF640R/RF670R (Page 533))
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:

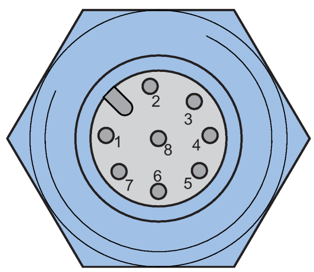
- Antenna is switched off
- A tag is used, that is not compatible with the reader protocol (EPC Global Class 1 Gen 2).
- Tag is defective
- Reader or antenna has a defect
- Tag is not in the field of radiation of the transmit antenna

---

For more detailed information on the flash codes of the reader see section Flashing codes RF640R/RF670R (Page 533)

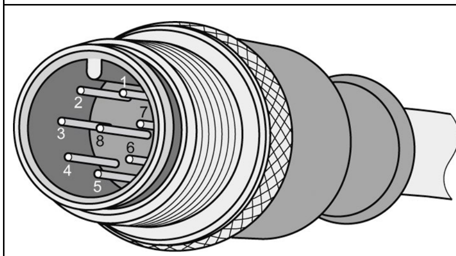
5.4.1.4 Pin assignment of the digital I/O interface

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- 13 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 electri-cally 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

5.4.1.5 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)

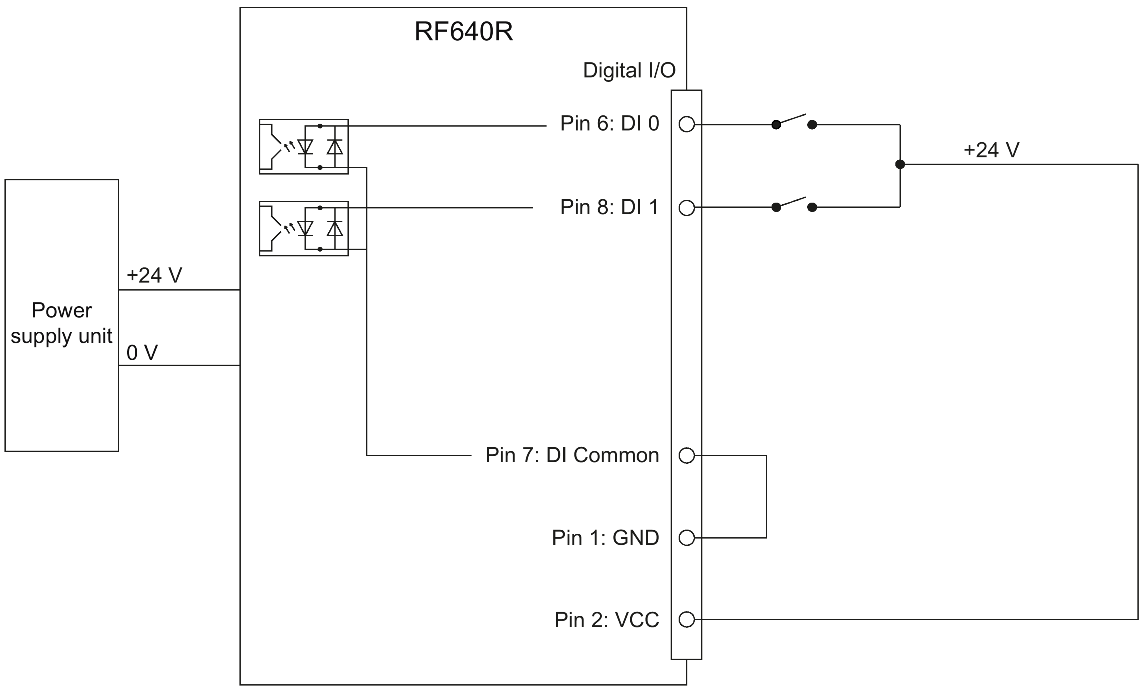


Figure 5-10 Example circuit 1: Digital inputs

Alternative connection possibilities:

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

Voltage infeed through external source

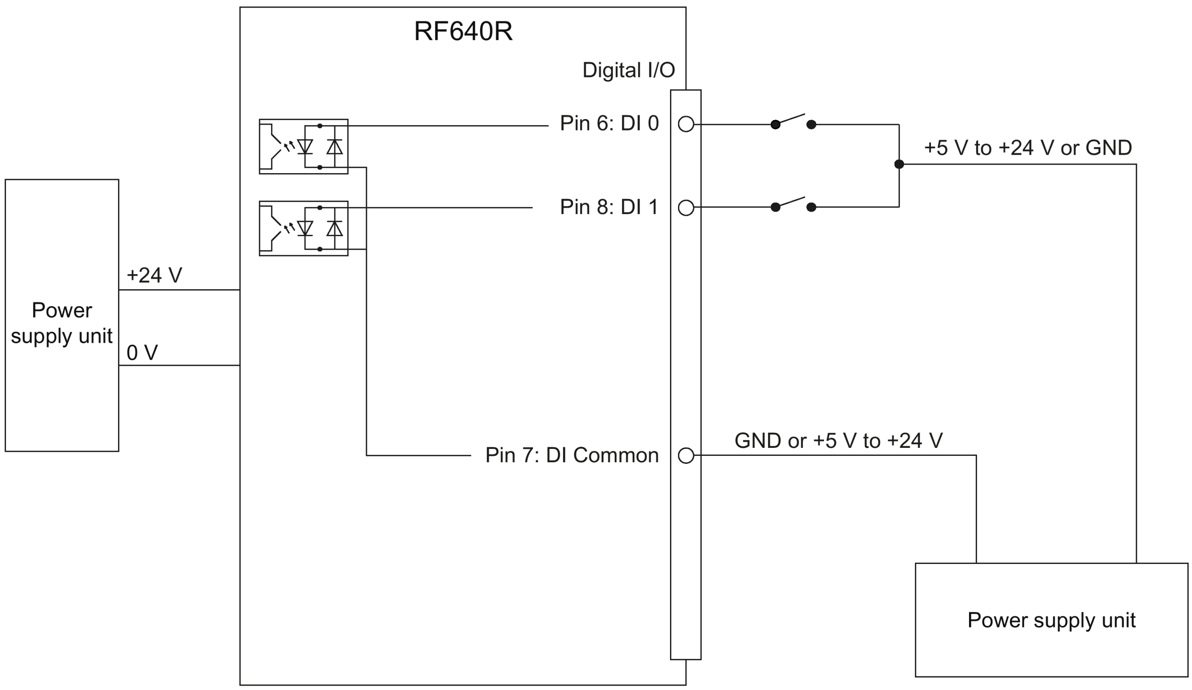


Figure 5-11 Example circuit 2: Digital inputs

Voltage infeed through external source with various voltages

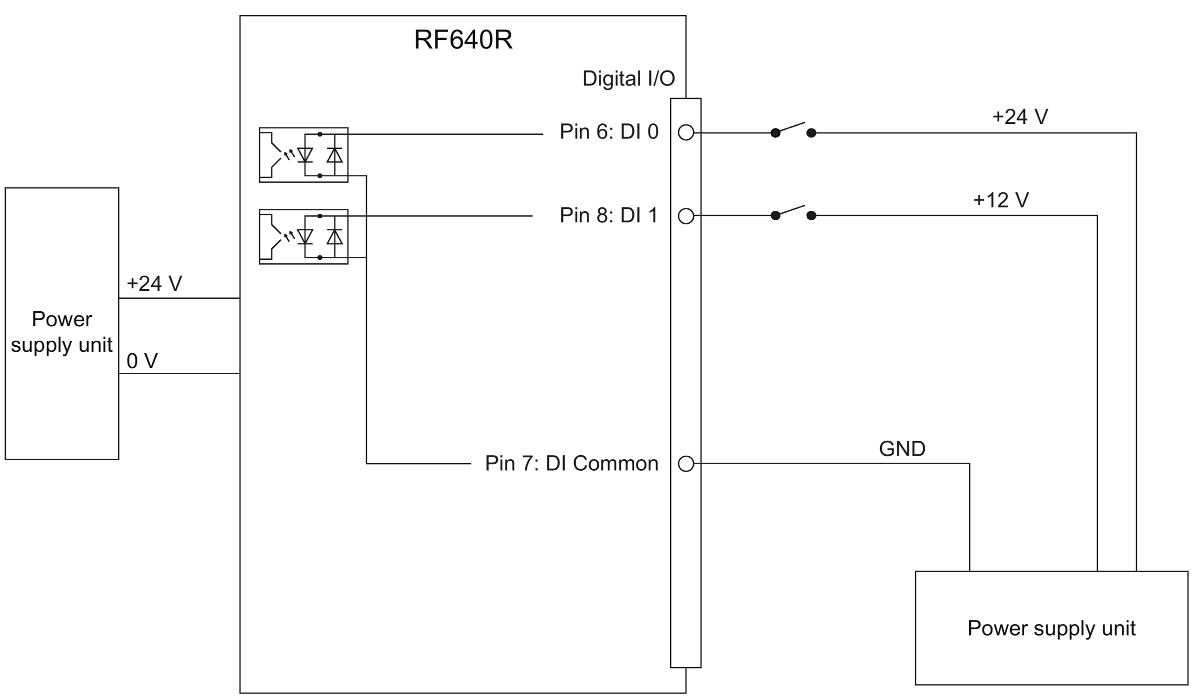


Figure 5-12 Example circuit 3: Digital inputs

Voltage infeed through internal source

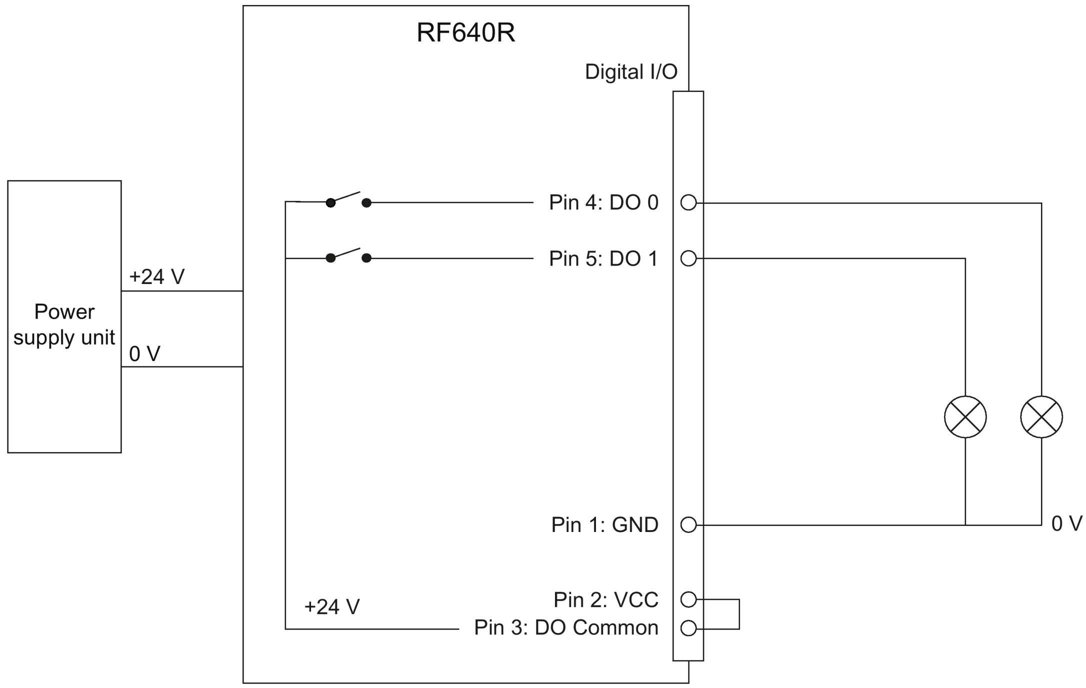


Figure 5-13 Example circuit 4: Digital outputs

Alternative connection possibilities:

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

Voltage infeed through external source

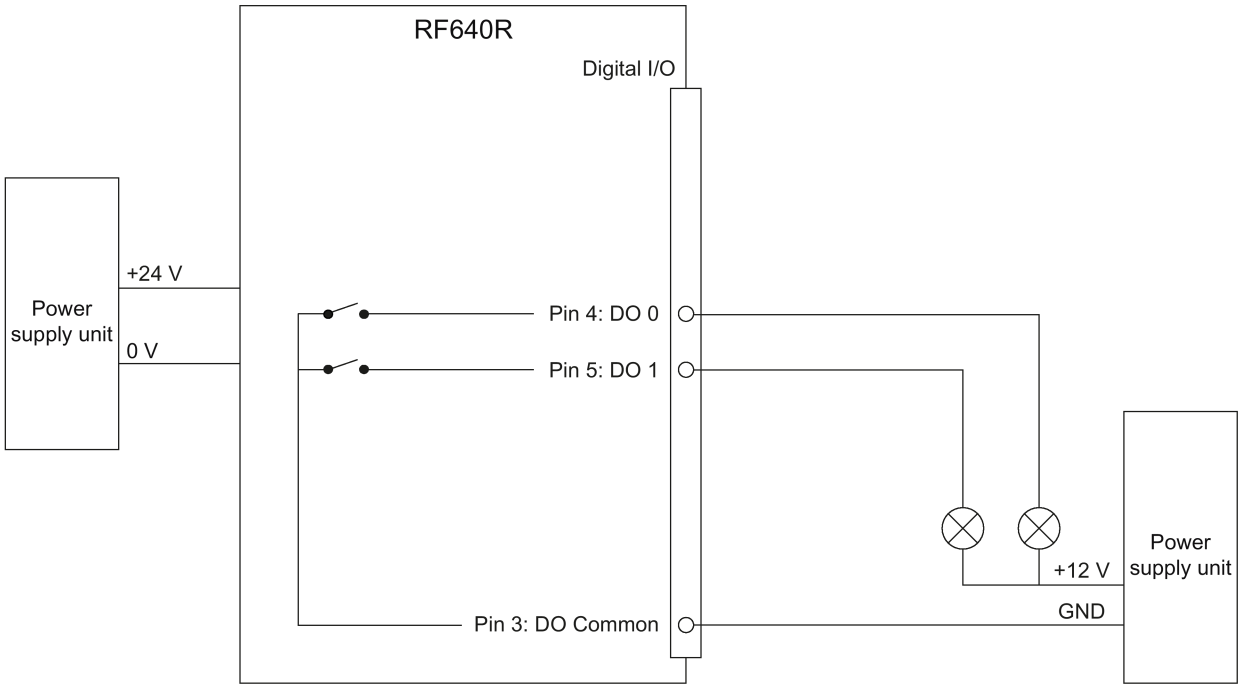


Figure 5-14 Example circuit 5: Digital outputs

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

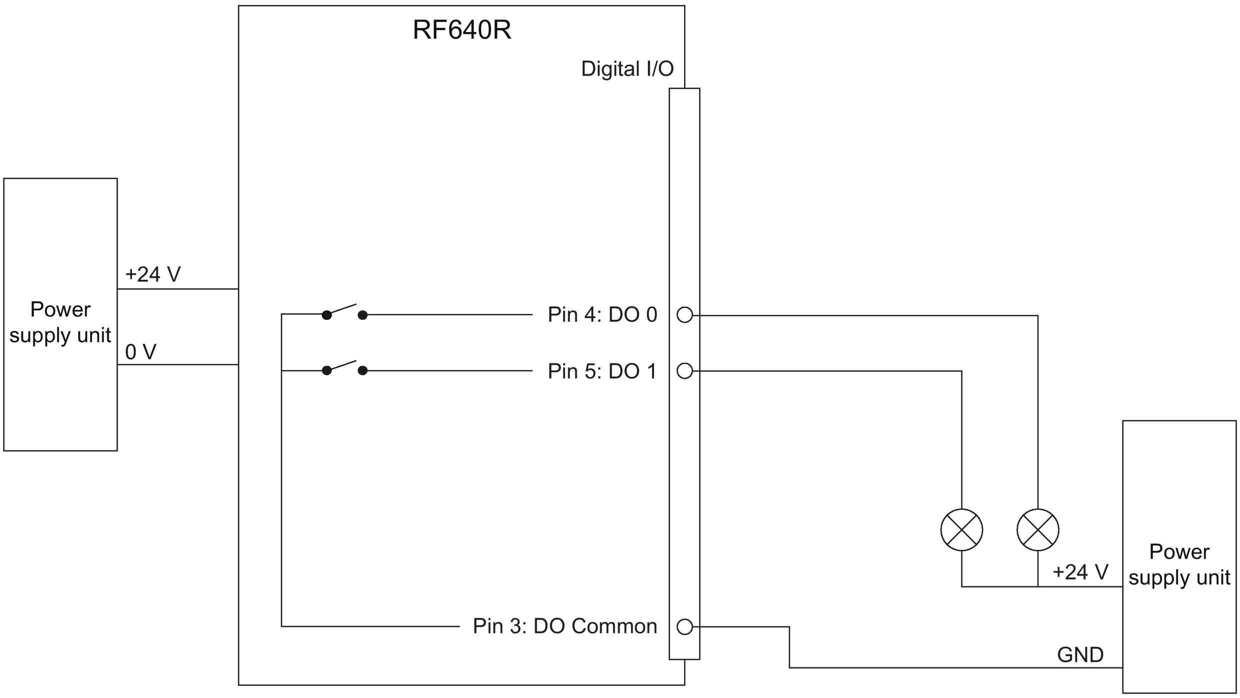
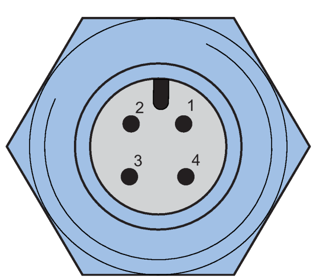


Figure 5-15 Example circuit 6: Digital outputs

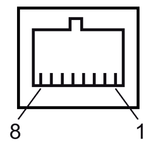
5.4.1.6 Pin assignment for power supply

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 RF640R is conforms with the PNO standard, in other words, normal PROFINET IO connectors 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 142)) 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!

5.4.1.8 Grounding connection

You can ground the RF640R reader using one of the mounting holes. Since the underside of the housing and therefore the mounting holes are varnished, a contact washer is required when securing the ground cable. The contact washer connects the housing to ground electrically. The tightening torque must be increased in this case from ≃ 1.5 Nm to 2.7 Nm to ensure that electrical contact is made.

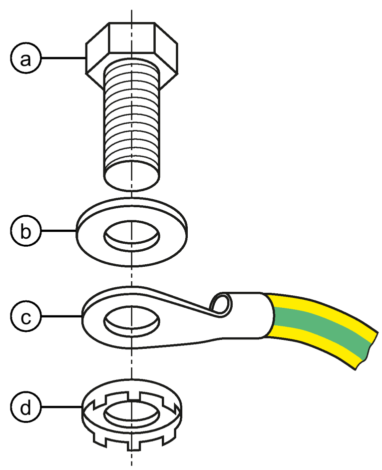
When mounting the reader with the antenna mounting kit, you require a nut to ground the reader via one of the mounting holes.

⚠ 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)	Flat washer
	(c)	Cable lug
	(d)	Contact washer: To make ground contact, use contact wash-ers according to the Siemens standard: SN 70093-6-FSt-flNnnc-480h, Siemens item no.: H70093-A60-Z3

5.4.2 Planning the use

5.4.2.1 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 V3".

5.4.2.2 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.

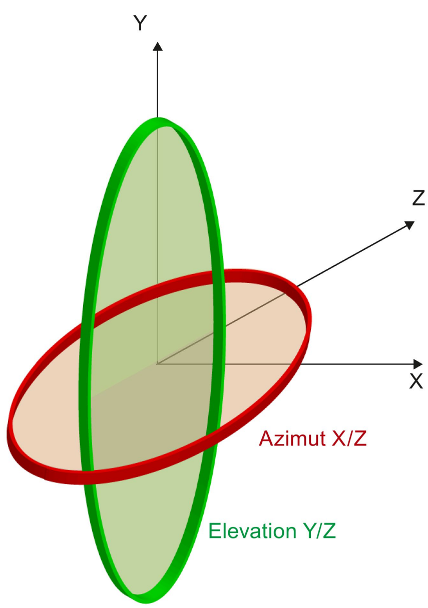
Note

Protective cap

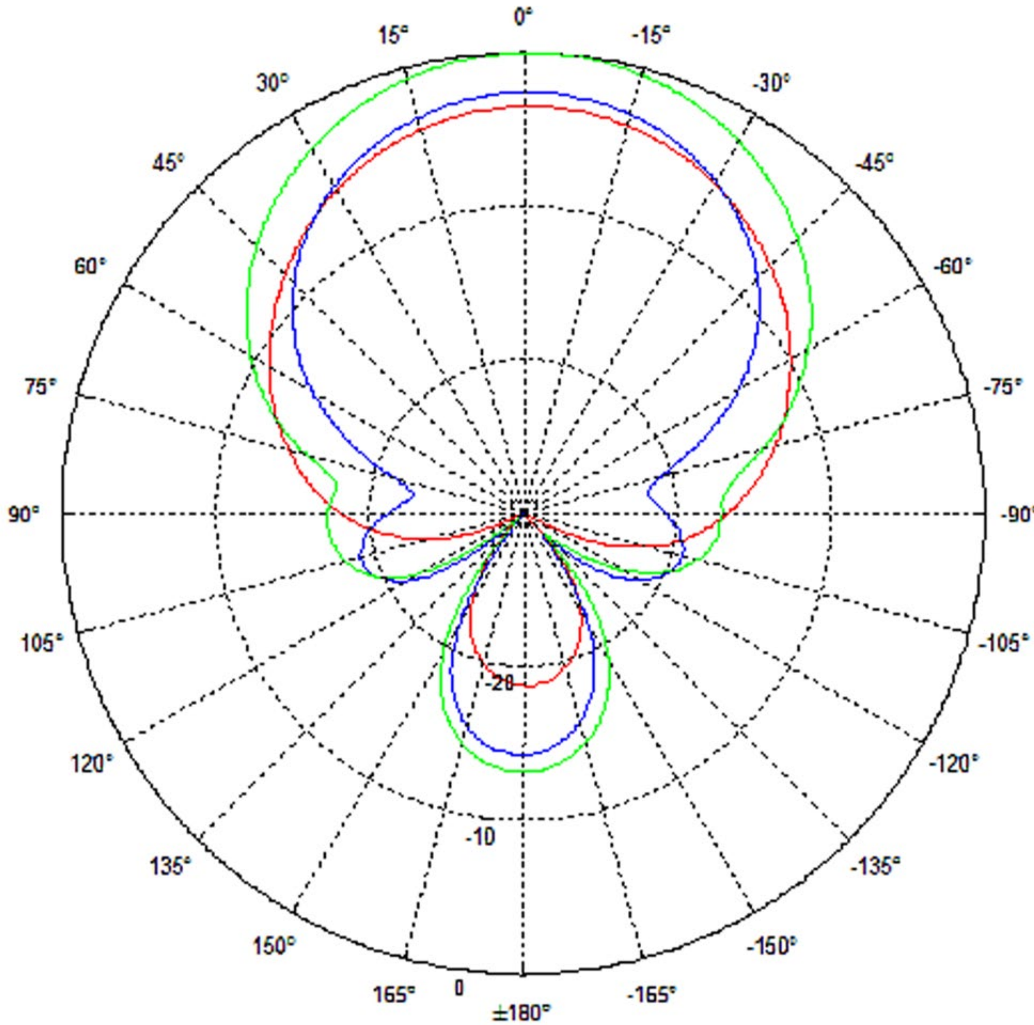
If you use the internal antenna of the reader, we recommend that you close the external, unused antenna connector on the reader using the supplied protective cap.

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)



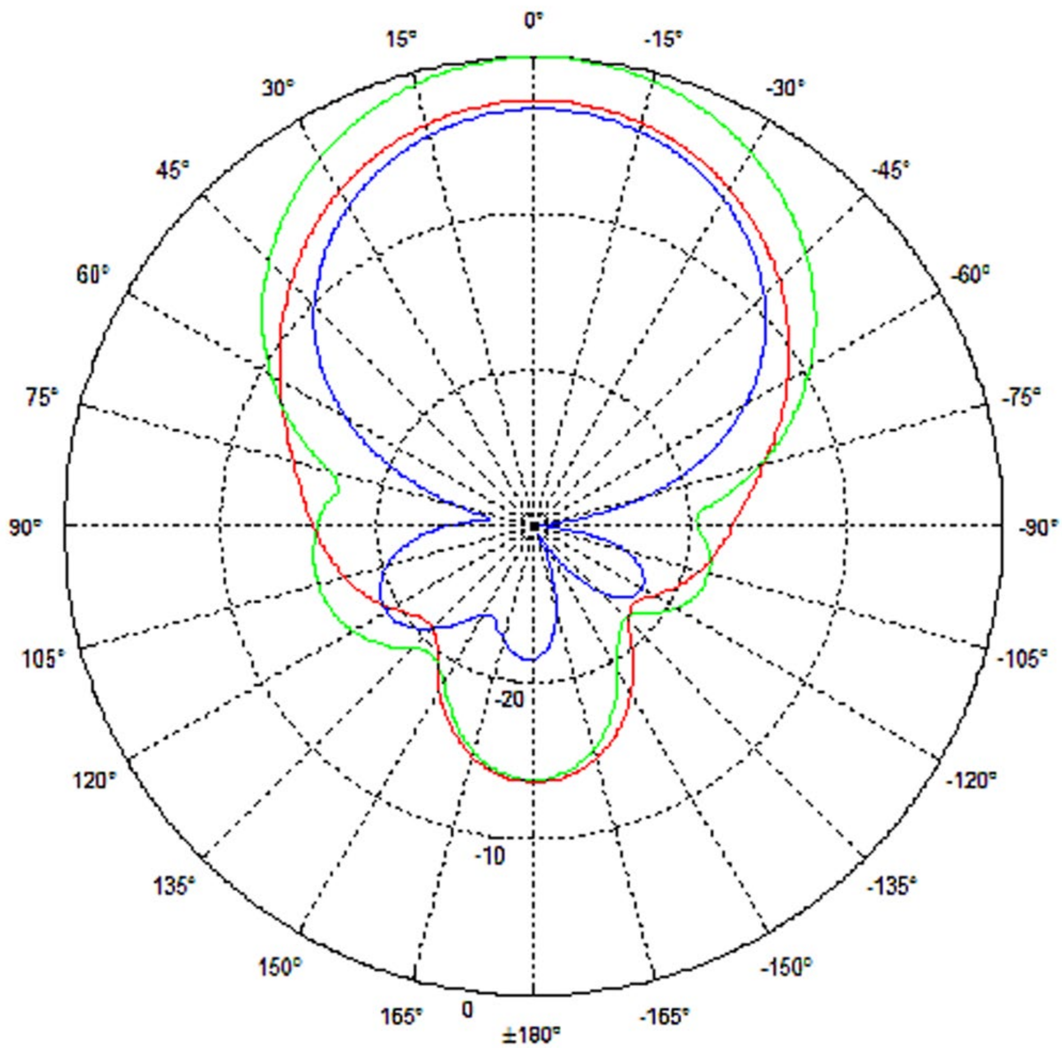
Vertical component of the polarization direction of the antenna

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

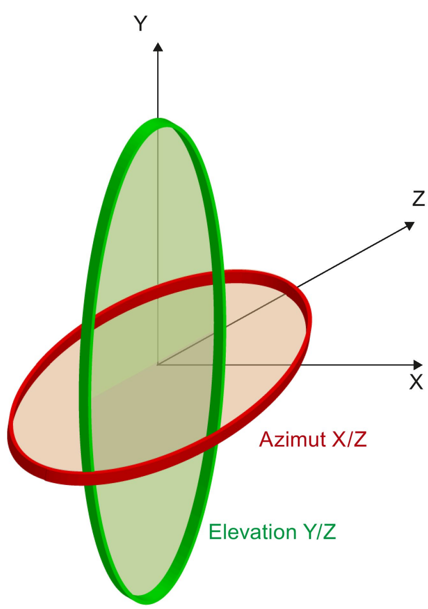
Table 5- 14 Maximum linear electrical aperture angle at 865 MHz:

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 59)

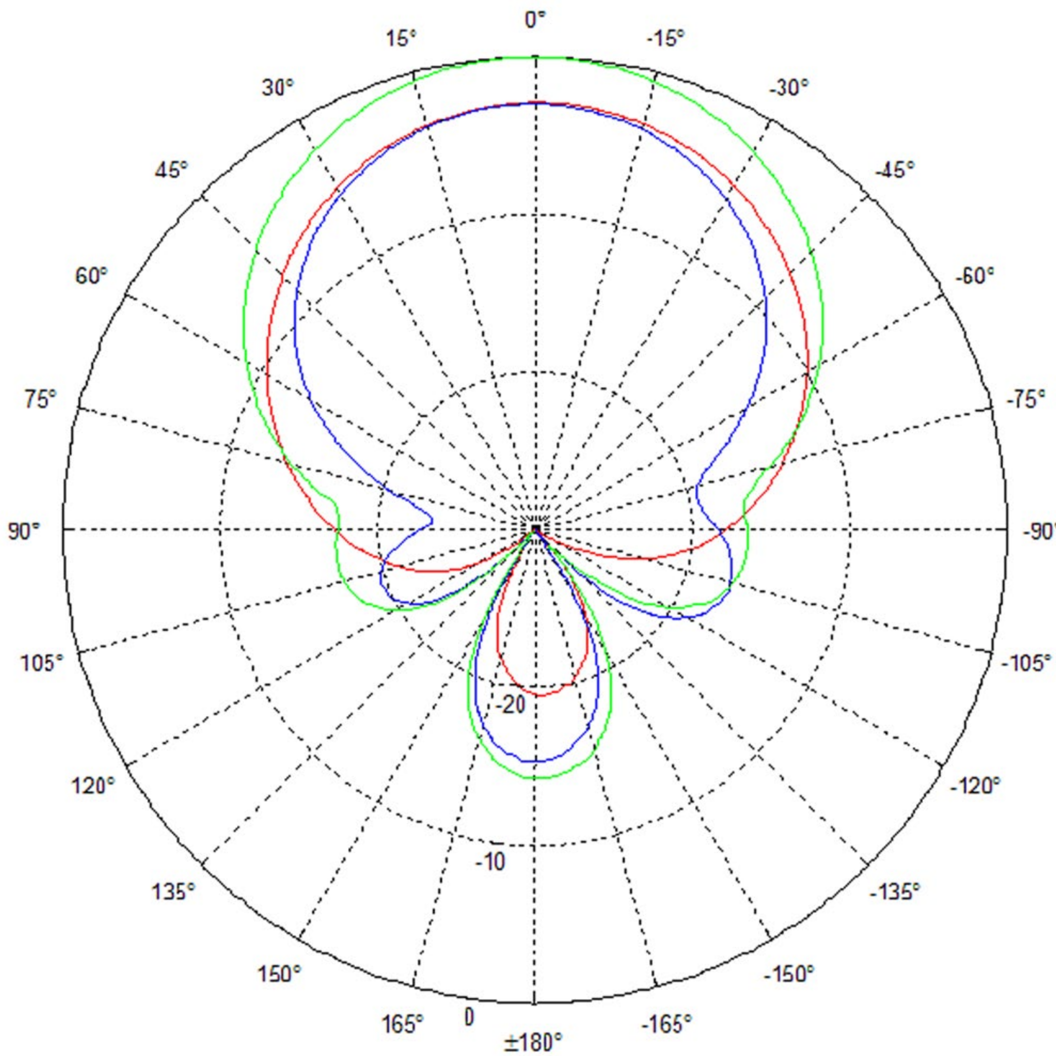
Antenna diagram for RF640R (FCC)

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)



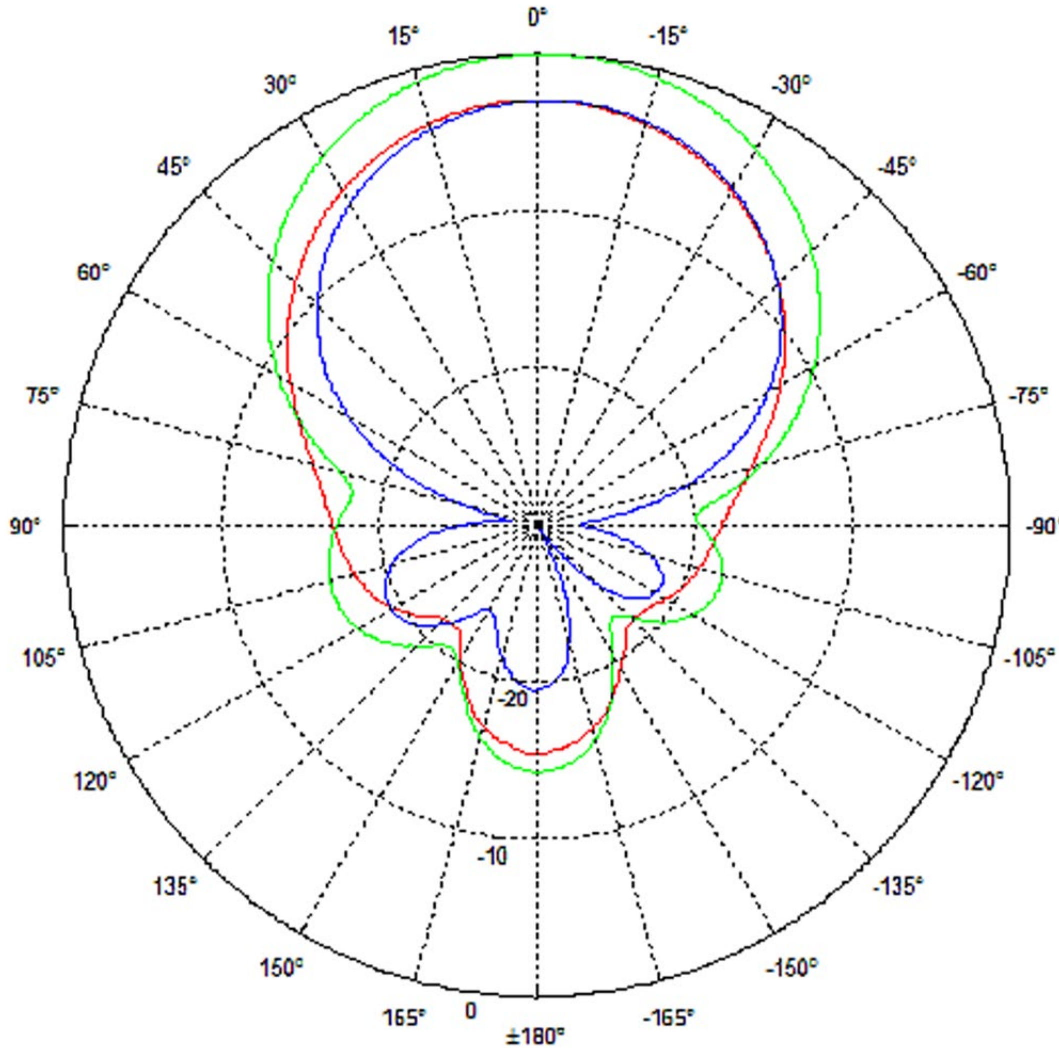
Vertical component of the polarization direction of the antenna

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- 15 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 59).

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 153), 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.

5.4.2.3 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.

5.4.3 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:

- Using a standardized VESA 100 mounting system using the Antenna Mounting Kit (refer to the section Mounting with antenna mounting kit (Page 360)).

  Tighten the M4 screws on the rear of the reader using a torque of ≤ 1.5 Nm.
- Directly on a flat surface (torque ≃ 1.5 Nm).

The positions of the mounting holes for the device are shown in the section Dimension drawings (Page 165).

5.4.4 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 the RF-MANAGER Basic V3
- 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.

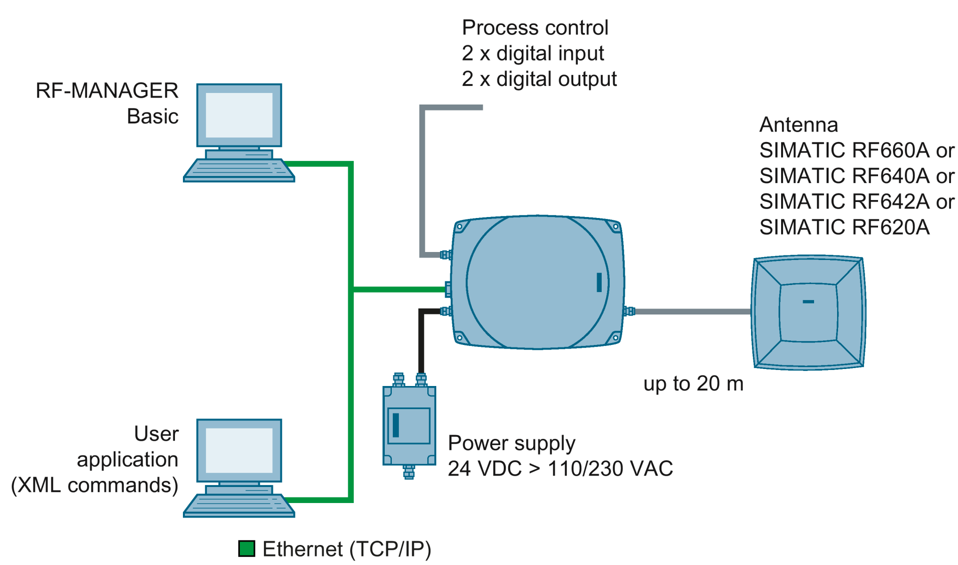


Figure 5-20 Overview of configuration of the RF640R reader

5.4.5 Technical data

5.4.5.1 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 trans-mit power)	Power requirement (in standby mode, no trans-mit 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

5.4.5.2 Technical data according to EPC and ISO

Technical specifications	
Frequency accuracy	max.± 10 ppm
Channel spacing	EU, EFTA, Turkey: 600 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)

5.4.6 Dimension drawings

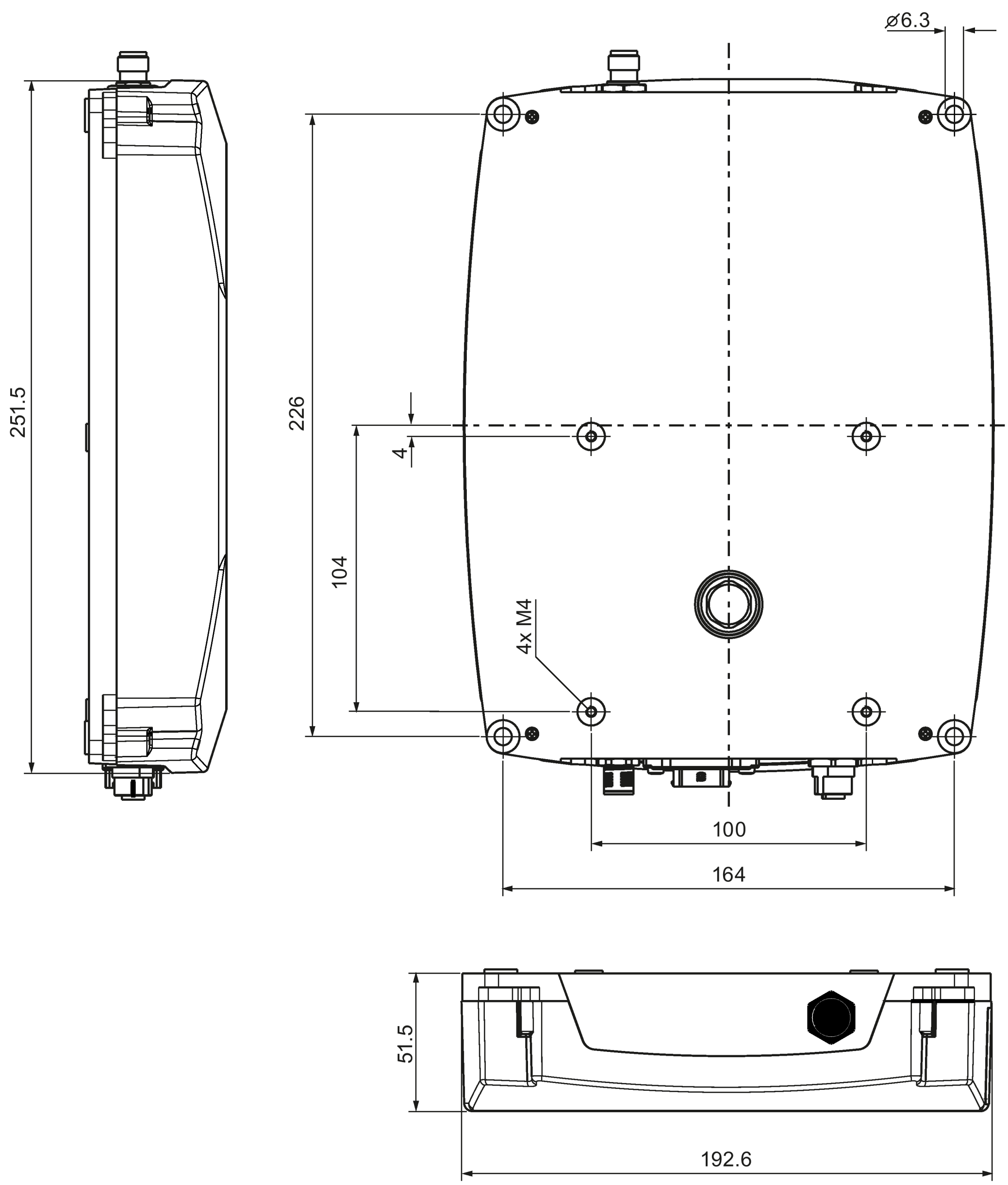


Figure 5-21 Dimensional drawing of RF640R

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- 16 6GT2811-3BA00-0AA0

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

Table 5- 17 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: MODELO: RF640R 3377-12-4061 (01)07894607536634 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- 18 6GT2811-3BA00-2AA1

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

5.4.7.1 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.

5.4.7.2 IC-FCB information

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

IC: 267X-RF600R, Model RF640R

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) This device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d`Industrie Canada applicables aux appareils radio exempts de licence. L`exploitation est autorisée aux deux conditions suivantes :

(1) L`appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l`appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d`en compromettre le fonctionnement.

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 RF650R reader

5.5.1 Description

5.5.1.1 Overview

The SIMATIC RF650R is a stationary reader in the UHF frequency band without an integrated antenna. Up to four external UHF RFID antennas can be connected via RP-TNC connectors.

The maximum RF power output is 1000°mW at 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 front edge. These interfaces can be used to connect the reader to the power supply and the PC for parameter assignment.

The degree of protection is IP30.

Pos.	Description
①	RP-TNC interfaces for connecting up to 4 external antennas
②	LED operating display
③	Digital I/O interface (M12, 12-pin)
④	RS-422 interface for connecting the power supply 24 VDC (M12 plug, 8-pin)
⑤	Ethernet interface (TCP/IP) (RJ-45 plug, 8-pin)

5.5.1.2 Ordering data

Table 5- 19 Ordering data RF650R

Product	Article number
RF650R (ETSI) reader for EU	6GT2811-6AB20-0AA0
RF650R (FCC) reader for the USA	6GT2811-6AB20-1AA0
RF650R (CMIIT) reader for China	6GT2811-6AB20-2AA0

Table 5- 20 Ordering data accessories

Product	Article number
Holders for securing the reader • DIN rail T35 (S7-1200) • S7-300 standard rail • S7-1500 standard rail	6GT2890-0AB00
Connecting cable and connectors • DI/DO cable connectors, open cable ends, 5 m • Ethernet cable RJ-45 ↔ RJ-45, 10 m • Ethernet connector, Standard IE FastConnect RJ-45 Plug 180 (IP20) • Ethernet cable by the meter, green (minimum 20 m)	• 6GT2891-0CH50 • 6XV1870-3QN10 • 6GK1901-1BB10-2AA0 • 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 reader ↔ wide-range power supply unit • with plug, 5 m • with open ends, 2 m • with open ends, 5 m	• 6GT2891-0PH50 • 6GT2891-4EH20 • 6GT2891-4EH50
RFID DVD "Software & Documentation"	6GT2080-2AA20

5.5.1.3 Status display

The operating statuses of the reader are displayed by the "RUN/STOP", "ERROR", and "PRESENCE" LEDs. The LEDs can adopt the colors green, red or yellow and the statuses off □, on ■, flashing ☼:

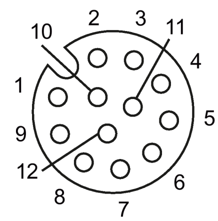
Table 5- 21 Display of operating statuses

R/S	ER	PRE	Meaning
□	□	□	The device is turned off.
■	■	■	The device is starting up.
☼	☼	-	The device is ready for operation. The connection to the XML application or S7 CPU is not established.
☼	□	-	The device is ready for operation. The connection to the XML application or S7 CPU is established.
■	□	-	The device is working. • STEP 7: The "writeconfig" command was received. • XML application: The "hostGreeting" command was received.
☼	☼	☼	Flash test for reader identification.
-	☼	-	There is an error. You will find more information on error messages in the section "RF650R/RF680R/RF685R error messages (Page 537)".
--	--	■	The antenna is switched on. There is no transponder in the antenna field.
-	-	☼	There is at least one transponder in the antenna field.
-	-	■	One or more transponders have been detected as valid.

5.5.1.4 Pin assignment of the digital I/O interface

View of socket (reader end)

Table 5- 22

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

Note

Requirement for external power sources

When the digital I/O interface is supplied by an external power source, the power source must meet the requirements for LPS (Limited Power Sources) and NEC Class 2.

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:

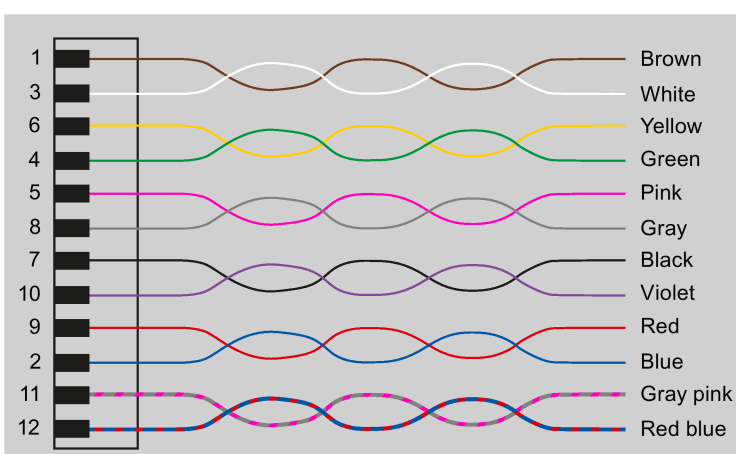


Figure 5-22 M12 connector wiring diagram

5.5.1.5 Connection scheme for the digital I/O interface

Connection possibilities

You can connect the RF650R 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.
- 4 digital outputs can be operated simultaneously each with up to 0.5 A (up to 1 A in total). With a total current > 1 A, you need to use an external power supply.
- 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 from internal source (no electrical isolation)

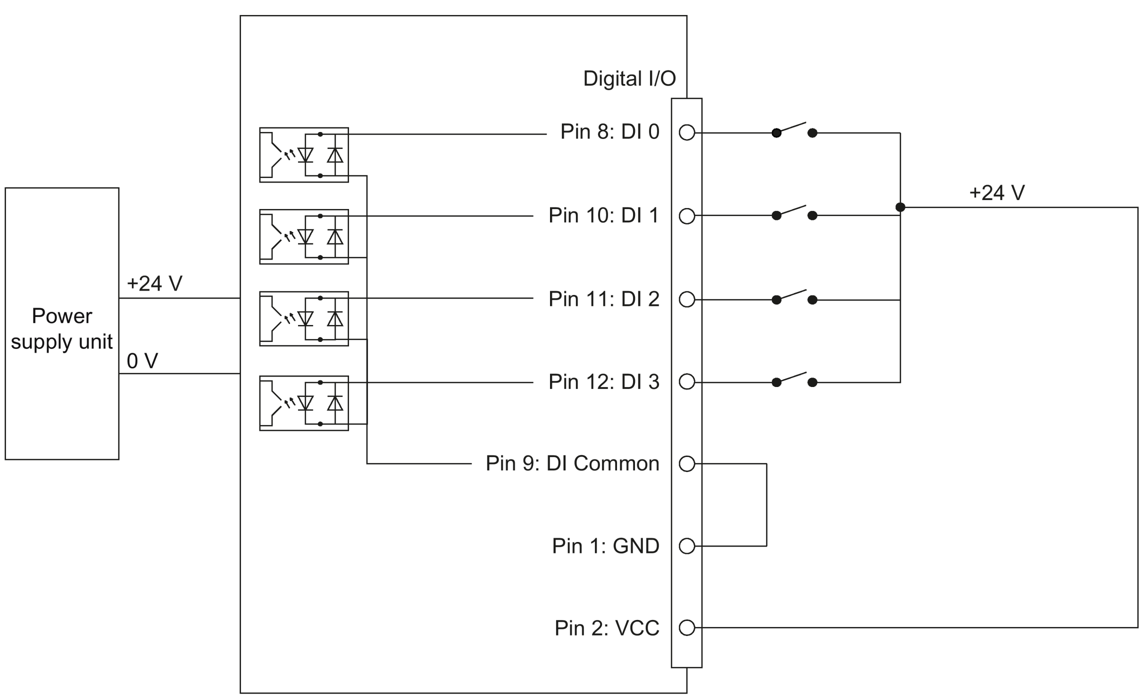


Figure 5-23 Circuit example 1: Digital inputs

Alternative connection possibilities:

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

Voltage infeed from external source

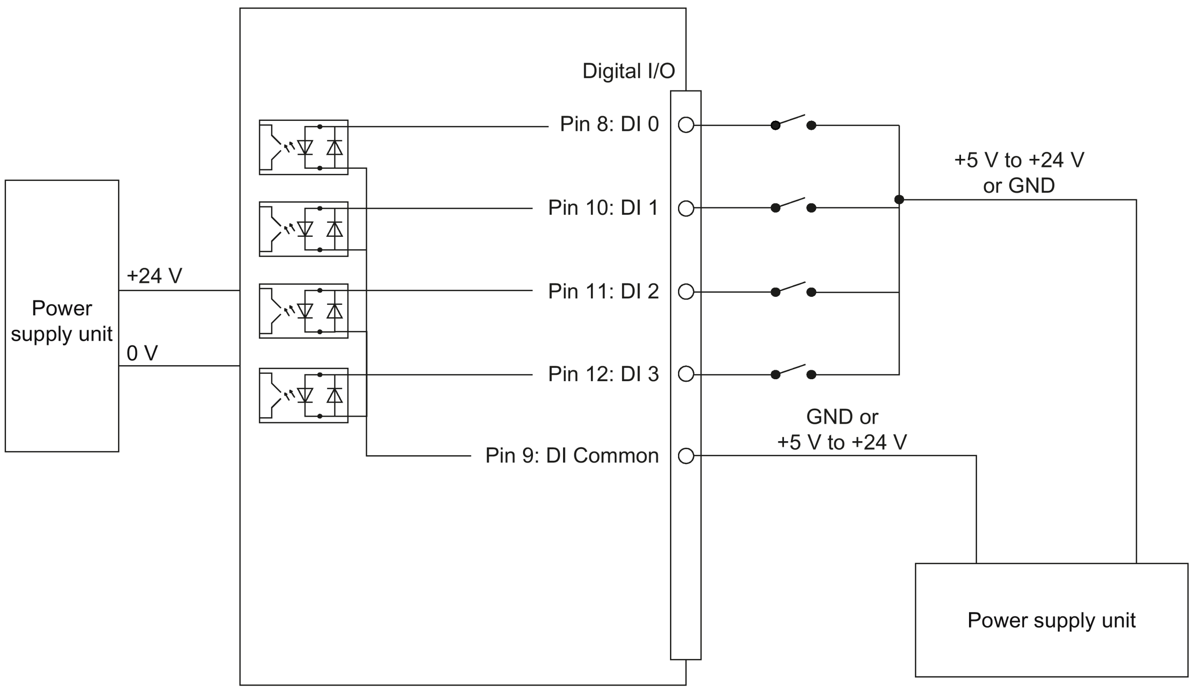


Figure 5-24 Circuit example 2: Digital inputs

Voltage infeed from external source with various voltages

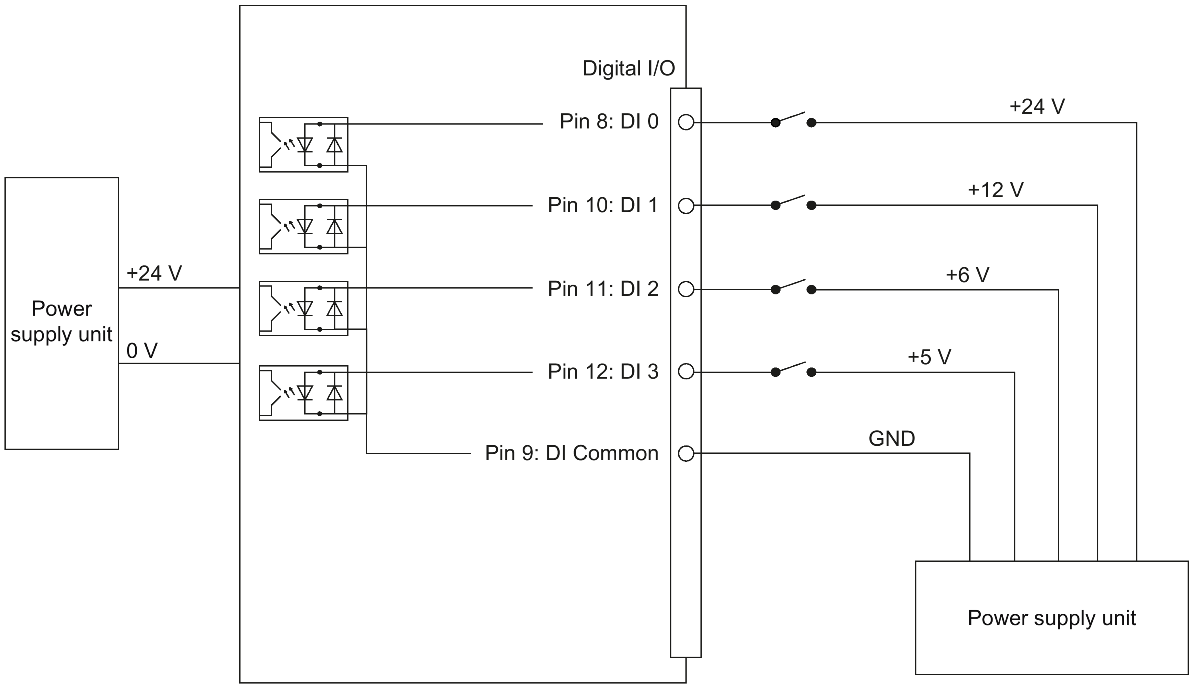


Figure 5-25 Circuit example 3: Digital inputs

Voltage infeed from internal source

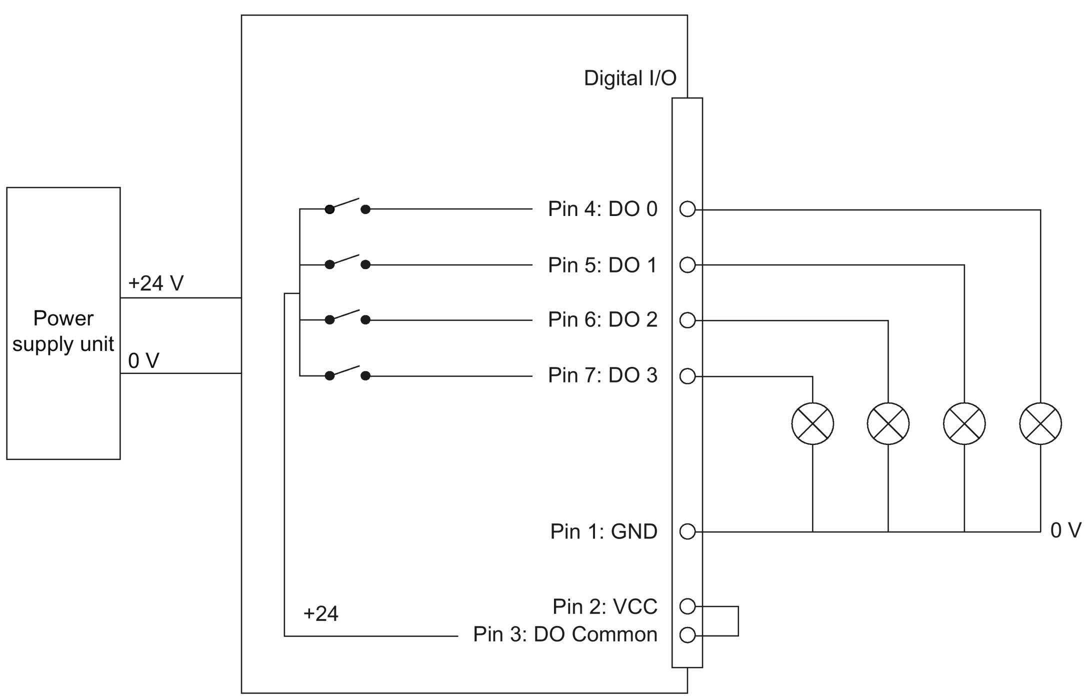


Figure 5-26 Circuit example 4: Digital outputs

Alternative connection possibilities:

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

Voltage infeed from external source

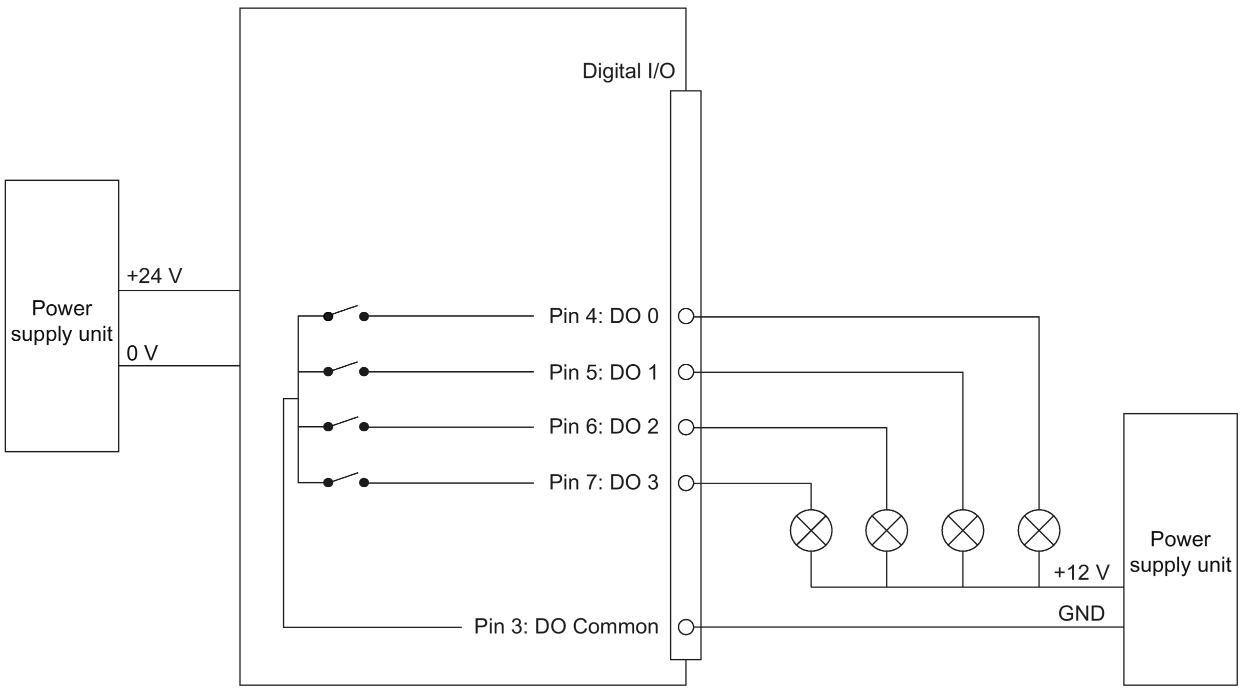


Figure 5-27 Circuit example 5: Digital outputs

Voltage infeed from an external source is shown here for 12°V as an example. Other voltages are also permissible.

Voltage infeed from external source with various voltages

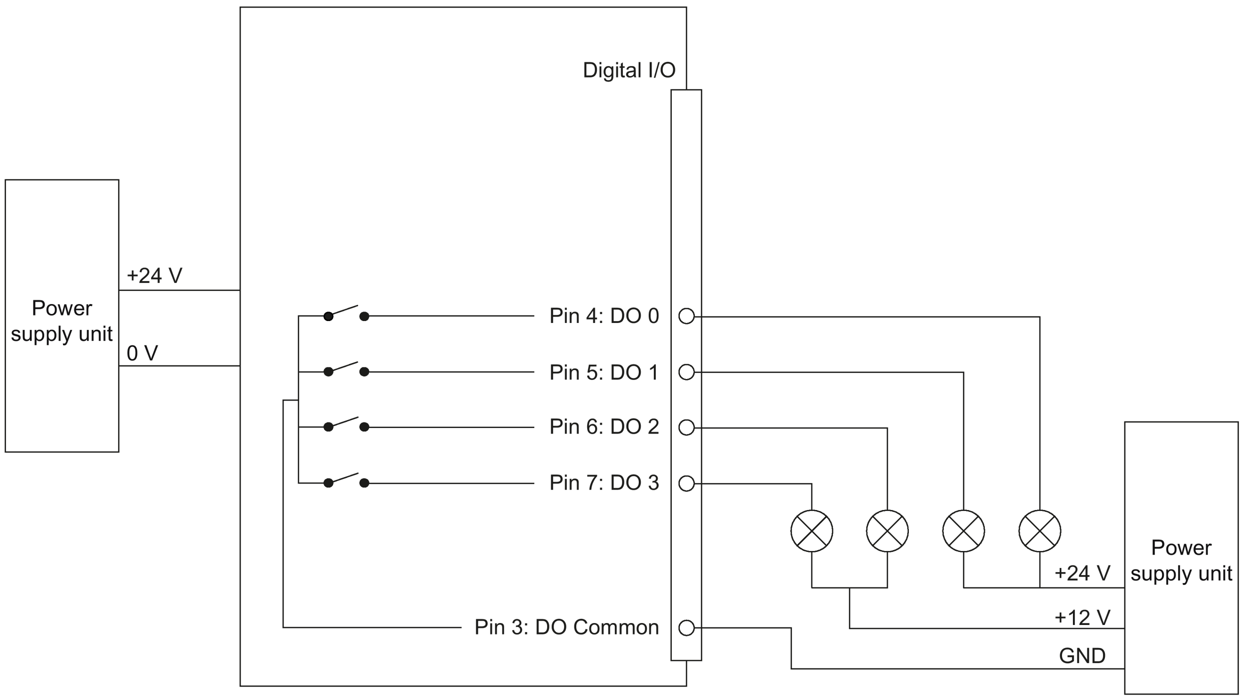
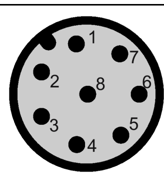


Figure 5-28 Circuit example 6: Digital outputs

5.5.1.6 Pin assignment 24 VDC (RS-422)

Pin	Pin Device end 8-pin M12	Wire colors	Assignment
	1	White	+ 24 V
	2 1)	Brown	- Transmit
	3	Green	0 V
	4 1)	Yellow	+ Transmit
	5 1)	Gray	+ Receive
	6 1)	Pink	- Receive
	7	-	Unassigned
	8	-	Earth (shield)

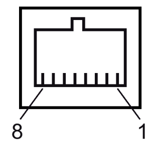
1) These pins are not required if the reader is operated via Ethernet.

Note

Requirement for external power sources

The reader must only be supplied with power by power supply units that meet the requirements of LPS (Limited Power Source) and NEC Class 2.

5.5.1.7 Pin assignment for Industrial Ethernet interface

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

Note

Use of Siemens cables

We recommend that you only use original Siemens cables and connectors (refer to the section Ordering data (Page 171)) to connect 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

Use only allowed inside buildings

Only Ethernet cables laid inside buildings may be connected.

5.5.1.8 Grounding connection

On the top of the reader there is a blind drill hole (M4 x 8) for grounding. Tighten the screw with a torque of ≈ 1.5 Nm.

WARNING

Hazardous voltage due to lightning strikes

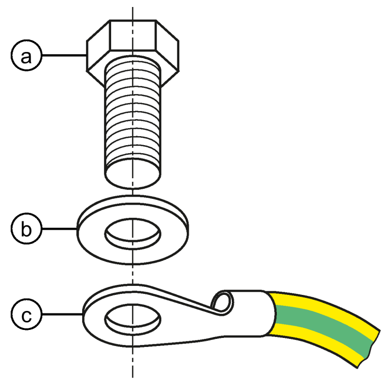
Death or serious injury may occur as a result of lightning strikes to antennas mounted outside buildings.

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

NOTICE

Installation only in protected areas

The antenna can be installed in the protected part of a building. When implementing your lightning protection concept, make sure you adhere to the VDE 0182 or IEC 62305 standards.

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

5.5.2 Planning operation

5.5.2.1 Antenna/read point configurations

You can connect up to four external antennas to the RF650R reader. The standard setting is that an antenna is connected when the reader is started. When connecting multiple antennas, note the information in the section "Specified minimum and maximum spacing of antennas (Page 54)".

With the WBM, you can set up various different configurations of antennas and/or reading points as required. Based on the number of data sources and subsequent assignment of the antennas, many tasks can be accomplished.

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 of the products.

5.5.3 Installation/mounting

Requirement

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

NOTICE
Close unused connectors
Note that the readers only have the specified degree of protection when all connectors are in use or when unused connectors are closed with the protective caps. If you do not use reader connectors, close them 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

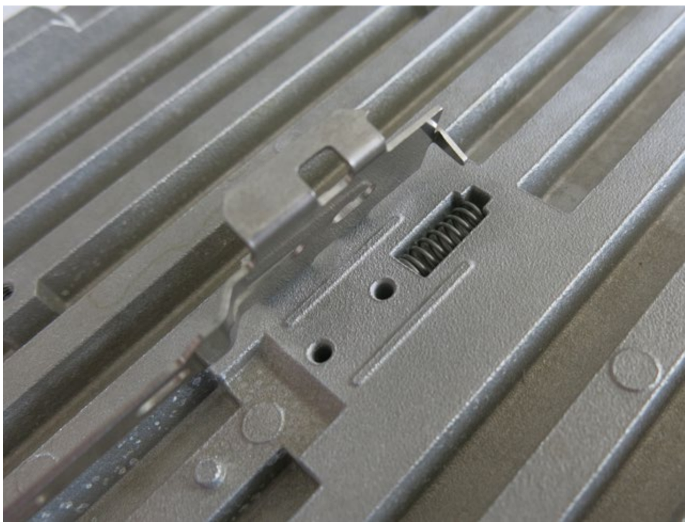
You can mount the reader in the following ways:

- DIN rail T35 (S7-1200)
- S7-300 standard rail
- S7-1500 standard rail
- directly on a flat surface using the VESA 100 mounting system (torque ≈ 1.5 Nm).

  The positions of the mounting holes for the device are shown in the section Dimension drawing (Page 189).

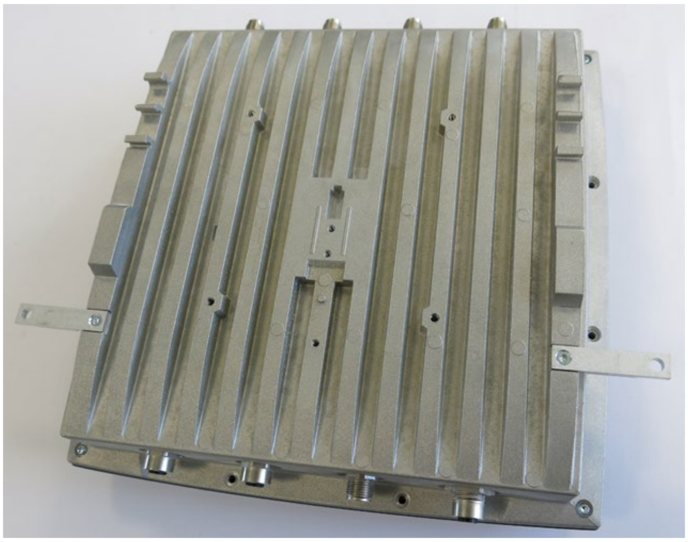
Mounting the reader on a DIN/standard rail

Table 5- 23 DIN rail mounting

	Description	
	1.	Place the spring in the groove.
	2.	Mount the holder using the supplied Torx screws. When mounting the holder, make sure that the angled tip is positioned above the spring in the groove.

		Description
	3.	Fit the lower part of the locking mechanism of the reader into the DIN rail. To be able to mount the reader on or remove it from the DIN rail, pull down the holder mounted in step 2.

Table 5- 24 Installation on a standard rail

		Description
	1.	Mount the two adapter pieces using the supplied Torx screws.
	2.	Fit the upper part of the locking mechanism of the reader into the standard rail.
	3.	Secure the reader using the supplied slotted-head screws.

5.5.4 Configuration/integration

An Ethernet interface is available for integrating the device into system environments/networks. The RF650R can be configured via the Ethernet interface and with direct connection to the PC. You can configure and program the reader using the following tools:

- using Web Based Management (WBM)
- using XML-based user applications

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

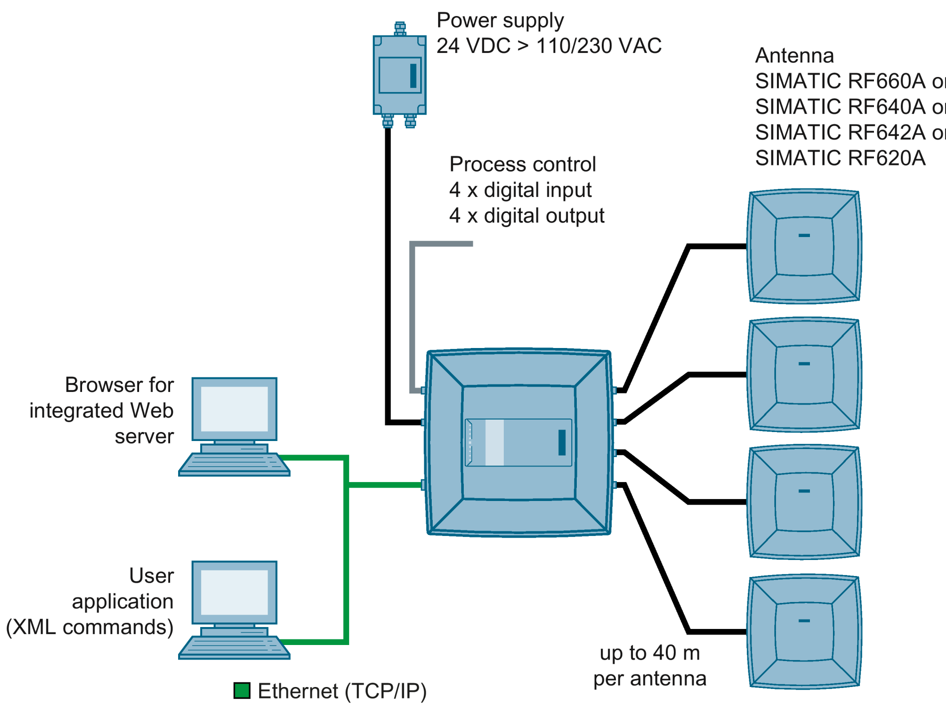


Figure 5-29 Overview of configuration of the RF650R reader

5.5.5 Technical specifications

Table 5- 25 Technical specifications, RF650R

	6GT2811-6AB20-xAA0
Product type designation	RF650R
Mechanical specifications	
Weight	2.4 kg
Dimensions (L x W x H)	258 × 258 × 80
Degree of protection	IP30
Material	
• Upper part of housing	Pocan DP CF 2200
• Lower part of housing	Aluminum
Color	
• Upper part of housing	TI-Grey
• Lower part of housing	Silver
Operating displays on the device	6 LEDs
Status display on the device	-
Interfaces	
• Antenna connectors	4 x RP-TNC plug
• Power supply	1 x RS 422 plug (M12, 8-pin)
• Digital I/O interface	1 x socket (M12, 12-pin)
• Digital inputs	4
• Digital outputs	4
• Ethernet interface	1 x RJ-45 plug TCP/IP (8-pin), 100 Mbps
MTBF	31 years
Electrical data	
Power supply	24 VDC (20 ... 30 VDC) [1)]
Max. permitted current consumption	2 A
Max. permitted current drain via the digital I/O interface	1 A
Current consumption (on standby)	
• 20 V input voltage on the reader (typical)	220 mA / 4.4 W
• 24 V input voltage on the reader (typical)	190 mA / 4.5 W
• 30 V input voltage on the reader (typical)	150 mA / 4.5 W

	6GT2811-6AB20-xAA0
Current consumption (at 1000 mW transmit power)	
• 20 V input voltage on the reader (typical)	450 mA / 9.0 W
• 24 V input voltage on the reader (typical)	370 mA / 8.9 W
• 30 V input voltage on the reader (typical)	300 mA / 9.0 W
Current consumption (at 2000 mW transmit power)	
• 20 V input voltage on the reader (typical)	610 mA / 12.2 W
• 24 V input voltage on the reader (typical)	500 mA / 12.0 W
• 30 V input voltage on the reader (typical)	410 mA / 12.3 W
Electromagnetic compatibility	
• ETSI	EN 301 489-1/-3, EN 302 208-1/-3 V1.4.1
• FCC	FCC CFR 47, Part 15 section 15.247

Permitted ambient conditions	
Ambient temperature	
• During operation	-25 ℃ to +55 ℃
• During transportation and storage	-40 °C to +85 °C
Shock resistant to EN 60068-2-27	30 g [2)]
Vibration resistant to EN 60068-2-6	30 m/s^2 [2)]

1) All supply and signal voltages must be safety extra low voltage (SELV/PELV according to EN 60950). The voltage sources must meet the requirements of limited power sources (LPS) and NEC Class 2.

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

Table 5- 26 Technical specifications according to EPC and ISO, RF650R

	6GT2811-6AB20-xAA0
Product type designation	RF650R
Frequency accuracy	max.± 10 ppm
Channel spacing	• EU, EFTA, Turkey: 600 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	• ≤ 2 W ERP
• FCC	• ≤ 4 W EIRP
Transmit power	
• ETSI/CMIIT	• ≤ 1 W
• FCC	• ≤ 1 W
Reading range	max. 8 m
Frequencies	
ETSI frequencies	
Frequency range for Europe, South Africa 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 at max. 2 W ERP)
Frequency range India	865.1 ... 866.9 MHz (4 channels at max. 2 W ERP, transmit power max. 1 W)
FCC frequencies	
Frequency range USA, Canada, Argentina, Mexico	902.75... 927.25 MHz (50 channels at max. 4 W EIRP, frequency hopping)
Frequency range Australia	918.25 ... 925.75 MHz (16 channels at max. 1 W EIRP, frequency hopping)
Frequency range Brazil [1)]	902.75 ... 907.25 MHz / 915.25 ... 927.25 MHz (35 channels at max. 4 W EIRP, frequency hopping)
Frequency range South Korea [1)]	917,3 ... 920.3 MHz (6 channels at max. 4 W EIRP)
CMIIT frequencies	
Frequency band China	920.625 ... 924.375 MHz (16 subchannels at 2 W ERP)

1) In preparation. Expected to be approved from 09/2015.

5.5.6 Dimension drawing

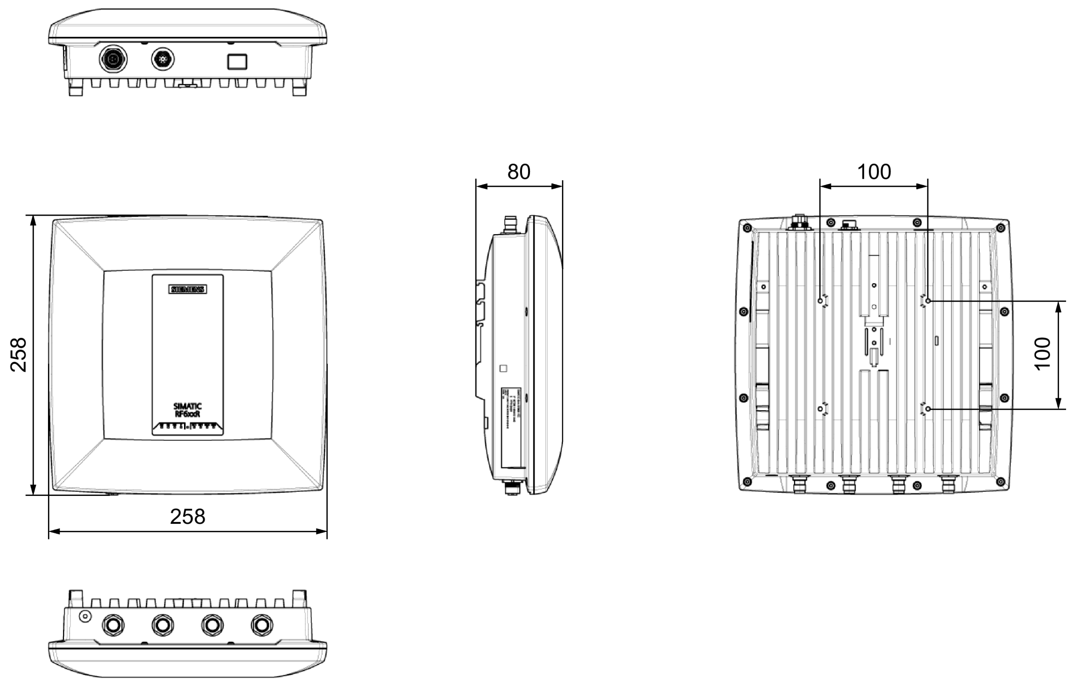


Figure 5-30 Dimension drawing RF650R

All dimensions in mm (± 0.5 mm tolerance)

5.5.7 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- 27 6GT2811-6AB20-0AA0

Certificate	Description
	Conformity with R&TTE directive
	South Africa radio approval: Radio Equipment Type Approval
India	India wireless approval Marking on the reader: No. NR-ETA/1587

Table 5- 28 6GT2811-6AB20-1AA0

Standard	
Federal Communications Commission	FCC CFR 47, Part 15 section 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-RF600R2
Industry Canada Radio Standards Specifications	RSS-210 Issue 7, June 2007, Section 2.2, A8 IC: 267X- RF600R2, Model: RF650R
	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 115352

Standard	
ANATEL	Brazil wireless approval Marking on the reader (6GT2811-6AB20-1AA0): ANATEL MODELO: RF650R 2892-15-4794 (01)07894607586820 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 2892-15-4794
	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. Certificate of the reader: MSIP-CMM-RF5-RF650R
C-14627	Argentina radio approval: Registro de la COMISION NACIONAL DE COMUNICACIONES
RCPSISI14-1926	Mexico radio approval: CERTIFICADO DE HOMOLOGACION, IFETEL
	Australia radio approval: This product meets the requirements of the AS/NZS 3548 Norm.

Table 5- 29 6GT2811-6AB20-2AA0

Standard	
CMIIT Certification	China radio approval Marking on the reader: CMIIT ID: 2014DJ3987

5.5.7.1 FCC information

Siemens SIMATIC RF650R (FCC): 6GT2811-6AB20-1AA0

FCC ID: NXW-RF600R2

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.

5.5.7.2 IC-FCB information

Siemens SIMATIC RF650R (FCC): 6GT2811-6AB20-1AA0

IC:

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) This device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d`Industrie Canada applicables aux appareils radio exempts de licence. L`exploitation est autorisée aux deux conditions suivantes :

(1) L`appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l`appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d`en compromettre le fonctionnement.

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.

5.6 RF670R reader

5.6.1 Description

5.6.1.1 Overview

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

The maximum RF power output is 1000°mW at 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 front edge. These interfaces can be used to connect the reader to the power supply and the PC for parameter assignment.

The degree of protection is IP65.

	Pos.	Description
	(1)	TNC reverse interfaces for connecting up to four antennas
	(2)	LED operating display
	(3)	24 VDC power supply
	(4)	Ethernet interface (TCP/IP)
	(5)	Digital I/O interface

5.6.1.2 Ordering data

Ordering data for RF670R

Product	Article 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 accessories

Product	Article number
Antenna mounting kit	6GT2890-0AA00
Connecting cable and connectors • Digital I/O, open cable ends, 5 m • Ethernet: 10 m (crossover cable) • Ethernet connector on reader according to IEC PAS 61076-3-117IE RJ-45 Plug PRO (IP67) • Ethernet connector, Standard IE FastConnect RJ-45 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 unit (for RF670R only, pin assignment is PNO-compliant)	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

5.6.1.3 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 RF640R/RF670R (Page 533))
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:

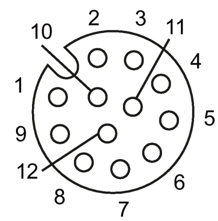
- Antenna is switched off
- A tag is used, that is not compatible with the reader protocol (EPC Global Class 1 Gen 2).
- Tag is defective
- Reader or antenna has a defect
- Tag is not in the field of radiation of the transmit antenna

For more detailed information on the flash codes of the reader see section Flashing codes RF640R/RF670R (Page 533)

5.6.1.4 Pin assignment of the digital I/O interface

View of socket (reader end)

Table 5- 30

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:

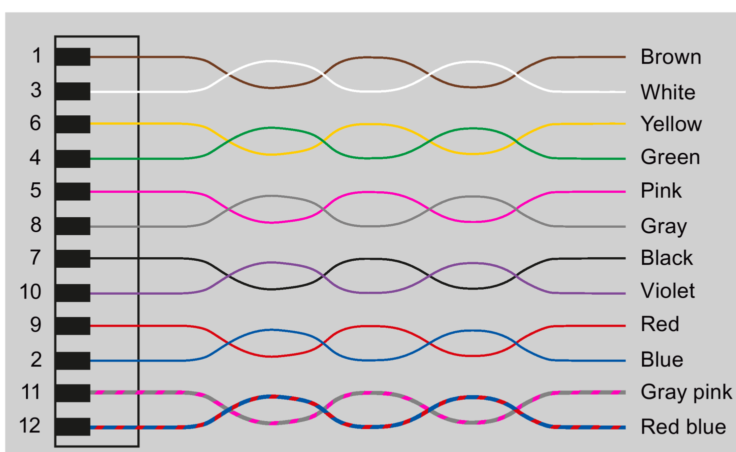


Figure 5-31 M12 connector wiring diagram

5.6.1.5 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)

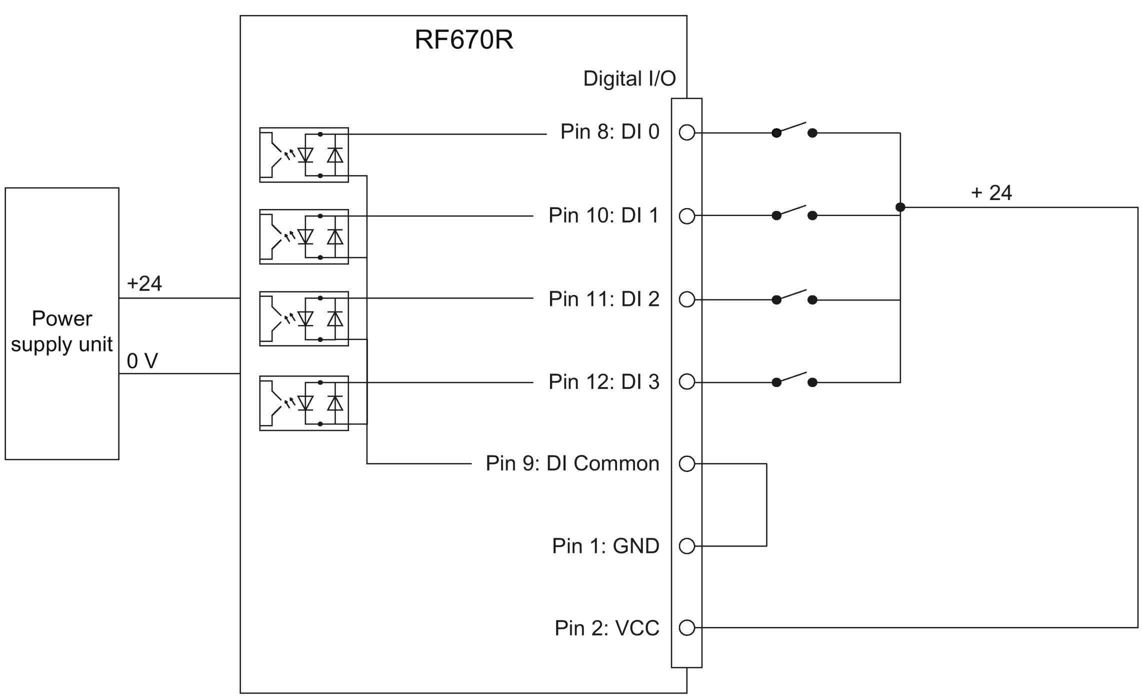


Figure 5-32 Example circuit 1: Digital inputs

Alternative connection possibilities:

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

Voltage infeed through external source

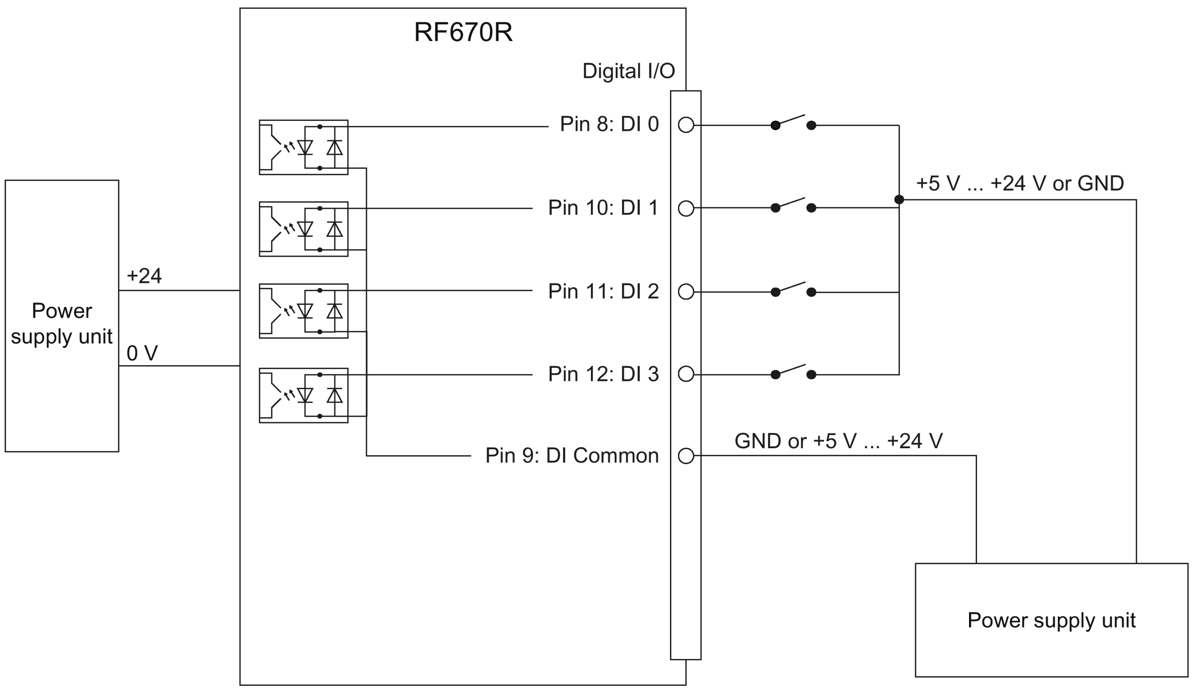


Figure 5-33 Example circuit 2: Digital inputs

Voltage infeed through external source with various voltages

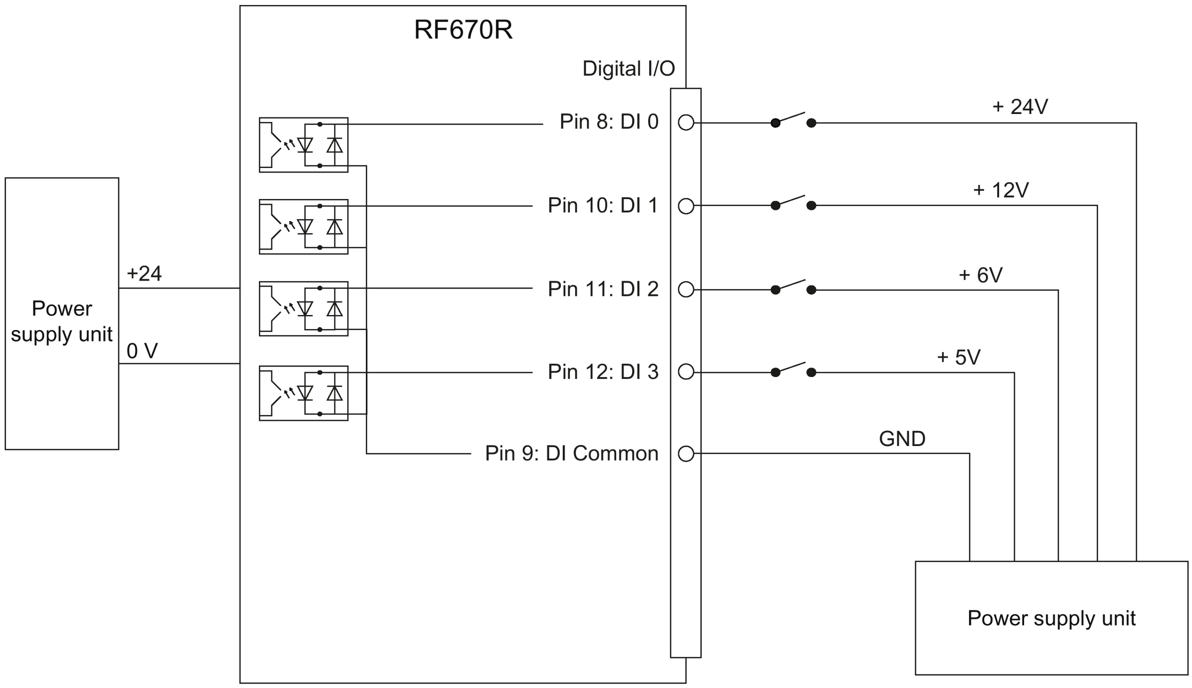


Figure 5-34 Example circuit 3: Digital inputs

Voltage infeed through internal source

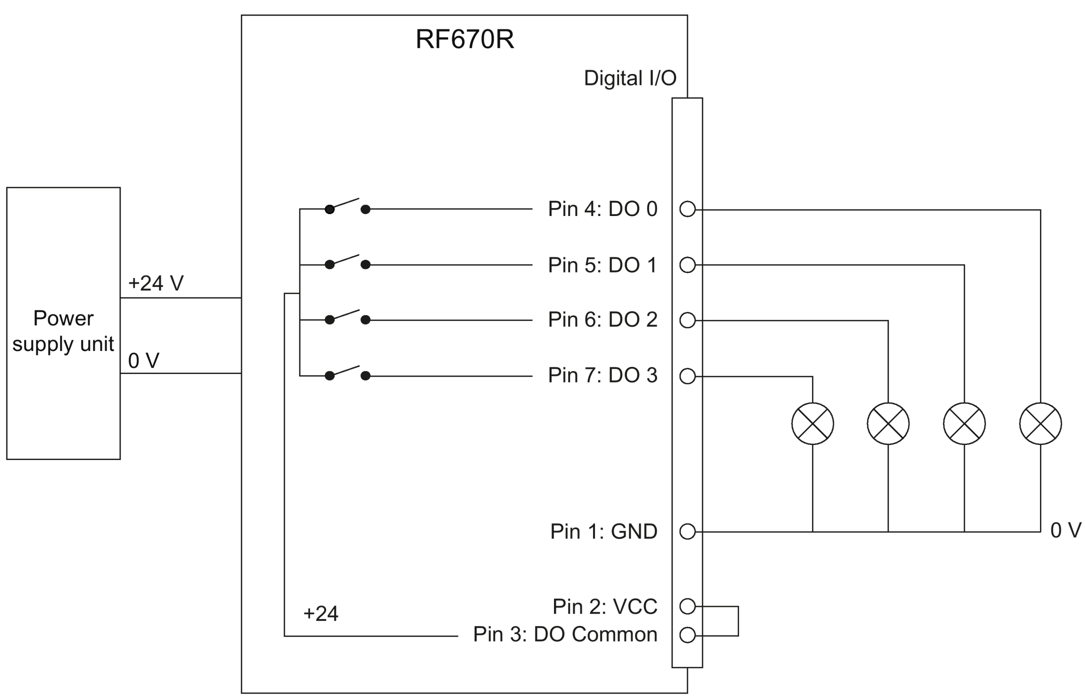


Figure 5-35 Example circuit 4: Digital outputs

Alternative connection possibilities:

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

Voltage infeed through external source

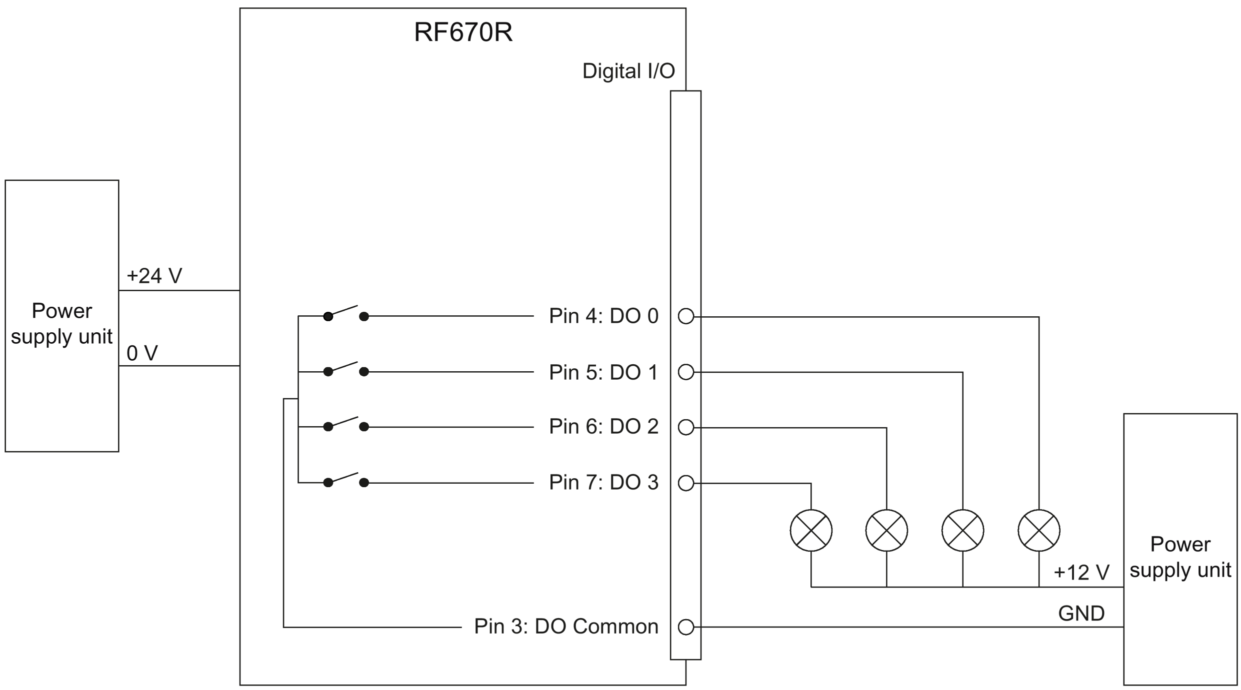


Figure 5-36 Example circuit 5: Digital outputs

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

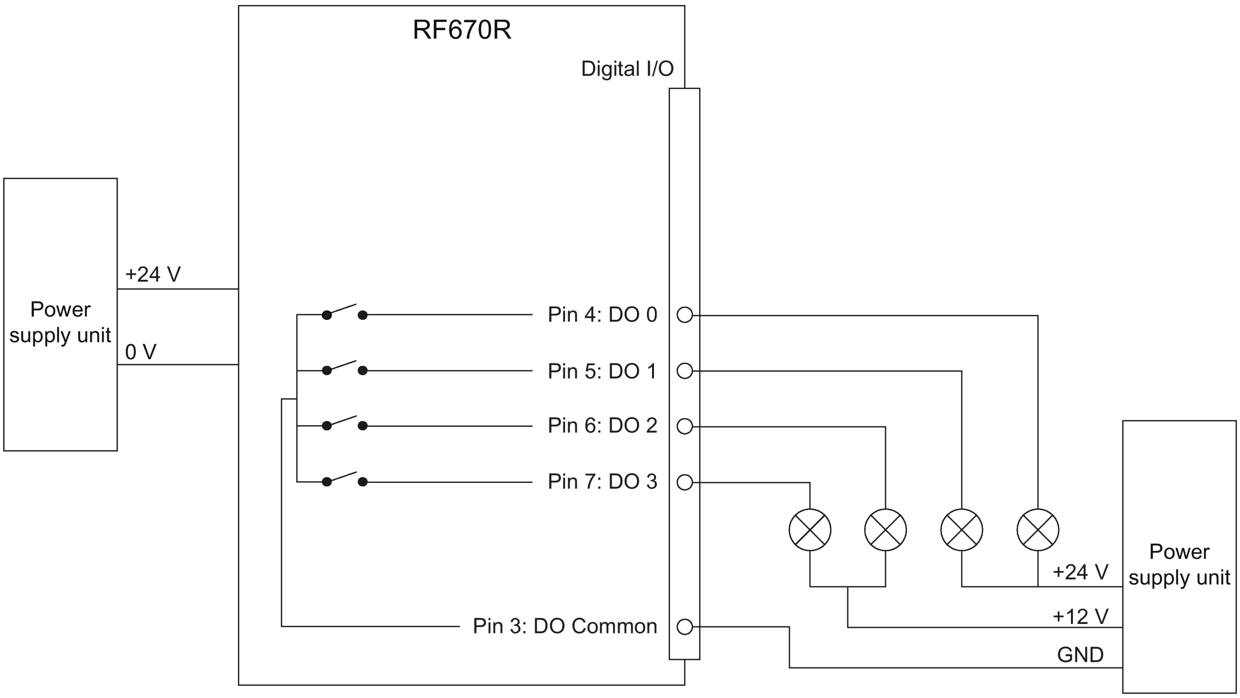
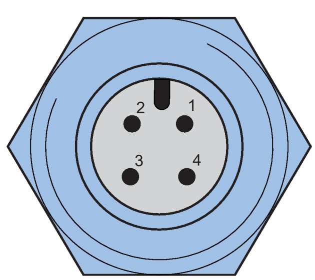


Figure 5-37 Example circuit 6: Digital outputs

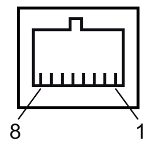
5.6.1.6 Pin assignment for power supply

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.

5.6.1.7 Pin assignment for Industrial Ethernet interface

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

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 195)) 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!

5.6.1.8 Grounding connection

You can ground the RF670R reader using one of the mounting holes. Since the underside of the housing and therefore the mounting holes are varnished, a contact washer is required when securing the ground cable. The contact washer connects the housing to ground electrically. The tightening torque must be increased in this case from ≃ 1.5 Nm to 2.7 Nm to ensure that electrical contact is made.

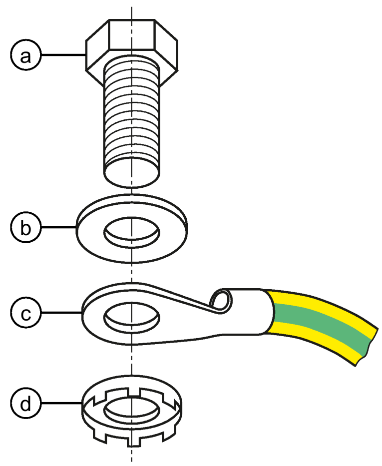
When mounting the reader with the antenna mounting kit, you require a nut to ground the reader via one of the mounting holes.

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)	Flat washer
	(c)	Cable lug
	(d)	Contact washer: To make ground contact, use contact washers according to the Siemens standard: SN 70093-6-FSt-flNnnc-480h, Siemens item no.: H70093-A60-Z3

5.6.2 Planning the use

5.6.2.1 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 54)".

With the RF-MANAGER Basic V3, you can set up various different configurations of antennas and/or reading points as required. Based on the number of data sources and subsequent assignment of the antennas, many tasks can be accomplished.

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 of the products.

5.6.3 Installing / mounting

Requirement

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

NOTICE
Close unused connectors
Note that the readers only have the specified degree of protection when all connectors are in use or when unused connectors are closed with the protective caps.
If you do not use reader connectors, close them 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:

- Using a standardized VESA 100 mounting system using the Antenna Mounting Kit (refer to the section Mounting with antenna mounting kit (Page 360)).

  Tighten the M4 screws on the rear of the reader using a torque of ≤ 1.5 Nm.
- Directly on a flat surface (torque ≈ 1.5 Nm).

The positions of the mounting holes for the device are shown in the section Dimension drawings (Page 210).

5.6.4 Configuration/integration

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 the RF-MANAGER Basic V3
- using XML-based user applications

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 using XML commands.

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

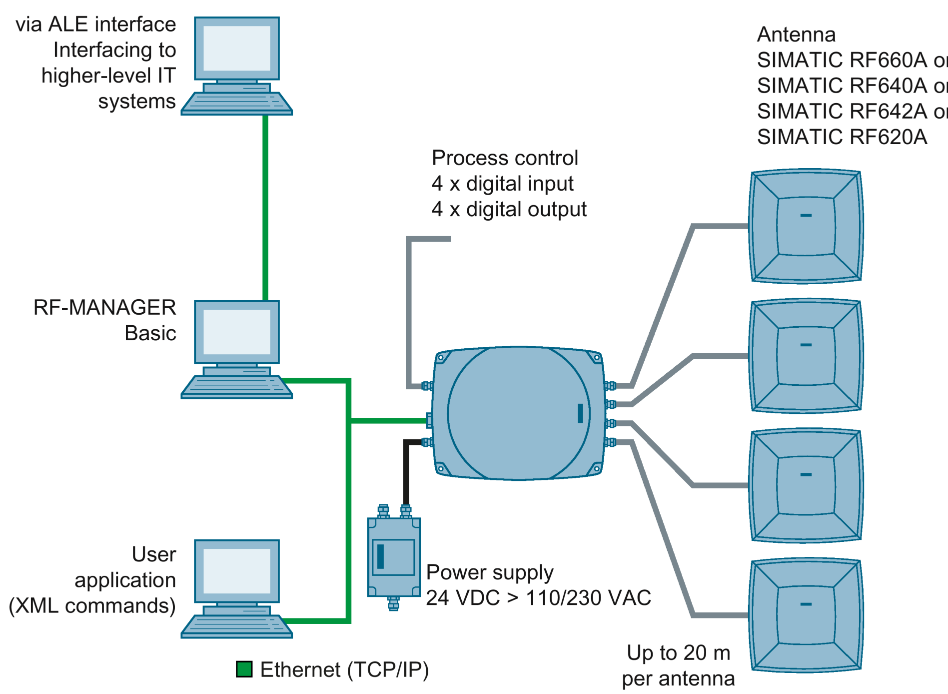


Figure 5-38 Overview of configuration of the RF670R reader

5.6.5 Technical data

5.6.5.1 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

5.6.5.2 Technical data according to EPC and ISO

Technical specifications	
Frequency accuracy	max.± 10 ppm
Channel spacing	EU, EFTA, Turkey: 600 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)

5.6.6 Dimension drawings

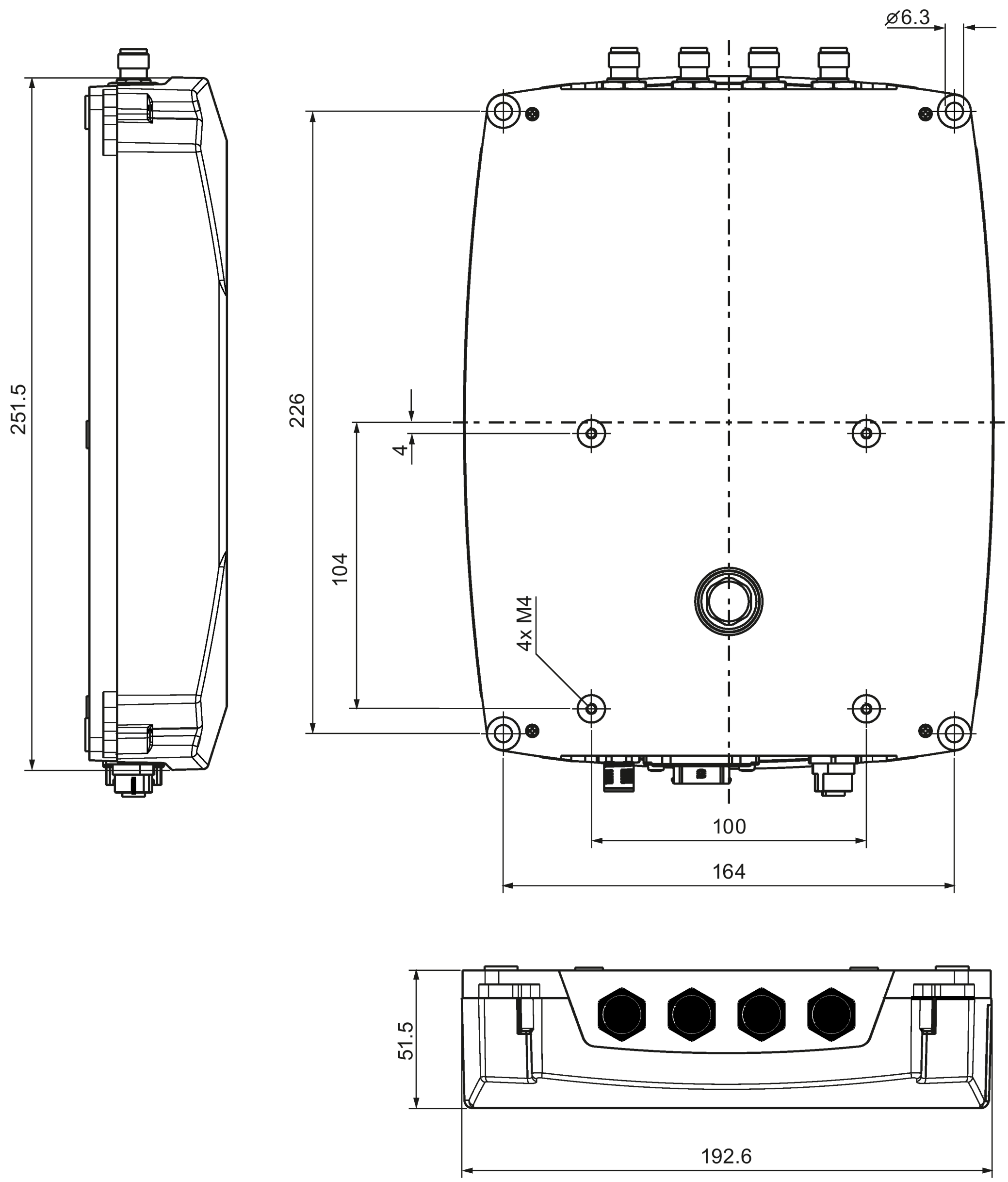


Figure 5-39 Dimension drawing for RF670R

All dimensions in mm (± 0.5 mm tolerance)

5.6.7 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- 31 6GT2811-0AB00-0AA0

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

Table 5- 32 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)
	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

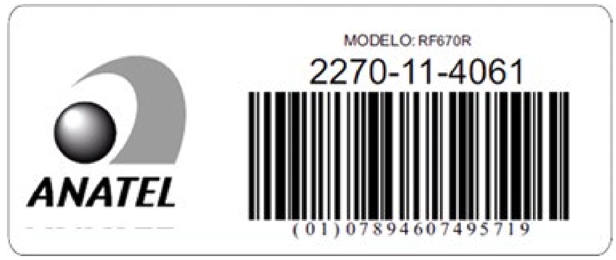
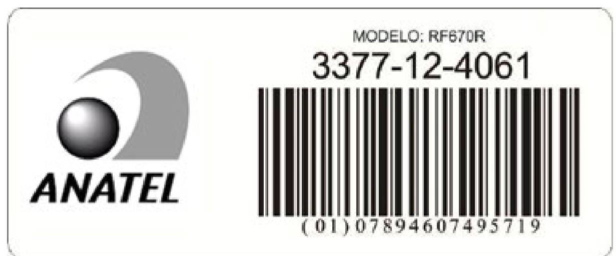
Standard	
	Brazil wireless approval Marking on the reader (as of FS: A):  Marking on the reader (as of FS: B1):  Statement relating to approval: Este equipamento opera em caráter secundário, isto é, não tem direito à proteção contra interferência prejudicial, mesmo de estações do mesmo tipo e não pode 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- 33 6GT2811-0AB00-2AA1

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

5.6.7.1 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.

5.6.7.2 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)

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) This device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d`Industrie Canada applicables aux appareils radio exempts de licence. L`exploitation est autorisée aux deux conditions suivantes :

(1) L`appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l`appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d`en compromettre le fonctionnement.

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.

5.7 RF680R reader

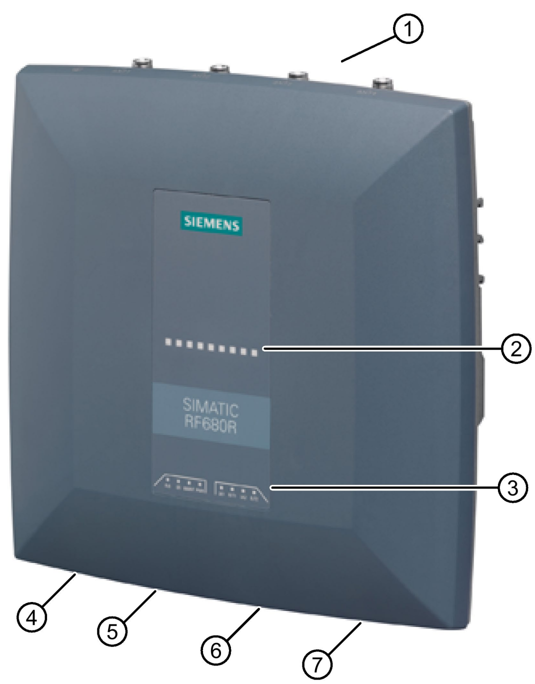
5.7.1 Description

5.7.1.1 Overview

The SIMATIC RF680R is a stationary reader in the UHF frequency band without an integrated antenna. Up to four external UHF RFID antennas can be connected via RP-TNC connectors.

The maximum RF power output is 2000°W at the reader output. The interfaces (Ethernet, RS-422 to the power supply, M12 digital I/O interface) are located along the narrow lower front edge. These interfaces can be used to connect the reader to the power supply and the PC for parameter assignment.

The degree of protection is IP65.

	Pos.	Description
	①	RP-TNC interfaces for connecting up to 4 external antennas
	②	LED status display
	③	LED operating display
	④	Digital I/O interface (M12, 12-pin)
	⑤	RS-422 interface[1)] for connecting the power supply 24 VDC (M12 plug, 8-pin)
	⑥	Ethernet interface (TCP/IP) (M12 plug, 4-pin)
	⑦	Ethernet interface (TCP/IP) (M12 plug, 4-pin)

1) Connection of the readers to the ASM 456 communications module via the RS-422 interface.

5.7.1.2 Ordering data

Table 5- 34 Ordering data RF680R

Product	Article number
RF680R (ETSI) reader for EU	6GT2811-6AA10-0AA0
RF680R (FCC) reader for the USA	6GT2811-6AA10-1AA0
RF680R (CMIIT) reader for China	6GT2811-6AA10-2AA0

Table 5- 35 Ordering data accessories

<table>
<tr><th colspan="2">Product</th><th>Article number</th></tr>
<tr><td colspan="2">Holder set for securing the reader
• DIN rail T35 (S7-1200)
• S7-300 standard rail
• S7-1500 standard rail</td><td>6GT2890-0AB00</td></tr>
<tr><td colspan="2">Connecting cable and connectors
• DI/DO cable connectors, open cable ends, 5 m
• Ethernet cable M12 ↔ RJ-45, 5 m
• Ethernet cable M12 ↔ M12, 5 m
• Ethernet connector on reader M12 d-coded (IP65)
• Ethernet connector, Standard IE FastConnect RJ-45 Plug 180 (IP20)
• Ethernet cable sold by the meter, green</td><td>
• 6GT2891-0CH50
• 6XV1871-5TH50
• 6XV1870-8AH50
• 6GK1901-0DB20-6AA0
• 6GK1901-1BB10-2AA0
• 6XV1840-2AH10</td></tr>
<tr><td>Connecting cable CM ↔ reader
RS-422, M12 plug, 8-pin socket</td><td>• 2 m
• 5 m
• 10 m
• 20 m
• 50 m</td><td>• 6GT2891-0FH20
• 6GT2891-0FH50
• 6GT2891-0FN10
• 6GT2891-0FN20
• 6GT2891-0FN50</td></tr>
<tr><td colspan="2">Wide-range power supply unit for SIMATIC RF systems
• With EU plug
• With UK plug
• With US plug</td><td>
• 6GT2898-0AA00
• 6GT2898-0AA10
• 6GT2898-0AA20</td></tr>
<tr><td colspan="2">24 V connecting cable reader ↔ wide-range power supply unit
• with plug, 5 m
• with open ends, 2 m
• with open ends, 5 m</td><td>
• 6GT2891-0PH50
• 6GT2891-4EH20
• 6GT2891-4EH50</td></tr>
</table>

Product	Article number
Set of protective caps Contains 3 protective caps for antenna output, one protective cap for digital I/O interface and 2 protective caps for Ethernet/PROFINET (required for IP65 degree of protection when some connectors are unused)	6GT2898-4AA10
RFID DVD "Software & Documentation"	6GT2080-2AA20

5.7.1.3 Status display

The operating statuses of the reader are displayed by the "RUN/STOP", "ERROR", and "MAINTENANCE" LEDs. The LEDs can adopt the colors green, red or yellow and the statuses off □, on ■, flashing ☼:

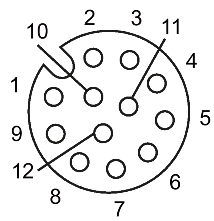
Table 5- 36 Display of operating statuses

R/S	ER	MAINT	Meaning
□	□	□	The device is turned off.
■	■	■	The device is starting up.
☼	☼	-	The device is ready for operation. The connection to the XML application or S7 CPU is not established or an error has occurred.
☼	□	-	The device is ready for operation. The connection to the XML application or S7 CPU is established.
■	□	-	The device is working. • STEP 7: The "writeconfig" command was received. • XML application: The "hostGreeting" command was received.
☼	☼	☼	Flash test for reader identification.
-	☼	-	There is an error. You will find more information on error messages in the section "RF650R/RF680R/RF685R error messages (Page 537)".
-	-	☼	There is at least one transponder in the antenna field.
-	-	■	One or more transponders have been detected as valid.

5.7.1.4 Pin assignment of the digital I/O interface

View of socket (reader end)

Table 5- 37

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

Note

Requirement for external power sources

When the digital I/O interface is supplied by an external power source, the power source must meet the requirements for LPS (Limited Power Sources) and NEC Class 2.

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:

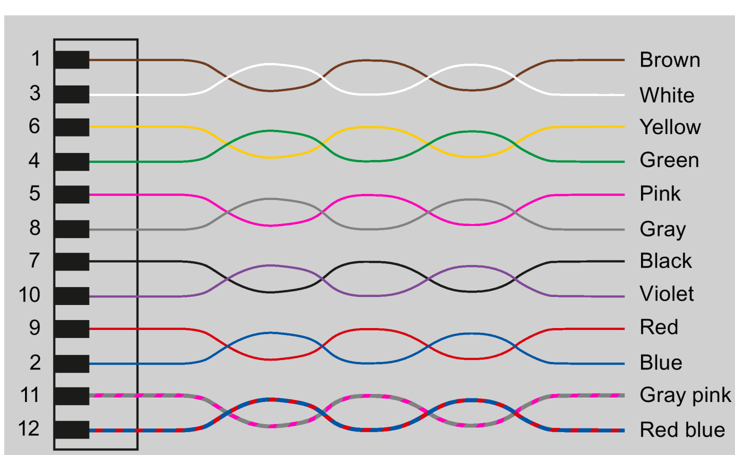


Figure 5-40 M12 connector wiring diagram

5.7.1.5 Connection scheme for the digital I/O interface

Connection possibilities

You can connect the RF680R 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.
- 4 digital outputs can be operated simultaneously each with up to 0.5 A (up to 1 A in total). With a total current > 1 A, you need to use an external power supply.
- 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 from internal source (no electrical isolation)

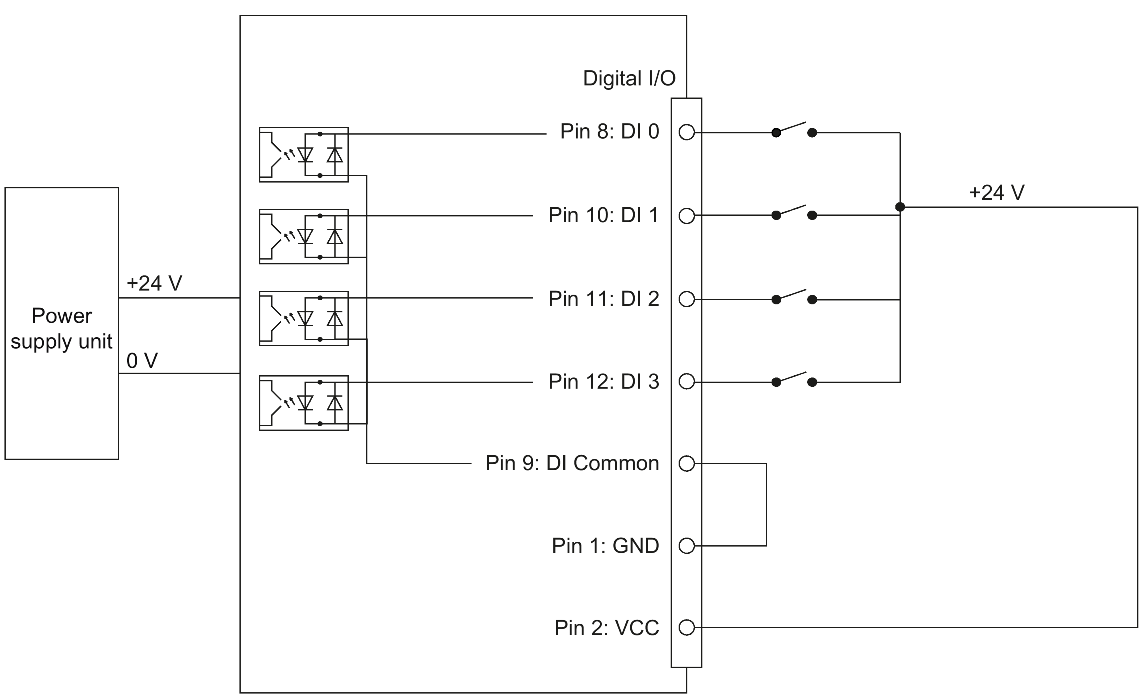


Figure 5-41 Circuit example 1: Digital inputs

Alternative connection possibilities:

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

Voltage infeed from external source

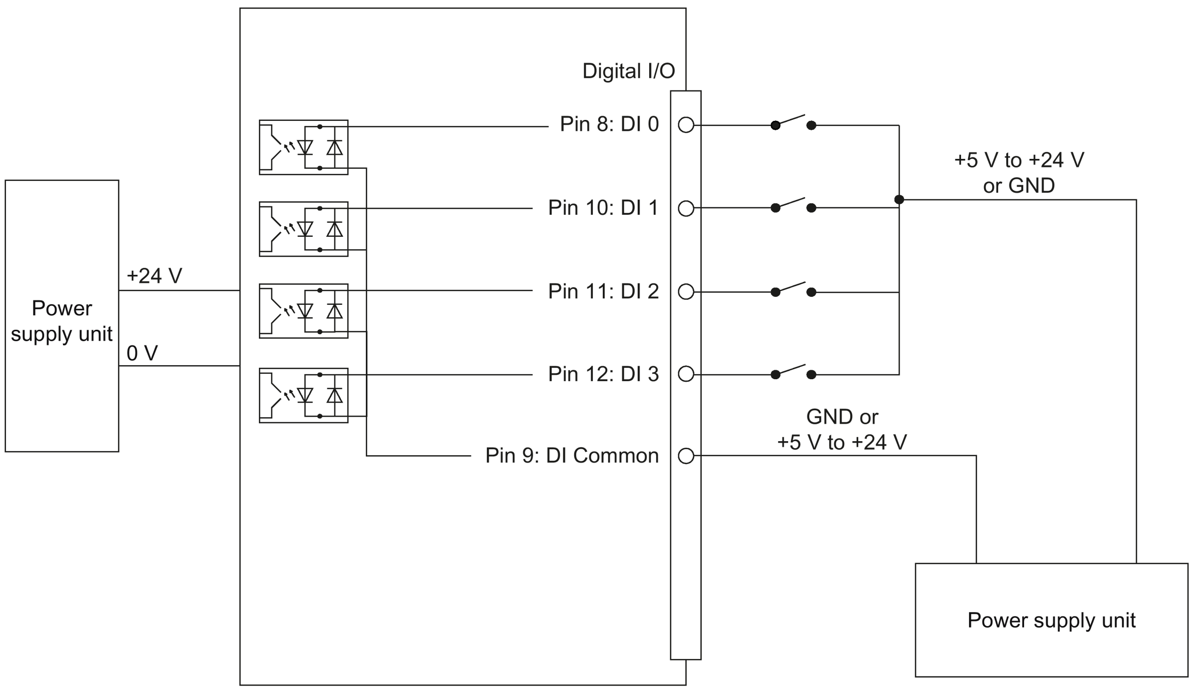


Figure 5-42 Circuit example 2: Digital inputs

Voltage infeed from external source with various voltages

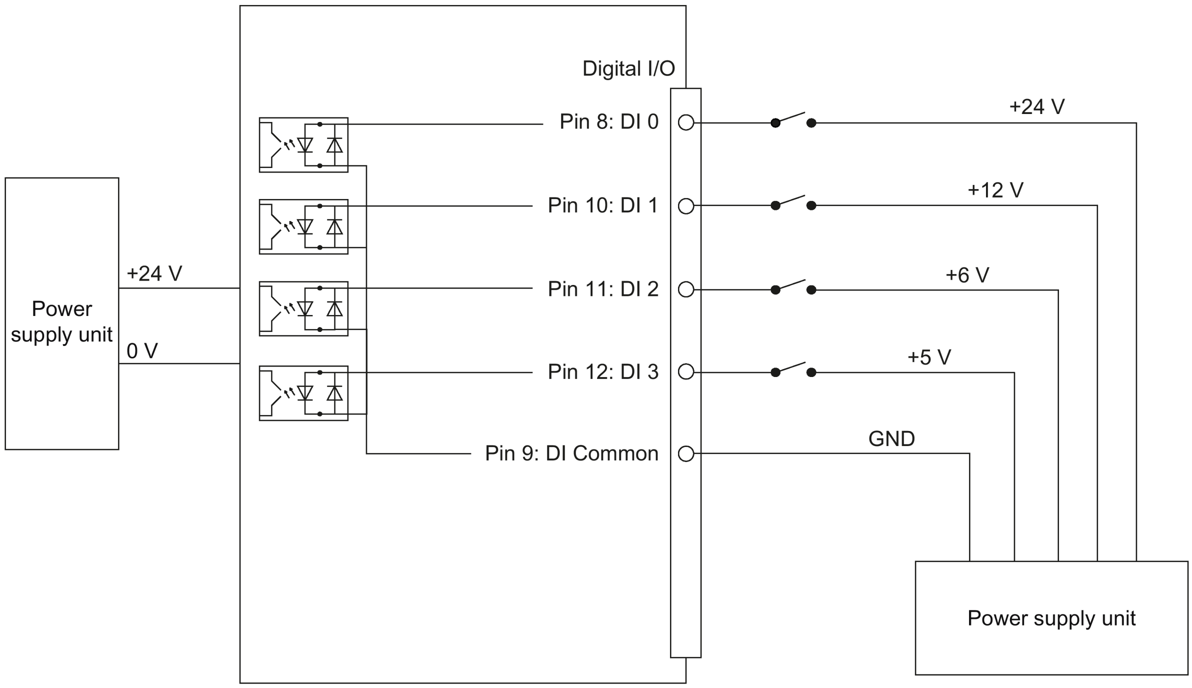


Figure 5-43 Circuit example 3: Digital inputs

Voltage infeed from internal source

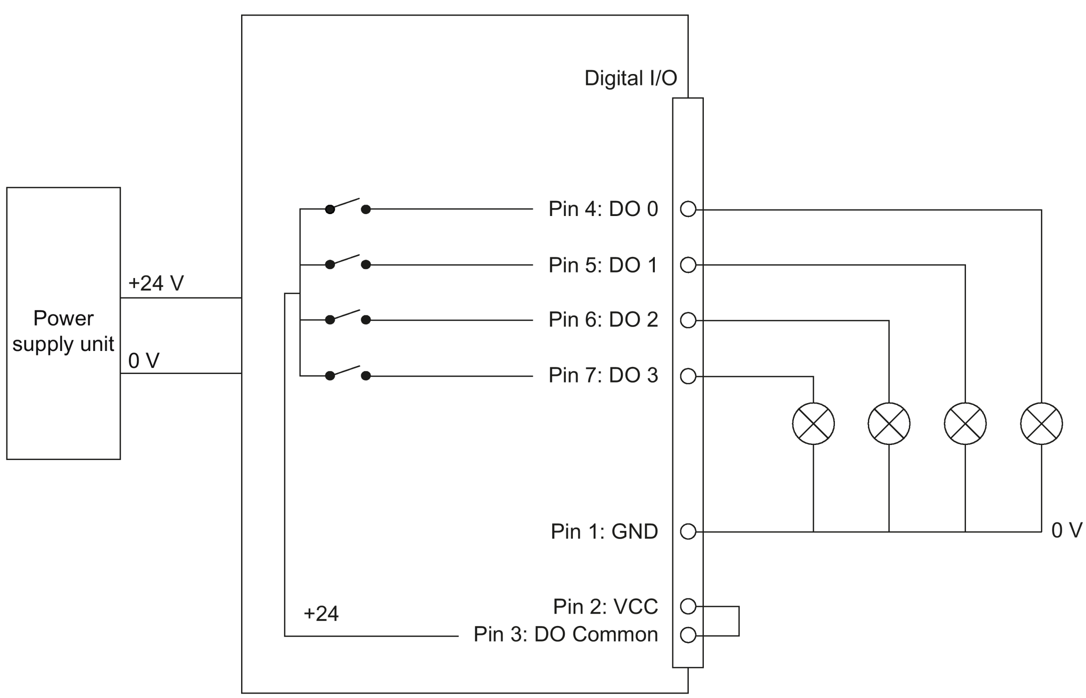


Figure 5-44 Circuit example 4: Digital outputs

Alternative connection possibilities:

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

Voltage infeed from external source

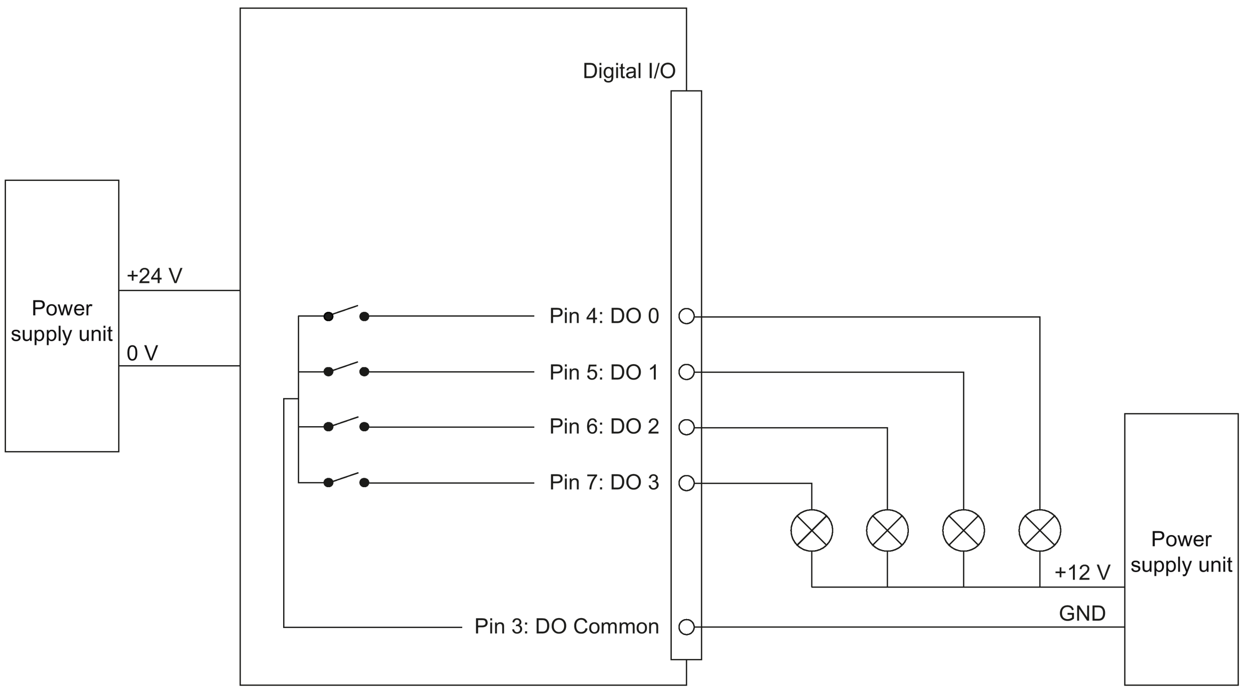


Figure 5-45 Circuit example 5: Digital outputs

Voltage infeed from an external source is shown here for 12°V as an example. Other voltages are also permissible.

Voltage infeed from external source with various voltages

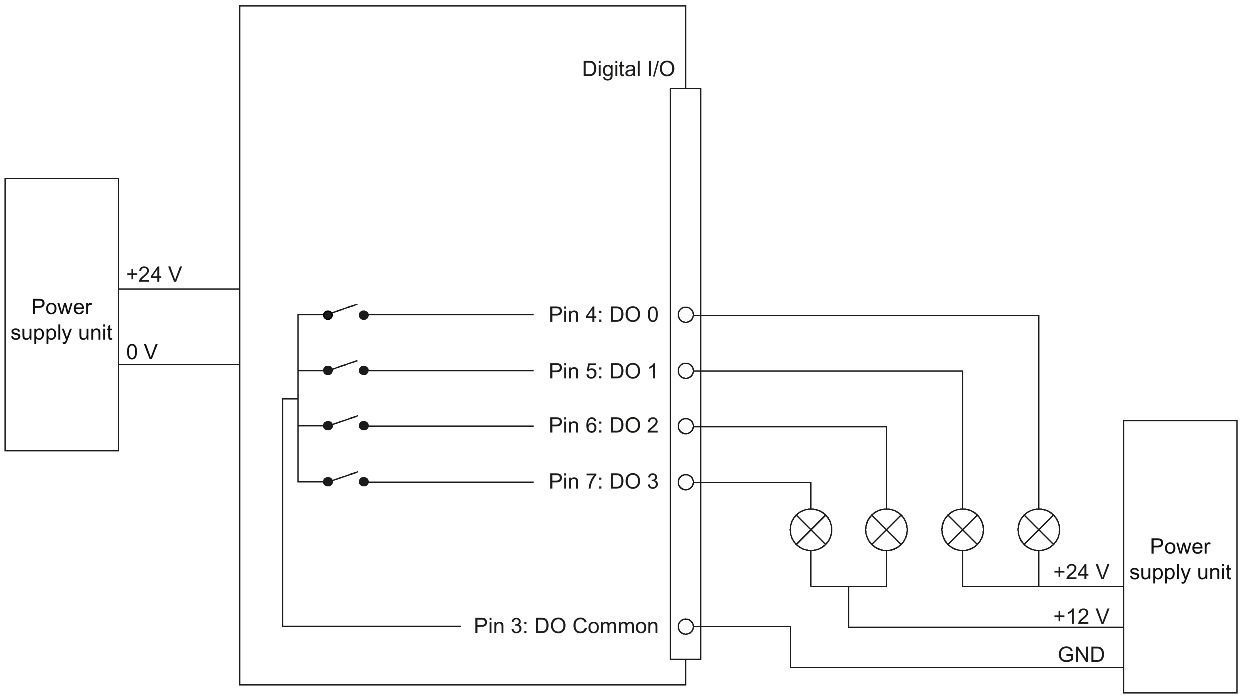
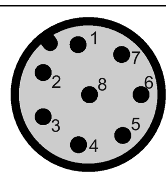


Figure 5-46 Circuit example 6: Digital outputs

5.7.1.6 Pin assignment 24 VDC (RS-422)

Pin	Pin Device end 8-pin M12	Wire colors	Assignment
	1	White	+ 24 V
	2 1)	Brown	- Transmit
	3	Green	0 V
	4 1)	Yellow	+ Transmit
	5 1)	Gray	+ Receive
	6 1)	Pink	- Receive
	7	-	Unassigned
	8	-	Earth (shield)

1) These pins are not required if the reader is operated via Ethernet.

Note

Do not use SIMATIC connecting cables with angled connectors

The knurled bolt of the M12 plug does not contact the shield (reader end). For this reason, do not use SIMATIC connecting cables that use angled M12 plugs.

Note

Requirement for external power sources

The reader must only be supplied with power by power supply units that meet the requirements of LPS (Limited Power Source) and NEC Class 2.

Note

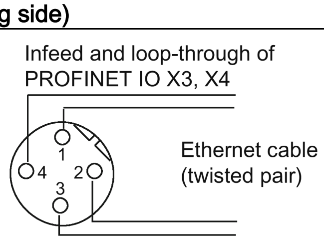
This cable has an 8-pin M12 connector at one end and the other cable end is "open". There are 8 color-coded single wires there for connecting to external devices. There are different cable lengths in the product range (3 m to 50 m). Long cables can be reduced if necessary.

Note

For long cables: Adapt supply voltage and data rate accordingly

Note that even with long cables, the supply voltage of 24 VDC must always be applied. Note also that the transmission speed on the serial interface must, if necessary, be reduced.

5.7.1.7 Pin assignment for Industrial Ethernet interface

View of M12 plug, 4-pin, D coding (wiring side)	Pin	Pin assignment
	1	Data line TxP
	2	Data line RxP
	3	Data line TxN
	4	Data line RxN

Note

Use only allowed inside buildings

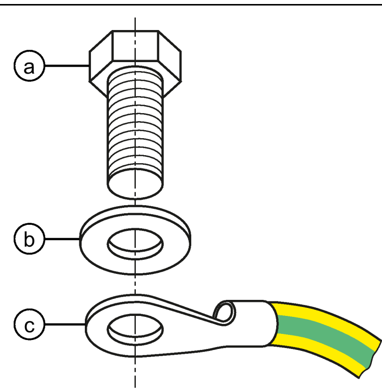
Only Ethernet cables laid inside buildings may be connected.

5.7.1.8 Grounding connection

On the top of the reader there is a blind drill hole (M4 x 8) for grounding. Tighten the screw with a torque of ≈ 1.5 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.

NOTICE
Installation only in protected areas
The antenna can be installed in the protected part of a building. When implementing your lightning protection concept, make sure you adhere to the VDE 0182 or IEC 62305 standards.

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

5.7.2 Planning operation

5.7.2.1 Antenna/read point configurations

You can connect up to four external antennas to the RF680R reader. The standard setting is that an antenna is connected when the reader is started. When connecting multiple antennas, note the information in the section "Specified minimum and maximum spacing of antennas (Page 54)".

With the WBM, you can set up various different configurations of antennas and/or reading points as required. Based on the number of data sources and subsequent assignment of the antennas, many tasks can be accomplished.

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 of the products.

5.7.3 Installation/mounting

Requirement

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

NOTICE
Close unused connectors
Note that the readers only have the specified degree of protection when all connectors are in use or when unused connectors are closed with the protective caps. If you do not use reader connectors, close them 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

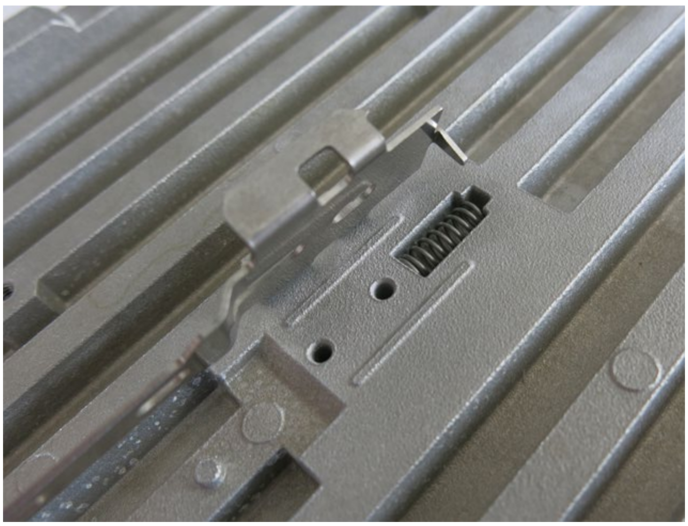
You can mount the reader in the following ways:

- DIN rail T35 (S7-1200)
- S7-300 standard rail
- S7-1500 standard rail
- directly on a flat surface using the VESA 100 mounting system (torque ≈ 1.5 Nm).

  The positions of the mounting holes for the device are shown in the section Dimension drawing (Page 235).

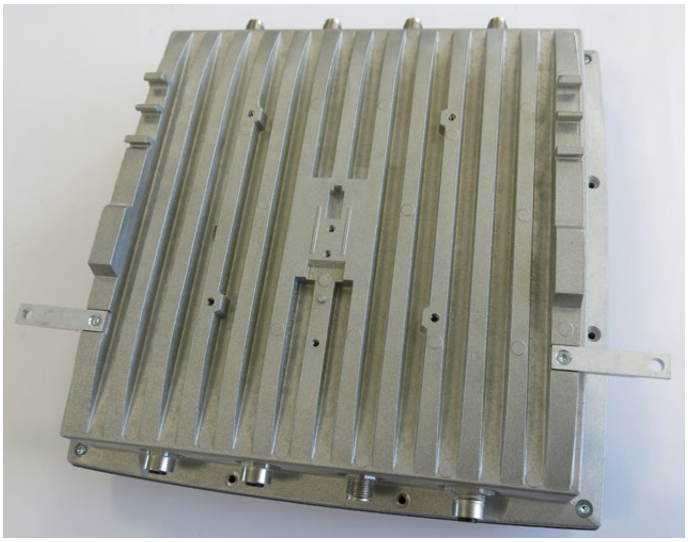
Mounting the reader on a DIN/standard rail

Table 5- 38 DIN rail mounting

		Description
	1.	Place the spring in the groove.
	2.	Mount the holder using the supplied Torx screws. When mounting the holder, make sure that the angled tip is positioned above the spring in the groove.

		Description
	3.	Fit the lower part of the locking mechanism of the reader into the DIN rail. To be able to mount the reader on or remove it from the DIN rail, pull down the holder mounted in step 2.

Table 5- 39 Installation on a standard rail

	Description	
	1.	Mount the two adapter pieces using the supplied Torx screws.
	2.	Fit the upper part of the locking mechanism of the reader into the standard rail.
	3.	Secure the reader using the supplied slotted-head screws.

5.7.4 Configuration/integration

An Ethernet interface is available for integrating the device into system environments/networks. The RF680R can be configured via the Ethernet interface and with direct connection to the PC. You can configure and program the reader using the following tools:

- using Web Based Management (WBM)
- STEP 7 Basic/Professional (TIA Portal)
- using XML-based user applications

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

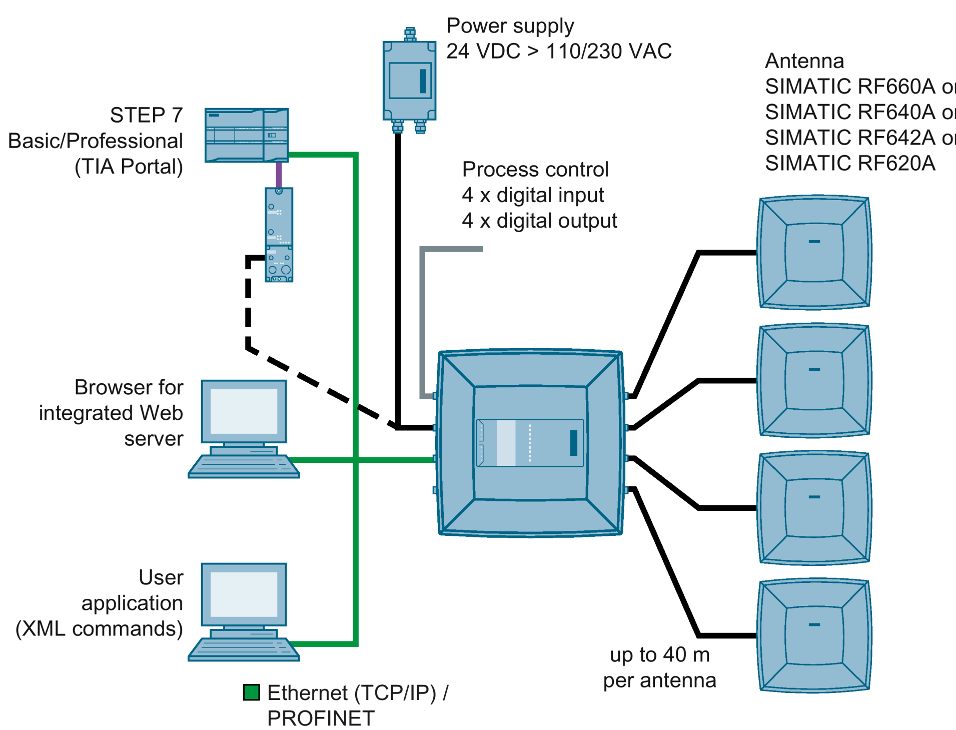


Figure 5-47 Overview of configuration of the RF680R reader

5.7.5 Technical specifications

Table 5- 40 Technical specifications, RF680R

	6GT2811-6AA10-xAA0
Product type designation	RF680R
Mechanical specifications	
Weight	2.4 kg
Dimensions (L x W x H)	258 × 258 × 80
Degree of protection	IP65
Material	
• Upper part of housing	Pocan DP CF 2200
• Lower part of housing	Aluminum
Color	
• Upper part of housing	TI-Grey
• Lower part of housing	Silver
Operating displays on the device	8 LEDs
Status display on the device	9 LEDs
Interfaces	
• Antenna connectors	4 x RP-TNC plug
• Power supply	1 x RS 422 plug (M12, 8-pin)
• Digital I/O interface	1 x socket (M12, 12-pin)
• Digital inputs	4
• Digital outputs	4
• Ethernet interface	2 x socket (M12, 4-pin), 100 Mbps
MTBF	28 years
Electrical data	
Power supply	24 VDC (20 ... 30 VDC) [1)]
Max. permitted current consumption	2 A
Max. permitted current drain via the digital I/O interface	1 A [2)]
Current consumption (on standby)	
• 20 V input voltage on the reader (typical)	220 mA / 4.4 W
• 24 V input voltage on the reader (typical)	190 mA / 4.5 W
• 30 V input voltage on the reader (typical)	150 mA / 4.5 W

	6GT2811-6AA10-xAA0
Current consumption (at 1000 mW transmit power)	
• 20 V input voltage on the reader (typical)	450 mA / 9.0 W
• 24 V input voltage on the reader (typical)	380 mA / 9.1 W
• 30 V input voltage on the reader (typical)	300 mA / 9.6 W
Current consumption (at 2000 mW transmit power)	
• 20 V input voltage on the reader (typical)	610 mA / 12.2 W
• 24 V input voltage on the reader (typical)	500 mA / 12.0 W
• 30 V input voltage on the reader (typical)	410 mA / 12.3 W
Electromagnetic compatibility	
• ETSI	EN 301 489-1/-3, EN 302 208-1/-3 V1.4.1
• FCC	FCC CFR 47, Part 15 section 15.247

Permitted ambient conditions	
Ambient temperature	
• During operation	-25 °C to +55 °C
• During transportation and storage	-40 °C to +85 °C
Shock resistant to EN 60068-2-27	30 g [3)]
Vibration resistant to EN 60068-2-6	30 m/s² [3)]

1) All supply and signal voltages must be safety extra low voltage (SELV/PELV according to EN 60950). The voltage sources must meet the requirements of limited power sources (LPS) and NEC Class 2.

2) Keep to the switching scheme of the digital I/O interface.

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

Table 5- 41 Technical specifications according to EPC and ISO, RF680R

	6GT2811-6AA10-xAA0
Product type designation	RF680R
Frequency accuracy	max.± 10 ppm
Channel spacing	• EU, EFTA, Turkey: 600 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	• ≤ 2 W ERP
• FCC	• ≤ 4 W EIRP
Transmit power	
• ETSI/CMIIT	• ≤ 2 W
• FCC	• ≤ 2 W
Reading range	max. 8 m
Frequencies	
ETSI frequencies	
Frequency range for Europe, South Africa 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 at max. 2 W ERP)
Frequency range India	865.1 ... 866.9 MHz (4 channels at max. 2 W ERP, transmit power max. 1 W)
FCC frequencies	
Frequency range USA, Canada, Argentina, Mexico	902.75... 927.25 MHz (50 channels at max. 4 W EIRP, frequency hopping)
Frequency range Australia	918.25 ... 925.75 MHz (16 channels at max. 1 W EIRP, frequency hopping)
Frequency range Brazil [1)]	902.75 ... 907.25 MHz / 915.25 ... 927.25 MHz (35 channels at max. 4 W EIRP, frequency hopping)
Frequency range South Korea [1)]	917,3 ... 920.3 MHz (6 channels at max. 4 W EIRP)
CMIIT frequencies	
Frequency band China	920.625 ... 924.375 MHz (16 subchannels at 2 W ERP)

[1)] In preparation. Expected to be approved from 09/2015.

5.7.6 Dimension drawing

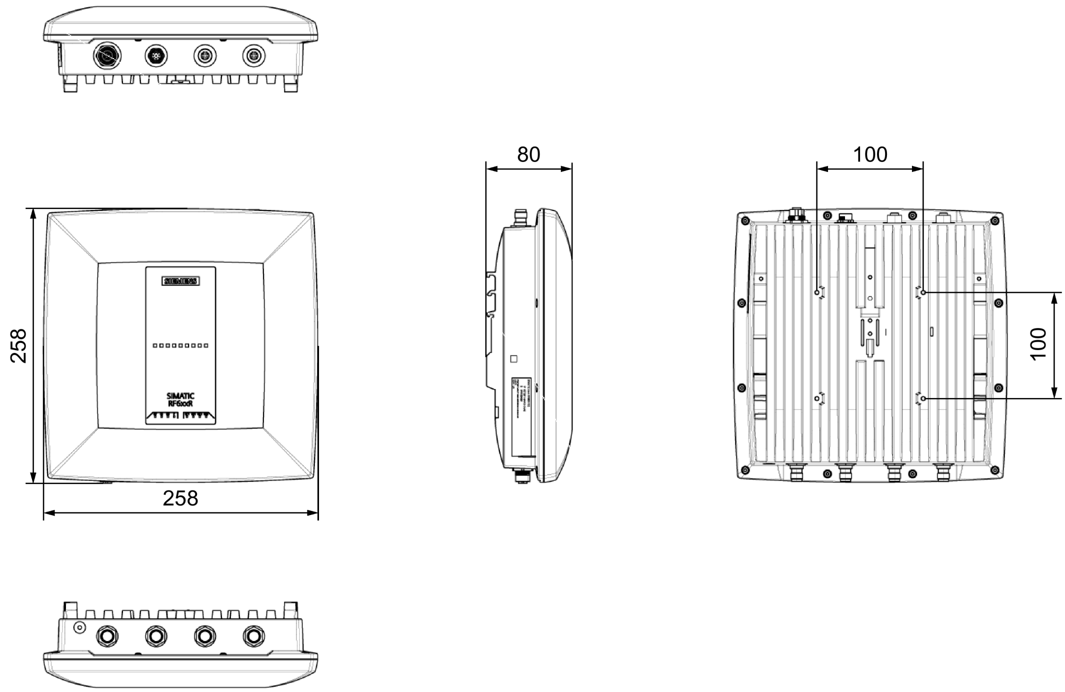


Figure 5-48 Dimension drawing RF680R

All dimensions in mm (± 0.5 mm tolerance)

5.7.7 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- 42 6GT2811-6AA10-0AA0

Certificate	Description
	Conformity with R&TTE directive
	South Africa radio approval: Radio Equipment Type Approval
India	India wireless approval Marking on the reader: No. NR-ETA/1588

Table 5- 43 6GT2811-6AA10-1AA0

Standard	
Federal Communications Commission	FCC CFR 47, Part 15 section 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-RF600R2
Industry Canada Radio Standards Specifications	RSS-210 Issue 7, June 2007, Section 2.2, A8 IC: 267X- RF600R2, Model: RF680R
	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 115352

Standard	
ANATEL	Brazil wireless approval Marking on the reader (6GT2811-6AA10-1AA0): ANATEL MODELO: RF680R 2892-15-4794 (01)07894607586813 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 2892-15-4794
	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. Certificate of the reader: MSIP-CMM-RF5-RF680R
C-141618	Argentina radio approval: Registro de la COMISION NACIONAL DE COMUNICACIONES
RCPSISI14-1926-A1	Mexico radio approval: CERTIFICADO DE HOMOLOGACION, IFETEL
	Australia radio approval: This product meets the requirements of the AS/NZS 3548 Norm.

Table 5- 44 6GT2811-6AA10-2AA0

Standard	
CMIIT Certification	China radio approval Marking on the reader: CMIIT ID: 2014DJ3988

5.7.7.1 FCC information

Siemens SIMATIC RF680R (FCC): 6GT2811-6AA10-1AA0

FCC ID: NXW-RF600R2

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.

5.7.7.2 IC-FCB information

Siemens SIMATIC RF680R (FCC): 6GT2811-6AA10-1AA0

IC:

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) This device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d`Industrie Canada applicables aux appareils radio exempts de licence. L`exploitation est autorisée aux deux conditions suivantes :

(1) L`appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l`appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d`en compromettre le fonctionnement.

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.

5.8 RF685R reader

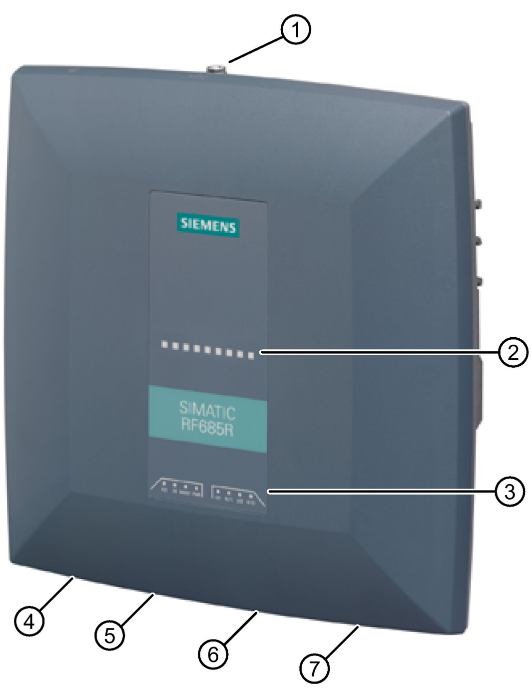
5.8.1 Description

5.8.1.1 Overview

The SIMATIC RF685R is a stationary reader in the UHF frequency band with an integrated antenna. An additional external UHF RFID antenna can be connected via an RP-TNC connector.

The maximum RF power output is 2000°W at the external reader output. The interfaces (Ethernet, RS-422 to the power supply, M12 digital I/O interface) are located along the narrow lower front edge. These interfaces can be used to connect the reader to the power supply and the PC for parameter assignment.

The degree of protection is IP65.



Pos.	Description
①	RP-TNC interface for connection of an external antenna
②	LED status display
③	LED operating display
④	Digital I/O interface (M12, 12-pin)
⑤	RS-422 interface[1)] for connecting the power supply 24 VDC (M12 plug, 8-pin)
⑥	Ethernet interface (TCP/IP) (M12 plug, 4-pin)
⑦	Ethernet interface (TCP/IP) (M12 plug, 4-pin)

1) Connection of the readers to the ASM 456 communications module via the RS-422 interface.

5.8.1.2 Ordering data

Table 5- 45 Ordering data RF685R

Product	Article number
RF685R (ETSI) reader for EU	6GT2811-6CA10-0AA0
RF685R (FCC) reader for the USA	6GT2811-6CA10-1AA0
RF685R (CMIIT) reader for China	6GT2811-6CA10-2AA0

Table 5- 46 Ordering data accessories

Product		Article number
Antenna mounting kit		6GT2890-0AA00
Holder set for securing the reader • DIN rail T35 (S7-1200) • S7-300 standard rail • S7-1500 standard rail		6GT2890-0AB00
Connecting cable and connectors • DI/DO cable connectors, open cable ends, 5 m • Ethernet cable M12 ↔ RJ-45, 5 m • Ethernet cable M12 ↔ M12, 5 m • Ethernet connector on reader M12 d-coded (IP65) • Ethernet connector, Standard IE FastConnect RJ-45 Plug 180 (IP20) • Ethernet cable by the meter green		• 6GT2891-0CH50 • 6XV1871-5TH50 • 6XV1870-8AH50 • 6GK1901-0DB20-6AA0 • 6GK1901-1BB10-2AA0 • 6XV1840-2AH10
Connecting cable CM ↔ reader RS-422, M12 plug, 8-pin socket	• 2 m • 5 m • 10 m • 20 m • 50 m	• 6GT2891-0FH20 • 6GT2891-0FH50 • 6GT2891-0FN10 • 6GT2891-0FN20 • 6GT2891-0FN50
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 reader ↔ wide-range power supply unit • with plug, 5 m • with open ends, 2 m • with open ends, 5 m		• 6GT2891-0PH50 • 6GT2891-4EH20 • 6GT2891-4EH50

Product	Article number
Set of protective caps Contains 3 protective caps for antenna output, one protective cap for digital I/O interface and 2 protective caps for Ethernet/PROFINET (required for IP65 degree of protection when some connectors are unused)	6GT2898-4AA10
RFID DVD "Software & Documentation"	6GT2080-2AA20

5.8.1.3 Status display

The operating statuses of the reader are displayed by the "RUN/STOP", "ERROR", and "MAINTENANCE" LEDs. The LEDs can adopt the colors green, red or yellow and the statuses off □, on ■, flashing ☼:

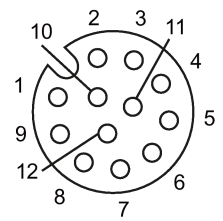
Table 5- 47 Display of operating statuses

R/S	ER	MAINT	Meaning
□	□	□	The device is turned off.
■	■	■	The device is starting up.
☼	☼	-	The device is ready for operation. The connection to the XML application or S7 CPU is not established or an error has occurred.
☼	□	-	The device is ready for operation. The connection to the XML application or S7 CPU is established.
■	□	-	The device is working. • STEP 7: The "writeconfig" command was received. • XML application: The "hostGreeting" command was received.
☼	☼	☼	Flash test for reader identification.
-	☼	-	There is an error. You will find more information on error messages in the section "RF650R/RF680R/RF685R error messages (Page 537)".
-	-	☼	There is at least one transponder in the antenna field.
-	-	■	One or more transponders have been detected as valid.

5.8.1.4 Pin assignment of the digital I/O interface

View of socket (reader end)

Table 5- 48

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

Note

Requirement for external power sources

When the digital I/O interface is supplied by an external power source, the power source must meet the requirements for LPS (Limited Power Sources) and NEC Class 2.

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:

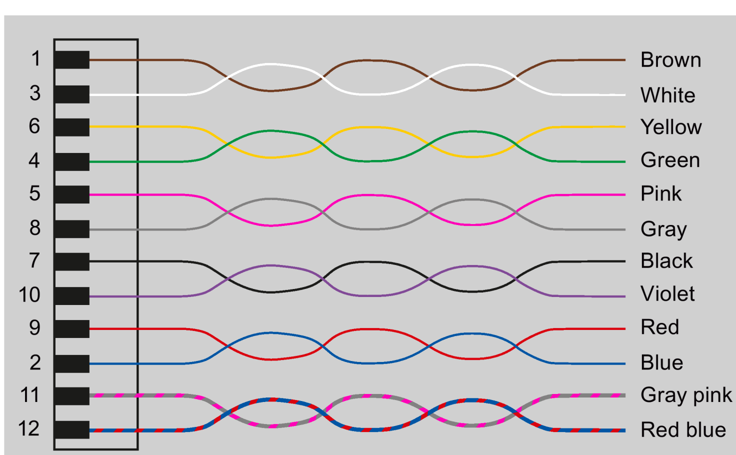


Figure 5-49 M12 connector wiring diagram

5.8.1.5 Connection scheme for the digital I/O interface

Connection possibilities

You can connect the RF680R 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.
- 4 digital outputs can be operated simultaneously each with up to 0.5 A (up to 1 A in total). With a total current > 1 A, you need to use an external power supply.
- 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 from internal source (no electrical isolation)

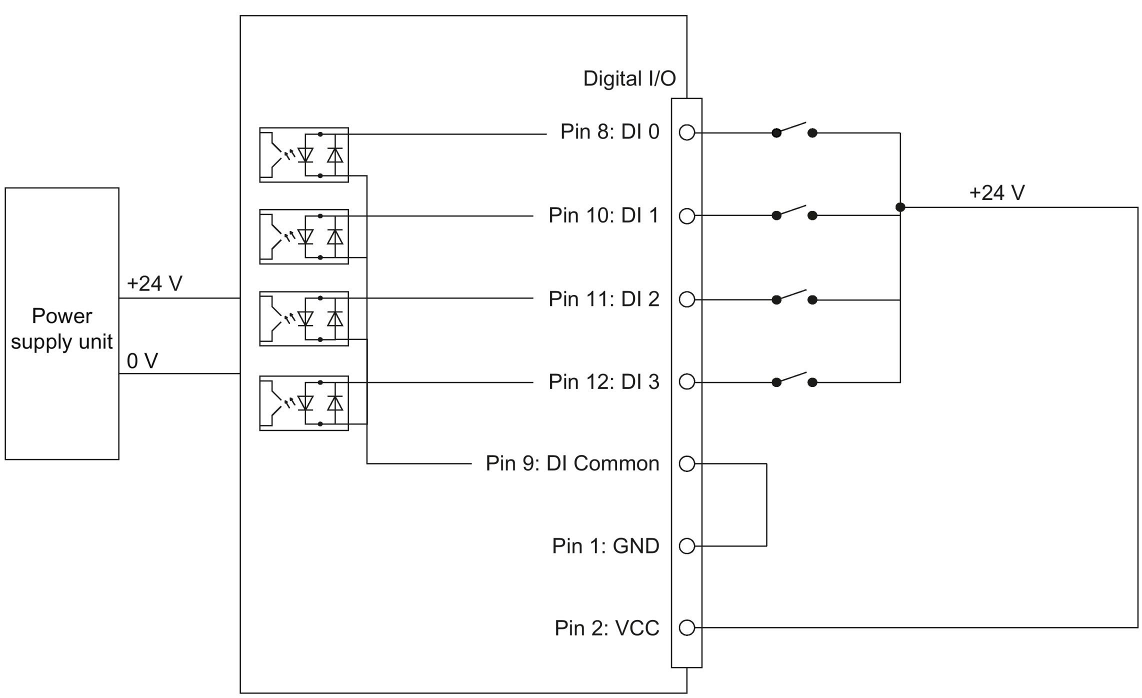


Figure 5-50 Circuit example 1: Digital inputs

Alternative connection possibilities:

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

Voltage infeed from external source

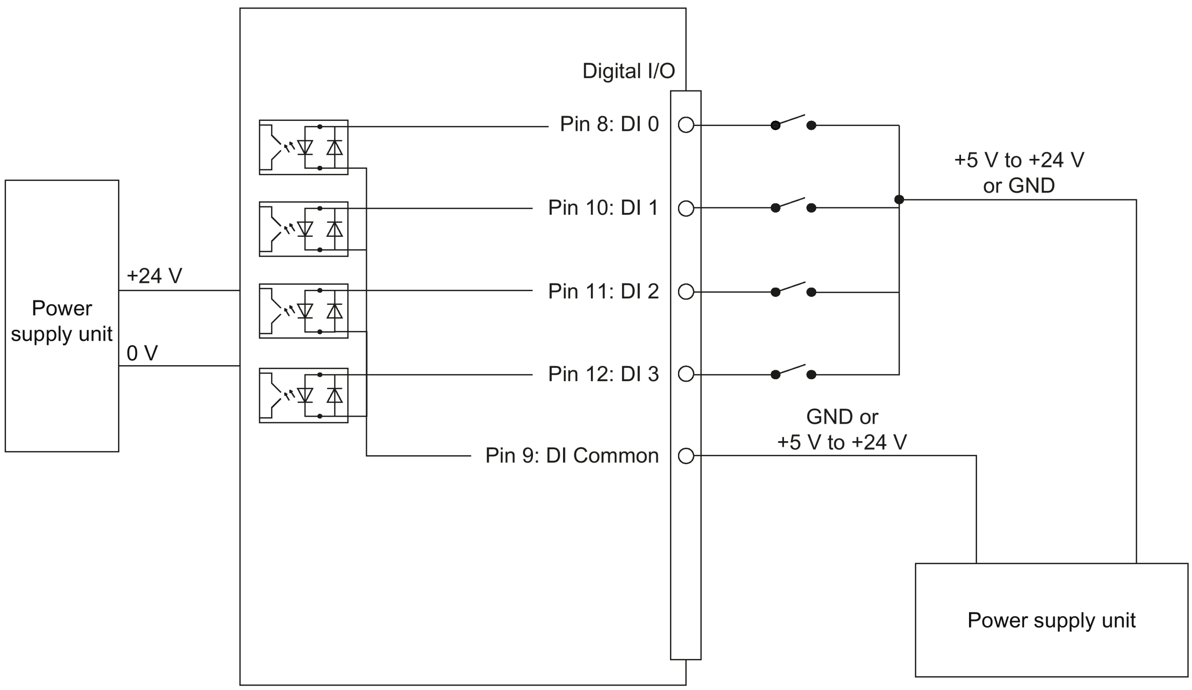


Figure 5-51 Circuit example 2: Digital inputs

Voltage infeed from external source with various voltages

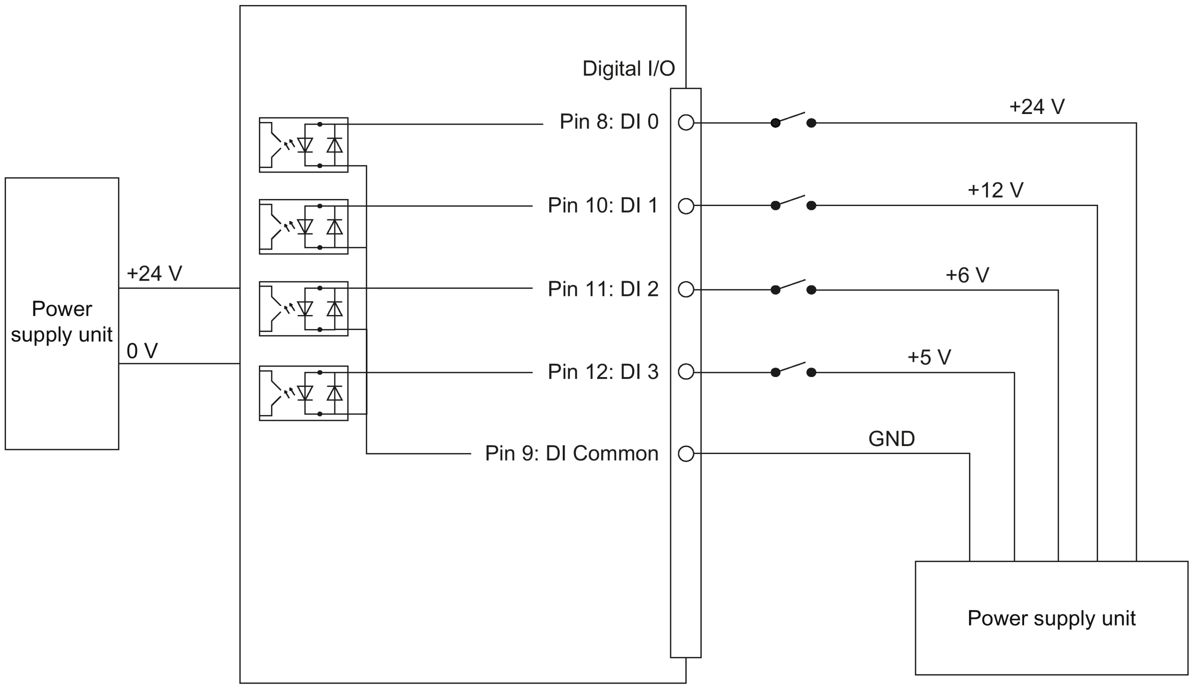


Figure 5-52 Circuit example 3: Digital inputs

Voltage infeed from internal source

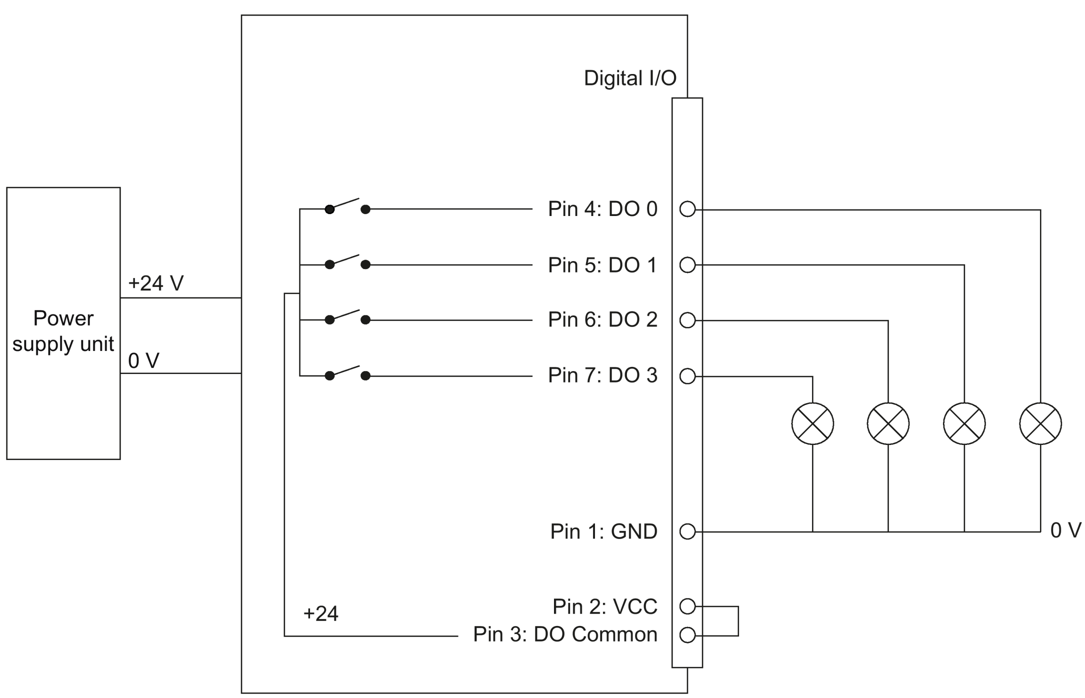


Figure 5-53 Circuit example 4: Digital outputs

Alternative connection possibilities:

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

Voltage infeed from external source

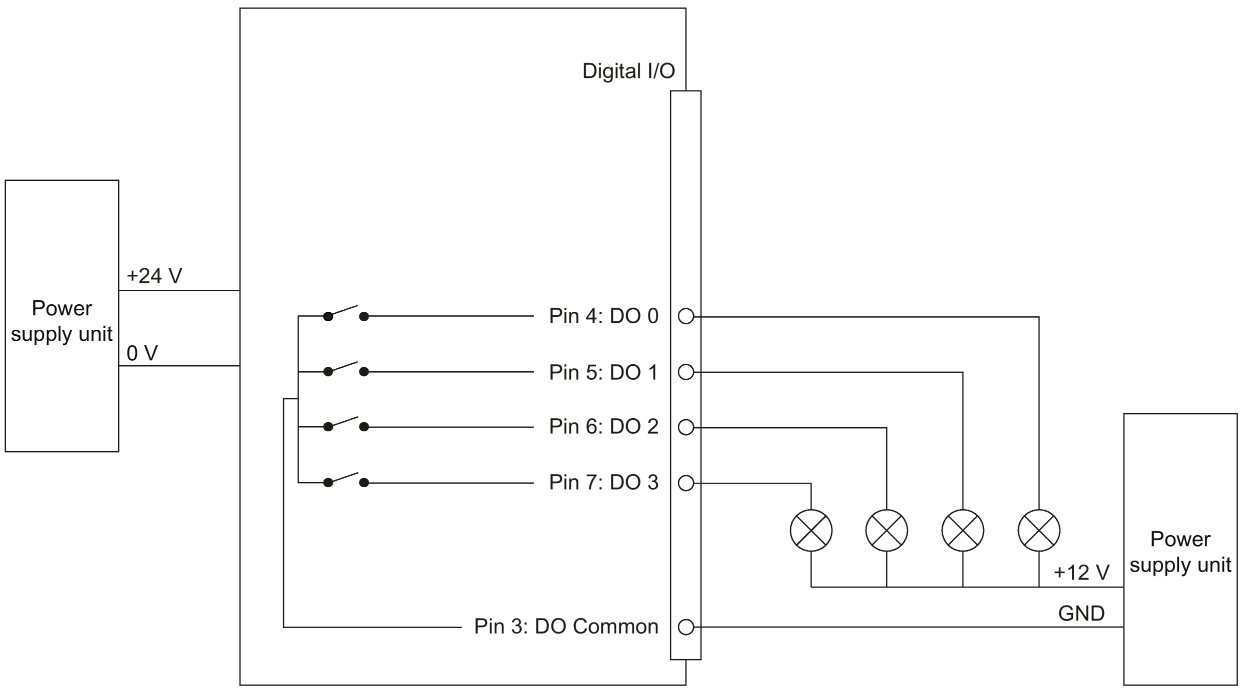


Figure 5-54 Circuit example 5: Digital outputs

Voltage infeed from an external source is shown here for 12°V as an example. Other voltages are also permissible.

Voltage infeed from external source with various voltages

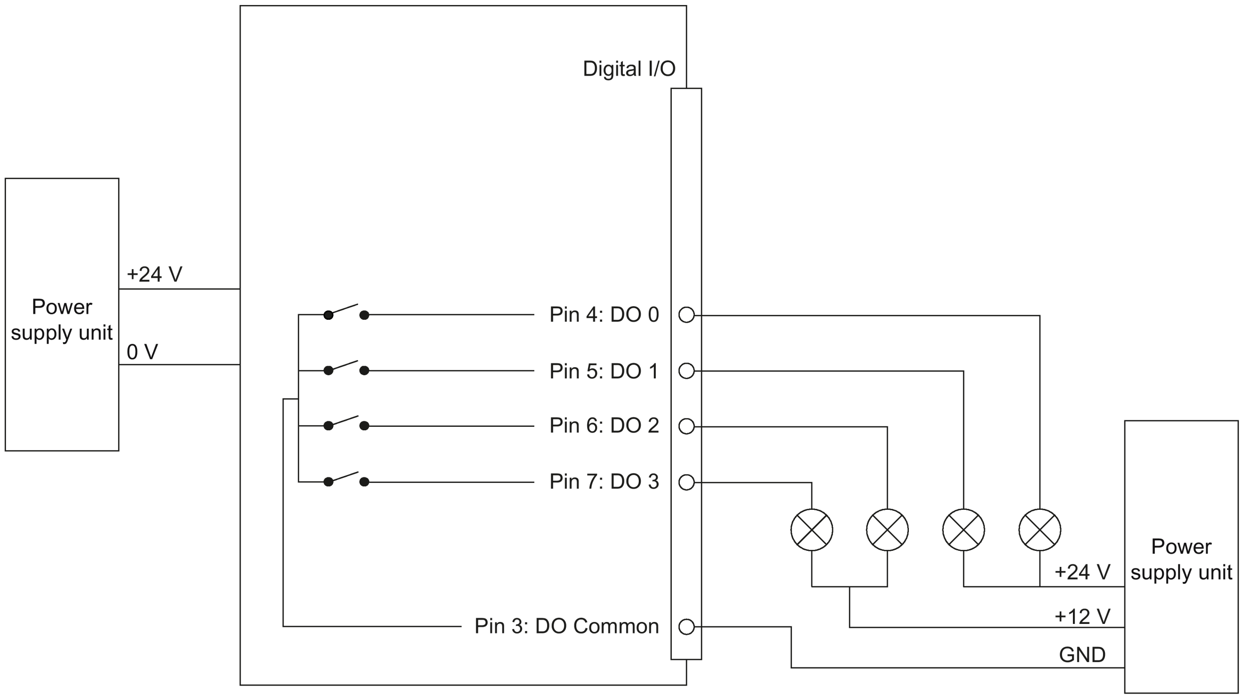
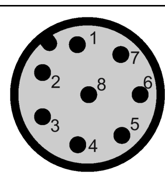


Figure 5-55 Circuit example 6: Digital outputs

5.8.1.6 Pin assignment 24 VDC (RS-422)

Pin	Pin Device end 8-pin M12	Wire colors	Assignment
	1	White	+ 24 V
	2 1)	Brown	- Transmit
	3	Green	0 V
	4 1)	Yellow	+ Transmit
	5 1)	Gray	+ Receive
	6 1)	Pink	- Receive
	7	-	Unassigned
	8	-	Earth (shield)

1) These pins are not required if the reader is operated via Ethernet.

Note

Do not use SIMATIC connecting cables with angled connectors

The knurled bolt of the M12 plug does not contact the shield (reader end). For this reason, do not use SIMATIC connecting cables that use angled M12 plugs.

Note

Requirement for external power sources

The reader must only be supplied with power by power supply units that meet the requirements of LPS (Limited Power Source) and NEC Class 2.

Note

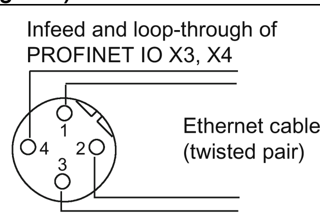
This cable has an 8-pin M12 connector at one end and the other cable end is "open". There are 8 color-coded single wires there for connecting to external devices. There are different cable lengths in the product range (3 m to 50 m). Long cables can be reduced if necessary.

Note

For long cables: Adapt supply voltage and data rate accordingly

Note that even with long cables, the supply voltage of 24 VDC must always be applied. Note also that the transmission speed on the serial interface must, if necessary, be reduced.

5.8.1.7 Pin assignment for Industrial Ethernet interface

View of M12 plug, 4-pin, D coding (wiring side)	Pin	Pin assignment
	1	Data line TxP
	2	Data line RxP
	3	Data line TxN
	4	Data line RxN

Note

Use only allowed inside buildings

Only Ethernet cables laid inside buildings may be connected.

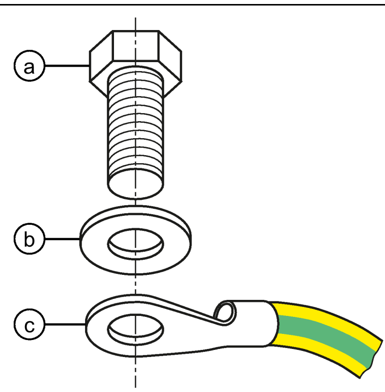
5.8.1.8 Grounding connection

On the top of the reader there is a blind drill hole (M4 x 8) for grounding. Tighten the screw with a torque of ≈ 1.5 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.

> **NOTICE**
>
> **Installation only in protected areas**
>
> The antenna can be installed in the protected part of a building. When implementing your lightning protection concept, make sure you adhere to the VDE 0182 or IEC 62305 standards.

Ground connection



(a)	Hexagon-head screw
(b)	Flat washer
(c)	Cable lug

5.8.2 Planning operation

5.8.2.1 Internal antenna

Minimum mounting clearances of two readers

The RF685R has an antenna with adaptive polarization. This means that you can set the antenna polarization to be either horizontal, vertical or circular. With the internal antenna active and at 2000 mW ERP radiated power, due to the aperture angle of the antennas, their fields can overlap considerably. This means it is no longer possible to be sure in which of the antenna fields the data of a transponder will be accessed.

In order to avoid this, always keep a minimum distance of 6 m between two readers with the maximum radiated power of 2000 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.

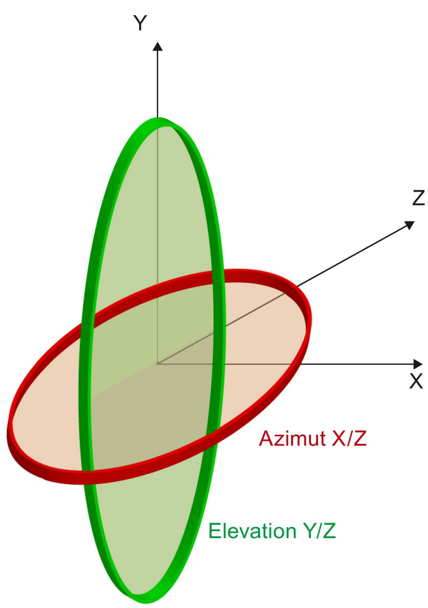
Note

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 RF685R (ETSI)

The following radiation diagrams show the directional characteristics of the internal antenna of the RF685R (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 secondary fields.



Radiation diagram (Azimuth section)

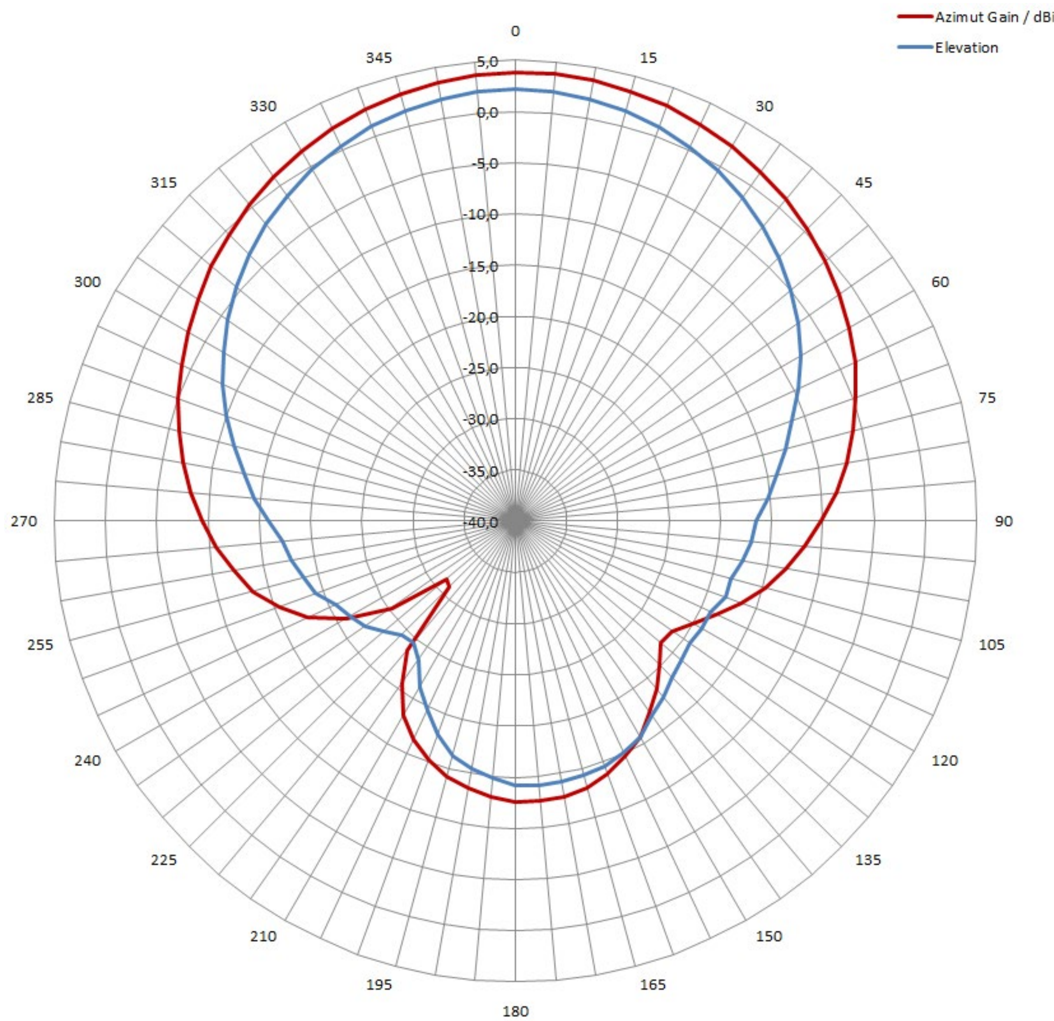


Figure 5-56 Azimuth section

Radiation diagram (elevation section)

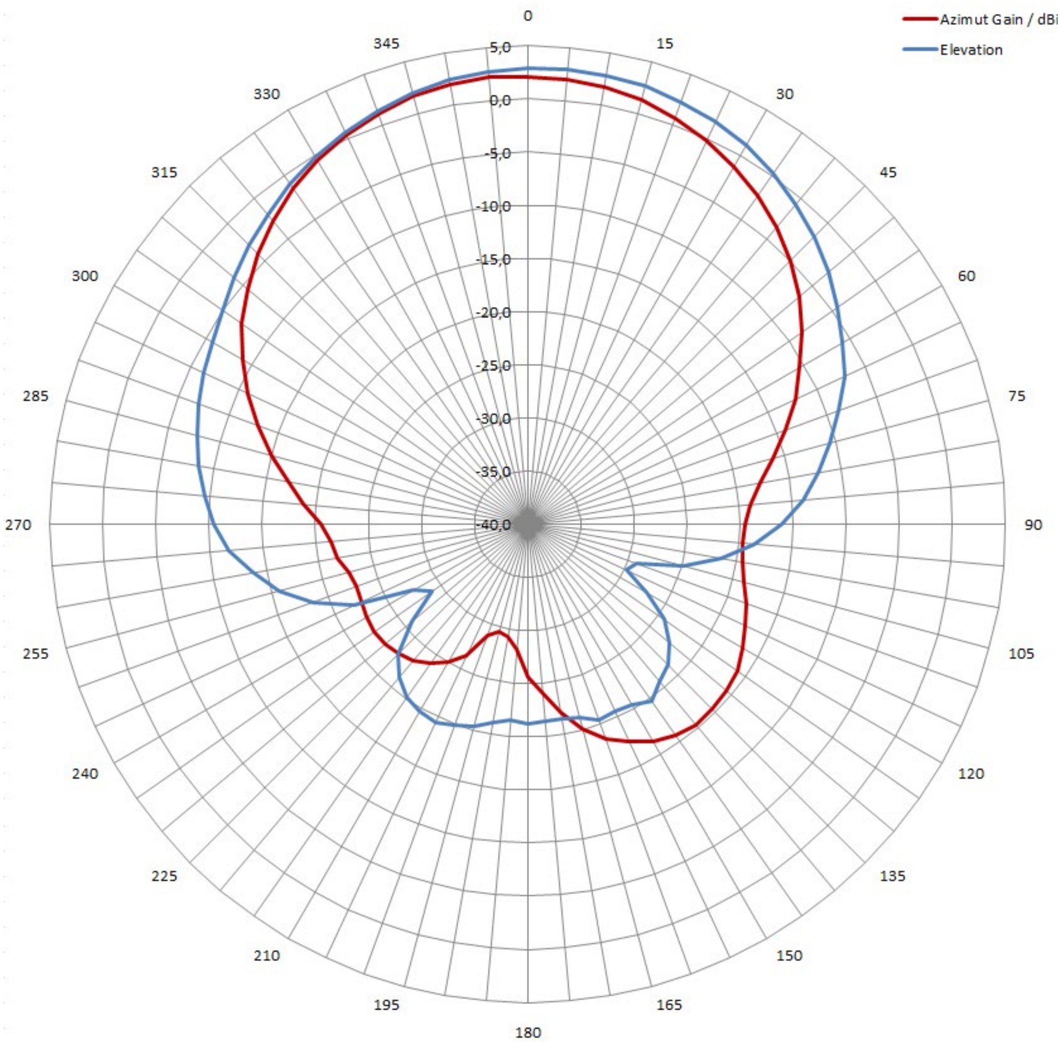


Figure 5-57 Elevation section

Radiation diagram circular

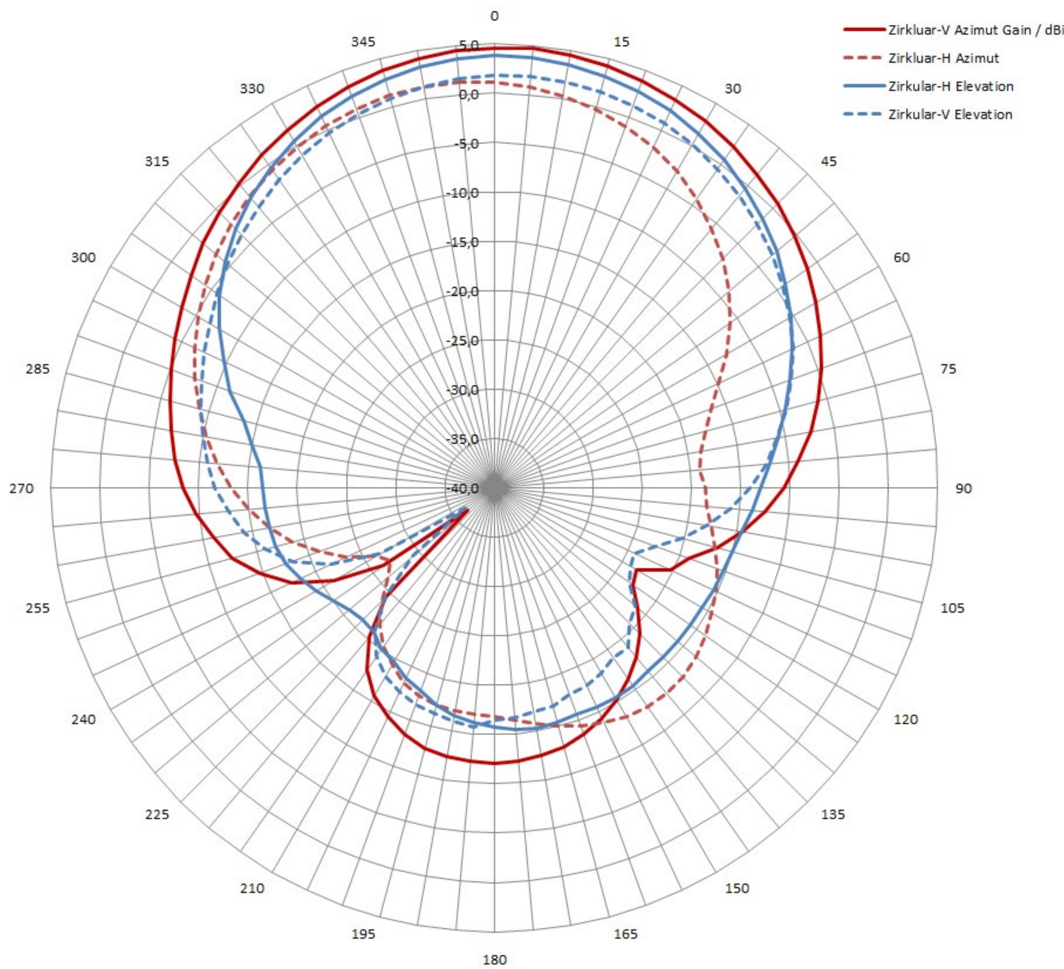


Figure 5-58 Circular section

Overview of the antenna parameters

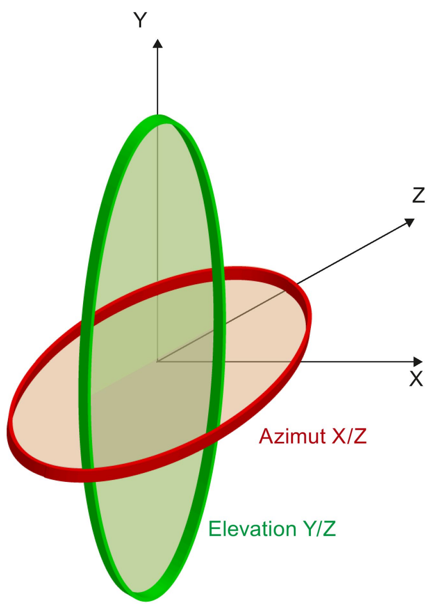
Table 5- 49 Maximum linear electrical aperture angle at 865 MHz:

	Polarization		Circular polarization
	Linear vertical	Linear horizontal	
Azimuth section	64°	61°	65°
Elevation section	64°	66°	63°
Typical antenna gain in the frequency band 865 to 868 MHz	5 dBi	3 dBi	5 dBi
Antenna axis ratio	--	--	2 dB

You will find more information on the antennas in the section "Guidelines for selecting RFID UHF antennas (Page 59)".

Antenna diagram for RF685R (FCC)

The following radiation diagrams show the directional characteristics of the internal antenna of the RF685R (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 secondary fields.



Azimuth	XZ plane
Elevation	YZ plane

Radiation diagram (Azimuth section)

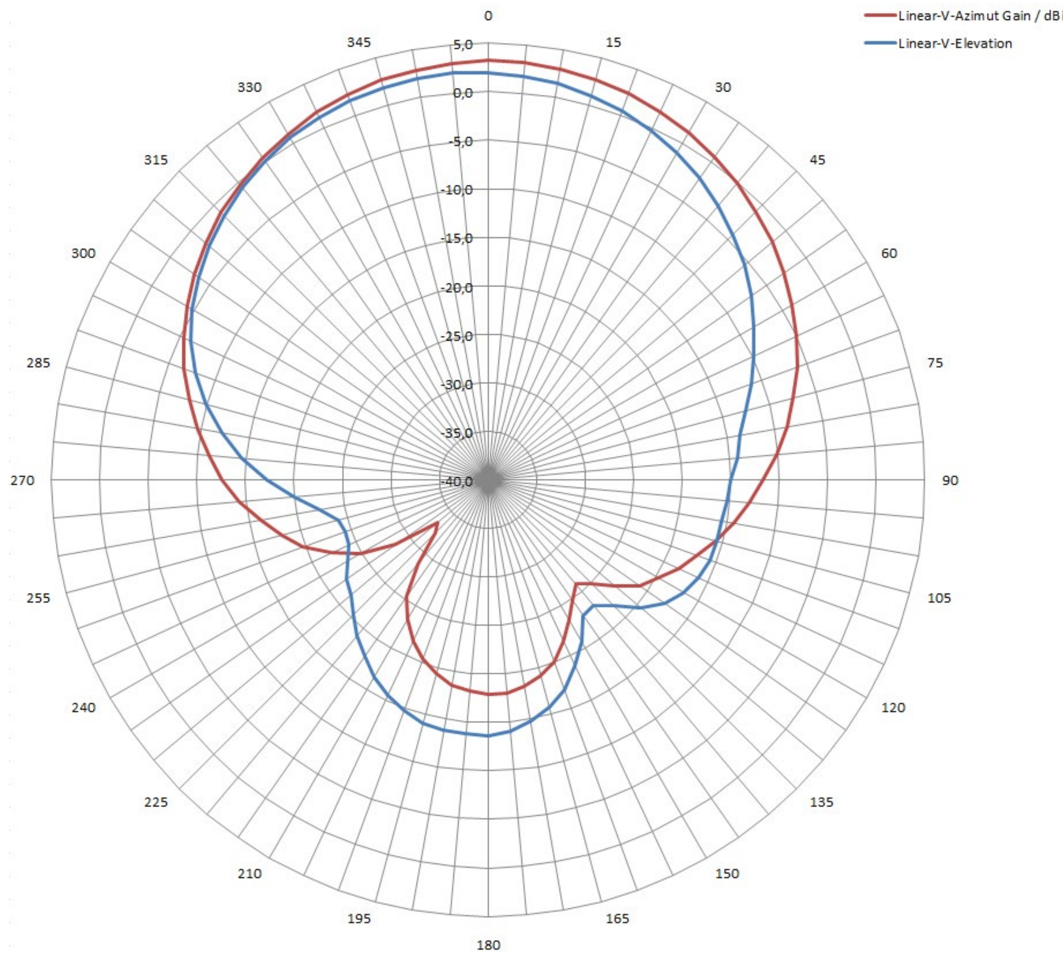


Figure 5-59 Azimuth section

Radiation diagram (elevation section)

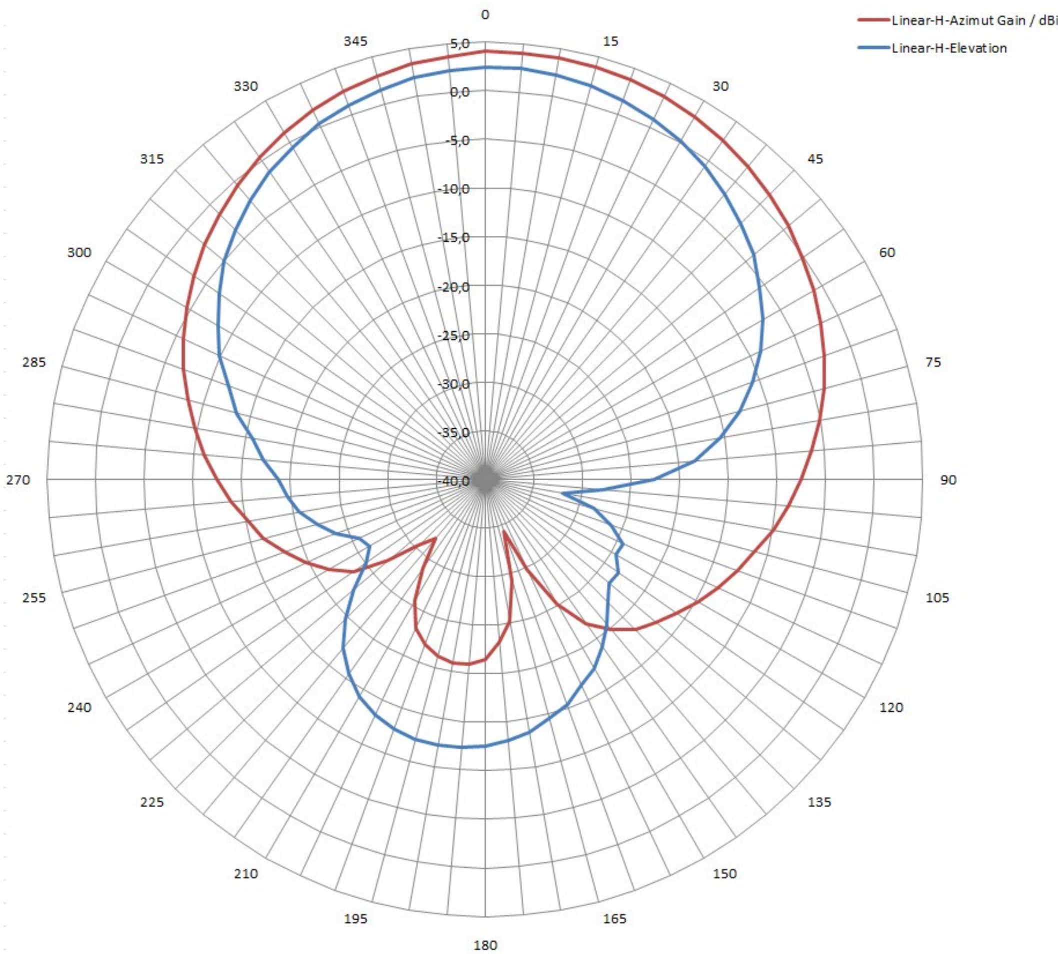


Figure 5-60 Elevation section

Radiation diagram (circular)

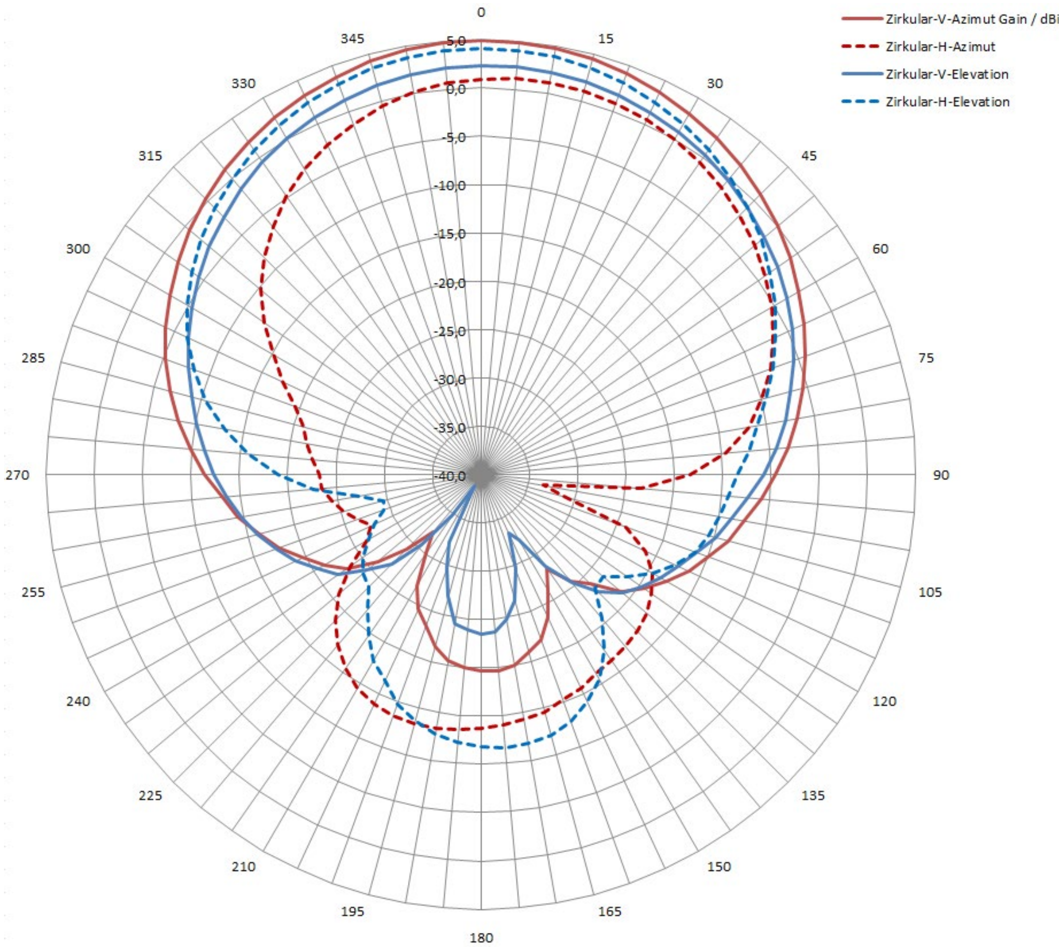


Figure 5-61 Circular section

Overview of the antenna parameters

Table 5- 50 Maximum linear electrical aperture angle at 915 MHz:

	Polarization		Circular polarization
	Linear vertical	Linear horizontal	
Azimuth section	74°	64°	73°
Elevation section	70°	78°	68°
Typical antenna gain in the frequency band 902 to 928 MHz	5 dBi	3 dBi	5 dBi
Antenna axis ratio	--	--	2 dB

You will find more information on the antennas in the section "Guidelines for selecting RFID UHF antennas (Page 59)".

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 the section Antenna diagram for RF685R (ETSI) (Page 251), the maximum antenna gain 0 dB is standardized. 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 RF685R reader has a switchable antenna (circular or linear polarization). You can cover one read point with this antenna. When several RF685R readers are used, the readers are addressed via the SIMATIC level.

5.8.2.2 External antenna

Preassembled standard cables in lengths of 1 m, 3 m, 5 m, 10 m, 15 m, 20 m and 40 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.

5.8.3 Installation/mounting

Requirement

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

NOTICE
Close unused connectors
Note that the readers only have the specified degree of protection when all connectors are in use or when unused connectors are closed with the protective caps.
If you do not use reader connectors, close them 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 the following ways:

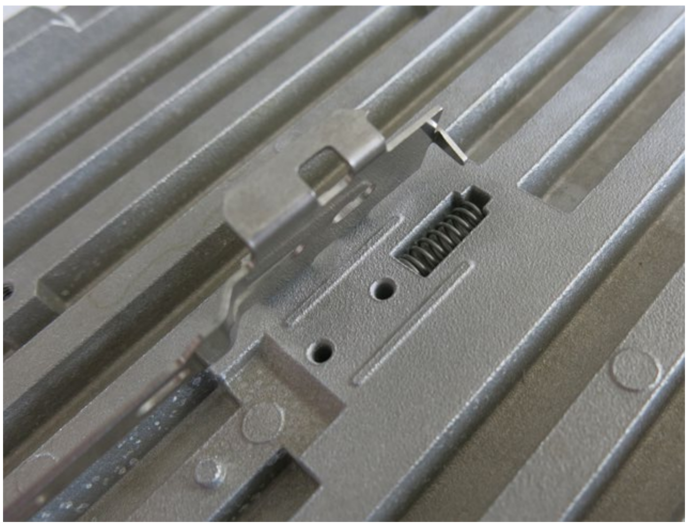
- Using a standardized VESA 100 mounting system and the Antenna Mounting Kit (refer to the section Mounting with antenna mounting kit (Page 360)).

  Tighten the M4 screws on the rear of the reader using a torque of ≤ 1.5 Nm.
- DIN rail T35 (S7-1200)
- S7-300 standard rail
- S7-1500 standard rail
- directly on a flat surface using the VESA 100 mounting system (torque ≈ 1.5 Nm).

  The positions of the mounting holes for the device are shown in the section Dimension drawing (Page 268).

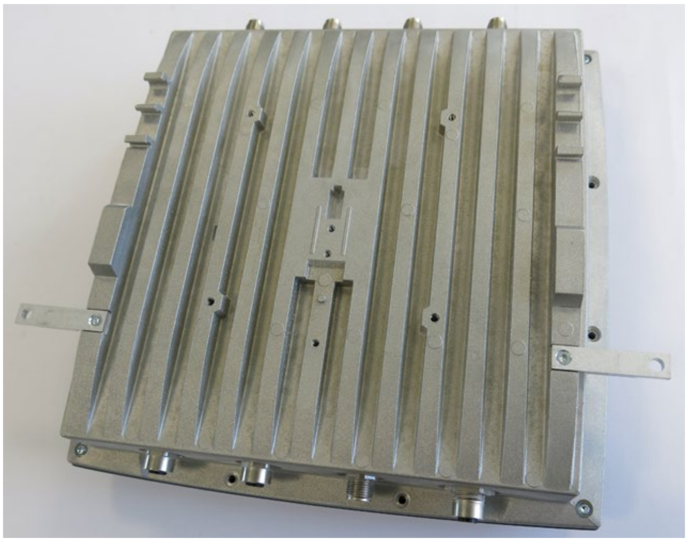
Mounting the reader on a DIN/standard rail

Table 5- 51 DIN rail mounting

	Description	
	1.	Place the spring in the groove.
	2.	Mount the holder using the supplied Torx screws. When mounting the holder, make sure that the angled tip is positioned above the spring in the groove.

	Description	
	3.	Fit the lower part of the locking mechanism of the reader into the DIN rail. To be able to mount the reader on or remove it from the DIN rail, pull down the holder mounted in step 2.

Table 5- 52 Installation on a standard rail

		Description
	1.	Mount the two adapter pieces using the supplied Torx screws.
	2.	Fit the upper part of the locking mechanism of the reader into the standard rail.
	3.	Secure the reader using the supplied slotted-head screws.

5.8.4 Configuration/integration

An Ethernet interface is available for integrating the device into system environments/networks. The RF685R can be configured via the Ethernet interface and with direct connection to the PC. You can configure and program the reader using the following tools:

- using Web Based Management (WBM)
- STEP 7 Basic/Professional (TIA Portal)
- using XML-based user applications

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

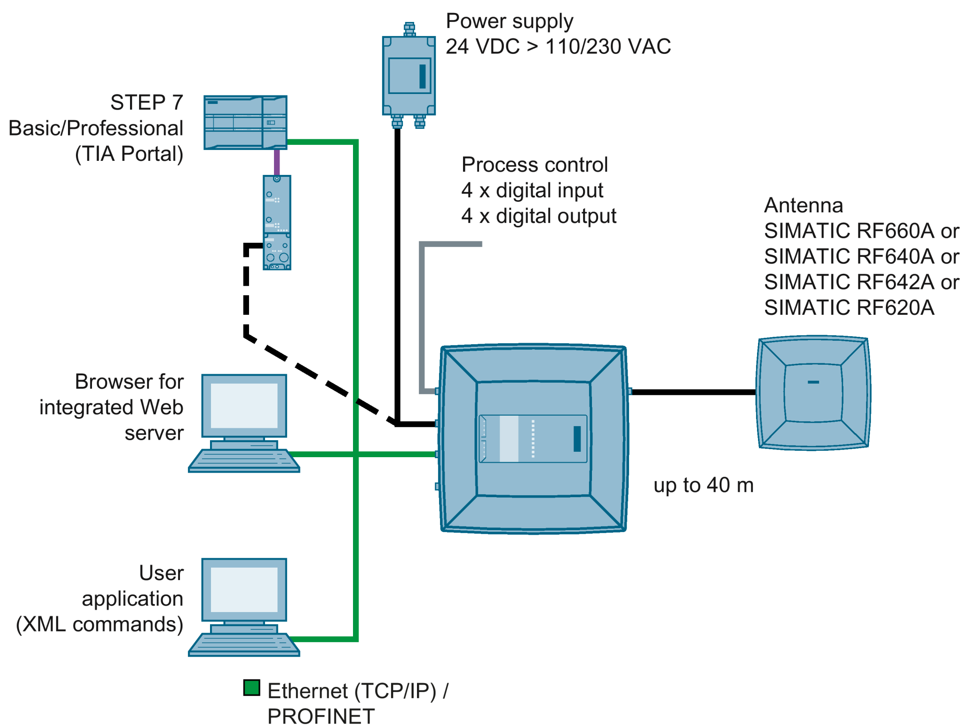


Figure 5-62 Overview of configuration of the RF685R reader

5.8.5 Technical specifications

Table 5- 53 Technical specifications, RF685R

	6GT2811-6CA10-xAA0
Product type designation	RF685R
Mechanical specifications	
Weight	2.47 kg
Dimensions (L x W x H)	258 × 258 × 80
Degree of protection	IP65
Material	
• Upper part of housing	Pocan DP CF 2200
• Lower part of housing	Aluminum
Color	
• Upper part of housing	TI-Grey
• Lower part of housing	Silver
Operating displays on the device	8 LEDs
Status display on the device	9 LEDs
Interfaces	
• Antenna connectors	1 x RP-TNC plug
• Power supply	1 x RS 422 plug (M12, 8-pin)
• Digital I/O interface	1 x socket (M12, 12-pin)
• Digital inputs	4
• Digital outputs	4
• Ethernet interface	2 x socket (M12, 4-pin), 100 Mbps
MTBF	29 years
Electrical data	
Power supply	24 VDC (20 ... 30 VDC) [1)]
Max. permitted current consumption	2 A
Max. permitted current drain via the digital I/O interface	1 A [2)]
Current consumption (on standby)	
• 20 V input voltage on the reader (typical)	220 mA / 4.4 W
• 24 V input voltage on the reader (typical)	190 mA / 4.5 W
• 30 V input voltage on the reader (typical)	150 mA / 4.5 W

	6GT2811-6CA10-xAA0
Current consumption (at 1000 mW transmit power)	
• 20 V input voltage on the reader (typical)	450 mA / 9.0 W
• 24 V input voltage on the reader (typical)	380 mA / 9.1 W
• 30 V input voltage on the reader (typical)	300 mA / 9.6 W
Current consumption (at 2000 mW transmit power)	
• 20 V input voltage on the reader (typical)	610 mA / 12.2 W
• 24 V input voltage on the reader (typical)	500 mA / 12.0 W
• 30 V input voltage on the reader (typical)	410 mA / 12.3 W
Electromagnetic compatibility	
• ETSI	EN 301 489-1/-3, EN 302 208-1/-3 V1.4.1
• FCC	FCC CFR 47, Part 15 section 15.247

Permitted ambient conditions	
Ambient temperature	
• During operation	-25 °C to +55 °C
• During transportation and storage	-40 °C to +85 °C
Shock resistant to EN 60068-2-27	30 g 3)
Vibration resistant to EN 60068-2-6	30 m/s² 3)

1) All supply and signal voltages must be safety extra low voltage (SELV/PELV according to EN 60950). The voltage sources must meet the requirements of limited power sources (LPS) and NEC Class 2.

2) Keep to the switching scheme of the digital I/O interface.

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

Table 5- 54 Technical specifications according to EPC and ISO, RF685R

	6GT2811-6CA10-xAA0
Product type designation	RF685R
Frequency accuracy	max.± 10 ppm
Channel spacing	• EU, EFTA, Turkey: 600 kHz • US: 500 kHz • China: 250 kHz
Modulation methods	ASK: DSB modulation & PR-ASK modulation Encoding, Manchester or Pulse Interval (PIE)
Effective radiated power (internal antenna)	
• ETSI/CMIIT	• ≤ 2 W ERP
• FCC	• ≤ 4 W EIRP
Effective radiated power (external antenna)	
• ETSI/CMIIT	• ≤ 2 W ERP
• FCC	• ≤ 4 W ERP
Transmit power	
• ETSI/CMIIT	• ≤ 2 W
• FCC	• ≤ 2 W
Reading range	max. 8 m
Frequencies	
ETSI frequencies	
Frequency range for Europe, South Africa 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 at max. 2 W ERP)
Frequency range India	865.1 ... 866.9 MHz (4 channels at max. 2 W ERP, transmit power max. 1 W)
FCC frequencies	
Frequency range USA, Canada, Argentina, Mexico	902.75... 927.25 MHz (50 channels at max. 4 W EIRP, frequency hopping)
Frequency range Australia	918.25 ... 925.75 MHz (16 channels at max. 1 W EIRP, frequency hopping)
Frequency range Brazil 1)	902.75 ... 907.25 MHz / 915.25 ... 927.25 MHz (35 channels at max. 4 W EIRP, frequency hopping)
Frequency range South Korea 1)	917.3 ... 920.3 MHz (6 channels at max. 4 W EIRP)
CMIIT frequencies	
Frequency range China	920.625 ... 924.375 MHz (16 subchannels at 2 W ERP)

1) In preparation. Expected to be approved from 09/2015.

5.8.6 Dimension drawing

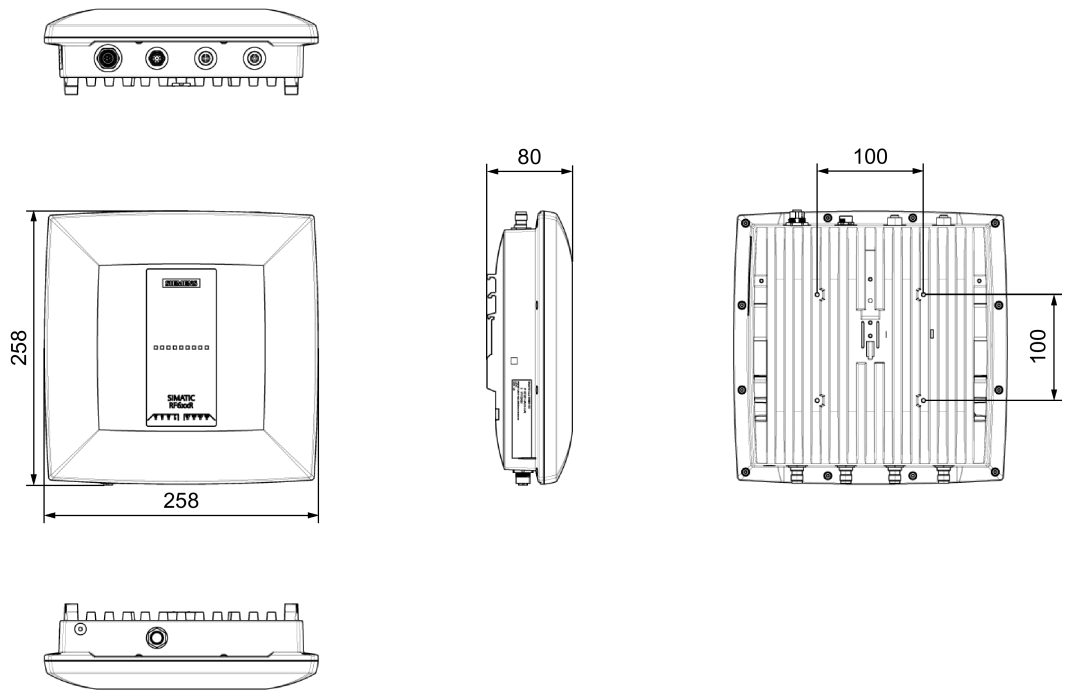


Figure 5-63 Dimension drawing RF685R

All dimensions in mm (± 0.5 mm tolerance)

5.8.7 Certificates and approvals

5.8.7.1 CE mark

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- 55 6GT2811-6CA10-0AA0

Certificate	Description
	Conformity with R&TTE directive
	South Africa radio approval: Radio Equipment Type Approval
India	India radio approval Marking on the reader: No. NR-ETA/1589

5.8.7.2 Country-specific certifications

Table 5- 56 6GT2811-6CA10-1AA0

Standard	
Federal Communications Commission	FCC CFR 47, Part 15 section 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-RF600R2
Industry Canada Radio Standards Specifications	RSS-210 Issue 6, Section 2.2, A8 IC: 267X- RF600R2, Model: RF685R
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 115352

Standard	
	Brazil radio approval Marking on the reader (6GT2811-6CA10-1AA0):  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 2892-15-4794
	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. Certificate of the reader: MSIP-CMM-RF5-RF685R
HC-141617	Argentina radio approval: Registro de la COMISION NACIONAL DE COMUNICACIONES
RCPSISI14-1926-A2	Mexico radio approval: CERTIFICADO DE HOMOLOGACION, IFETEL
	Australia radio approval: This product meets the requirements of the AS/NZS 3548 Norm.

Table 5- 57 6GT2811-6CA10-2AA0

Standard	
CMIIT Certification	China radio approval Marking on the reader: CMIIT ID: 2014DJ3989

5.8.7.3 FCC information

Siemens SIMATIC RF685R (FCC): 6GT2811-6CA10-1AA0

FCC ID: NXW-RF600R2

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.

5.8.7.4 IC-FCB information

Siemens SIMATIC RF685R (FCC): 6GT2811-6CA10-1AA0

IC:

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) This device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d`Industrie Canada applicables aux appareils radio exempts de licence. L`exploitation est autorisée aux deux conditions suivantes :

(1) L`appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l`appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d`en compromettre le fonctionnement.

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.

5.9 Reader RF680M

5.9.1 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.

5.9.2 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 EPC-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 EPC-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.

Antennas 6

6.1 Overview

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

Table 6- 1 Characteristics of the RF620A and RF660A antennas

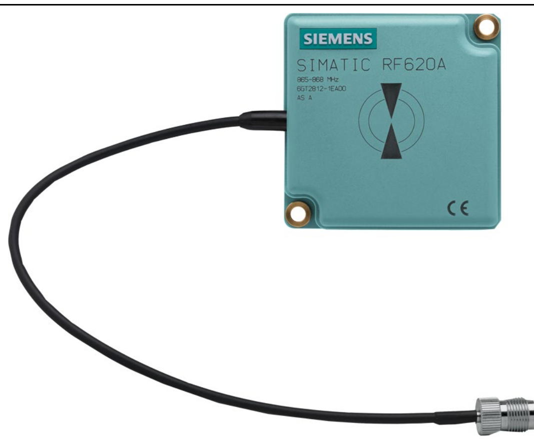
Features	RF620A antenna 865-868	RF620A antenna 902-928	RF660A antenna 865-868	RF660A antenna 902-928
Material	PA 12, silicon-free			
Frequency band	865-868 MHz	902-928 MHz	865-868 MHz	902-928 MHz
Impedance	50 Ohm nominal			
Antenna gain	-10…-5 dBi		7 dBi	6 dBi
VSWR (standing wave ratio)	2:1 max.			
Polarization	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
RF650R	1, 2, 3 or 4 antennas			
Max. radiated power	170 mW ERP / 280 mW EIRP		2000 mW ERP	3550 mW EIRP
RF680R	1, 2, 3 or 4 antennas			
Max. radiated power	340 mW ERP / 560 mW EIRP		2000 mW ERP	4000 mW EIRP
RF685R	1 antenna			
Max. radiated power	340 mW ERP / 560 mW EIRP		2000 mW ERP	4000 mW EIRP

Table 6- 2 Characteristics of the RF640A and RF642A antennas

Features		RF640A antenna		RF642A antenna	
Material		PA 12, silicon-free			
Frequency band		865-868 MHz	902-928 MHz	865-868 MHz	902-928 MHz
Impedance		50 Ohm nominal			
Antenna gain		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
	RF650R	1, 2, 3 or 4 antennas			
	Max. radiated power	1360 mW ERP	2400 mW EIRP	2000 mW ERP	4000 mW EIRP
	RF680R	1, 2, 3 or 4 antennas			
	Max. radiated power	2000 mW ERP	4000 mW EIRP	2000 mW ERP	4000 mW EIRP
	RF685R	1 antenna			
	Max. radiated power	2000 mW ERP	4000 mW EIRP	2000 mW ERP	4000 mW EIRP

6.2 RF620A antenna

6.2.1 Description

SIMATIC RF620A	Characteristics	
	Area of application	The SIMATIC RF620A is an antenna with a compact design suitable for industry. 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 while passing the antenna. See also section Alignment of transponders to the antenna (Page 283)
	Write/read distance	Approx. 1.3 m depending on the transponder (see section Read/write ranges (Page 292))
	Connecting cable	30 cm movable connecting cable and RTNC coupling (an antenna cable, e.g. 6GT2815-0BH30 is required for connection to the reader)
	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- 3 Ordering data RF620A

Product	Article number
SIMATIC RF620A (ETSI)	6GT2812-1EA00
SIMATIC RF620A (FCC)	6GT2812-1EA01

Table 6- 4 Ordering data accessories

Product		Article number
Connecting cable between reader and antenna	1 m (cable loss 0.5 dB)	6GT2815-0BH10
	3 m (cable loss 1.0 dB)	6GT2815-0BH30
	5 m, suitable for drag chains (cable loss 1.5 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

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

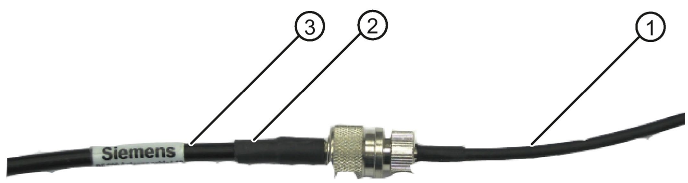
Note

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	Fixed connection to antenna	0,3	--	15	Once
Antenna cable	6GT2815-0BH10	1	0,5	51	Once
Antenna cable	6GT2815-0BH30	3	1	51	Once
Antenna cable, suitable for drag chains	6GT2815-2BH50	5	1,5	48	1)
Antenna cable	6GT2815-1BN10	10	2	77	Once
Antenna cable	6GT2815-0BN10	10	4	51	Once
Antenna cable, suitable for drag chains	6GT2815-2BN15	15	4	24	1)
Antenna cable	6GT2815-0BN20	20	4	77	Once

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.

6.2.5 Parameter settings of RF620A for RF620R/RF630R

Operation within the EU, EFTA, or Turkey according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 V1.4.1

RF600 systems that are put into operation within the EU, EFTA, or Turkey (ETSI) can be operated with an RF620A 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 maximum permitted 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 (https://support.industry.siemens.com/cs/ww/en/view/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)

To meet the FCC and IC-FCB requirements, 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 (≤ -5 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 dBi 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 according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 V1.4.1

RF600 systems that are put into operation within the EU, EFTA, or Turkey (ETSI) can be operated with an RF620A 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 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 maximum permitted radiated power at the antenna is not exceeded.

Operation in China

By setting a max. radiated power of 220 mW ERP (or 23.35 dBm ERP, 360 mW EIRP, 25.5 dBm EIRP), an RF620A antenna gain of -5 dBi and the cable loss associated with the antenna cable (see table), the 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)

To meet the FCC and IC requirements, 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 (≤ -5 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 dBi and the maximum transmit power of 500 mW of the reader, the maximum permitted radiated power cannot be exceeded.

6.2.7 Setting RF620A parameters for RF650R/RF680R/RF685R

Operation within the EU according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 V1.4.1

RF600 systems that are put into operation within the EU, EFTA, or Turkey (ETSI) can be operated with an RF620A antenna with a maximum radiated power of up to 500 mW ERP (or 27 dBm ERP, 820 mW EIRP, 29 dBm EIRP).

By setting the transmit power of up to 340 mW ERP (or 25.35 dBm ERP, 560 mW EIRP, 27.5 dBm EIRP) an RF620A antenna gain of -5 dBi and taking into account the cable loss associated with the antenna cable, the maximum permitted radiated power of the antenna cannot be exceeded.

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. 2000 mW radiated power of the readers 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)

To meet the FCC and IC requirements, 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 (≤ -5 dBi)
- Cable loss a_k dB (≥ 1 dB)

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

By selecting the correct country profile/frequency range and setting the radiated power (see technical specifications of the reader being used) and setting the parameters for antenna gain and cable loss, the maximum radiated power will not be exceeded.

6.2.8 Alignment of transponders to the antenna

Polarization axis

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

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

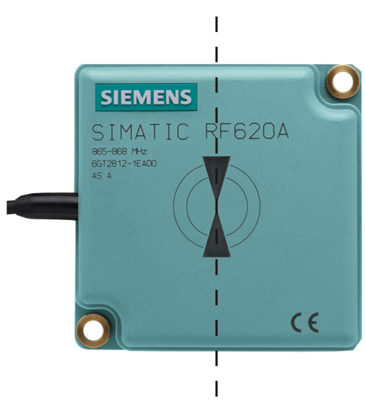


Figure 6-2 Polarization axis

Alignment

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

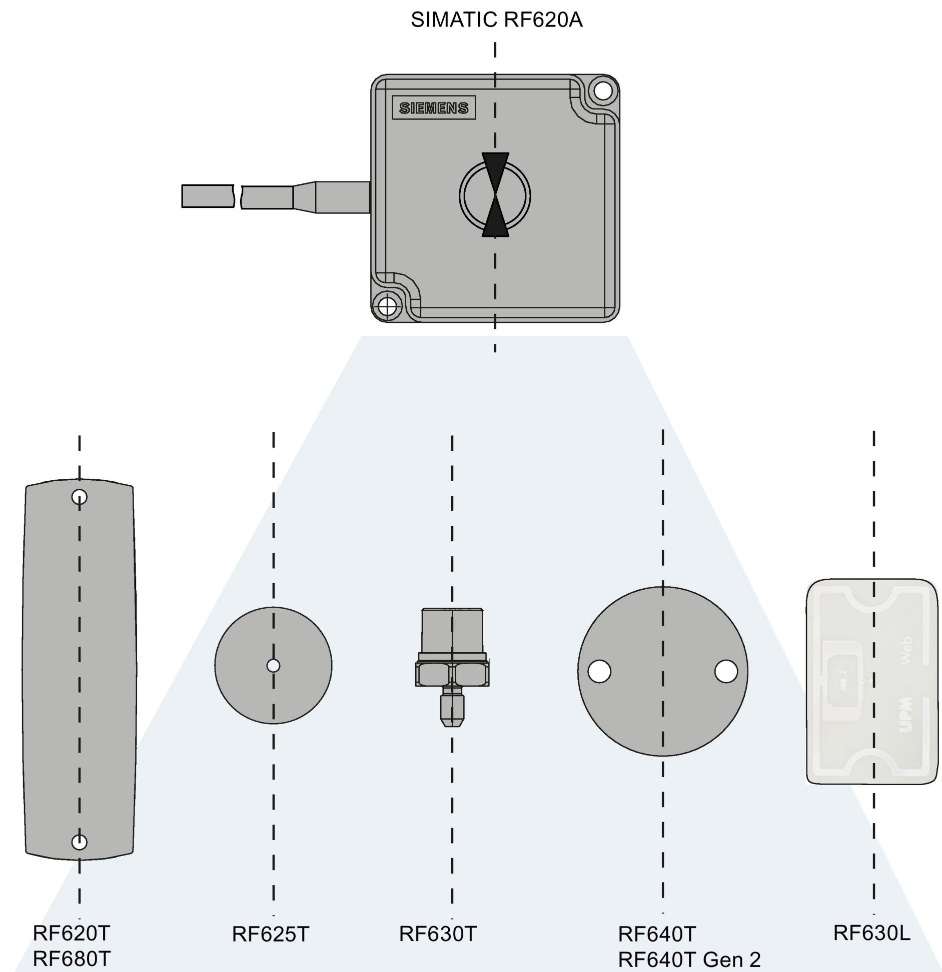


Figure 6-3 Antenna/transponder alignment

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

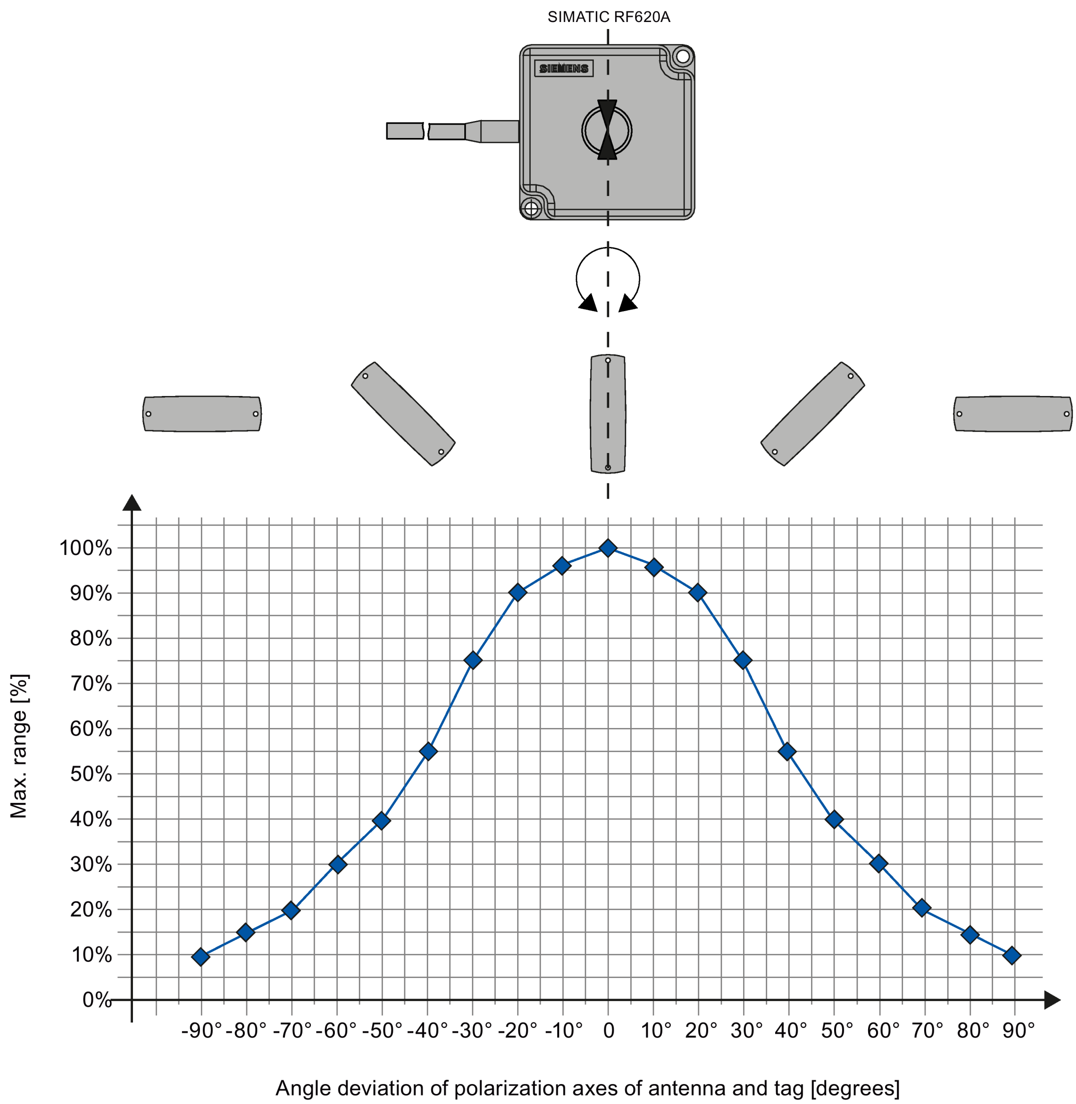


Figure 6-4 Angle deviation diagram for alignment

6.2.9 Antenna patterns

6.2.9.1 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.

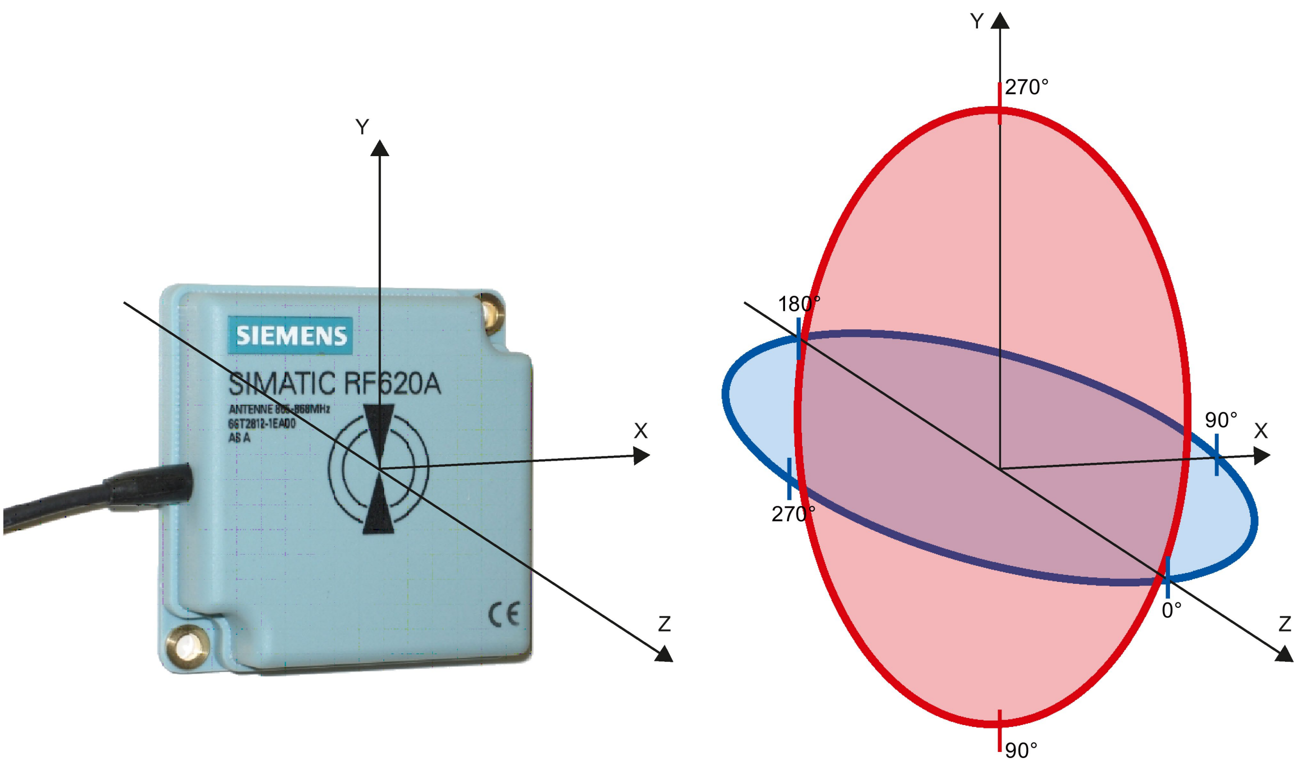


Figure 6-5 Reference system

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)

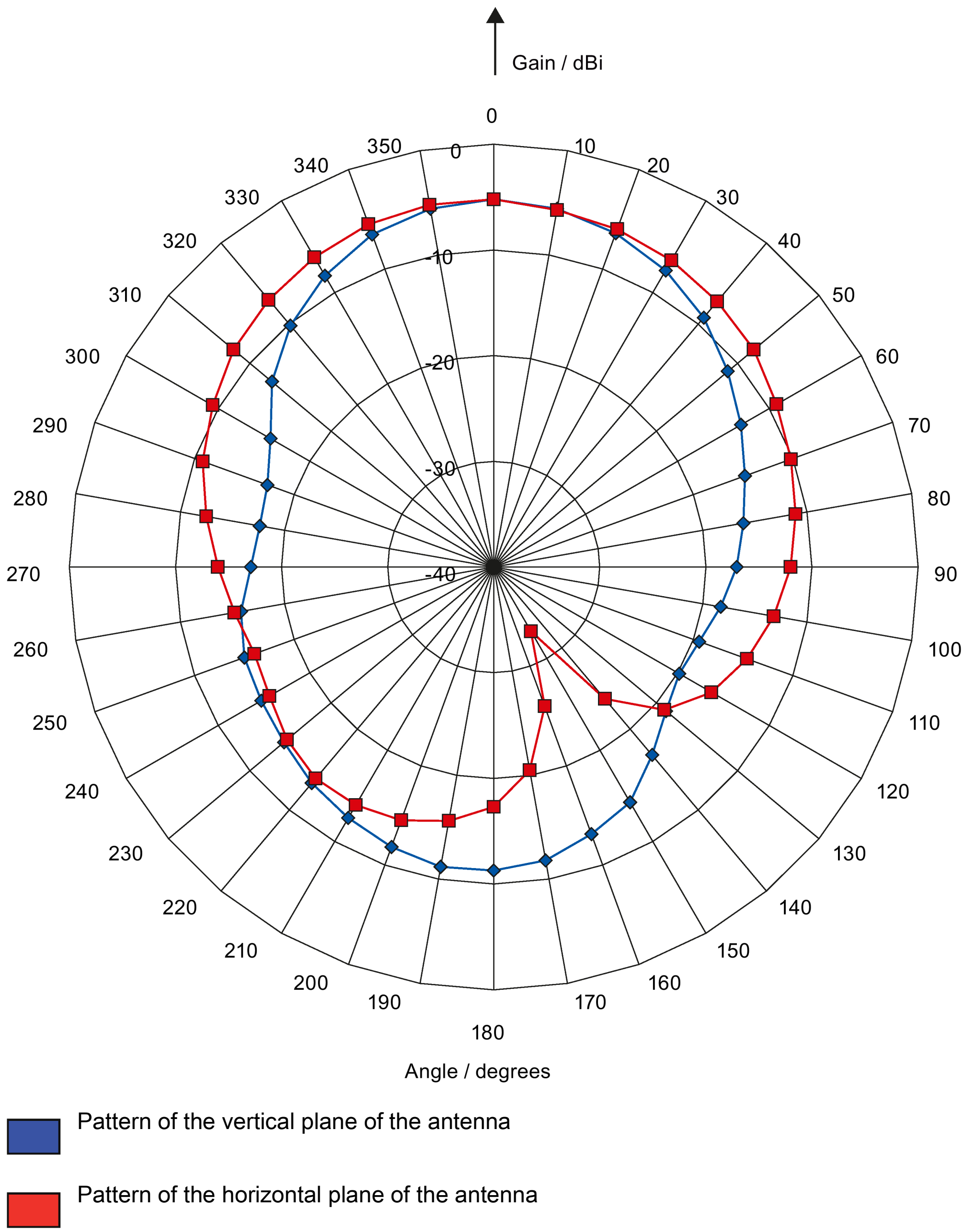


Figure 6-6 Directional radiation pattern RF620A ETSI on metallic mounting surface

Directional radiation pattern ETSI on non-metallic mounting surface

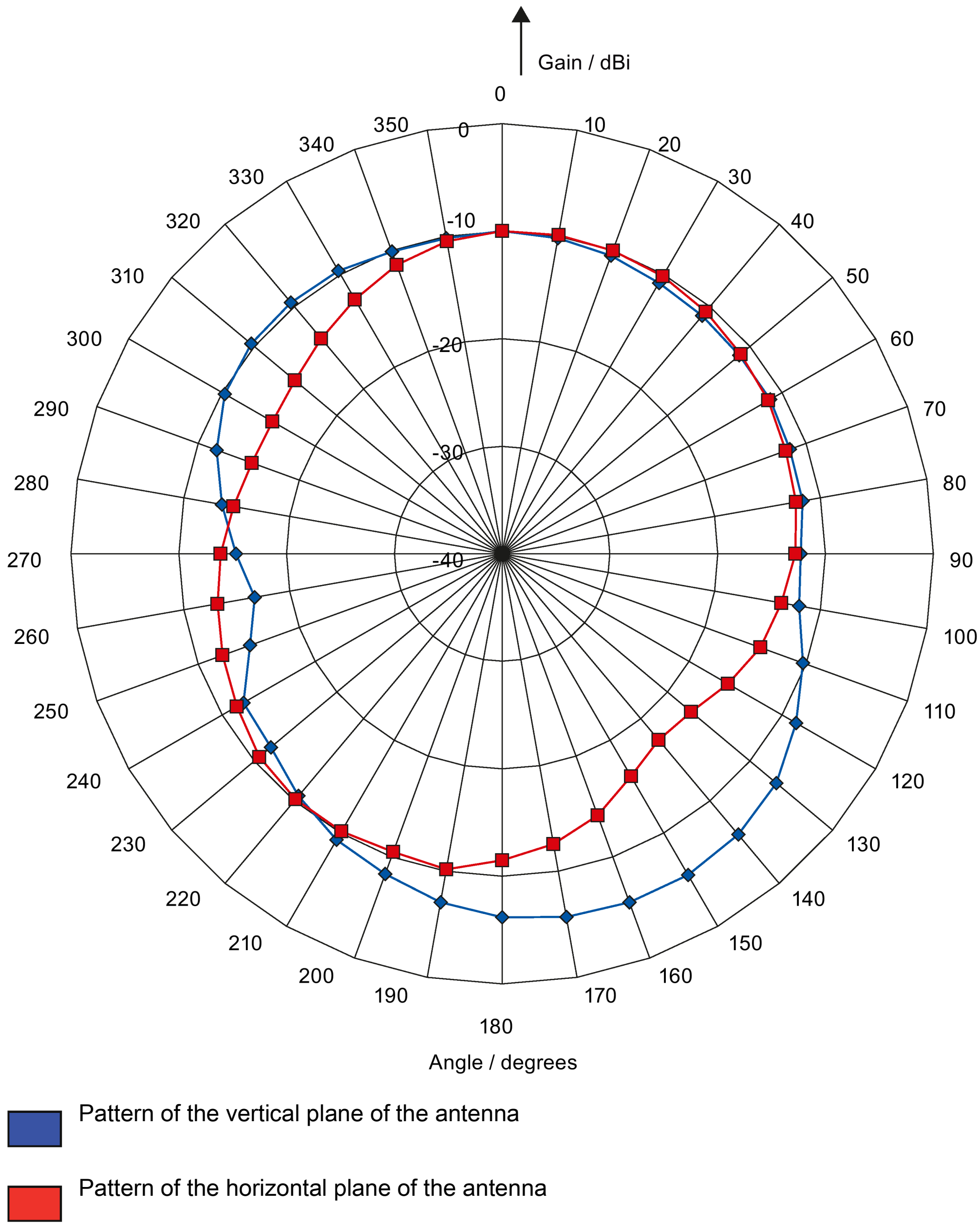


Figure 6-7 Directional radiation pattern RF620A ETSI on non-metallic mounting surface

6.2.9.2 Antenna pattern FCC

Directional radiation pattern USA (FCC)

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

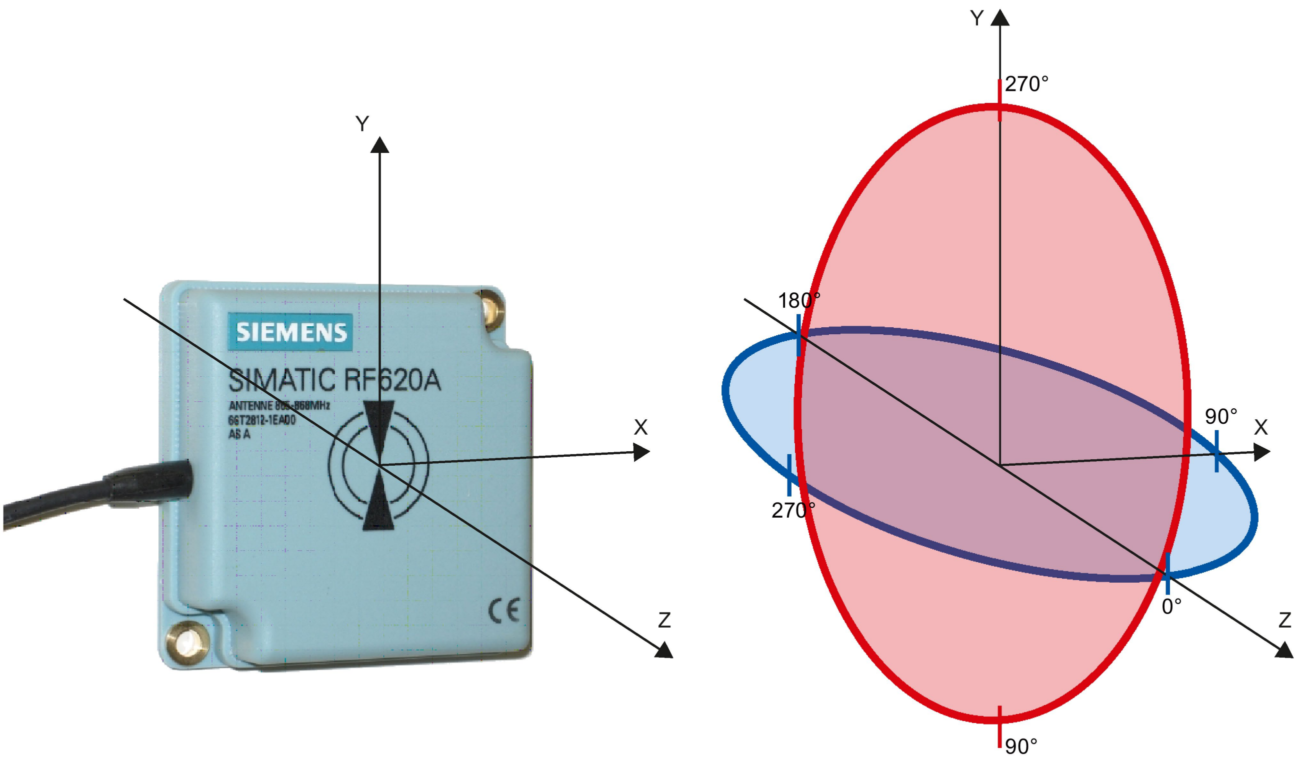


Figure 6-8 Reference system

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)

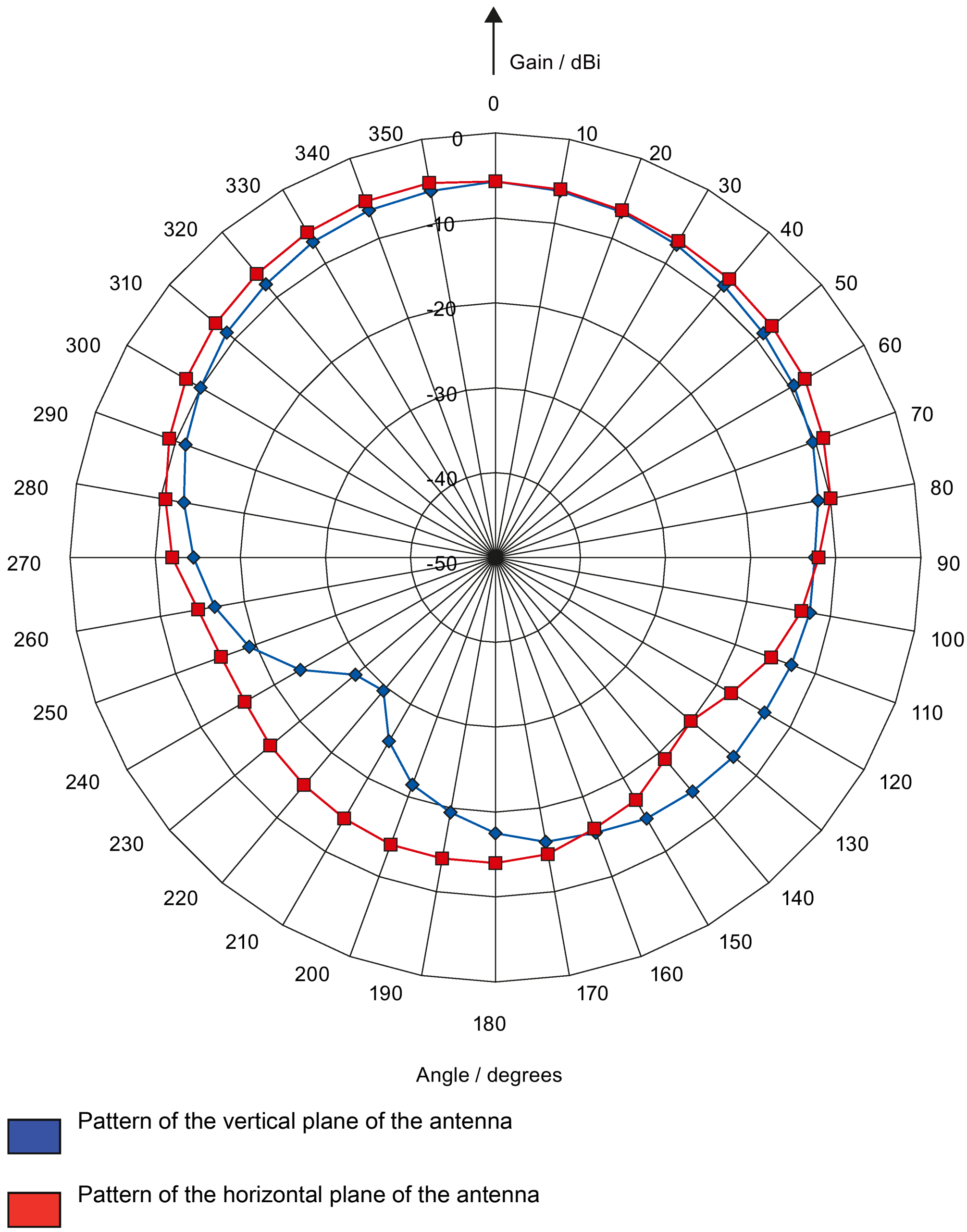


Figure 6-9 Directional radiation pattern of the RF620A (FCC) on metallic mounting surface

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

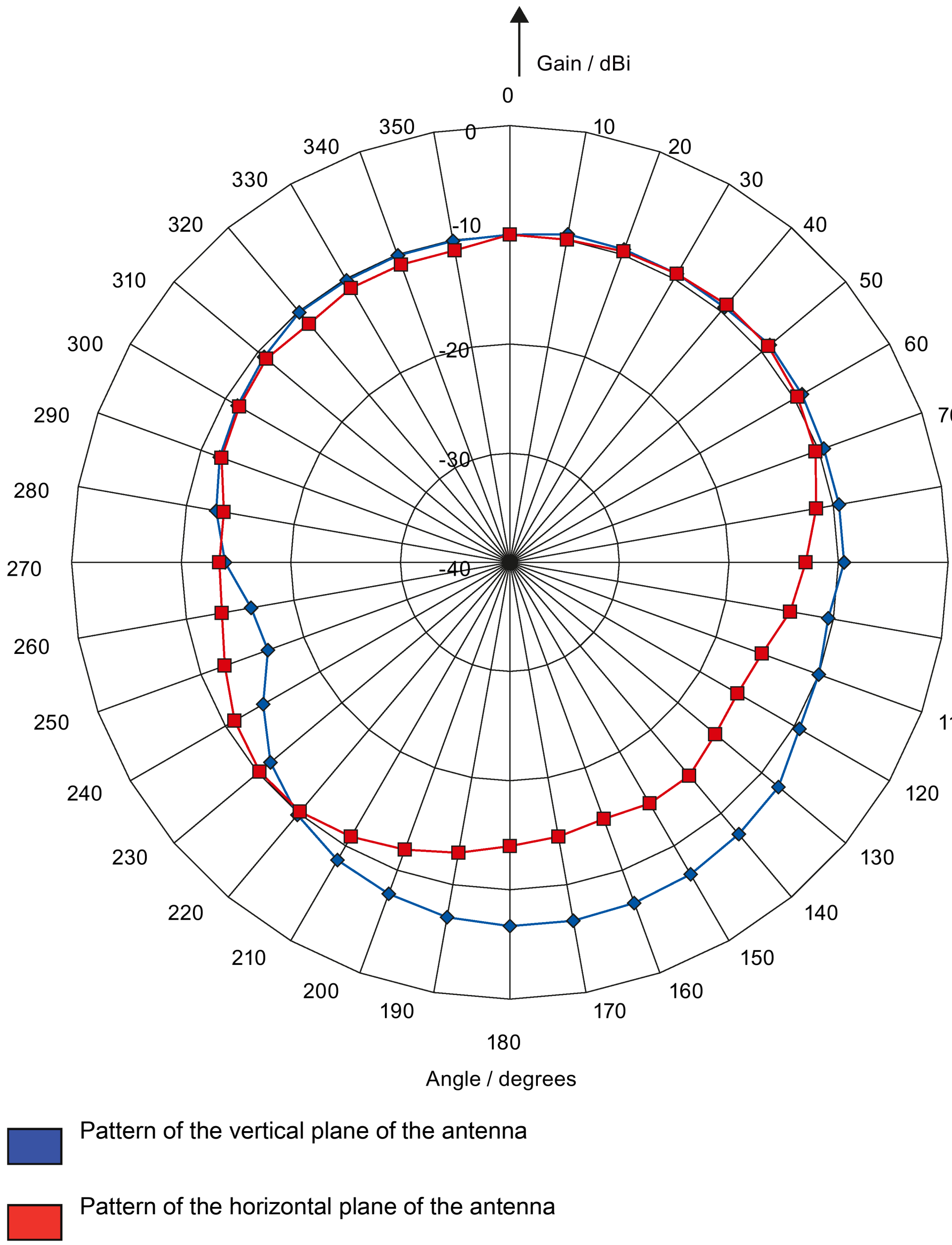


Figure 6-10 Directional radiation pattern of the RF620A (FCC) on non-metallic mounting surface

6.2.9.3 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 286), 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).

6.2.10 Read/write ranges

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

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	Article number	Length [m]	Cable loss [dB]	Read/write range [%]
Antenna cable	6GT2815-0BH10	1	0.5	100
Antenna cable	6GT2815-0BH30	3	1	100
Antenna cable, suitable for drag chains	6GT2815-2BH50	5	1.5	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- 5 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- 6 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
RF690L				
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- 7 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)

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- 8 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 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

Read distances RF650R

Table 6- 9 Read distances RF650R

Transponder	Connection to RF650R			
	RF620A ETSI on metal [cm]	RF620A ETSI on non-metal [cm]	RF620A FCC on metal [cm]	RF620A on non-metal [cm]
RF622L 1)	40	35	35	30
RF630L 1) (6GT2810-2AB00, -2AB01, -2AB02-0AX0)	135	120	100	90

Transponder	Connection to RF650R			
	RF620A ETSI on metal [cm]	RF620A ETSI on non-metal [cm]	RF620A FCC on metal [cm]	RF620A on non-metal [cm]
RF630L (6GT2810-2AB03)	85	70	75	65
RF640L [2)]	25	20	25	20
RF680L	85	70	75	65
RF690L [2)]	40	35	40	35
RF610T	85	70	75	65
RF620T	85	85	95	95
RF622T [1)]	40	35	35	30
RF625T [2)]	50	45	60	45
RF630T [2)]	40	35	50	35
RF640T Gen 2 [2)]	90	70	70	50
RF680T	90	90	135	95

1) Transponder mounted on cardboard

2) Transponder mounted on metal

Write distances RF650R

Table 6- 10 Write distances RF650R

Transponder	Connection to RF650R			
	RF620A ETSI on metal [cm]	RF620A ETSI on non-metal [cm]	RF620A FCC on metal [cm]	RF620A on non-metal [cm]
RF622L [1)]	30	25	25	20
RF630L [1)] (6GT2810-2AB00, -2AB01, -2AB02-0AX0)	110	90	55	50
RF630L (6GT2810-2AB03)	75	70	60	55
RF640L [2)]	10	10	10	10
RF680L	75	70	60	55
RF690L [2)]		20	25	20
RF610T	75	70	60	55
RF620T	60	55	60	45
RF622T [1)]	30	25	25	20
RF625T [2)]	40	30	45	30
RF630T [2)]	30	25	35	25

Transponder	Connection to RF650R			
	RF620A ETSI on metal [cm]	RF620A ETSI on non-metal [cm]	RF620A FCC on metal [cm]	RF620A on non-metal [cm]
RF640T Gen 2 [2)]	70	60	50	40
RF680T	80	75	100	80

1) Transponder mounted on cardboard

2) Transponder mounted on metal

Read distances RF680R/RF685R

Table 6- 11 Read distances RF680R/RF685R

Transponder	Connection to RF680R/RF685R			
	RF620A ETSI on metal [cm]	RF620A ETSI on non-metal [cm]	RF620A FCC on metal [cm]	RF620A on non-metal [cm]
RF622L [1)]	40	35	35	30
RF630L [1)] (6GT2810-2AB00, -2AB01, -2AB02-0AX0)	135	120	100	90
RF630L (6GT2810-2AB03)	85	70	75	65
RF640L [2)]	25	20	25	20
RF680L	85	70	75	65
RF690L [2)]	40	35	40	35
RF610T	85	70	75	65
RF620T	85	85	95	95
RF622T [1)]	40	35	35	30
RF625T [2)]	50	45	60	45
RF630T [2)]	40	35	40	30
RF640T Gen 2 [2)]	90	70	70	50
RF680T	90	90	135	95

1) Transponder mounted on cardboard

2) Transponder mounted on metal

Write distances RF680R/RF685R

Table 6- 12 Write distances RF680R/RF685R

Transponder	Connection to RF680R/RF685R			
	RF620A ETSI on metal [cm]	RF620A ETSI on non-metal [cm]	RF620A FCC on metal [cm]	RF620A on non-metal [cm]
RF622L [1)]	30	25	25	20
RF630L [1)] (6GT2810-2AB00, -2AB01, -2AB02-0AX0)	110	90	55	50
RF630L (6GT2810-2AB03)	75	70	60	55
RF640L [2)]	15	15	15	15
RF680L	75	70	60	55
RF690L [2)]	30	25	30	25
RF610T	75	70	60	55
RF620T	60	55	60	45
RF622T [1)]	30	25	25	20
RF625T [2)]	40	30	45	30
RF630T [2)]	30	25	35	25
RF640T Gen 2 [2)]	70	60	50	40
RF680T	80	75	100	80

1) Transponder mounted on cardboard

2) Transponder mounted on metal

6.2.11 Technical data

Table 6- 13 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 286)	Depends on background, refer to the section Antenna pattern FCC (Page 289)
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 286)	• Horizontal plane: 130° • Vertical plane: 105° See section Antenna pattern FCC (Page 289)
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.

6.2.12 Dimension drawing

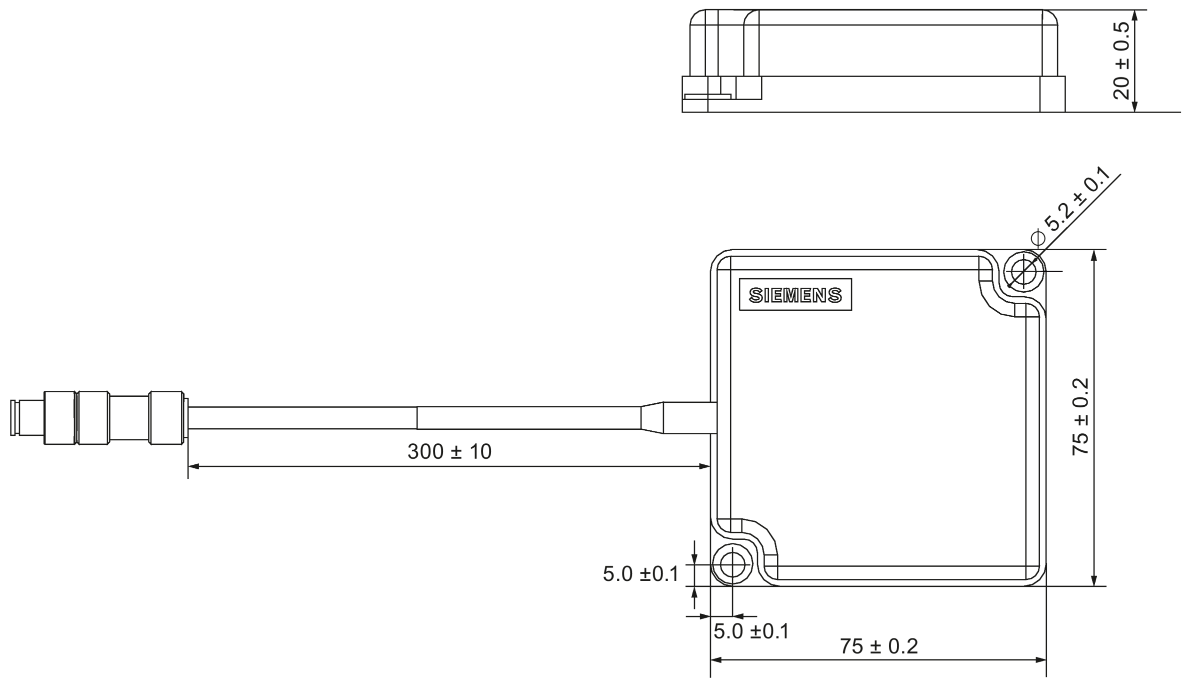


Figure 6-11 Dimension drawing RF620A

All dimensions in mm

6.2.13 Approvals & certificates

Table 6- 14 6GT2812-1EA00

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

Table 6- 15 6GT2812-1EA01

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) • FCC ID: NXW-RF600R2 (for RF650R: 6GT2811-6AB20-1AA0, RF680R: 6GT2811-6AA10-1AA0, RF685R: 6GT2811-6CA10-1AA0)
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) • IC: 267X-RF600R2, Model RF650R (for 6GT2811-6AB20-1AA0) • IC: 267X-RF600R2, Model RF680R (for 6GT2811-6AA10-1AA0) • IC: 267X-RF600R2, Model RF685R (for 6GT2811-6CA10-1AA0)
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. 6 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	IP65

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- 16 Ordering data RF640A

Product	Article number
SIMATIC RF640A	6GT2812-0GA08

Table 6- 17 Ordering data accessories

Product		Article number
Connecting cable between reader and antenna	1 m (cable loss 0.5 dB)	6GT2815-0BH10
	3 m (cable loss 1.0 dB)	6GT2815-0BH30
	5 m, suitable for drag chains (cable loss 1.5 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
	40 m (cable loss 5.0 dB)	6GT2815-0BN40
Antenna mounting kit	See "RF600 System Manual", section "Antennas" > "Mounting types"	6GT2890-0AA00

6.3.3 Installation and assembly

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", section "Antennas" > "Types of mounting").

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 1 m, 3 m, 5 m, 10 m, 15 m and 20 m are available to connect the antenna.

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

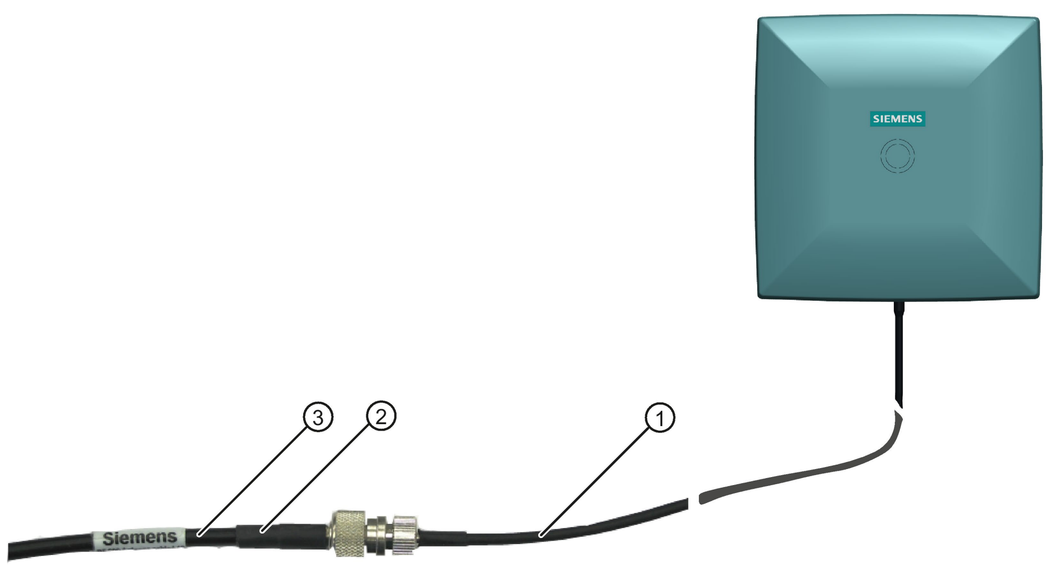
Note

Use of Siemens antenna cable

To ensure optimum functioning of the antenna, it is recommended that a Siemens antenna cable 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 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	Article number	Length [m]	Cable loss [dB]	Bending radius [mm]	Bending cycle
RF640A connecting cable	Fixed connection to antenna	0.3	--	15	Once
Antenna cable	6GT2815-0BH10	1	0.5	51	Once
Antenna cable	6GT2815-0BH30	3	1	51	Once
Antenna cable (suitable for drag chains)	6GT2815-2BH50	5	1.5	48	1)
Antenna cable	6GT2815-1BN10	10	2	77	Once
Antenna cable	6GT2815-0BN10	10	4	51	Once
Antenna cable (suitable for drag chains)	6GT2815-0BN15	15	4	24	1)
Antenna cable	6GT2815-0BN20	20	4	77	Once
Antenna cable	6GT2815-0BN40	40	5	77	Once

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 DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 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 (7 dBic) and the cable loss associated with the antenna cable (see table), the maximum permitted 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 (https://support.industry.siemens.com/cs/ww/en/view/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 transmit power to 4000 mW EIRP (36 dBm EIRP)

To meet the FCC and IC-FCB requirements, 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 according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 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 setting a radiated power of up to 1300 mW ERP (or 31.15 dBm ERP, 2140 mW EIRP, 33.3 dBm EIRP), an RF640A antenna gain of 4 dBi (7 dBic) and taking into account the cable loss associated with the antenna cable (see table), the maximum permitted 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), an RF640A antenna gain of 4.3 dBi (7.3 dBic) and taking into account 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 transmit power to 4000 mW EIRP (36 dBm EIRP)

To meet the FCC and IC requirements, 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

6.3.7 Setting RF640A parameters for RF650R

Operation within the EU according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 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 setting a radiated power of up to 1360 mW ERP (or 31.35 dBm ERP, 2240 mW EIRP, 33.5 dBm EIRP), an RF640A antenna gain of 4 dBi (7 dBic) and taking into account the cable loss associated with the antenna cable (see table (Page 305)), the maximum permitted 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 1460 mW ERP (or 31.35 dBm ERP, 2400 mW EIRP, 33.8 dBm EIRP), an RF640A antenna gain of 4.3 dBi (7.3 dBic) and taking into account the cable loss associated with the antenna cable (see table (Page 305)), the radiated power of the reader is correctly configured.

Operation in the USA, Canada

Note

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

To meet the FCC and IC requirements, 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

6.3.8 Setting RF640A parameters for RF680R/RF685R

Operation within the EU according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 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 setting a radiated power of up to 2000 mW ERP, an antenna gain of 4 dBi (7 dBic) for the RF640A and the cable loss of the antenna cable (see table (Page 305)), the transmit power of the reader is correctly configured and the maximum permitted radiated power of the antenna is 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), an RF640A antenna gain of 4.3 dBi (7.3 dBic) and taking into account the cable loss associated with the antenna cable (see table (Page 305)), the radiated power of the reader is correctly configured.

Operation in the USA, Canada

Note

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

To meet the FCC and IC requirements, 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)

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

By selecting the correct country profile/frequency range and setting the radiated power (see technical specifications of the reader being used) and setting the parameters for antenna gain and cable loss, the maximum radiated power will not be exceeded.

6.3.9 Antenna patterns

6.3.9.1 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.

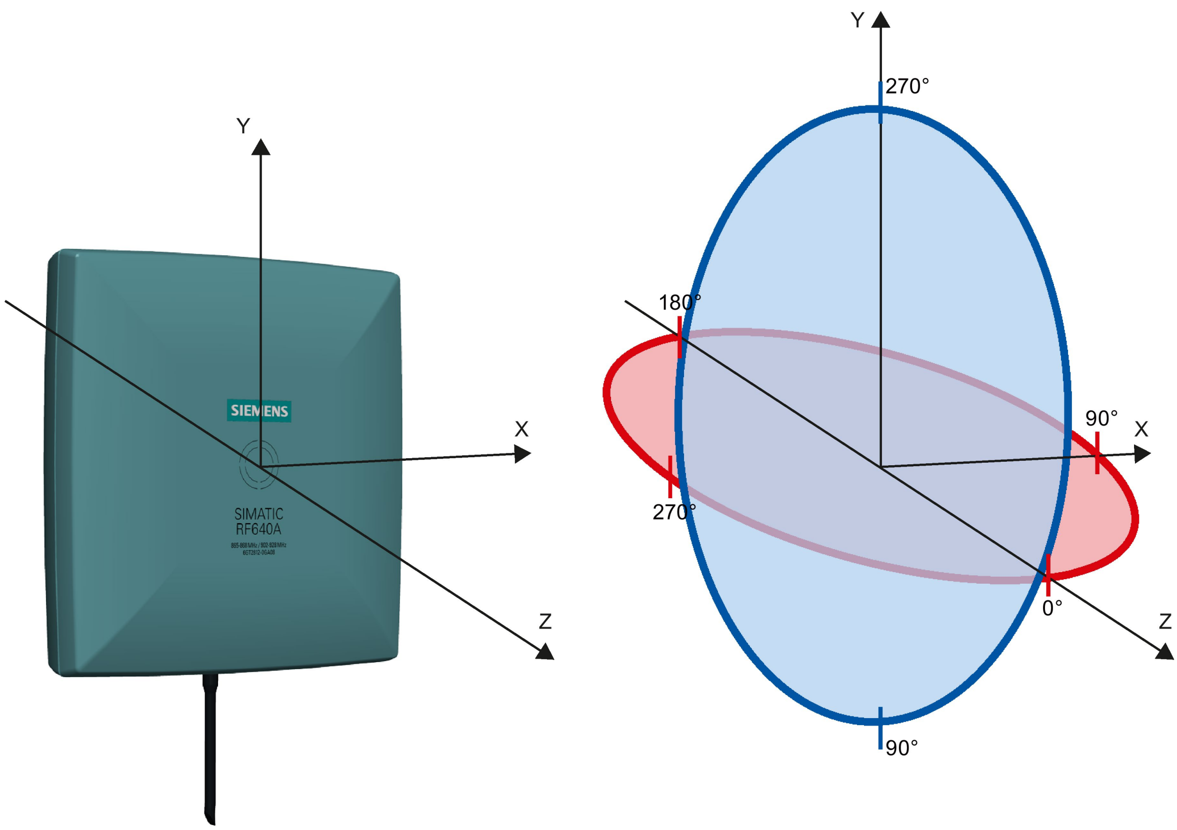


Figure 6-13 Reference system

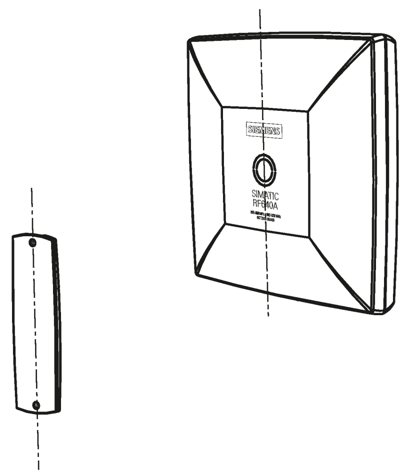
The half-power beam width of the antenna is defined by the angle between the two -3 dB points. Which range (in %) corresponds to the dB values in the patterns can be obtained from this table (Page 320).

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.



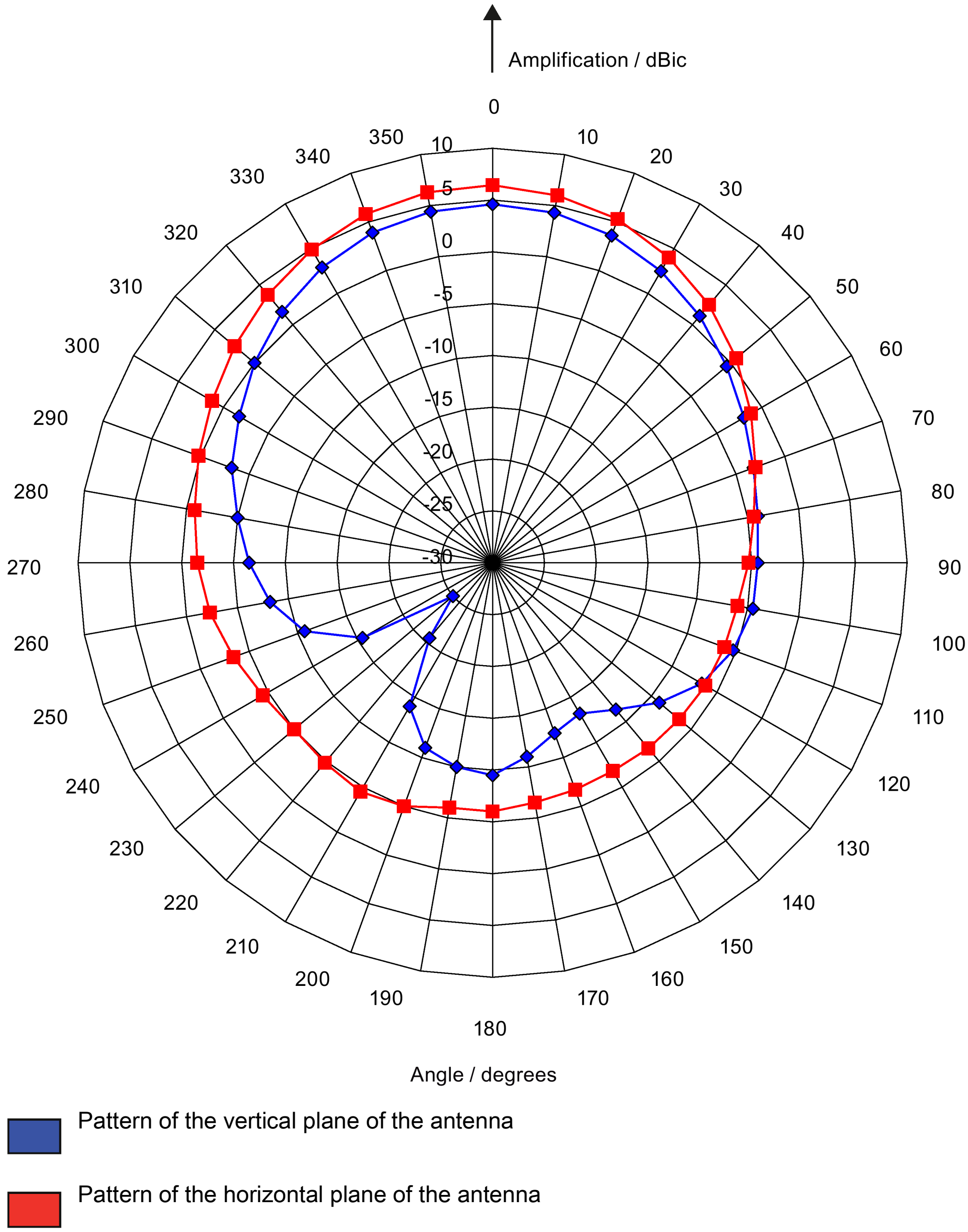
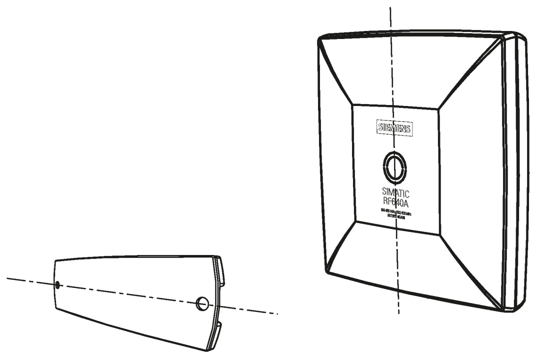


Figure 6-14 The RF640A directional radiation pattern in the ETSI frequency band, polarization axis of the transponder, and axis of symmetry of the antenna are parallel to each other.

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.



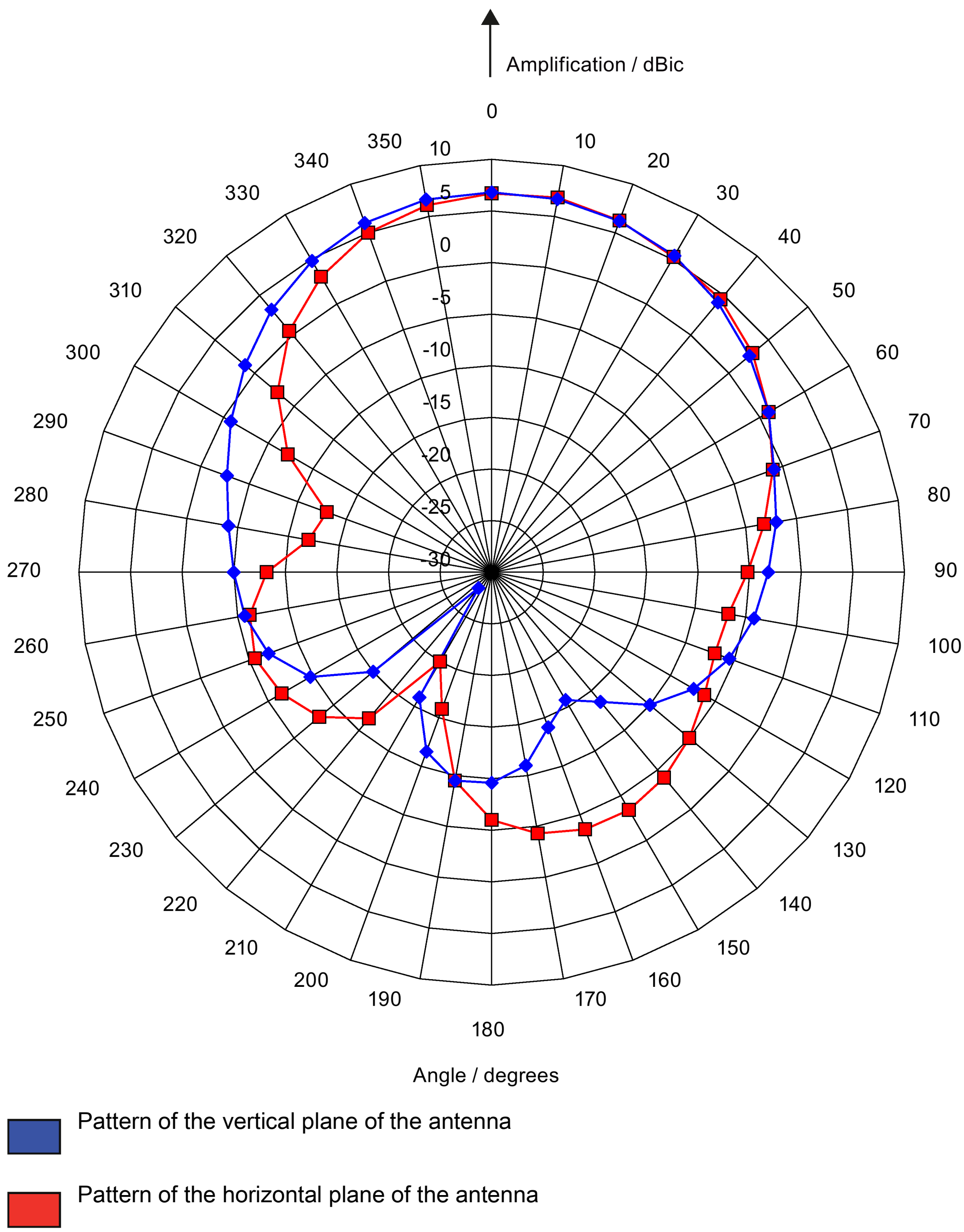


Figure 6-15 The RF640A directional radiation pattern in the ETSI frequency band, axis of symmetry of the antenna, and polarization axis of the transponder are orthogonal to each other

6.3.9.2 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.

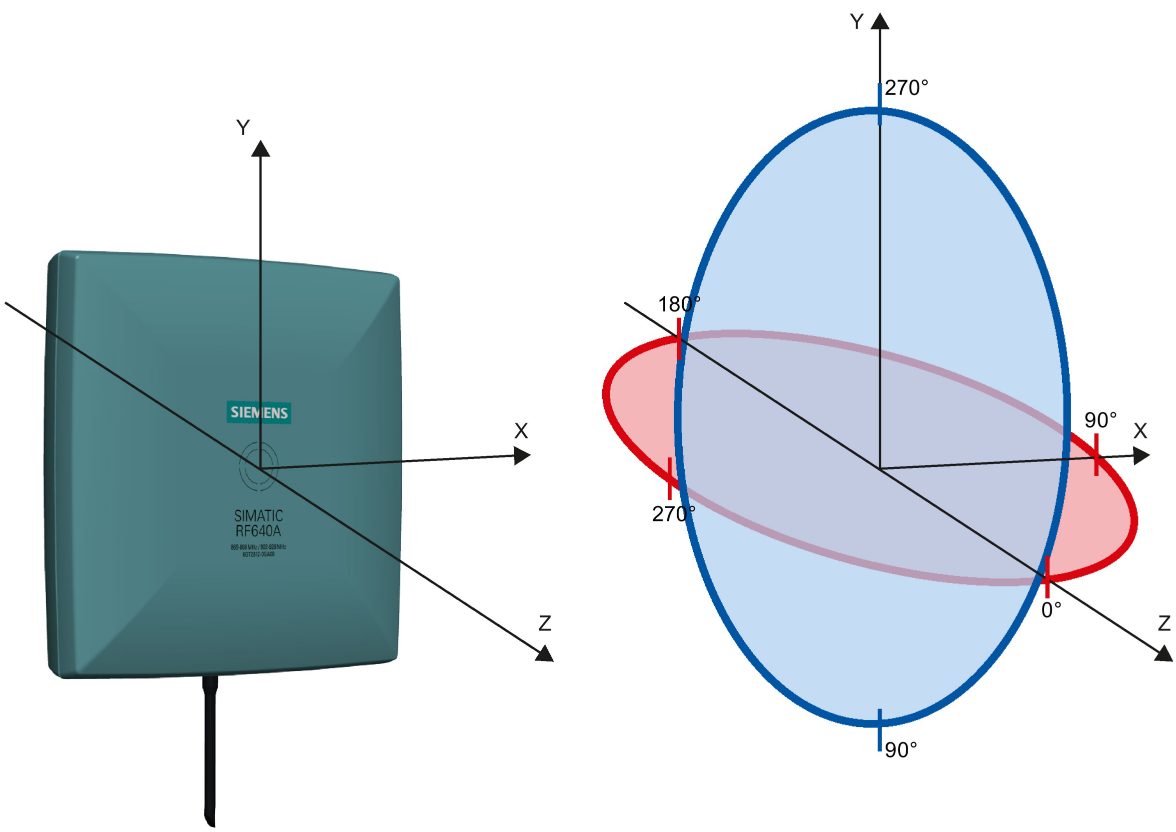


Figure 6-16 Reference system

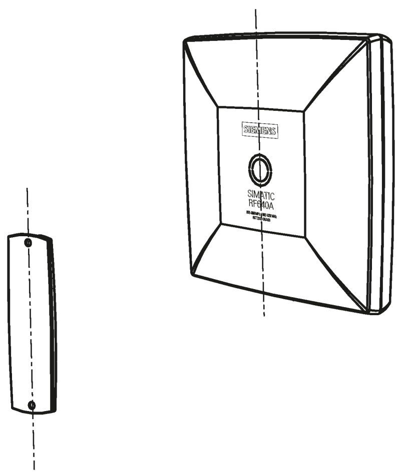
The half-power beam width of the antenna is defined by the angle between the two -3 dB points (corresponding to half the power referred to the maximum power). Which range (in %) corresponds to the dB values in the patterns can be obtained from this table (Page 320).

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.



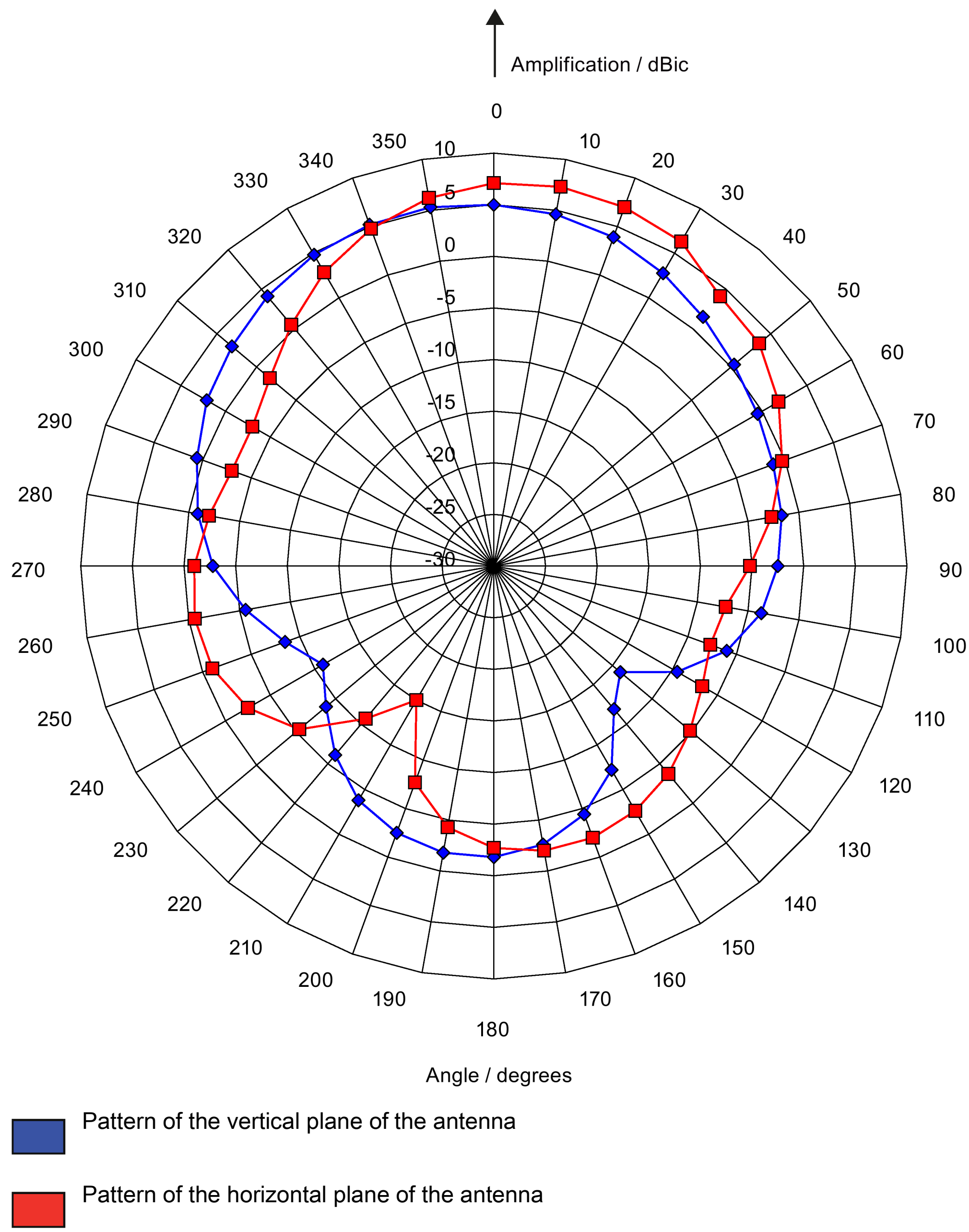
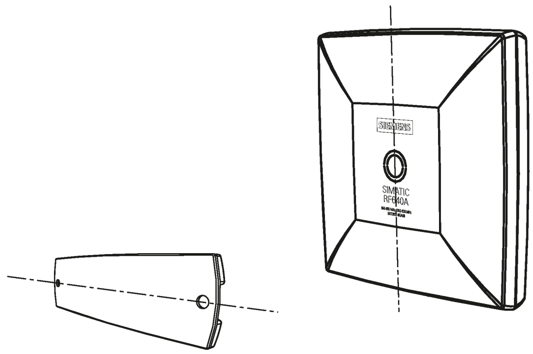


Figure 6-17 The RF640A directional radiation pattern in the FCC frequency band, polarization axis of the transponder, and axis of symmetry of the antenna are parallel to each other

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.



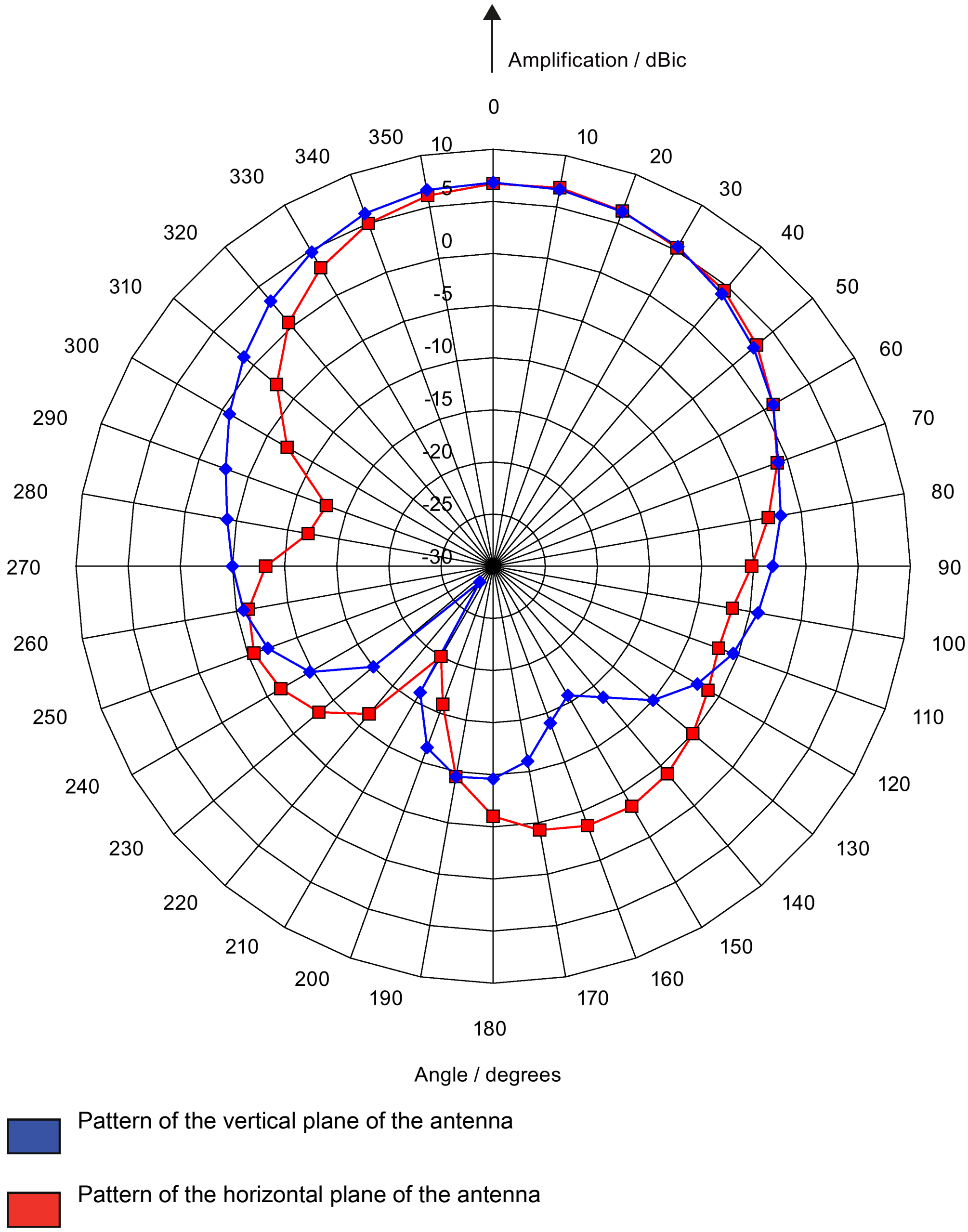


Figure 6-18 The RF640A directional radiation pattern in the FCC frequency band, axis of symmetry of the antenna, and polarization axis of the transponder are orthogonal to each other

6.3.9.3 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 311), 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 311) and the associated representation of the reference system (Page 310)).

6.3.10 Technical data

Table 6- 18 General technical specifications RF640A

	6GT2812-0GA08
Product type designation	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 band	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 • RF650R: ≤ 1300 mW ERP • RF680R/RF685R: ≤ 2000 mW ERP
Max. radiated power according to CMIIT	• RF620R, RF630R: ≤ 650 mW ERP • RF640R, RF670R: ≤ 1300 mW ERP • RF650R: ≤ 1300 mW ERP • RF680R/RF685R: ≤ 2000 mW ERP
Max. radiated power according to FCC	• RF620R, RF630R: ≤ 1070 mW EIRP • RF640R, RF670R: ≤ 2700 mW EIRP • RF650R: ≤ 2000 mW EIRP • RF680R/RF685R: ≤ 4000 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

	6GT2812-0GA08
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
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	IP65
Weight, approx.	600 g

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

6.3.11 Dimension drawing

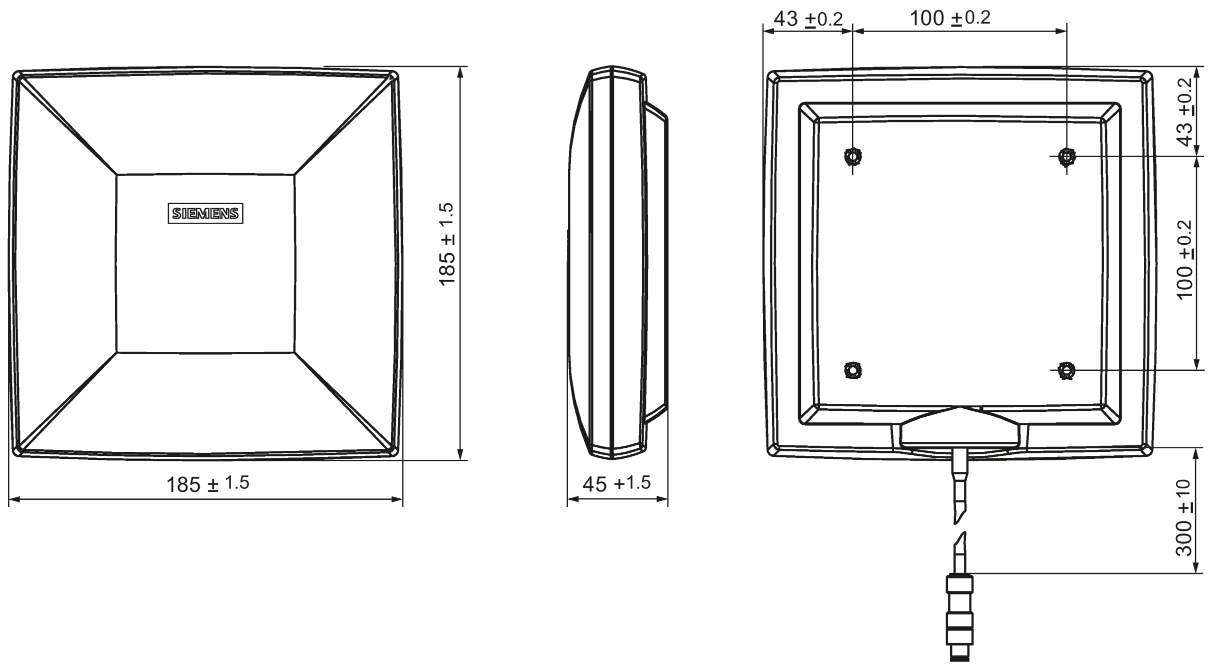


Figure 6-19 Dimension drawing RF640A

All dimensions in mm

6.3.12 Approvals & certificates

Table 6- 19 6GT2812-0GA08

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

Table 6- 20 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 • FCC ID: NXW-RF600R2 (for RF650R: 6GT2811-6AB20-1AA0, RF680R: 6GT2811-6AA10-1AA0, RF685R: 6GT2811-6CA10-1AA0)
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) • IC: 267X-RF600R2, Model RF650R (for 6GT2811-6AB20-1AA0) • IC: 267X-RF600R2, Model RF680R (for 6GT2811-6AA10-1AA0) • IC: 267X-RF600R2, Model RF685R (for 6GT2811-6CA10-1AA0)
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. 8 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	IP65

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- 21 Ordering data RF642A

Product	Article number
SIMATIC RF642A	6GT2812-1GA08

Table 6- 22 Ordering data accessories

Product		Article number
Connecting cable between reader and antenna	1 m (cable loss 0.5 dB)	6GT2815-0BH10
	3 m (cable loss 1.0 dB)	6GT2815-0BH30
	5 m, suitable for drag chains (cable loss 1.5 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
	40 m (cable loss 5.0 dB)	6GT2815-0BN40
Antenna mounting kit	See "RF600 System Manual", section "Antennas" > "Mounting types"	6GT2890-0AA00

6.4.3 Installation and assembly

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", section "Antennas" > "Types of mounting").

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 1 m, 3 m, 5 m, 10 m, 15 m and 20 m are available to connect the antenna.

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

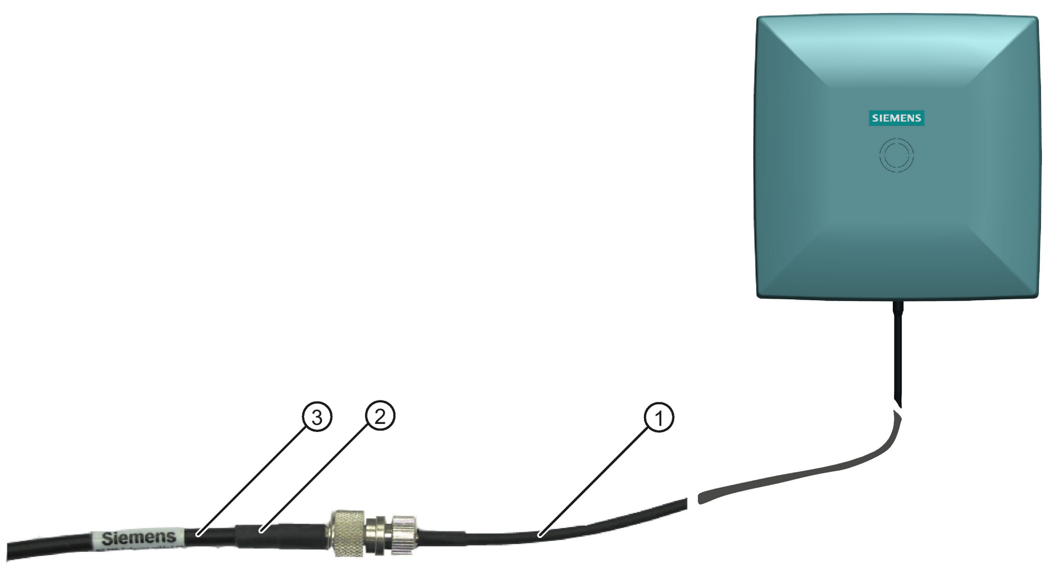
Note

Use of Siemens antenna cable

To ensure optimum functioning of the antenna, it is recommended that a Siemens antenna cable 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 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	Article number	Length [m]	Cable loss [dB]	Bending radius [mm]	Bending cycle
RF642A connecting cable	Fixed connection to antenna	0.3	-	15	Once
Antenna cable	6GT2815-0BH10	1	0.5	51	Once
Antenna cable	6GT2815-0BH30	3	1	51	Once
Antenna cable (suitable for drag chains)	6GT2815-2BH50	5	1.5	48	1)
Antenna cable	6GT2815-1BN10	10	2	77	Once
Antenna cable	6GT2815-0BN10	10	4	51	Once
Antenna cable (suitable for drag chains)	6GT2815-0BN15	15	4	24	1)
Antenna cable	6GT2815-0BN20	20	4	77	Once
Antenna cable	6GT2815-0BN40	40	5	77	Once

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.

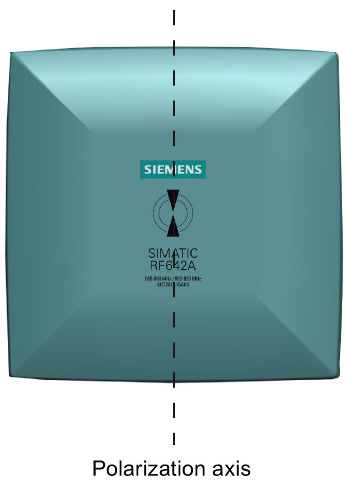


Figure 6-21 Polarization axis

Alignment

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

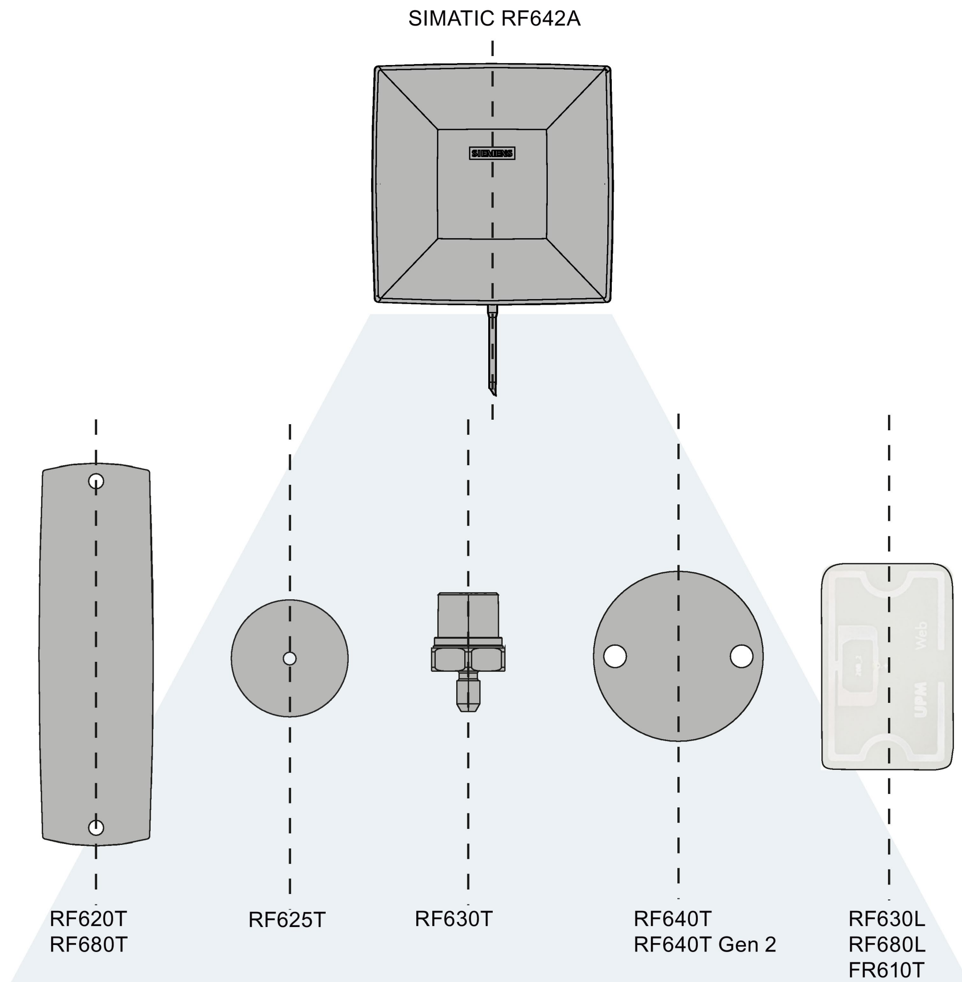


Figure 6-22 Antenna/transponder alignment

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

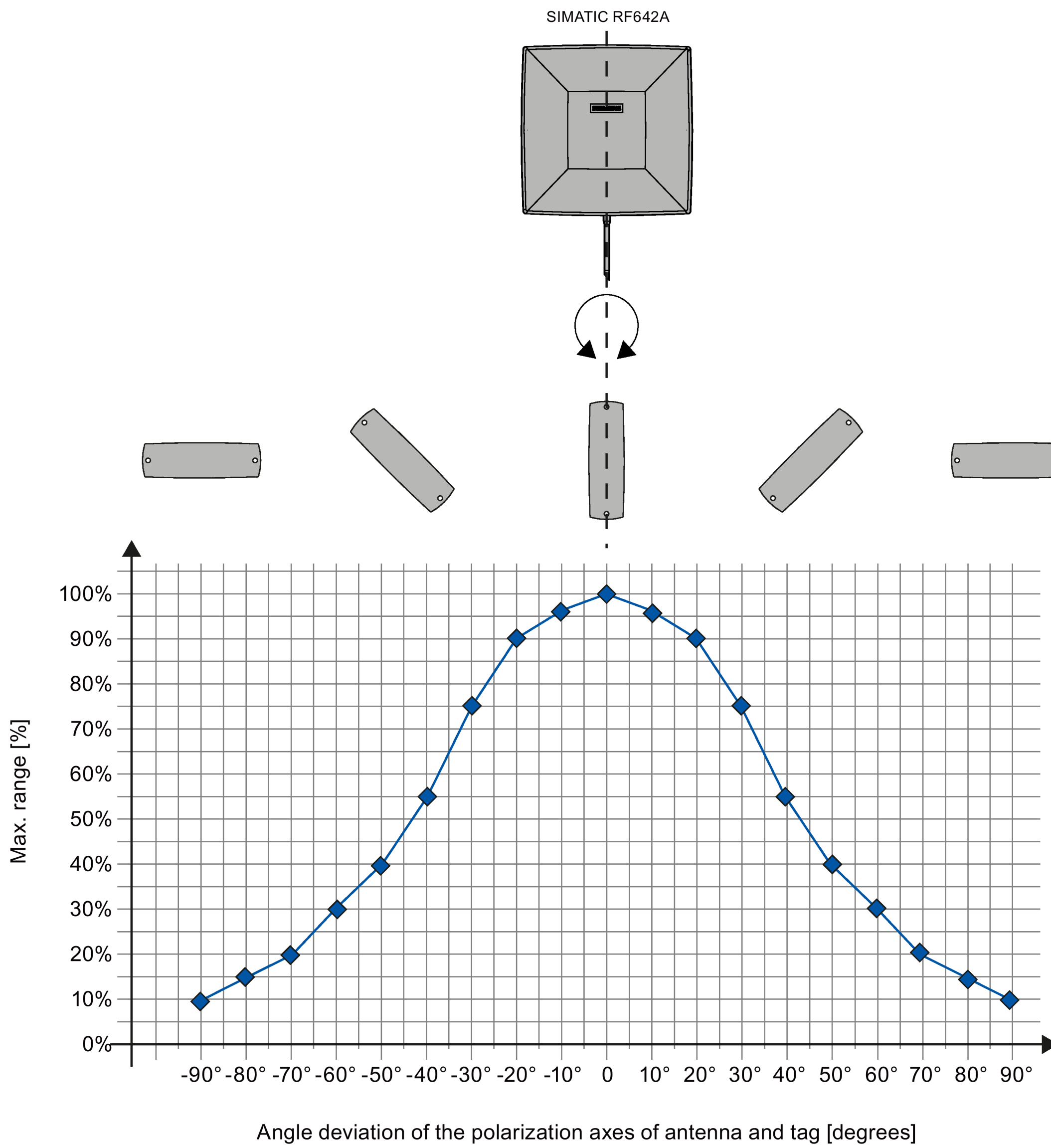


Figure 6-23 Angle deviation diagram for alignment

6.4.6 Parameter settings of RF642A for RF620R/RF630R

Operation within the EU, EFTA, or Turkey according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 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 setting a 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 maximum permitted 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 (https://support.industry.siemens.com/cs/ww/en/view/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 transmit 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 can be put into operation, as long as the 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)

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

6.4.7 Parameter settings of RF642A for RF640R/RF670R

Operation within the EU, EFTA, or Turkey according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 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 setting a radiated power of up to 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP), an RF642A antenna gain of 6 dBi and taking into account the cable loss associated with the antenna cable (see table), the maximum transmit power of the reader is correctly configured and the maximum permitted radiated power of the antenna is 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), an RF642A antenna gain of 7 dBi and taking into account the cable loss associated with the antenna cable (see table), the reader's transmit power is correctly configured.

Operation in the USA, Canada

Note

Limitation of the transmit 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 can be put into operation, as long as the 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 Setting RF642A parameters for RF650R

Operation within the EU according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 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 setting a radiated power of up to 2000 mW ERP (or 33 dBm ERP, 3250 mW EIRP, 35 dBm EIRP), an RF642A antenna gain of 6 dBi and taking into account the cable loss associated with the antenna cable (see table (Page 328)), the maximum transmit power of the reader is correctly configured and the maximum permitted radiated power of the antenna is 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), an RF642A antenna gain of 7 dBi and taking into account the cable loss associated with the antenna cable (see table (Page 328)), the reader's transmit power is correctly configured.

Operation in the USA, Canada

Note

Limitation of the transmit 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 can be put into operation, as long as the 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)

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

6.4.9 Setting RF642A parameters for RF680R/RF685R

Operation within the EU according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 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 setting a radiated power of up to 2000 mW ERP, an antenna gain of 6 dBi for the RF642A and the cable loss of the antenna cable (see table (Page 328)), the transmit power of the reader is correctly configured and the maximum permitted radiated power of the antenna is 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), an RF642A antenna gain of 7 dBi and taking into account the cable loss associated with the antenna cable (see table (Page 328)), the reader's transmit power is correctly configured.

Operation in the USA, Canada

Note

Limitation of the transmit 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 can be put into operation, as long as the 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)

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

By selecting the correct country profile/frequency range and setting the radiated power (see technical specifications of the reader being used) and setting the parameters for antenna gain and cable loss, the maximum radiated power will not be exceeded.

6.4.10 Antenna patterns

6.4.10.1 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.

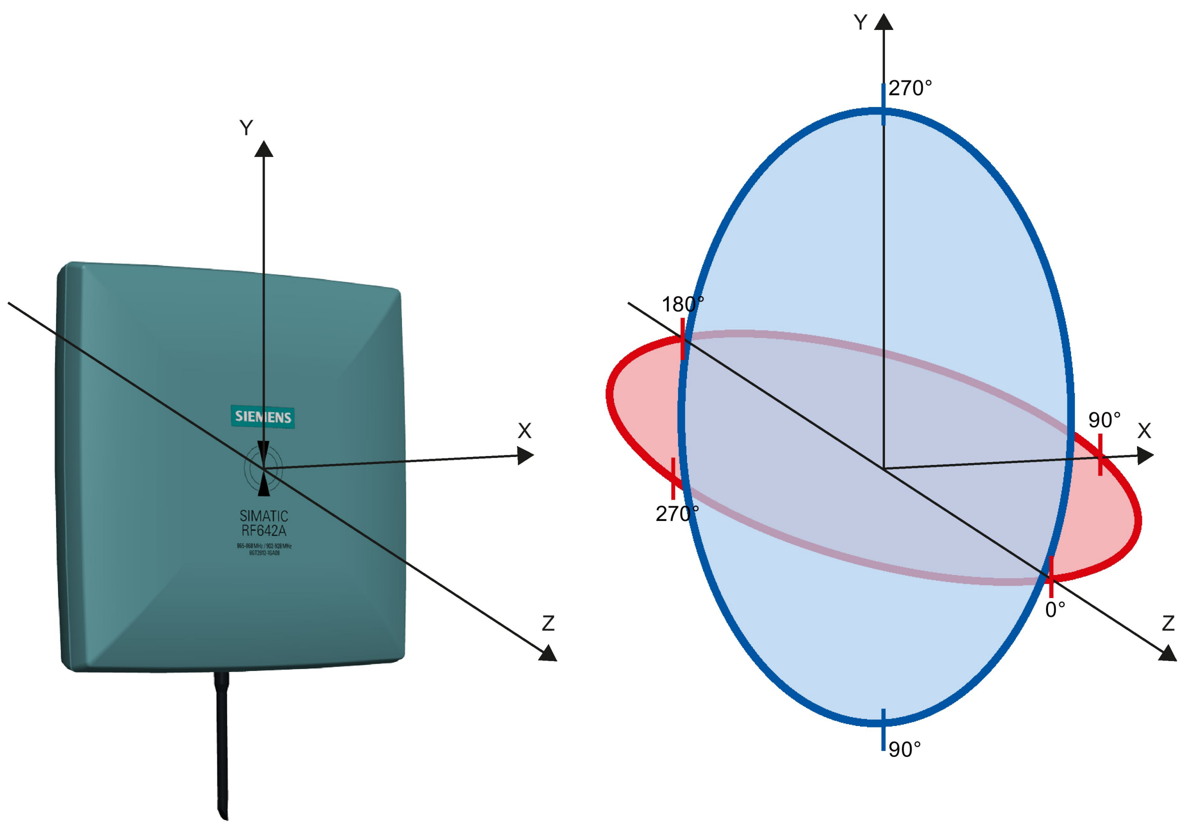


Figure 6-24 Reference system

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 (Page 339).

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

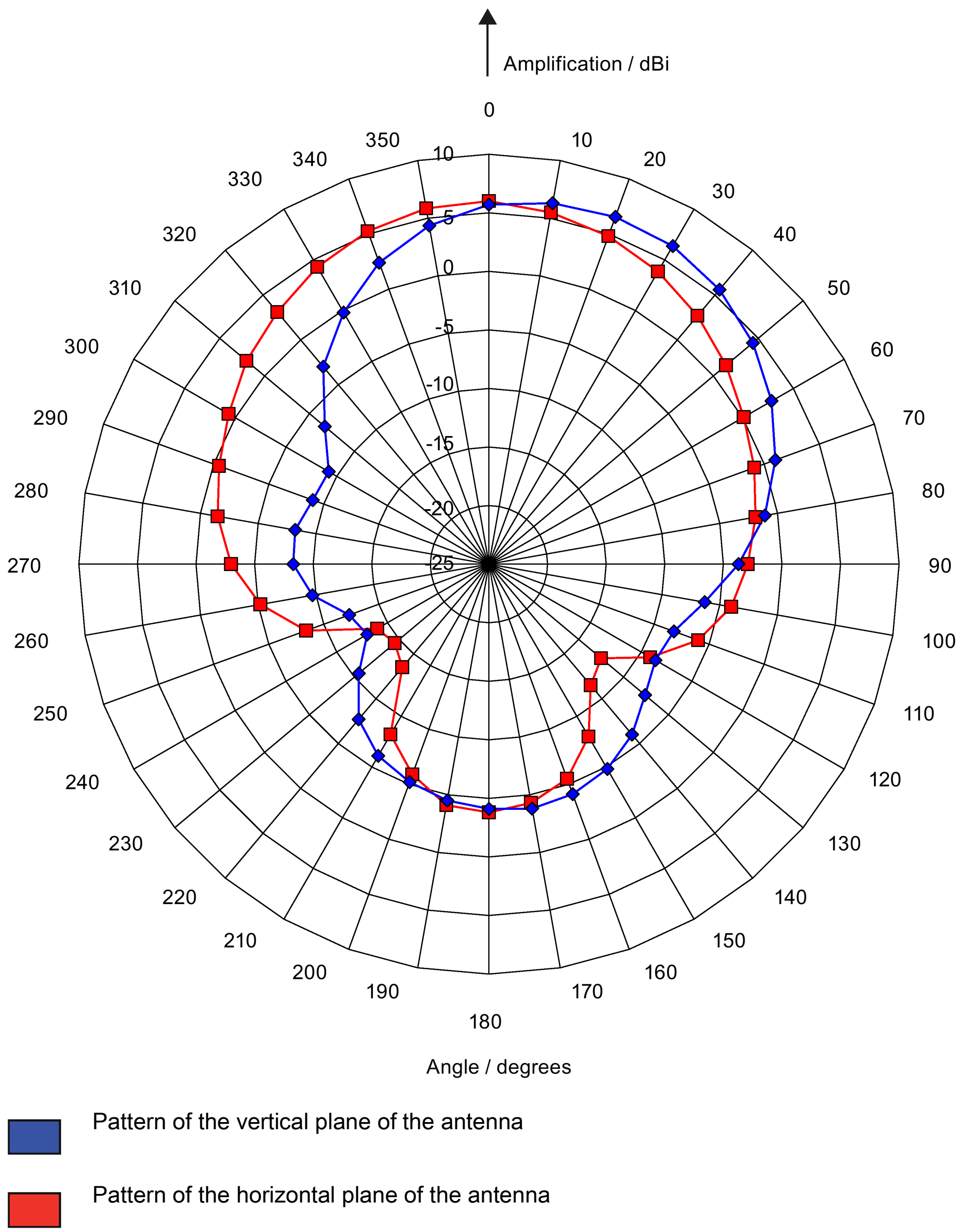


Figure 6-25 Directional radiation pattern of RF642A in the ETSI frequency band

6.4.10.2 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.

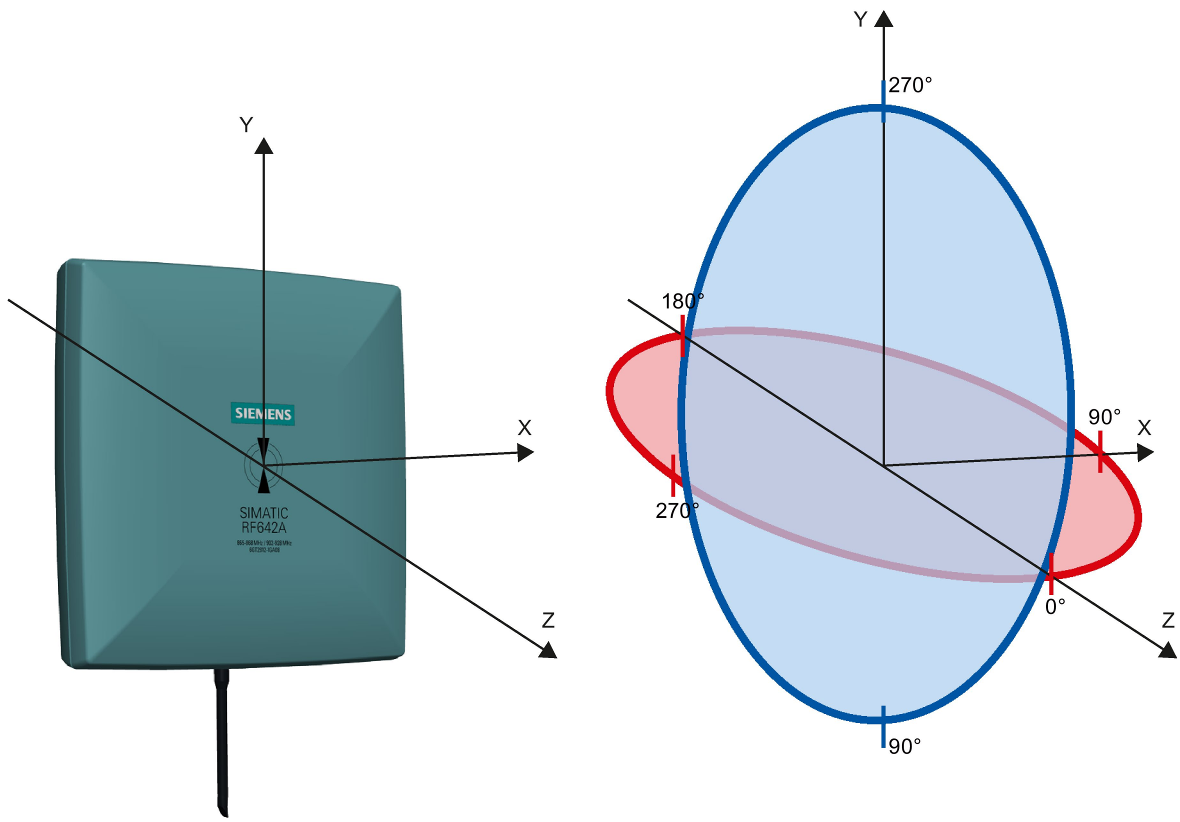


Figure 6-26 Reference system

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

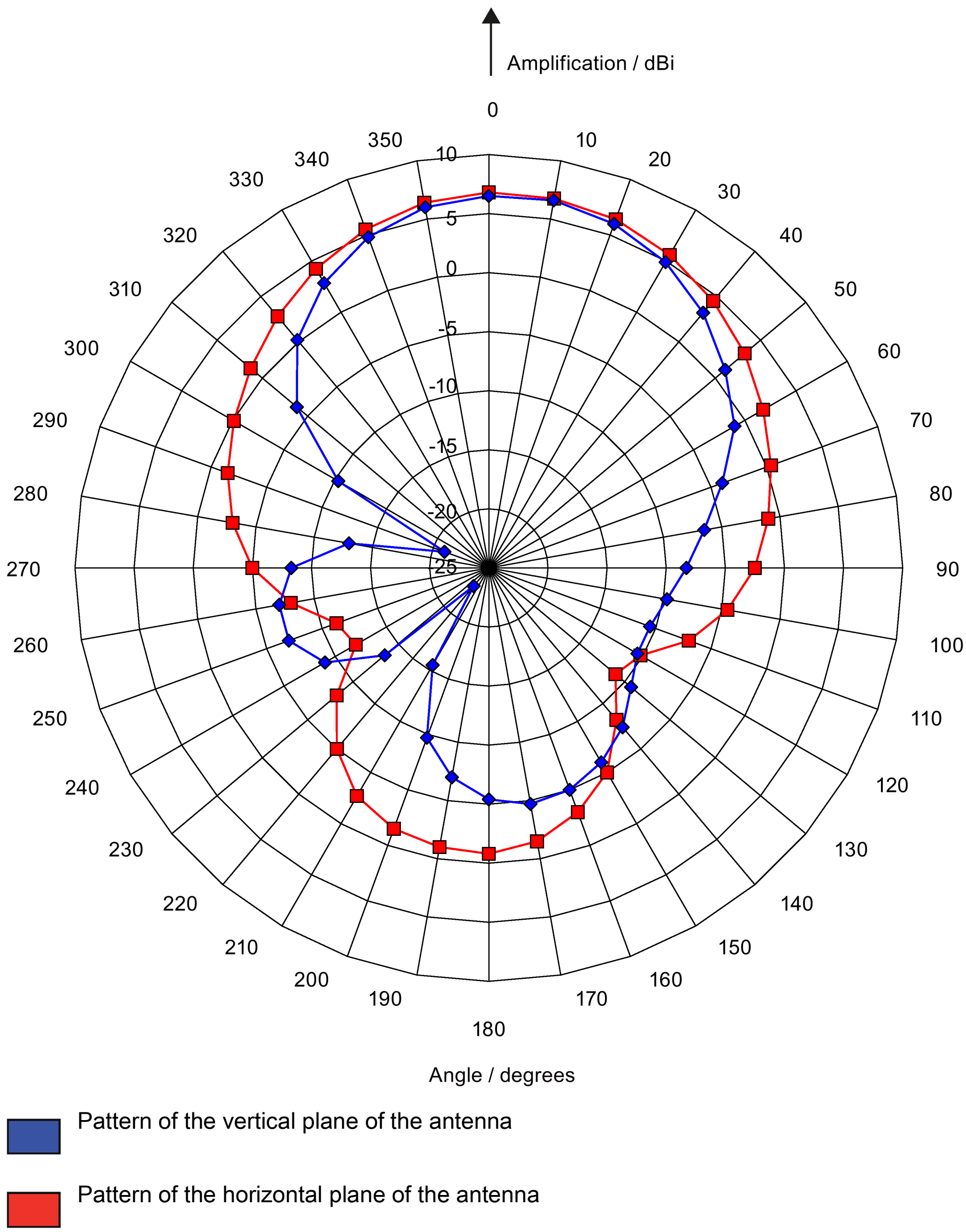


Figure 6-27 Directional radiation pattern of the RF642A in the FCC frequency band

6.4.10.3 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 337), 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 336) and the associated representation of the reference system (Page 336)).

6.4.11 Technical data

Table 6- 23 General technical specifications RF642A

	6GT2812-1GA08
Product type designation	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 band	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
Max. radiated power according to ETSI	• RF620R, RF630R: < 970 mW ERP • RF640R, RF670R: ≤ 1900 mW ERP • RF650R: ≤ 1900 mW ERP • RF680R/RF685R: ≤ 2000 mW ERP

	6GT2812-1GA08
Max. radiated power according to CMIIT	• RF620R, RF630R: < 1200 mW ERP • RF640R, RF670R: ≤ 2000 mW ERP • RF650R: ≤ 1900 mW ERP • RF680R/RF685R: ≤ 2000 mW ERP
Max. radiated power according to FCC	• RF620R, RF630R: ≤2000 mW EIRP • RF640R, RF670R: ≤ 4000 mW EIRP • RF650R: ≤ 3160 mW EIRP • RF680R/RF685R: ≤ 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 • During operation • During transportation 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.

6.4.12 Dimension drawing

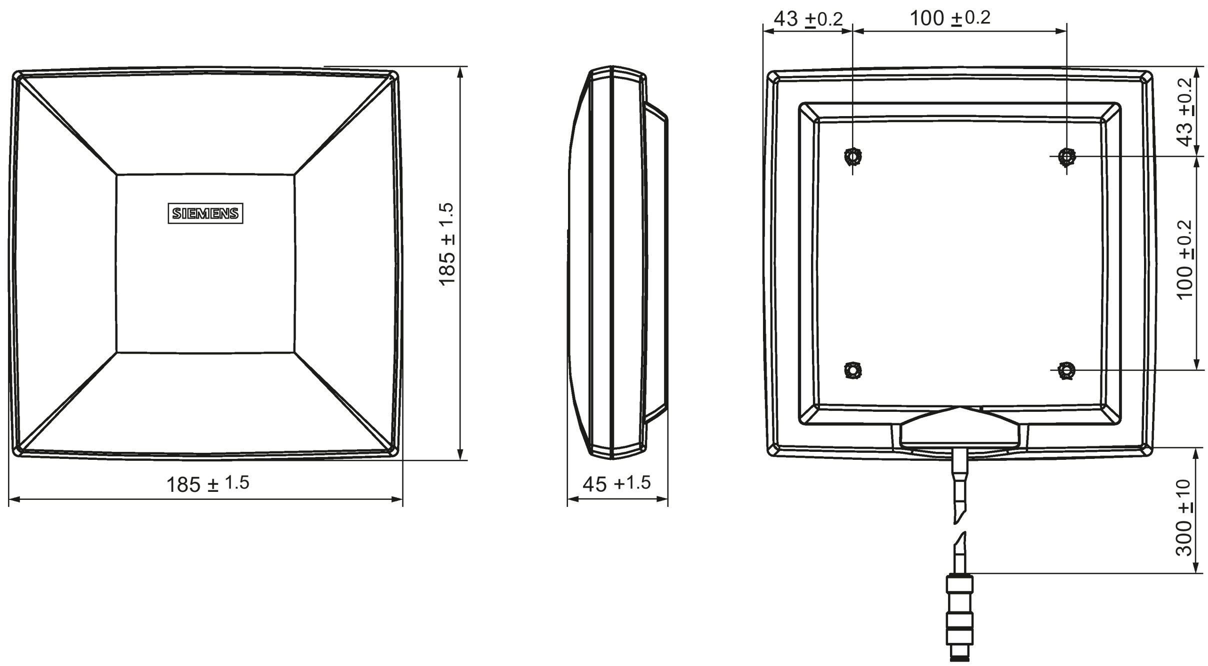


Figure 6-28 Dimensional drawing of RF642A

All dimensions in mm

6.4.13 Approvals & certificates

Table 6- 24 6GT2812-1GA08

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

Table 6- 25 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) • FCC ID: NXW-RF600R2 (for RF650R: 6GT2811-6AB20-1AA0, RF680R: 6GT2811-6AA10-1AA0, RF685R: 6GT2811-6CA10-1AA0)
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) • IC: 267X-RF600R2, Model RF650R (for 6GT2811-6AB20-1AA0) • IC: 267X-RF600R2, Model RF680R (for 6GT2811-6AA10-1AA0) • IC: 267X-RF600R2, Model RF685R (for 6GT2811-6CA10-1AA0)
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

6.5 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. 8 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 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, 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.

Table 6- 26 Ordering data RF660A

Description	Article number
RF660A antenna for Europe (865-868)	6GT2812-0AA00
RF660A antenna for China and the USA (902-928)	6GT2812-0AA01

Table 6- 27 Ordering data accessories

Product		Article number
Connecting cable between reader and antenna	1 m (cable loss 0.5 dB)	6GT2815-0BH10
	3 m (cable loss 1.0 dB)	6GT2815-0BH30
	5 m, suitable for drag chains (cable loss 1.5 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
	40 m (cable loss 5.0 dB)	6GT2815-0BN40
Antenna mounting kit	See "RF600 System Manual", section "Antennas" > "Mounting types"	6GT2890-0AA00

6.5.2 Installation and assembly

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", section "Antennas" > "Types of mounting").

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.

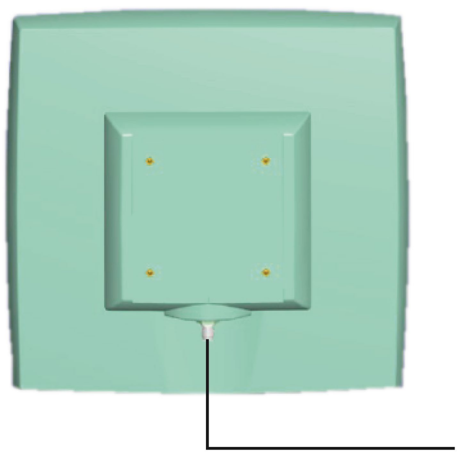


Figure 6-29 Rear of antenna with RTNC connection

Connecting RF660A to RF640R/RF670R

Preassembled standard cables in lengths of 1 m, 3 m, 5 m, 10 m, 15 m and 20 m are available to connect the antenna.

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	Article number	Length [m]	Cable loss [dB]	Bending radius [mm]	Bending cycle
RF642A connecting cable	Fixed connection to antenna	0.3	-	15	Once
Antenna cable	6GT2815-0BH10	1	0.5	51	Once
Antenna cable	6GT2815-0BH30	3	1	51	Once
Antenna cable (suitable for drag chains)	6GT2815-2BH50	5	1.5	48	[1)]
Antenna cable	6GT2815-1BN10	10	2	77	Once
Antenna cable	6GT2815-0BN10	10	4	51	Once
Antenna cable (suitable for drag chains)	6GT2815-0BN15	15	4	24	[1)]
Antenna cable	6GT2815-0BN20	20	4	77	Once
Antenna cable	6GT2815-0BN40	40	5	77	Once

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.

6.5.4 Parameter settings of RF660A for RF620R/RF630R

Operation within the EU, EFTA, or Turkey according to DIN EN 302208 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 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 (10 dBic) and the cable loss associated with the antenna cable (see table (Page 347)), the maximum permitted 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 (https://support.industry.siemens.com/cs/ww/en/view/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 transmit power to 4000 mW EIRP (36 dBm EIRP)

To meet the FCC and IC-FCB requirements, 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 (≤ 6 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 according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 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 setting a radiated power of up to 1300 mW ERP (or 31.15 dBm ERP, 2140 mW EIRP, 33.3 dBm EIRP), an RF660A antenna gain of 7 dBi (10 dBic) and taking into account the cable loss associated with the antenna cable (see table (Page 347)), the maximum permitted 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 (9 dBic) and the cable loss associated with the antenna cable (see table (Page 347)), the transmit power of the reader is correctly configured.

Operation in the USA, Canada

Note

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

To meet the FCC and IC requirements, 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 (≤ 6 dBi)
- Cable loss a_k dB (≥ 1 dB)

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

6.5.6 Setting RF660A parameters for RF650R

Operation within the EU according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 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 setting a radiated power of up to 1300 mW ERP, an antenna gain of 7 dBi (10 dBic) for the RF660A and the cable loss of the antenna cable (see table (Page 347)), the transmit power of the reader is correctly configured and the maximum permitted radiated power of the antenna is 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 RF660A antenna gain of 6 dBi (9 dBic) and the cable loss associated with the antenna cable (see table (Page 347)), the transmit power of the reader is correctly configured.

Operation in the USA, Canada

Note

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

To meet the FCC and IC requirements, 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 (≤ 6 dBi)
- Cable loss a_k dB (≥ 1 dB)

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

6.5.7 Setting RF660A parameters for RF680R/RF685R

Operation within the EU according to DIN EN 302208 V1.4.1

Note

Limitation of the radiated power according to DIN EN 302208 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 setting a radiated power of up to 2000 mW ERP, an antenna gain of 7 dBi (10 dBic) for the RF660A and the cable loss of the antenna cable (see table (Page 347)), the transmit power of the reader is correctly configured and the maximum permitted radiated power of the antenna is 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 RF660A antenna gain of 6 dBi (9 dBic) and the cable loss associated with the antenna cable (see table (Page 347)), the transmit power of the reader is correctly configured.

Operation in the USA, Canada

Note

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

To meet the FCC and IC requirements, 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 (≤ 6 dBi)
- Cable loss a_k dB (≥ 1 dB)

P(dBm) ≤ 30 dBm - (G_i - 6 dBi) + a_k

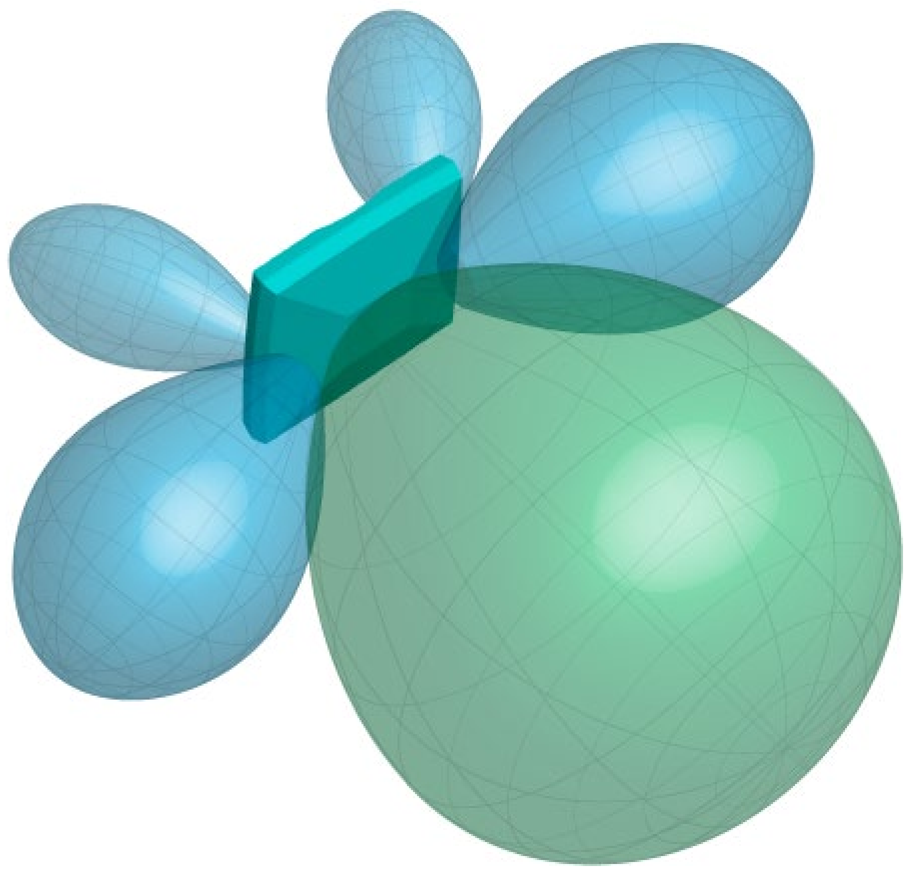
By selecting the correct country profile/frequency range and setting the radiated power (see technical specifications of the reader being used) and setting the parameters for antenna gain and cable loss, the maximum radiated power will not be exceeded.

6.5.8 Antenna patterns

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.

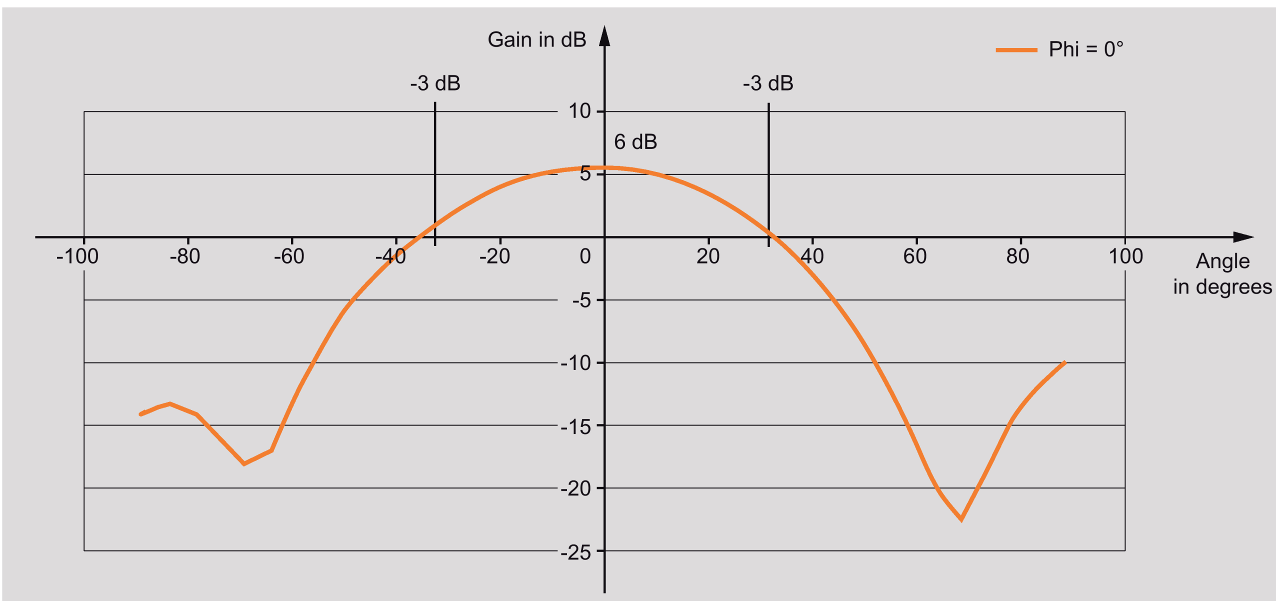


Figure 6-31 Directional radiation pattern of the antenna (at 865 MHz, horizontal alignment)

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.

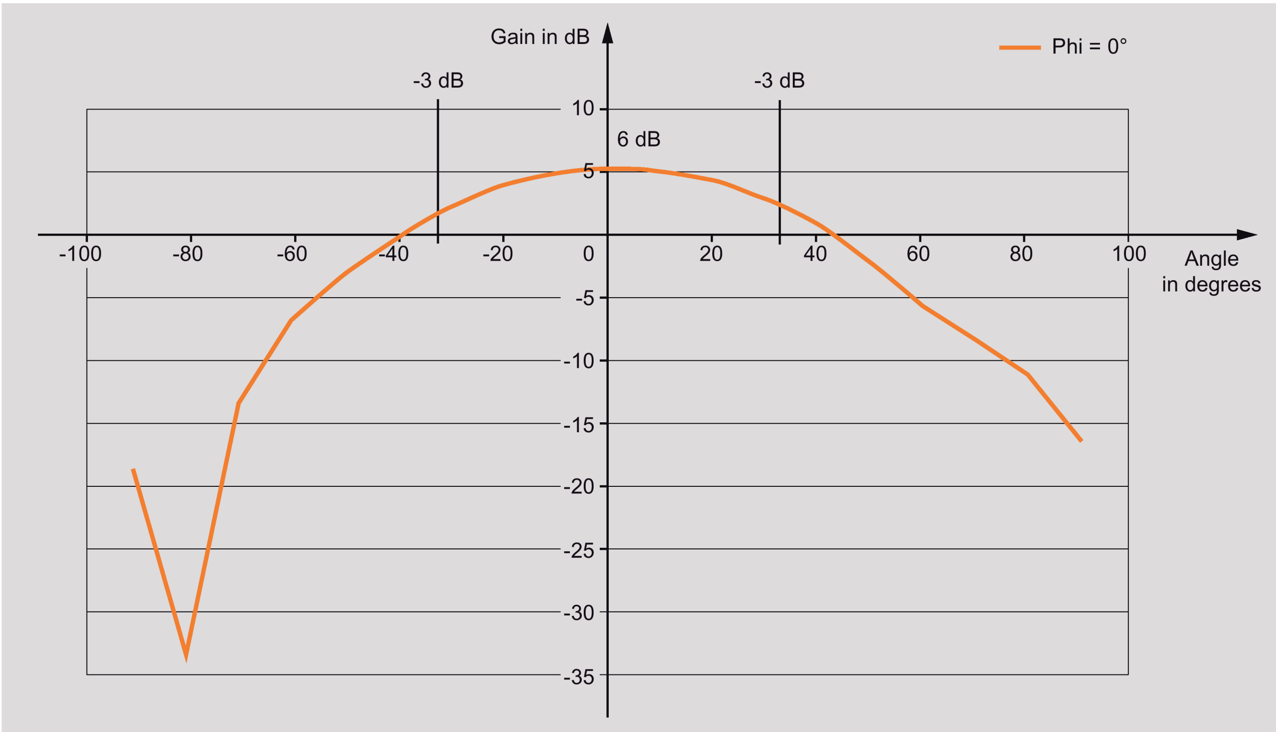


Figure 6-32 Directional radiation pattern of the antenna (at 915 MHz, horizontal alignment)

6.5.9 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 patterns (Page 352), 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.

6.5.10 Technical data

Table 6- 28 General technical specifications RF660A

	6GT2812-0AA00	6GT2812-0AA01
	ETSI	**FCC, CMIIT**
Product type designation	SIMATIC RF660A	
Dimensions (L x W x H)	313 x 313 x 80 mm	
Color	Pastel turquoise	
Material	PA 12 (polyamide 12)	
	Silicone-free	
Frequency band	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 • RF650R: < 2000 mW ERP • RF680R/RF685R: < 2000 mW ERP	-
Max. radiated power according to CMIIT	-	• RF620R, RF630R: < 1000 mW ERP • RF640R, RF670R: < 2000 mW ERP • RF650R: < 2000 mW ERP • RF680R/RF685R: < 2000 mW ERP

	6GT2812-0AA00	6GT2812-0AA01
	ETSI	**FCC, CMIIT**
Max. radiated power according to FCC	-	• RF620R, RF630R: < 1600 mW EIRP • RF640R, RF670R: < 4000 mW EIRP • RF650R: < 4000 mW EIRP • RF680R/RF685R: < 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	
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	

6.5.11 Dimension drawing

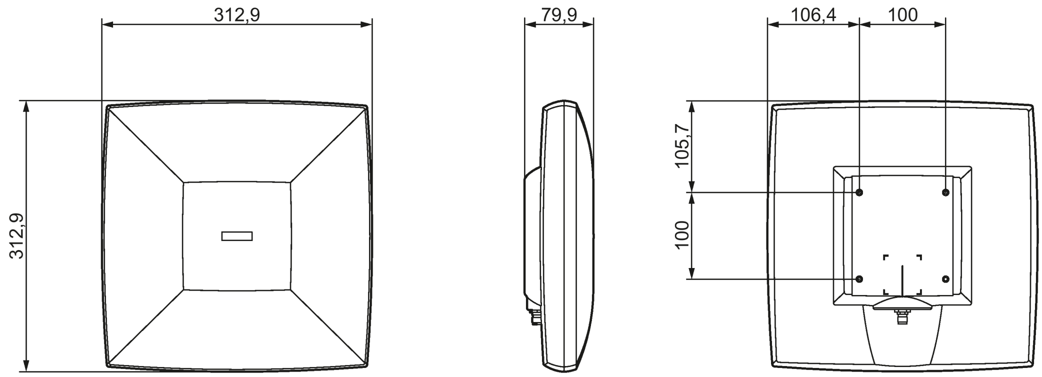


Figure 6-33 Dimension drawing RF660A

All dimensions in mm (± 0.5 mm tolerance)

6.5.12 Approvals & certificates

Table 6- 29 6GT2812-0AA00

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

Table 6- 30 6GT2812-0AA01

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) • FCC ID: NXW-RF600R2 (for RF650R: 6GT2811-6AB20-1AA0, RF680R: 6GT2811-6AA10-1AA0, RF685R: 6GT2811-6CA10-1AA0)
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) • IC: 267X-RF600R2, Model RF650R (for 6GT2811-6AB20-1AA0) • IC: 267X-RF600R2, Model RF680R (for 6GT2811-6AA10-1AA0) • IC: 267X-RF600R2, Model RF685R (for 6GT2811-6CA10-1AA0)
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

6.6 Mounting types

6.6.1 Overview

The following read points have a standardized VESA 100 mounting system (4 x M4) and can be secured with an antenna mounting kit:

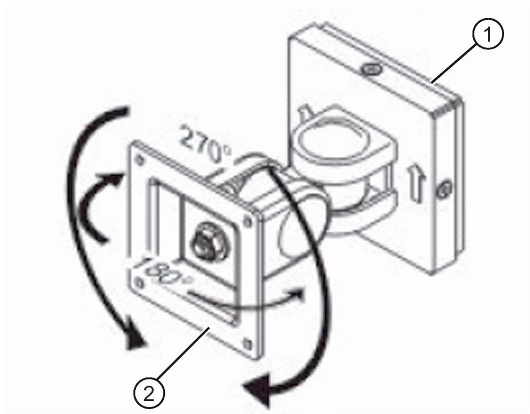
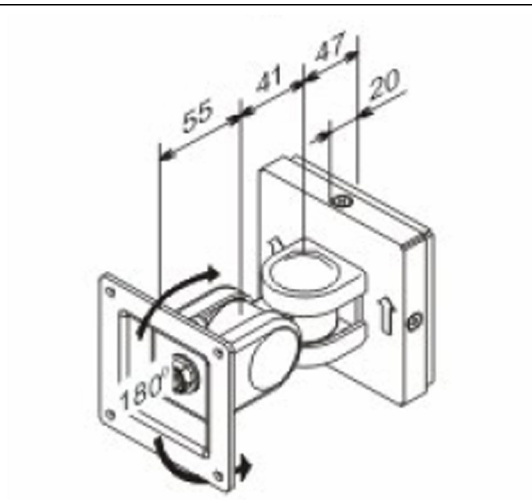
- SIMATIC RF620R/RF630R/RF640R/RF670R
- SIMATIC RF685R
- SIMATIC RF640A
- SIMATIC RF642A
- SIMATIC RF660A

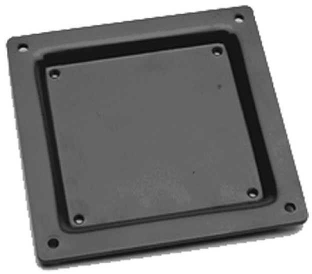
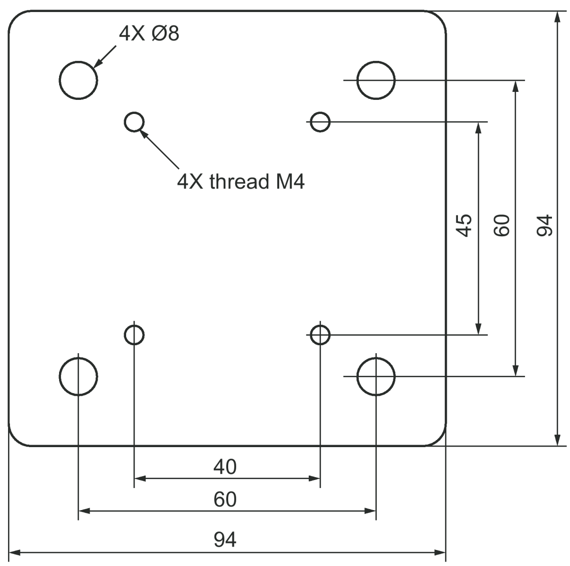
6.6.2 Ordering data

Description	Article number
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 in any direction 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 to fix the antenna to the antenna mounting kit.
	Hole drilling template for fixing the antenna mounting kit to the wall

7 Transponder/tags

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)

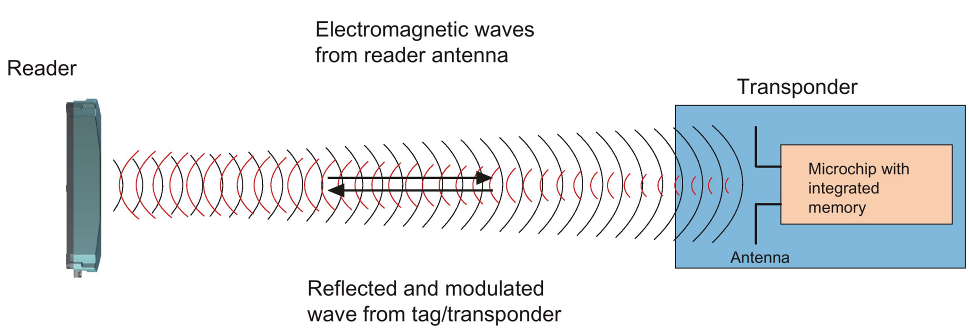


Figure 7-1 Mode of operation of transponders

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)
- TID
- 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.

Default setting of the EPC-ID Siemens industrial transponders

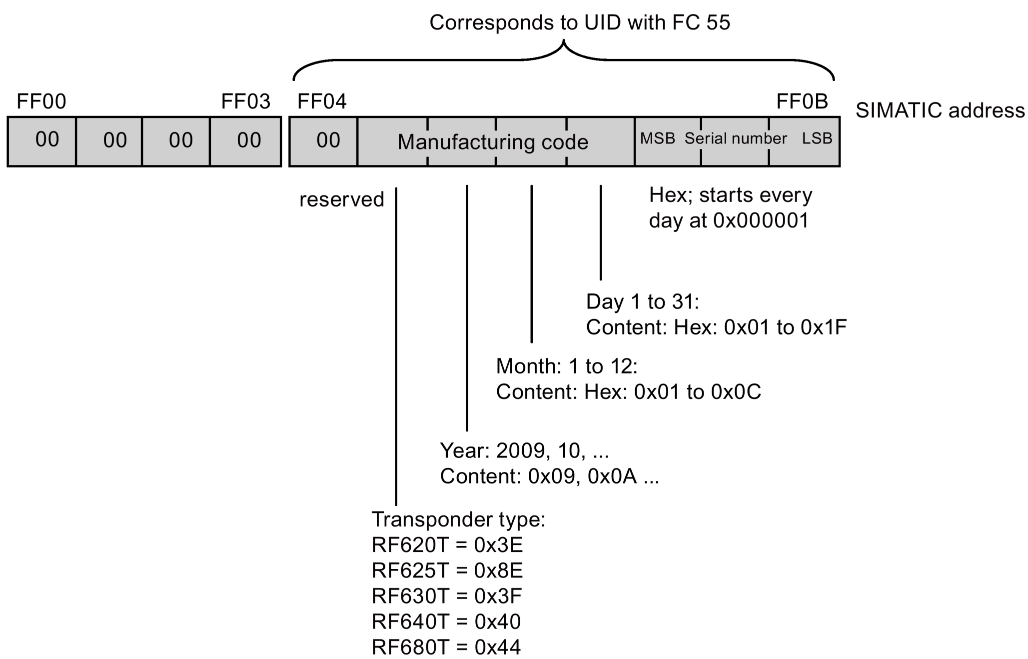


Figure 7-2 Assignment of the EPC-ID on delivery of the transponder

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.

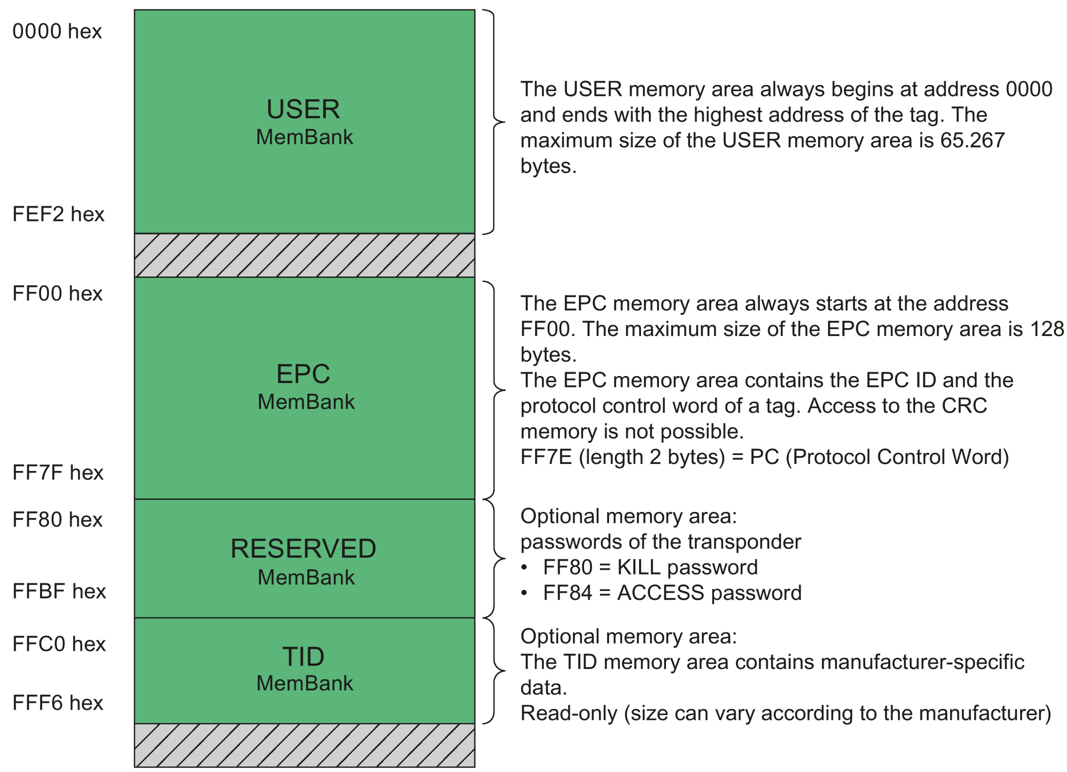


Figure 7-3 SIMATIC memory areas of the RF600 transponders

Special memory configuration of the RF600 transponders and labels

Table 7- 1 Address spaces of the transponder variants for RF620R/RF630R

Tags	Chip type	User [1)] [hex]	EPC		TID (read only)	RESERVED (passwords)	Special	
		Area / length	Area / length (max. and default)	Access	Area / length	Area / length	KILL-PW	Lock function
RF622L	Fujitsu MB97R803	00 - 6AFF 3224 bytes	FF00-FF45 / 560 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFFC 32 bytes	FF80-FF87 8 bytes	yes	yes
RF630L (-2AB00, -2AB01)	Impinj Monza 2	-	FF00-FF0B / 96 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFC3 4 bytes	FF80-FF87 8 bytes	Yes	Yes
RF630L (-2AB02)	Impinj Monza 4QT [2)]	00 - 3F 64 bytes	FF00-FF0F / 128 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFCB 12 bytes	FF80-FF87 8 bytes	Yes	Yes
RF630L (-2AB03)	NXP G2XM	00 - 3F 64 bytes	FF00-FF1D / 240 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFC7 8 bytes	FF80-FF87 8 bytes	Yes	Yes
RF640L	Alien Higgs 3	00 - 0F/3F [3)] 16/64 bytes	FF00-FF3C / 480 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFD8 24 bytes	FF80-FF87 8 bytes	Yes	Yes
RF680L	NXP G2XM	00 - 3F 64 bytes	FF00-FF1D / 240 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFC7 8 bytes	FF80-FF87 8 bytes	Yes	Yes
RF690L	Alien Higgs 3	00 - 0F/3F [3)] 16/64 bytes	FF00-FF3C / 480 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFD8 24 bytes	FF80-FF87 8 bytes	Yes	Yes
RF610T	NXP G2XM	00 - 3F 64 bytes	FF00-FF1D / 240 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFC7 8 bytes	FF80-FF87 8 bytes	LOCKED	Yes
RF620T	Impinj Monza 4QT [2)]	00 - 3F 64 bytes	FF00-FF0F / 128 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFCB 12 bytes	FF80-FF87 8 bytes	LOCKED	Yes
RF622T	Fujitsu MB97R803	00 - 6AFF 3224 bytes	FF00-FF45 / 560 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFFC 32 bytes	FF80-FF87 8 bytes	yes	yes
RF625T	Impinj Monza 4QT [2)]	00 - 3F 64 bytes	FF00-FF0F / 128 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFCB 12 bytes	FF80-FF87 8 bytes	LOCKED	Yes
RF630T	NXP G2XM	00 - 3F 64 bytes	FF00-FF1D / 240 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFC7 8 bytes	FF80-FF87 8 bytes	LOCKED	Yes

Tags	Chip type	User [1] [hex]	EPC		TID (read only)	RESERVED (passwords)	Special	
		Area / length	Area / length (max. and default)	Access	Area / length	Area / length	KILL-PW	Lock function
RF640T	NXP G2XM	00 - 3F 64 bytes	FF00-FF1D / 240 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFC7 8 bytes	FF80-FF87 8 bytes	LOCKED	Yes
RF680T	NXP G2XM	00 - 3F 64 bytes	FF00-FF1D / 240 bits FF00-FF0B / 96 bits	read/ write	FFC0-FFC7 8 bytes	FF80-FF87 8 bytes	LOCKED	Yes

1) The user area also applies to the new readers RF650R/RF680R/RF685R in memory bank 3.

2) Uses User Memory Indicator (UMI).

3) The EPC memory area of the Alien Higgs chips can be increased at the cost of the user memory. You will find further information in the relevant transponder sections.

Address spaces of the transponder variants for RF650R/RF680R/RF685R

With the new readers RF650R/RF680R/RF685R, the user data, TID, EPC and passwords are read out via the relevant memory banks. To read out the required data, the relevant memory bank must be selected.

The table above shows the area and length of the user data ("USER" column). You can read out the EPC-ID using an inventory command. As an alternative, you can also read out the EPC-ID using a Read command to memory bank 1, start address 0x04.

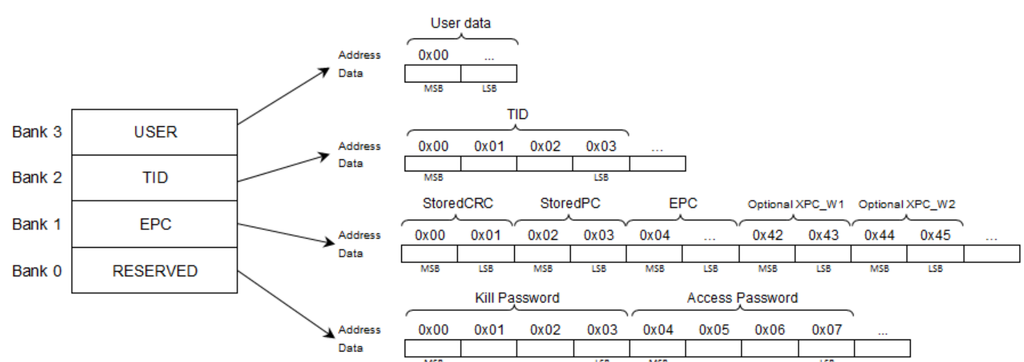


Figure 7-4 Memory configuration

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 "Default setting of the EPC-ID Siemens industrial transponders").

Parameter assignment

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 515)". Detailed information on parameter assignment as well as examples for describing and reading specific memory areas can be found in the referenced sections of the documentation.

7.1.5 Memory map of the RF600 transponders according to ISO 18000-6C

The memory of the ISO 18000-6C 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	Specified by the manufacturer. The TID contains the class identifier and depending on the transponder type also the serial number of the transponder.
MemBank 01_2	EPC	Contains the EPC-ID data, the protocol information (Protocol Control Word) and the CRC data of the transponder. You can write to the EPC memory area.
MemBank 00_2	RESERVED	Contains the access and kill password.

The following graphics show the precise memory assignment of the various chips. Each box in the right part of the graphic represents one word (16 bits) in the memory.

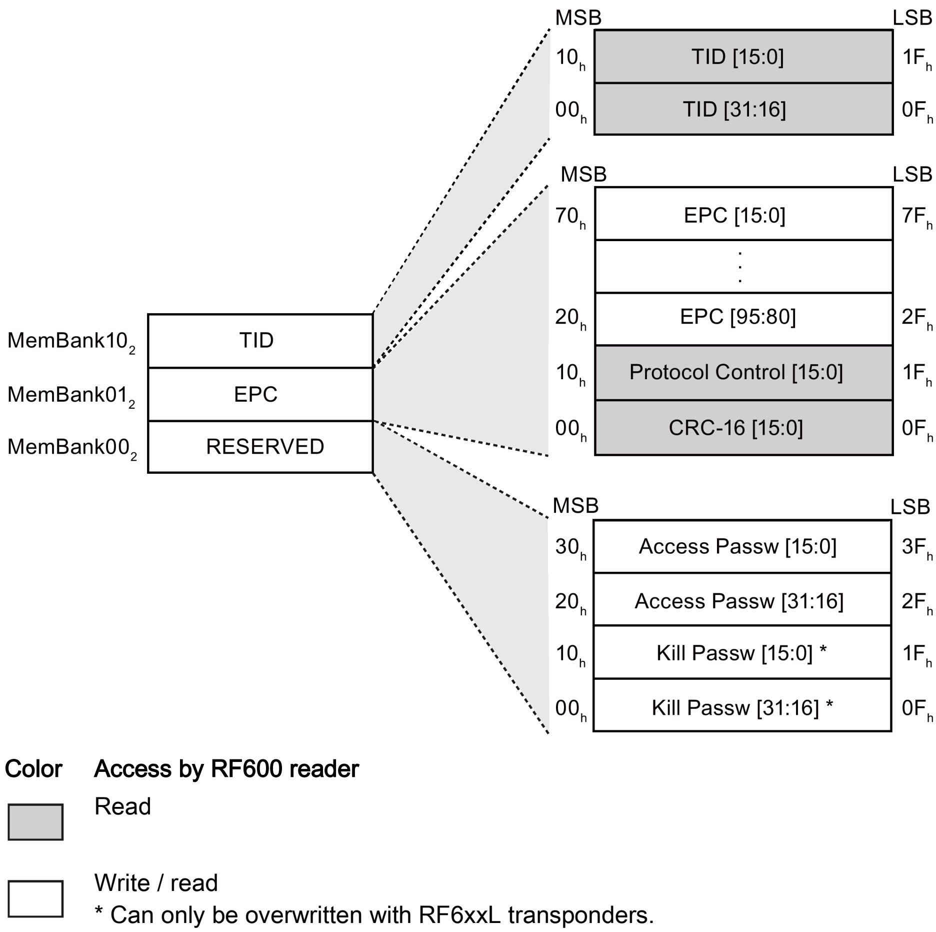


Figure 7-5 Memory map of the ISO 18000-6C Monza 2 chip according to EPC

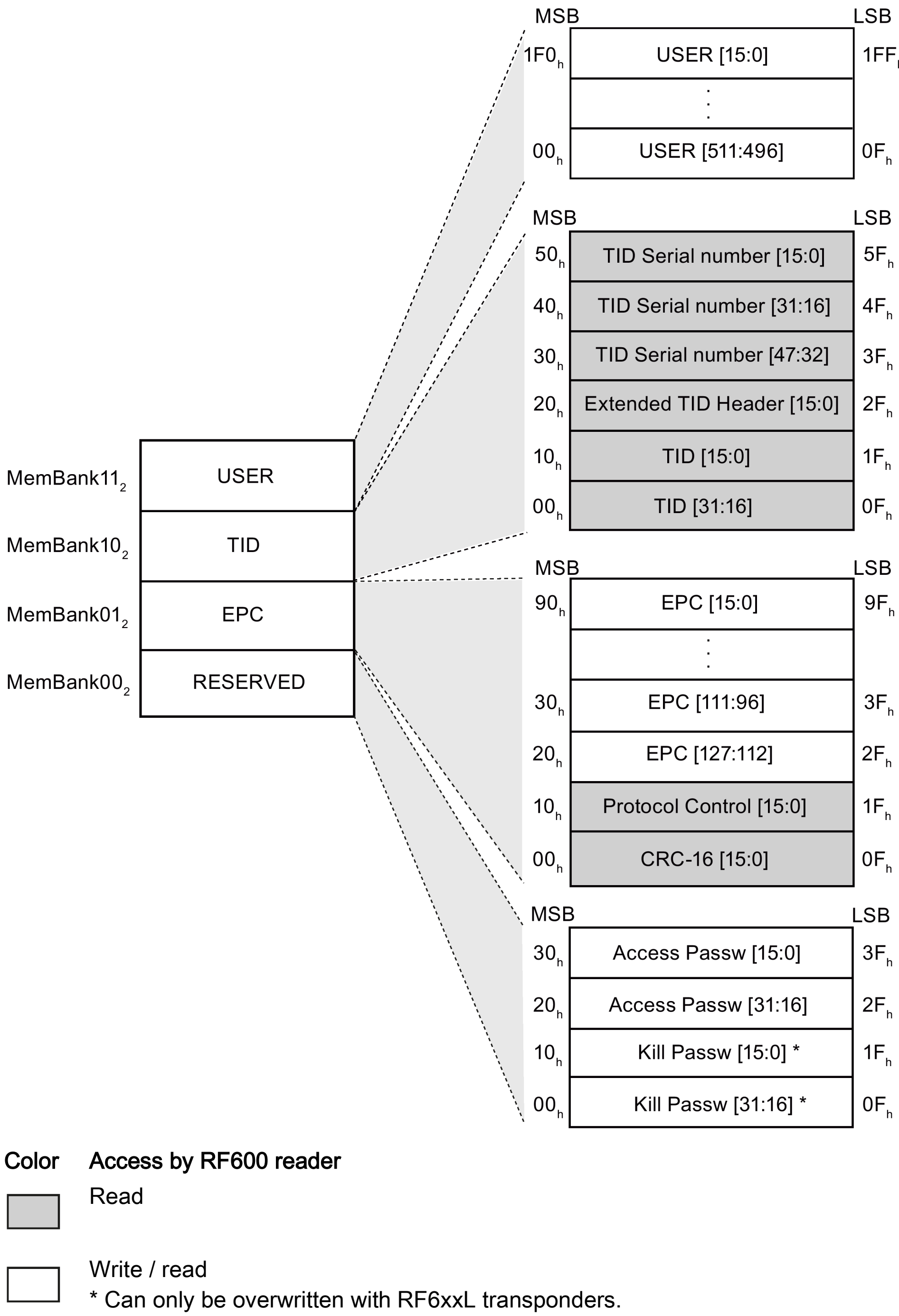
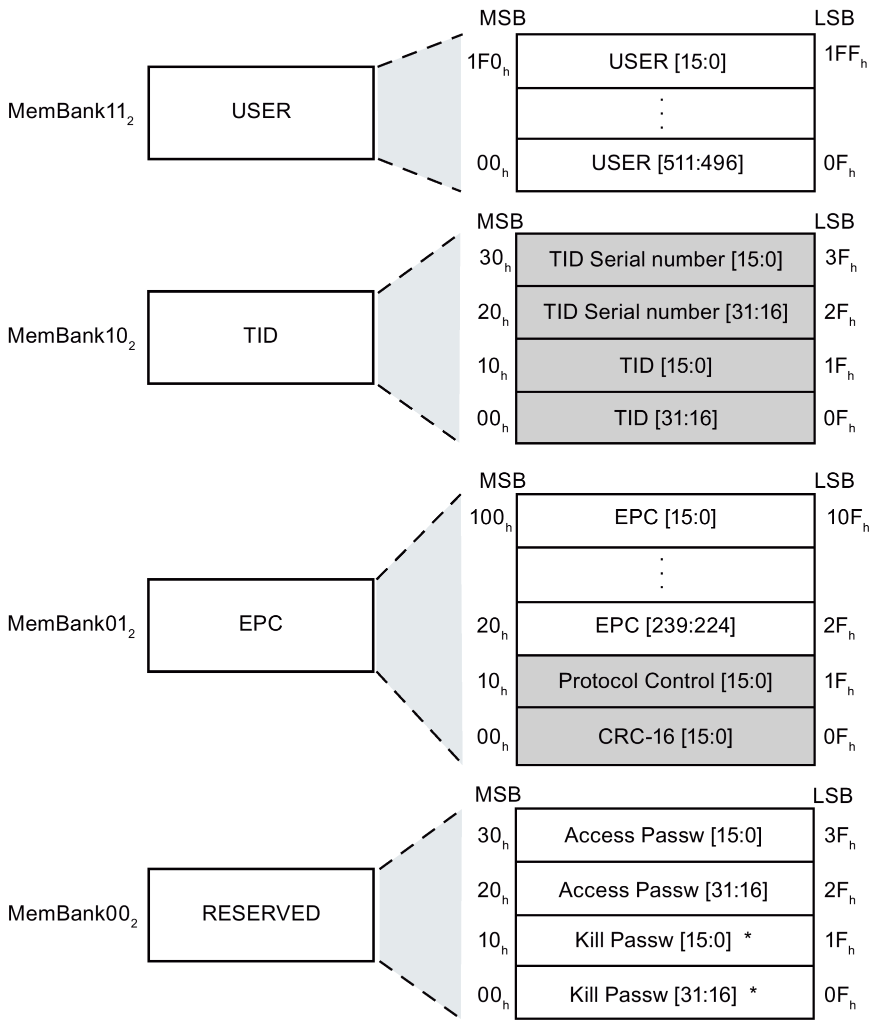
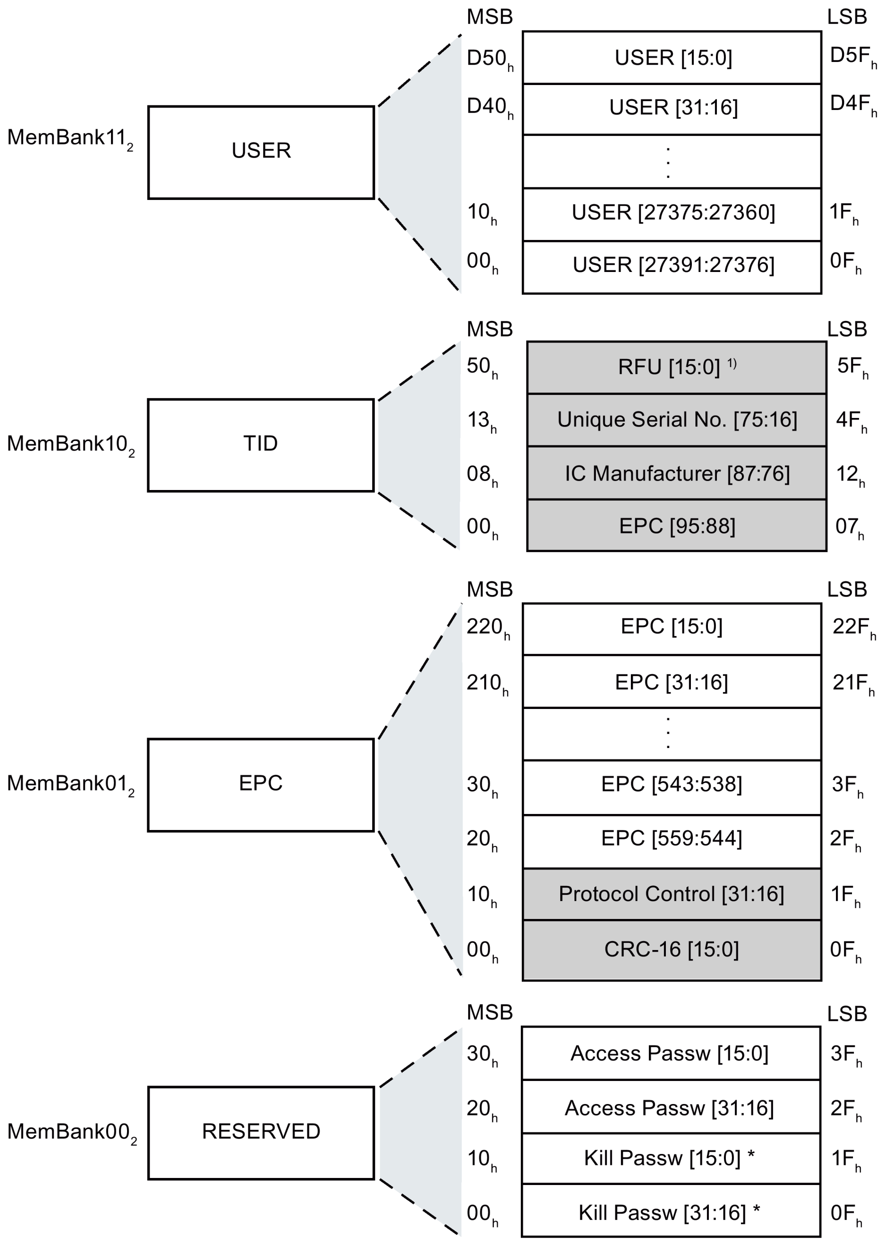


Figure 7-6 Memory map of the ISO 18000-6C Monza 4QT chip according to EPC



Color	Access by RF600 reader
(grey)	Read
(white)	Write / read * Can only be overwritten with RF6xxL transponders.

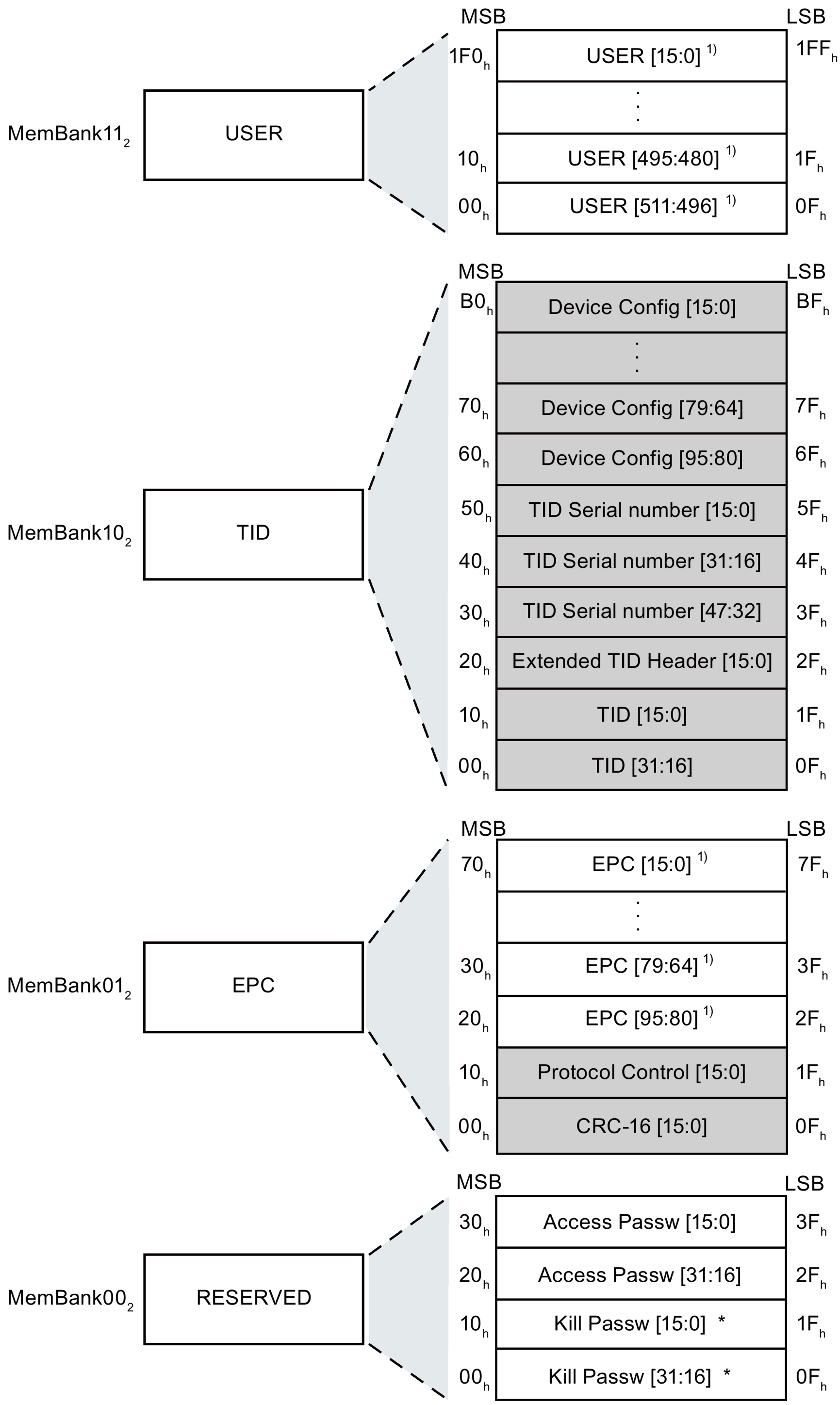
Figure 7-7 Memory map of the ISO 18000-6C G2XM chip according to EPC



Color	Access by RF600 reader
(grey)	Read
(white)	Write / read * Can only be overwritten with RF6xxL transponders.

1) Reserved for future use

Figure 7-8 Memory configuration of the ISO 18000-6C Fujitsu MB97R803 chip according to EPC



Color	Access by RF600 reader
(grey)	Read
(white)	Write / read * Can only be overwritten with RF6xxL transponders.

1) The EPC memory area of the Alien Higgs chips can be increased at the cost of the user memory. This affects the indicated memory areas. You will find further information in the relevant transponder sections.

Figure 7-9 Memory map of the ISO 18000-6C Alien Higgs 3 chip according to EPC

7.1.6 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 375)").
- The optimum mounting surface for the transponder has been selected (see section "Effects of the materials of the mounting surfaces on the range (Page 377)")
- The maximum range shown in the section "Maximum read/write ranges of transponders (Page 378)" 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 48)").

7.1.6.1 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.

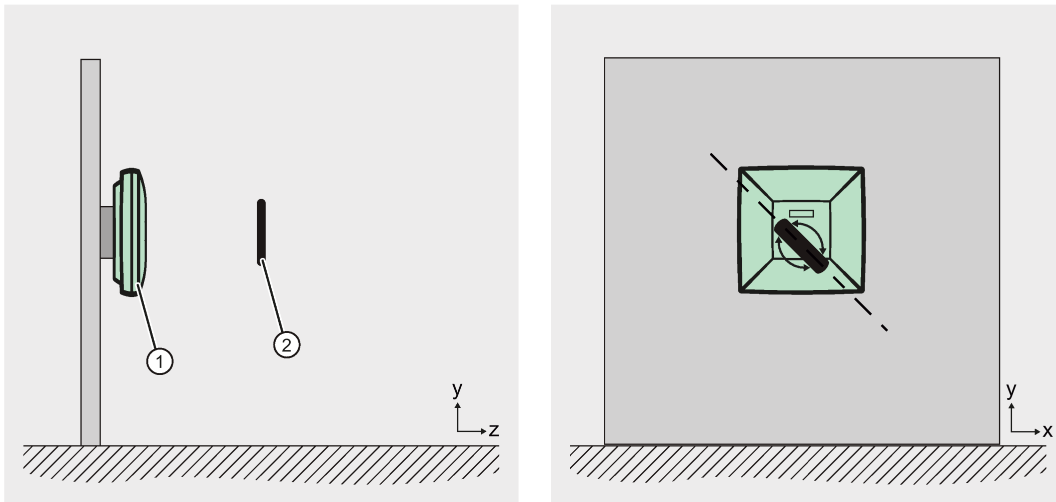
Note

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 283)" or "Alignment of transponders to the antenna (Page 329)".

Possible transponder alignments depending on the antenna type

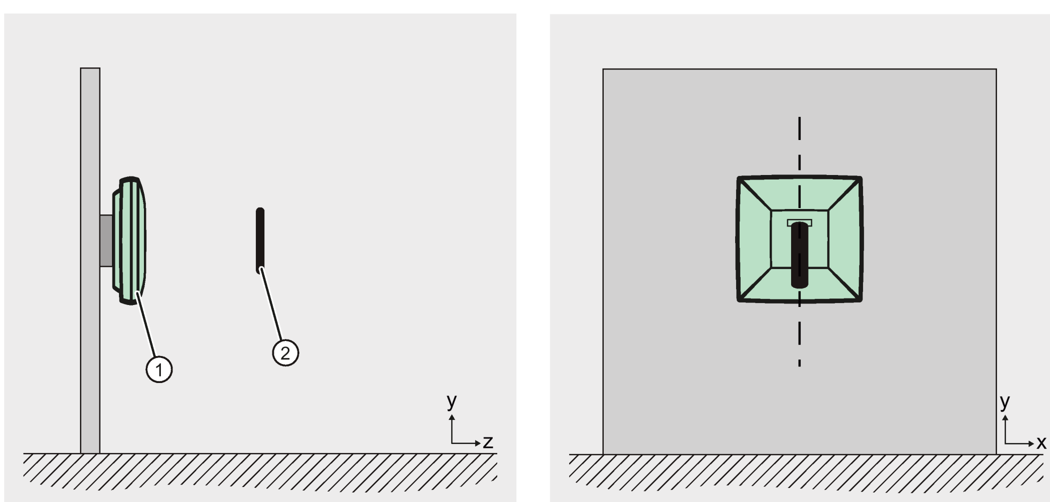
To achieve the maximum read/write range with RF640A or RF660A antennas, make sure that the planes of the polarization axes have the same alignment. Changing the transponder angle within the x-y plane has no effect on the range.



① Antenna RF640A or RF660A
② Transponder

Figure 7-10 Possible transponder alignment with RF640A or RF660A

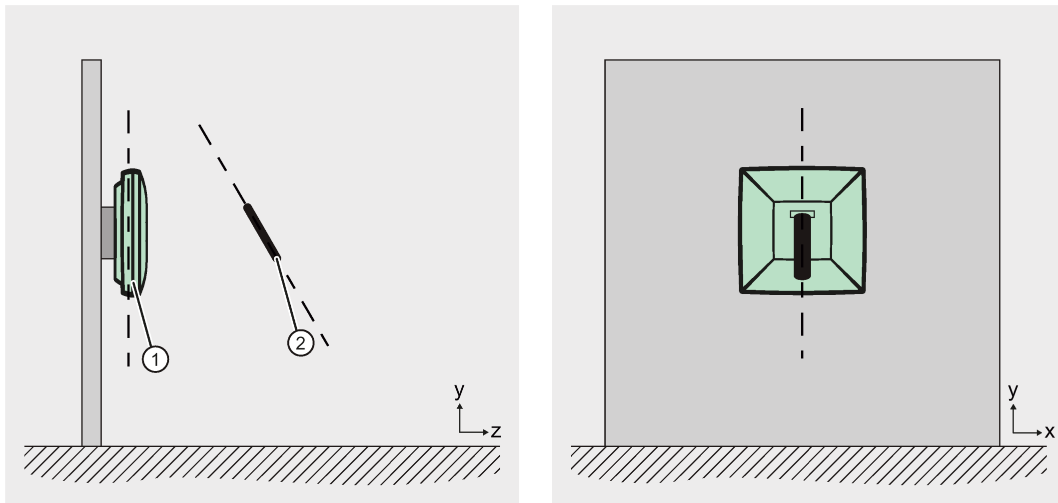
To achieve the maximum range with RF620A or RF642A antennas, make sure that the polarization axes of the antenna and transponder are parallel to each other. Changing the transponder angle within the x-y plane leads to a reduction of the range.



① Antenna RF620A or RF642A
② Transponder

Figure 7-11 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 7-12 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.

7.1.6.2 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 286)".

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%.

7.1.6.3 Maximum read/write ranges of transponders

Maximum read ranges

Table 7- 2 Read ranges of transponders at a room temperature of +25 °C (all ranges in m)

	SIMATIC RF622L	SIMATIC RF630L 6GT2810-2AB00, 6GT2810-2AB01, 6GT2810-2AB02-0AX0	SIMATIC RF630L 6GT2810-2AB03	SIMATIC RF640L
SIMATIC RF620R with internal antenna	1.8	5	3	2
with RF620A	0.2	0.9	0.55	0.35
with RF640A	2.0	4.5	2.8	2
with RF642A	3.0	5.5	3.5	2.5
with RF660A	3.0	6	4	3
SIMATIC RF630R with RF620A	0.2	0.9	0.55	0.35
with RF640A	2.0	4.5	2.8	2
with RF642A	3.0	5.5	3.5	2.5
with RF660A	3.0	6	4	3
SIMATIC RF640R with internal antenna	3.0	7	4	2
with RF620A	0.4	0.95	0.6	0.35
with RF640A	2.5	6	4	2
with RF642A	3.0	8	5	2.5
with RF660A	3.0	8	5	3

	SIMATIC RF622L	SIMATIC RF630L 6GT2810-2AB00, 6GT2810-2AB01, 6GT2810-2AB02-0AX0	SIMATIC RF630L 6GT2810-2AB03	SIMATIC RF640L
SIMATIC RF650R with RF620A	0.4	0.95	0.6	0.35
with RF640A	2.5	4.6	3	2
with RF642A	3.0	8	5	2.5
with RF660A	3.0	8	5	3.5
SIMATIC RF670R with RF620A	0.4	0.95	0.6	0.35
with RF640A	2.5	6	4	2
with RF642A	3.0	8	5	2.5
with RF660A	3.0	8	5	3
SIMATIC RF680R with RF620A	0.4	1.35	0.85	0.35
with RF640A	2.5	6	4	2
with RF642A	3.0	8	5	2.5
with RF660A	3.0	8	5	3.5
SIMATIC RF685R with internal antenna	3.0	7	4	3
with RF620A	0.4	1.35	0.85	0.35
with RF640A	2.5	6	4	2
with RF642A	3.0	8	5	2.5
with RF660A	3.0	8	5	3.5

	SIMATIC RF680L	SIMATIC RF690L	SIMATIC RF610T
SIMATIC RF620R with internal antenna	2.5	2.5	3
with RF620A	0.5	0.7	0.55
with RF640A	2.2	3	2.8
with RF642A	2.8	4.5	3.5
with RF660A	3	5	4
SIMATIC RF630R with RF620A	0.55	0.7	0.55
with RF640A	2.2	3	2.8
with RF642A	2.8	4.5	3.5
with RF660A	3	5	4

	SIMATIC RF680L	SIMATIC RF690L	SIMATIC RF610T
SIMATIC RF640R with internal antenna	3.5	3.5	4.5
with RF620A	0.6	0.7	0.6
with RF640A	3.1	3	4
with RF642A	4	4.5	5
with RF660A	4	5	5
SIMATIC RF650R with RF620A	0.6	0.7	0.6
with RF640A	2.3	3	3
with RF642A	4	4.5	5
with RF660A	4	5	5
SIMATIC RF670R with RF620A	0.6	0.7	0.6
with RF640A	3	3	4
with RF642A	4	4.5	5
with RF660A	4	5	5
SIMATIC RF680R with RF620A	0.85	0.7	0.85
with RF640A	3	3	4
with RF642A	4	4.5	5
with RF660A	4	5	5
SIMATIC RF685R with internal antenna	3.5	4	4.5
with RF620A	0.85	0.7	0.85
with RF640A	3	3	4
with RF642A	4	4.5	5
with RF660A	4	5	5

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.

	SIMATIC RF620T 1)	SIMATIC RF622T 2)	SIMATIC RF625T 2)
SIMATIC RF620R with internal antenna	5	1.8	1
with RF620A	0.55	0.2	0.3
with RF640A	4.5	2.0	0.8
with RF642A	5.5	3.0	1.1
with RF660A	6	3.0	1.2

	SIMATIC RF620T 1)	SIMATIC RF622T 2)	SIMATIC RF625T 2)
SIMATIC RF630R with RF620A	0.55	0.2	0.3
with RF640A	4.5	2.0	0.8
with RF642A	5.5	3.0	1.1
with RF660A	6	3.0	1.2
SIMATIC RF640R with internal antenna	7	3.0	1.3
with RF620A	0.6	0.4	0.4
with RF640A	6	2.5	1.2
with RF642A	8	3.0	1.5
with RF660A	8	3.0	1.5
SIMATIC RF650R with RF620A	0.6	0.4	0.35
with RF640A	4.6	2.5	1.2
with RF642A	8	3.0	1.5
with RF660A	8	3.0	1.5
SIMATIC RF670R with RF620A	0.6	0.4	0.4
with RF640A	6	2.5	1.2
with RF642A	8	3.0	1.5
with RF660A	8	3.0	1.5
SIMATIC RF680R with RF620A	0.85	0.4	0.5
with RF640A	6	2.5	1.2
with RF642A	8	3.0	1.5
with RF660A	8	3.0	1.5
SIMATIC RF685R with internal antenna	7	3.0	1.5
with RF620A	0.85	0.4	0.5
with RF640A	6	2.5	1.2
with RF642A	8	3.0	1.5
with RF660A	8	3.0	1.5

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.

	SIMATIC RF630T [2)]	SIMATIC RF640T [2)]	SIMATIC RF680T [2)]
SIMATIC RF620R with internal antenna	0.8	2.5	2.5
with RF620A	0.3	0.8	1.3
with RF640A	0.7	2.2	3.5
with RF642A	0.8	2.8	5
with RF660A	0.9	3	5
SIMATIC RF630R with RF620A	0.3	0.8	1.3
with RF640A	0.7	2.2	3.5
with RF642A	0.8	2.8	5
with RF660A	0.9	3	5
SIMATIC RF640R with internal antenna	1	3.5	6
with RF620A	0.3	1.1	1.8
with RF640A	0.9	3	5
with RF642A	1.2	4	7
with RF660A	1.2	4	7
SIMATIC RF650R with RF620A	0.3	0.6	0.6
with RF640A	1.5	3	3
with RF642A	2	4	4
with RF660A	2	4	4
SIMATIC RF670R with RF620A	0.3	1.1	1.8
with RF640A	0.9	3	5
with RF642A	1.2	4	7
with RF660A	1.2	4	7
SIMATIC RF680R with RF620A	0.4	0.9	0.9
with RF640A	2	4	4
with RF642A	2	4	4
with RF660A	2	4	4
SIMATIC RF685R with internal antenna	2	4	4
with RF620A	0.4	0.9	0.9
with RF640A	2	4	4
with RF642A	2	4	4
with RF660A	2	4	4

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.

7.1.6.4 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- 3 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
RF685R, internal antenna	200 mm

7.1.7 Storage and transportation roll goods

NOTICE

Notes on storage and transportation of rolls

Note the following information on the storage and transportation of rolls:

- Protect the transponders from direct sunlight and heat (e.g. heating appliances).
- Prior to use, store the label rolls in the polyethylene bag or the shrink film of the original packaging.
- Store the label rolls in a cool and dry location.
  Ideal conditions: 18 °C ±5 °C, 40-60 % humidity
- Stack several label rolls lying flat and centered one above the other.
- Avoid external pressure (e.g. a narrow box).

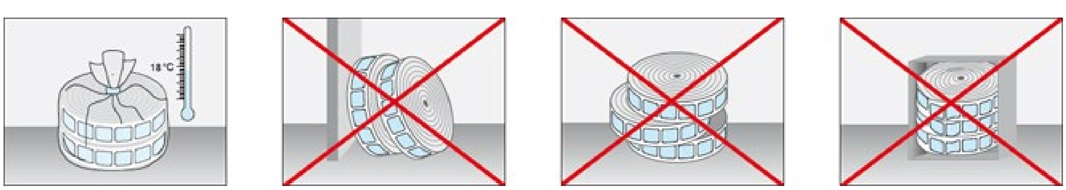


Figure 7-13 Storage of transponders

7.2 SIMATIC RF622L

7.2.1 Features

The SIMATIC RF622L Smartlabel is a passive and maintenance-free data carrier. It operates based on the UHF Class 1 Gen 2 technology and has a fast FRAM user memory of 3,424 bytes.

The SIMATIC RF622L achieves a read range of up to 3 m on a non-metallic base and provides numerous options for use in a wide range of applications such as in logistics.

SIMATIC RF622L Smartlabel	Characteristics	
	Area of application	Industrial plant management, RFID identification of tools, containers and non-metallic equipment.
	Frequency band	860 ... 960 MHz
	Air interface	according to ISO°18000-6C
	Memory	EPC 496 bits User memory: 3424 bytes
	Write range	Up to 3.0 m on a non-metallic surface [1)]
	Read range	Up to 3.0 m on a non-metallic surface [1)]
	Mounting	Self-adhesive

1) Depending on the environment

7.2.2 Ordering data

Table 7- 4 Ordering data RF622L

	Article number
SIMATIC RF622L Delivery package: 500 labels on the roll	6GT2810-4AC80

7.2.3 Technical specifications

Table 7- 5 Technical specifications of SIMATIC RF622L

	6GT2810-4AC80
Product designation	SIMATIC RF622L
Memory	
Chip (manufacturer/type)	Fujitsu MB97R803
Memory configuration	
• EPC	• 496 bits
• User memory	• 3424 bytes
• TID	• 256 bits [1)]
Write cycles (min., at 22 °C)	> 10^{10}
Data retention (at 55 °C)	10 years
Mechanical specifications	
Material	Plastic
Material surface	PET
Color	White glossy
Antenna material	Aluminum
Type of antenna	Shortened dipole
Printing	Can be printed using heat transfer technique
Roll core diameter	76 mm
Roll outer diameter	≤ 120 mm
Label carrier	PET, siliconized, opaque paper liner (reverse side is not siliconized)
Electrical data	
Air interface	ISO 18000-6C
Polarization direction	Linear
Frequency band	860 ... 960 MHz
Write/read distance	
• Write	• Up to 3 m on a non-metallic surface [2)]
• Read	• Up to 3 m on a non-metallic surface [2)]

	6GT2810-4AC80
Permitted ambient conditions	
Ambient temperature	
• In operation during write/read access	• -20 ... +85 °C
• In operation, outside write/read access	• -40 ... +85 °C
• During transportation and storage	• Optimum 18 °C ± 5 °C [3)]
Distance from metal	Not suitable for mounting directly on metal
Degree of protection	IP64 (when adhered)
Design, dimensions and weight	
Dimensions (L x W x H)	90 × 18 × 0.5 mm
Weight	Approx. 0.1 g
Type of mounting	Single-sided adhesive (self-adhesive labels); silicone-free acrylate glue; Minimum adhesive temperature: +10 °C

[1)] In the current chip version of the transponder, the TID can be written to. It is not recommended that you use the TID as user memory.

[2)] Depending on the environment

[3)] For more information, refer to the section "Storage and transport".

7.2.4 Certificates and approvals

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

7.2.5 Dimension drawing

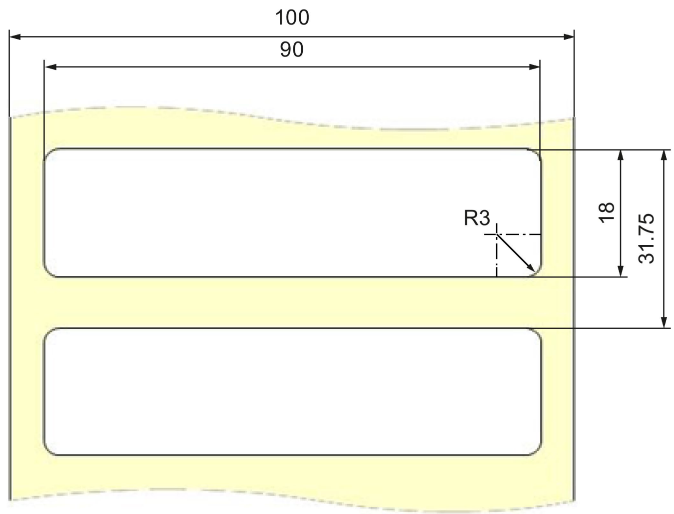


Figure 7-14 Dimension drawing RF622L

All dimensions in mm

7.3 SIMATIC RF630L Smartlabel

7.3.1 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	12 bytes		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 375)".				

7.3.2 Ordering data

RF630L transponder	Article number	Packaging
RF630L transponder, SmartLabel 101.6 mm x 152.4 mm (4" x 6")	6GT2810-2AB00	Minimum order 1600 items (800 on one roll)
RF630L transponder, SmartLabel 101.6 mm x 50.8 mm (4" x 2")	6GT2810-2AB01	Minimum order 1000 items (1000 on one roll)
RF630L transponder, SmartLabel 97 mm x 27 mm	6GT2810-2AB02-0AX0	Minimum order 5000 items (5000 on one roll)
RF630L transponder, SmartLabel 54 mm x 34 mm	6GT2810-2AB03	Minimum order 2000 items (2000 on one roll)

7.3.3 Minimum spacing between labels

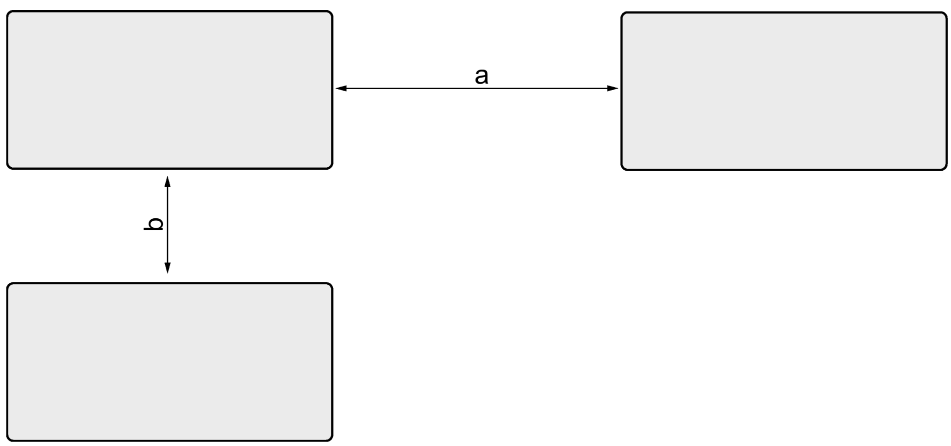


Figure 7-15 Minimum spacing between labels

The specified minimum spacing is valid for the SIMATIC RF630L Smartlabel with the following article numbers:

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

Table 7- 6 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.

7.3.4 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 366).

7.3.5 Technical data

Table 7- 7 Technical specifications of SIMATIC RF630L

	6GT2810-2AB00	6GT2810-2AB01
Product designation	SIMATIC RF630L	
Memory		
Memory configuration		
• EPC	• 96 bits	
• User memory	• 12 bytes	
• TID	• 32 bits	
Type	EPC Class 1 Gen 2	
Read cycles	10^{14}	
Write cycles	10^{5}	
Data retention (at 25 °C)	10 years	
Anti collision	approx. 100 labels/second	
Mechanical specifications		
Material	Paper with integrated antenna	
Material surface	Paper	
Color	White	
Antenna material	Aluminum	
Type of antenna	Shortened dipole	
Printing	Can be printed using heat transfer technique	
Static pressure	10 N/mm²	

	6GT2810-2AB00	6GT2810-2AB01
Electrical data		
Air interface	ISO 18000-6C	
Polarization direction	Linear, parallel to the short side of the paper label	Linear, parallel to the long side of the paper label
Frequency band	860 ... 960 MHz	
Range 1)	max. 8 m	
Minimum spacing between labels		
• Vertically	• 50 mm	
• Horizontally	• 100 mm	
Energy source	Field energy via antenna, without battery	
Multitag capability	Yes	
Permitted ambient conditions		
Ambient temperature		
• During operation	• -40 ... +65 ℃	
	• to 80 ℃ (200 cycles)	
• During transportation and storage	• +15 ... +25 °C (humidity between 40% and 60%)	
Distance from metal	Not suitable for mounting directly on metal	
Storage duration	Two years, determined by the shelf life of the adhesive	
Torsion and bending load	permitted with limits	
Degree of protection	None, the label must be protected against humidity	
Design, dimensions and weight		
Dimensions (L x W x H)	101.6 mm x 152.4 mm (approx. 4" x 6")	101.6 mm x 50.8 mm (approx. 4" x 2")
Weight	approx. 3 g	approx. 2 g
Type of mounting	Single-sided adhesive (self-adhesive labels)	

[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 375)".

Table 7- 8 Technical specifications of SIMATIC RF630L

	6GT2810-2AB02-0AX0	6GT2810-2AB03
Product designation	SIMATIC RF630L	
Memory		
Memory configuration		
• EPC	• 96/128 bits	• 96/240 bits
• User memory	• 64 bytes	• 64 bytes
• TID	• 96 bits	• 64 bits
Type	EPC Class 1 Gen 2	
Read cycles	10^{14}	
Write cycles	10^5	
Data retention (at 25 °C)	10 years	
Anti collision	approx. 100 labels/second	
Mechanical specifications		
Material	Plastic with integrated antenna	
Material surface	Plastic PET	
Color	Transparent	
Antenna material	Aluminum	
Type of antenna	Shortened dipole	
Printing	Can be printed using heat transfer technique	
Static pressure	10 N/mm²	
Electrical data		
Air interface	ISO 18000-6C	
Polarization direction	Linear, parallel to the long side of the inlay	
Frequency band	860 ... 960 MHz	
Range 1)	max. 5 m	
Minimum spacing between labels		
• Vertically	• 50 mm	
• Horizontally	• 100 mm	
Energy source	Field energy via antenna, without battery	
Multitag capability	Yes	

	6GT2810-2AB02-0AX0	6GT2810-2AB03
Permitted ambient conditions		
Ambient temperature		
• During operation	• -40 ... +65 °C	
	• to 80 °C (200 cycles)	
• During transportation and storage	• +15 ... +25 °C (humidity between 40% and 60%)	
Distance from metal	Not suitable for mounting directly on metal	
Storage duration	Two years, determined by the shelf life of the adhesive	
Torsion and bending load	permitted with limits	
Degree of protection	IP65	
Design, dimensions and weight		
Dimensions (L x W x H)	97 mm x 27 mm	54 mm x 34 mm
Weight	approx. 1 g	
Type of mounting	Single-sided adhesive (self-adhesive labels)	

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 375)".

7.3.6 Certificates and approvals

Certificate	Description
CE	Compatible with R&TTE directive
FCC Federal Communications Commission	Passive labels and transponders comply with the valid regulations; certification is not required.

7.3.7 Dimension drawings

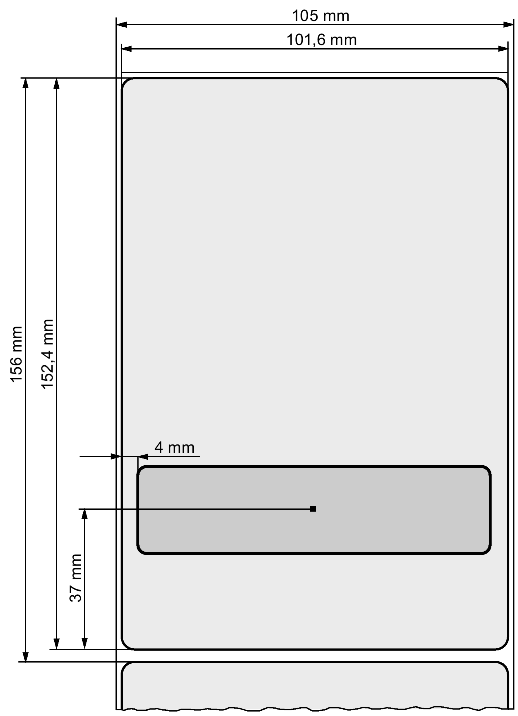


Figure 7-16 SIMATIC RF630L 6GT2810-2AB00 dimension drawing

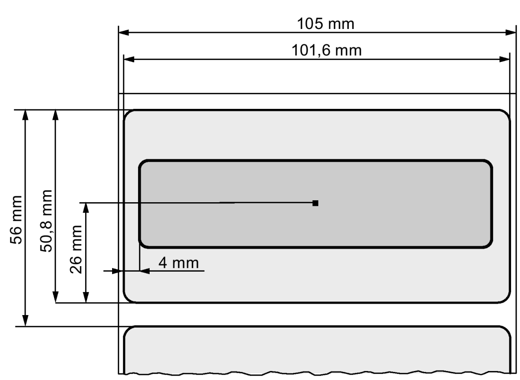


Figure 7-17 SIMATIC RF630L 6GT2810-2AB01 dimension drawing

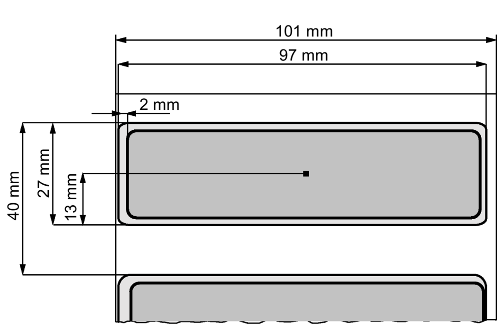


Figure 7-18 Dimension drawing SIMATIC RF630L 6GT2810-2AB02-0AX0

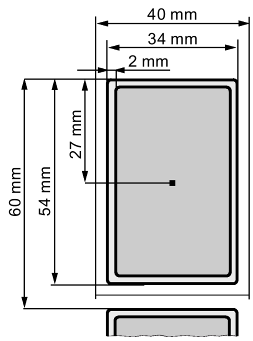


Figure 7-19 SIMATIC RF630L 6GT2810-2AB03 dimension drawing

7.4 SIMATIC RF640L Smartlabel

7.4.1 Features

The SIMATIC RF640L Smartlabel is a passive and maintenance-free data carrier. It operates based on the UHF Class 1 Gen 2 technology and is used to store the "Electronic Product Code" (EPC). The transponder also has a user memory.

The SIMATIC RF640L is designed for direct mounting on metal surfaces and under these conditions achieves a read range of up to 4 m.

Smartlabel SIMATIC RF640L	**Features**	
	Application	Industrial plant management, RF identification of tools, containers and metallic equipment.
	Frequency band	• Europe: 865 ... 868 MHz • USA/Canada: 902 ... 928 MHz
	Air interface	According to ISO 18000-6C
	Memory	EPC 96... 480 bits [1)] user memory: 16 ... 64 bytes [1)]
	Write range	• up to 0.5 m[2)]
	Read range	• Up to 4 m on metal [2)] • Up to 2.3 m on non-metallic surface [2)]
	Mounting	Self-adhesive for mounting on metal

1) The EPC memory has a default size of 96 bits. When necessary, the EPC memory size can be expanded to 480 bits in steps of 16 bits at the cost of the user memory.

2) Depending on the environment

7.4.2 Ordering data

Table 7- 9 Ordering data RF640L

	Article number
SIMATIC RF640L (Europe) Delivery package: 500 labels on the roll	6GT2810-2AC00
SIMATIC RF640L (USA, Canada) Delivery package: 500 labels on the roll	6GT2810-2AC10

7.4.3 Memory organization

Transponders with an "Alien Higgs 3" chip have an EPC memory with a standard size of 96 Bits (12 bytes). When necessary, the EPC memory size can be expanded to 480 bits (60 bytes) in steps of 16 bits at the cost of the user memory.

The following table shows how many bytes can be added to the EPC memory and how this affects the size of the user memory.

Table 7- 10 Size of the EPC memory and effect on the user memory

EPC memory		User memory
[bytes]	[bits]	[bytes]
54 ... 60	432 ... 480	16
46 ... 52	368 ... 416	24
38 ... 44	304 ... 352	32
30 ... 36	240 ... 288	40
22 ... 28	176 ... 224	48
14 ... 20	112 ... 160	56
0 ... 12	0 ... 96	64

7.4.4 Technical specifications

Table 7- 11 Technical specifications of SIMATIC RF640L

	6GT2810-2ACx0
Product designation	SIMATIC RF640L
Memory	
Chip (manufacturer/type)	Alien Higgs 3
Memory configuration	
• EPC	• 96 ... 480 bits [1)]
• User memory	• 16 ... 64 bytes [1)]
• TID	• 32 bits
• Unique TID	• 64 bits
• TID device configuration	• 96 bits
Type	EPC Class 1 Gen 2
Write cycles (min., at 22 °C)	> 500
MTBF (Mean Time Between Failures)	50 years
Mechanical specifications	
Material	Plastic
Material surface	PET
Color	White glossy
Antenna material	Aluminum
Type of antenna	Shortened dipole
Printing	Can be printed using heat transfer technique
Roll core diameter	76 mm
Roll outer diameter	200 mm
Label carrier	PET
Electrical data	
Air interface	ISO 18000-6C
Polarization direction	Linear
Frequency band	• Europe: 865 ... 868 MHz • USA/Canada: 902 ... 928 MHz
Writing/reading distance	
• Write	• up to 0.5 m[2)]
• Read	• Up to 4 m on metal [2)] • Up to 2.3 m on non-metallic surface [2)]

	6GT2810-2ACx0
Permitted ambient conditions	
Ambient temperature	
• During operation	• -20 ... +85 °C
• During transportation and storage	• -20 ... +85 °C
Distance from metal	for direct attachment to metal
Degree of protection	IP67
Design, dimensions and weight	
Dimensions (L x W x H)	50 × 22.5 × 1.6 mm
Weight	approx. 4 g
Type of mounting	Single-sided adhesive (self-adhesive labels)

1) The EPC memory has a default size of 96 bits. When necessary, the EPC memory size can be expanded to 480 bits in steps of 16 bits at the cost of the user memory.

2) Depending on the environment

7.4.5 Dimension drawing

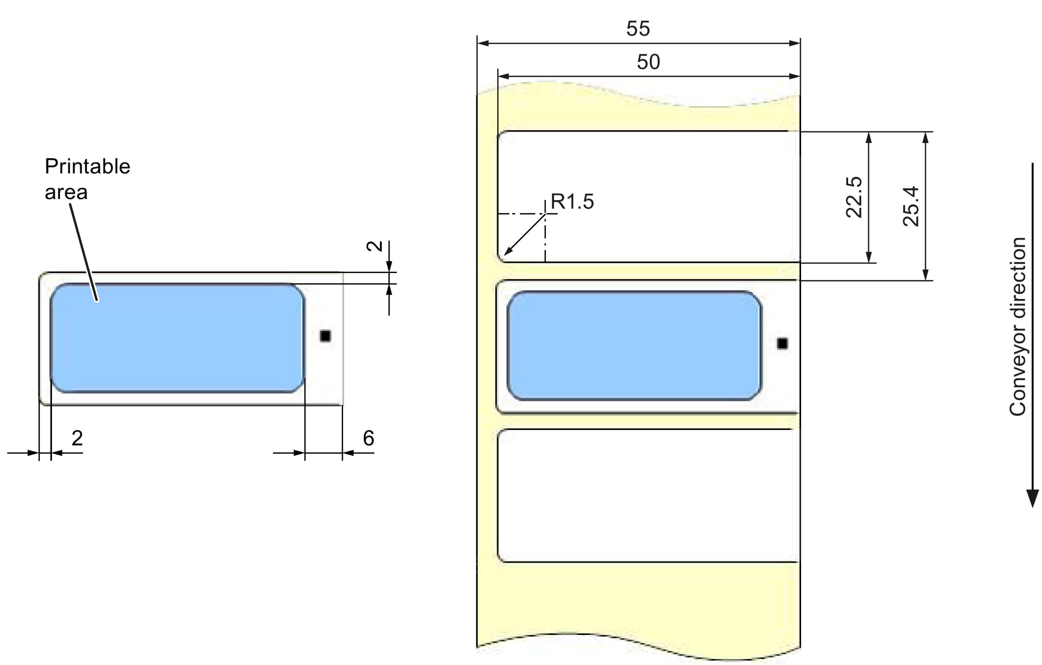


Figure 7-20 RF640L dimension drawing

All dimensions in mm

7.5 SIMATIC RF680L Smartlabel

7.5.1 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.

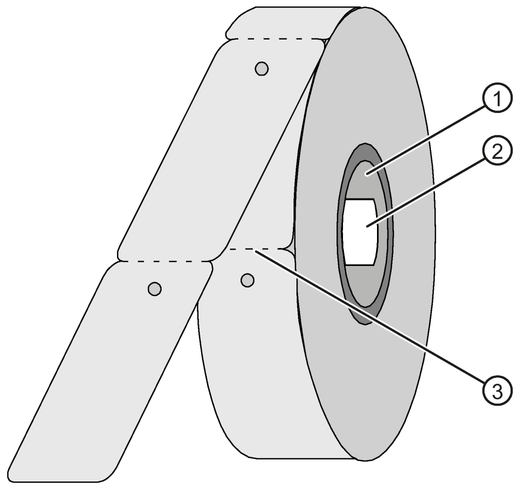
The SIMATIC RF680L is a heat-resistant Smartlabel with a limited service life. Its target use is the direct identification of objects in high-temperature applications.

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 375)".		

7.5.2 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 7-21 SIMATIC RF680L roll

7.5.3 Ordering data

Ordering data	Article number	Packaging
SIMATIC RF680L • Smartlabels 54 x 89 mm • heat-resistant	6GT2810-2AG80	1,000 units on a roll

7.5.4 Minimum spacing between labels

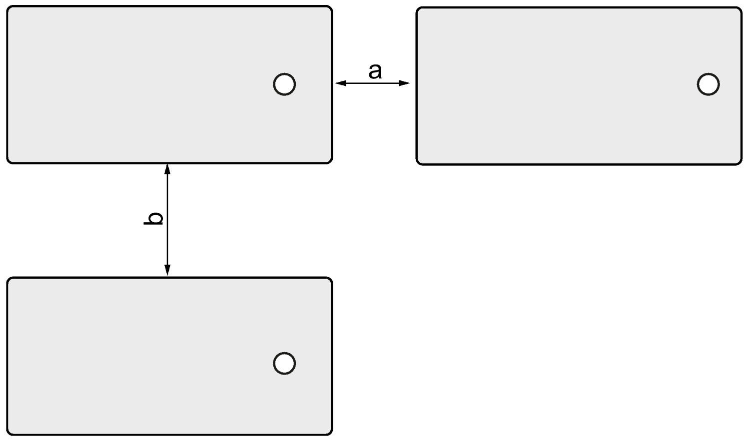


Figure 7-22 Minimum spacing between labels

Table 7- 12 Minimum spacing

Minimum spacing	
a	20 mm
b	50 mm

7.5.5 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 366).

7.5.6 Mounting on metal

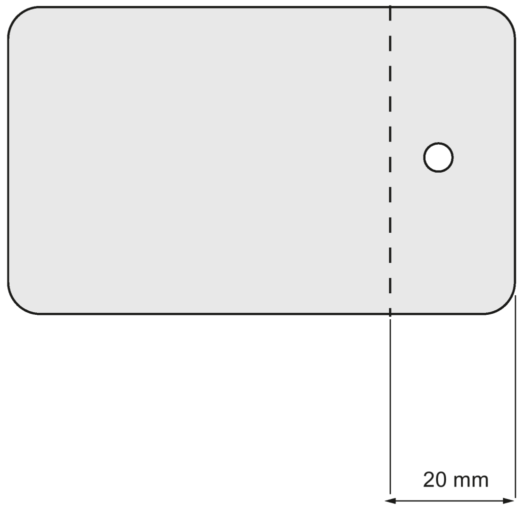


Figure 7-23 Metal mounting surface

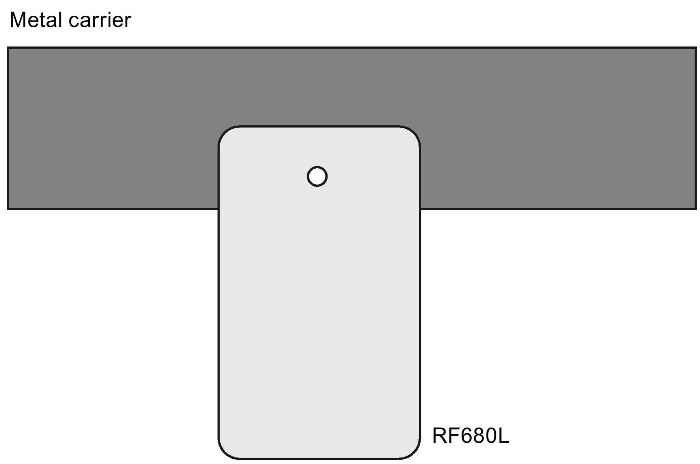


Figure 7-24 Mounting on metal

7.5.7 Technical specifications

Table 7- 13 Technical specifications of SIMATIC RF680L

	6GT2810-2AG80
Product designation	SIMATIC RF680L
Memory	
Memory configuration	
• EPC	• 96/240 bits
• User memory	• 64 bytes
• TID	• 64 bits
• Reserved (passwords)	• 64 bits
Type	EPC Class 1 Gen 2
Read cycles (max., at < 40 °C)	10^{14}
Write cycles (max., at < 40 °C)	10^5
Data retention (at < 40 ℃)	10 years
Mechanical specifications	
Material	Synthetic paper
Color	beige
Antenna material	Copper
Type of antenna	Shortened dipole
Static pressure	10 N/mm²
Printing	According customer wishes, thermotransfer method
Silicone-free	Yes
Transponder arching	max. 6 mm (see dimension drawing)
Electrical data	
Air interface	according to ISO°18000-6C
Polarization direction	Linear, parallel to the long side of the inlay
Frequency band	• Europe 865 … 868 MHz • USA 902 … 928 MHz
Range 1)	max. 4 m
Minimum spacing between labels	
• Vertically	50 mm
• Horizontally	20 mm
Energy source	Field energy via antenna, without battery
Multitag capability	Yes

	6GT2810-2AG80	
Permitted ambient conditions		
Ambient temperature		
• During operation	• -25…+85 °C	• Permanent
	• -25…+200 °C	• Up to 6 hours
	• -25…+220 °C	• Up to 1 hour
	• -25…+230 °C	• briefly
• During transportation and storage	• -40…+85 °C	
Distance from metal	Not suitable for mounting entire surface directly on metal	
Torsion and bending load	permitted with limits	
Design, dimensions and weight		
Dimensions (L x W x H)	54 mm x 89 mm x 0.3 mm	
Weight	approx. 3 g	
Type of mounting	Adhesive, cable tie, screws	

1) The information relates to the maximum read range. You will find more information on ranges in the section "Minimum clearances and maximum distances (Page 375)".

7.5.8 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

7.5.9 Dimension drawing

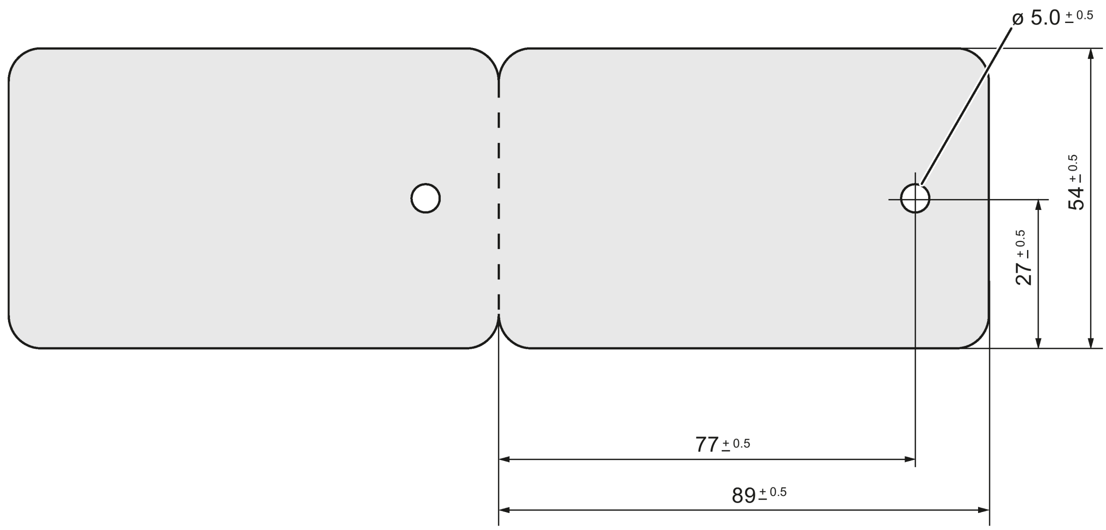


Figure 7-25 SIMATIC RF680L

7.6 SIMATIC RF690L Smartlabel

7.6.1 Characteristics

The SIMATIC RF690L High Temp Smartlabel is a passive and maintenance-free data carrier. It operates based on the UHF Class 1 Gen 2 technology and is used to store the "Electronic Product Code" (EPC). The transponder also has a user memory.

The SIMATIC RF690L achieves a read distance of up to 4.5 m and can also be mounted on metal.

Smartlabel SIMATIC RF690L	Features	
	Application	Heat-proof UHF label for a wide range of possible applications with high temperatures up to +230 °C on metal.
	Frequency band	• Europe: 865 ... 868 MHz • USA/Canada: 902 ... 928 MHz
	Air interface	According to ISO 18000-6C
	Memory	EPC 96... 480 bits [1)] user memory: 16 ... 64 bytes [1)]
	Write range	• Up to 1.5 m [2)]
	Read range	• Up to 4.5 m on non-metallic surface [2)] • Up to 2.4 m on metal [2)]
	Mounting	Self-adhesive for mounting on metal

1) The EPC memory has a default size of 96 bits. When necessary, the EPC memory size can be expanded to 480 bits in steps of 16 bits at the cost of the user memory.

2) Depending on the environment

7.6.2 Ordering data

Table 7- 14 Ordering data RF690L

	Article number
SIMATIC RF690L (Europe) Delivery package: 400 labels on the roll	6GT2810-2AG00
SIMATIC RF690L (USA, Canada) Delivery package: 400 labels on the roll	6GT2810-2AG10

7.6.3 Memory organization

Transponders with an "Alien Higgs 3" chip have an EPC memory with a standard size of 96 Bits (12 bytes). When necessary, the EPC memory size can be expanded to 480 bits (60 bytes) in steps of 16 bits at the cost of the user memory.

The following table shows how many bytes can be added to the EPC memory and how this affects the size of the user memory.

Table 7- 15 Size of the EPC memory and effect on the user memory

EPC memory		User memory
[bytes]	**[bits]**	**[bytes]**
54 ... 60	432 ... 480	16
46 ... 52	368 ... 416	24
38 ... 44	304 ... 352	32
30 ... 36	240 ... 288	40
22 ... 28	176 ... 224	48
14 ... 20	112 ... 160	56
0 ... 12	0 ... 96	64

7.6.4 Technical specifications

Table 7- 16 Technical specifications of SIMATIC RF690L

	6GT2810-2AGx0
Product designation	SIMATIC RF690L
Memory	
Chip (manufacturer/type)	Alien Higgs 3
Memory configuration	
• EPC	• 96 ... 480 bits [1)]
• User memory	• 16 ... 64 bytes [1)]
• TID	• 32 bits
• Unique TID	• 64 bits
• TID device configuration	• 96 bits
Type	EPC Class 1 Gen 2
Write cycles (min., at 22 °C)	> 500
MTBF (Mean Time Between Failures)	50 years

	6GT2810-2AGx0
Mechanical specifications	
Material	Plastic
Material surface	PEN ungummed, transparent
Color	Transparent
Antenna material	Aluminum
Type of antenna	Dipole
Imprint	Can be printed using heat transfer technique
Roll core diameter	76 mm
Roll outer diameter	200 mm
Label carrier	Siliconized, opaque paper liner (reverse side is not siliconized)
Electrical data	
Air interface	ISO 18000-6C
Polarization direction	Linear
Frequency band	• Europe: 865 to 868 MHz • USA/Canada: 902 to 928 MHz
Writing/reading distance	
• Write	• Up to 1.5 m [2)]
• Read	• Up to 4.5 m on non-metallic surface [2)] • Up to 2.4 m on metal [2)]
Permitted ambient conditions	
Ambient temperature	
• During operation	• -25 to +100 °C
	• Above +100 °C: 20% reduction in the limit distance
	• Above +140 °C: No processing possible
	• At +230 °C: No processing possible; Memory retention tested for 3 cycles each up to 30 minutes;
• During transportation and storage	• -25 to +100 °C
Distance from metal	Suitable for direct attachment to metal
Degree of protection	IP67

	6GT2810-2AGx0
Design, dimensions and weight	
Dimensions (L x W x H)	• Europe: 88 × 25 × 1.6 mm • USA/Canada: 77 × 25 × 1.6 mm
Weight	Approx. 5 g
Type of mounting	Single-sided adhesive (self-adhesive labels), acrylate glue

1) The EPC memory has a default size of 96 bits. When necessary, the EPC memory size can be expanded to 480 bits in steps of 16 bits at the cost of the user memory.

2) Depending on the environment

7.6.5 Dimension drawing

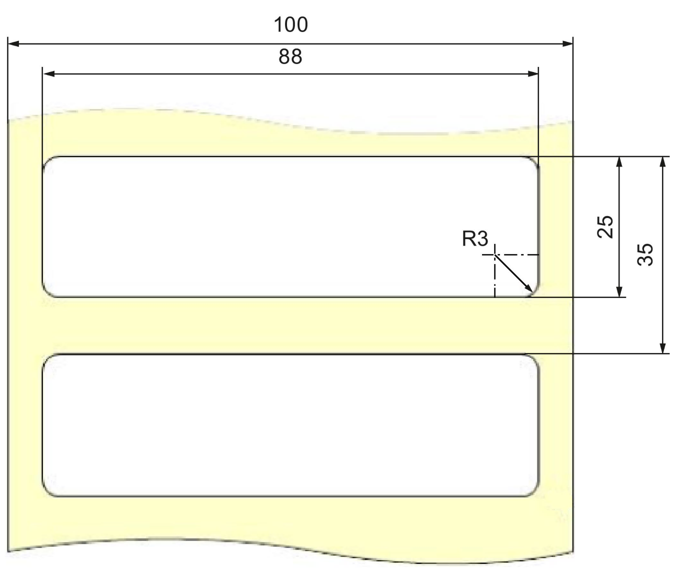


Figure 7-26 Dimension drawing RF690L (Europe, article number: 6GT2810-2AG00)

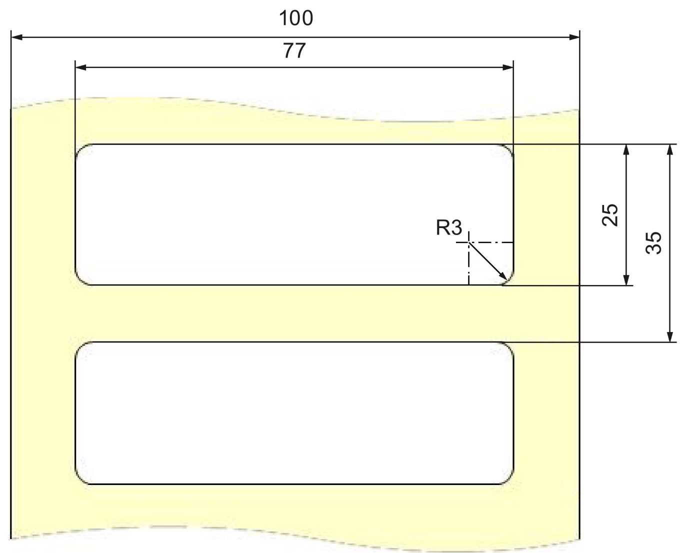


Figure 7-27 Dimension drawing RF690L (USA/Canada, article number: 6GT2810-2AG10)

All dimensions in mm

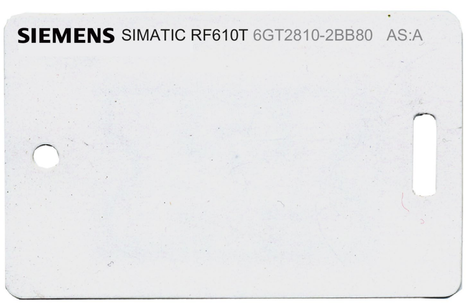
7.7 SIMATIC RF610T

7.7.1 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	Characteristics	
	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 bits/240 bits User 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 375)".		

7.7.2 Ordering data

Ordering data	Article number	Packaging
SIMATIC RF610T	6GT2810-2BB80	Min. order quantity 500 units

7.7.3 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 (https://support.industry.siemens.com/cs/ww/en/ps/14971/man) and only in combination with third-party devices and components recommended and/or approved by Siemens.

7.7.4 Minimum spacing between labels

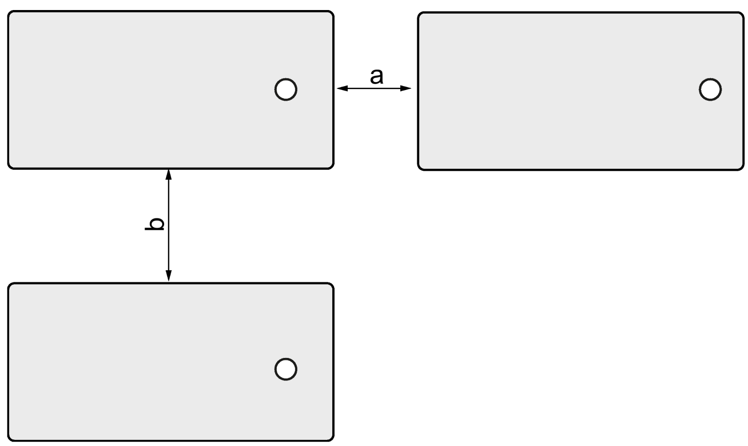


Figure 7-28 Minimum spacing between labels

Table 7- 17 Minimum spacing

Minimum spacing	
a	20 mm
b	50 mm

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 366).

7.7.6 Technical specifications

Table 7- 18 Technical specifications of SIMATIC RF610T

	6GT2810-2BB80
Product designation	SIMATIC RF610T
Memory	
Memory configuration	
• EPC	• 96/240 bits
• User memory	• 512 bits
• TID	• 64 bits
• Reserved (passwords)	• 64 bits
Type	EPC Class 1 Gen 2
Read cycles (max., at < 40 °C)	10^{14}
Write cycles (max., at < 40 °C)	10^{5}
Data retention (at < 40 ℃)	10 years
Mechanical specifications	
Material	PVC
Color	white
Antenna material	Aluminum
Type of antenna	Shortened dipole
Static pressure	10 N/mm²
Printing	with thermotransfer method
Electrical data	
Air interface	according to ISO°18000-6C
Polarization direction	Linear, parallel to the long side of the inlay
Frequency band	• Europe 865 … 868 MHz • USA 902 … 928 MHz
Range [1)]	max. 5 m
Energy source	Field energy via antenna, without battery
Multitag capability	Yes

	6GT2810-2BB80
Permitted ambient conditions	
Ambient temperature	
• During operation	• -25…+85 ℃
• During transportation and storage	• -40…+85 ℃
Distance from metal	Not suitable for mounting directly on metal
Torsion and bending load	permitted with limits
Shock resistant to EN 60068-2-27	100 g [2)]
Vibration resistant to EN 60068-2-6	50 g [2)]
Degree of protection	IP67
Design, dimensions and weight	
Dimensions (L x W x H)	54 mm x 86 mm x 0.4 mm
Weight	approx. 3 g
Type of mounting	Adhesive, cable tie, screws

[1)] The information relates to the maximum read range. You will find more information on ranges in the section "Minimum clearances and maximum distances (Page 375)".

[2)] 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.

7.7.7 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

7.7.8 Dimension drawing

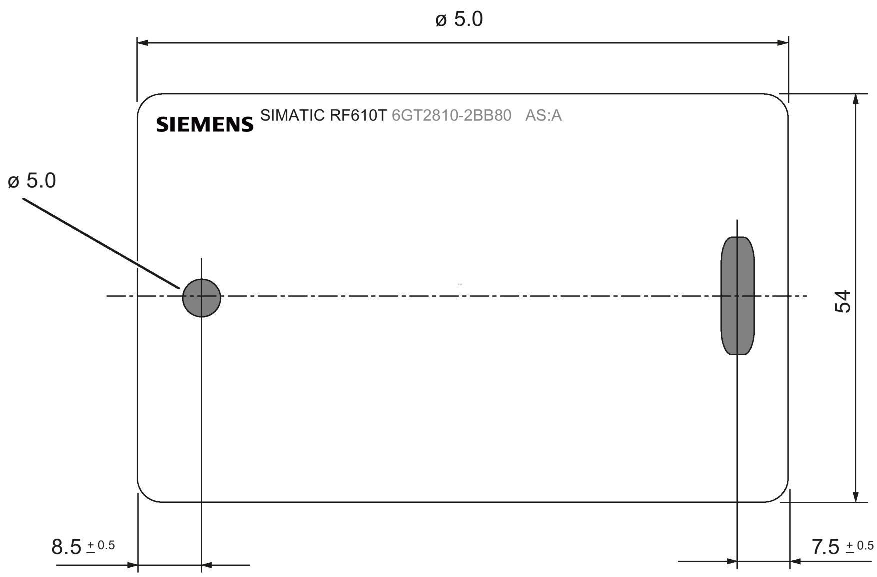


Figure 7-29 Dimensional drawing of SIMATIC RF610T

All dimensions in mm

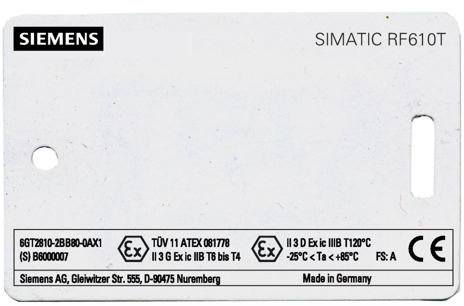
7.8 SIMATIC RF610T ATEX

7.8.1 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">Characteristics</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 bits/240 bits
User 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 375)".</td></tr>
</table>

7.8.2 Ordering data

Ordering data	Article number	Packaging
SIMATIC RF610T special variant ATEX	6GT2810-2BB80-0AX1	Min. order quantity 500 units

7.8.3 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 (https://support.industry.siemens.com/cs/ww/en/ps/14971/man) and only in combination with third-party devices and components recommended and/or approved by Siemens.

7.8.4 Minimum spacing between labels

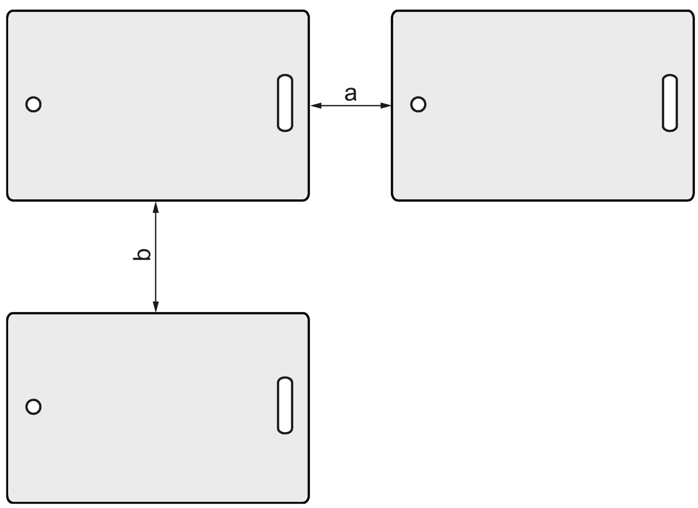


Figure 7-30 Minimum spacing between labels

Table 7- 19 Minimum spacing

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

7.8.5 Memory configuration

The memory configuration of the transponder is described in section SIMATIC memory configuration of the RF600 transponder and labels (Page 366).

7.8.6 Use of the transponder in hazardous areas

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.

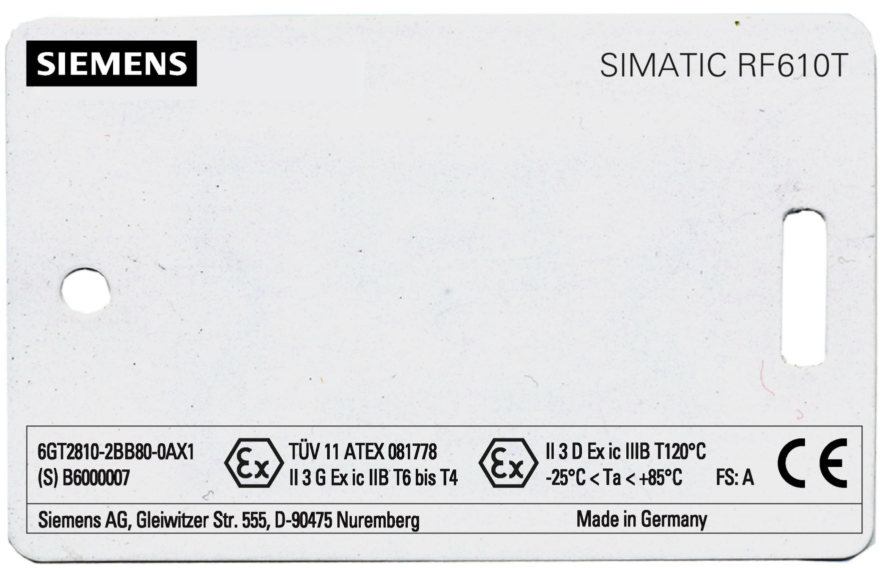
Identification

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

7.8.6.1 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.

7.8.6.2 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.

7.8.7 Technical specifications

Table 7- 20 Technical specifications of the SIMATIC RF610Tspecial variant ATEX

	6GT2810-2BB80-0AX1
Product designation	SIMATIC RF610T special variant ATEX
Memory	
Memory configuration	
• EPC	• 96/240 bits
• User memory	• 64 bytes
• TID	• 64 bits
• Reserved (passwords)	• 64 bits
Type	EPC Class 1 Gen 2
Read cycles (max., at < 40 °C)	10^{14}
Write cycles (min., at > 22 °C)	10^{5}
Data retention (at < 40 ℃)	10 years
Mechanical specifications	
Material	PVC
Color	white
Antenna material	Aluminum
Type of antenna	Shortened dipole
Static pressure	10 N/mm²
Printing	with thermotransfer method

	6GT2810-2BB80-0AX1
Electrical data	
Air interface	according to ISO°18000-6C
Polarization direction	Linear, parallel to the long side of the inlay
Frequency band	• Europe 865 … 868 MHz • USA 902 … 928 MHz
Range [1]	max. 5 m
Energy source	Field energy via antenna, without battery
Multitag capability	Yes
Permitted ambient conditions	
Ambient temperature	
• During operation	• -25…+85 ℃
• During transportation and storage	• -40…+85 ℃
Distance from metal	Not suitable for mounting directly on metal
Torsion and bending load	permitted with limits
Shock resistant to EN 60068-2-27	100 g [2]
Vibration resistant to EN 60068-2-6	50 g [2]
Degree of protection	IP67
Design, dimensions and weight	
Dimensions (L x W x H)	54 mm x 86 mm x 0.4 mm
Weight	approx. 3 g
Type of mounting	Adhesive, cable tie, screws

1) The information relates to the maximum read range. You will find more information on ranges in the section "Minimum clearances and maximum distances (Page 375)".

2) 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.

7.8.8 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.

7.8.9 Dimension drawing

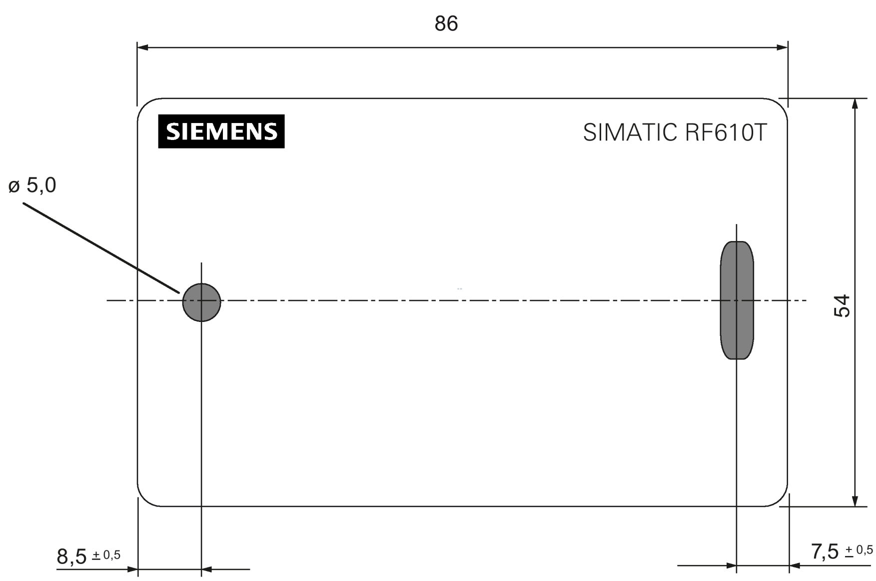


Figure 7-31 Dimension drawing SIMATIC RF610T (special variant ATEX)

All dimensions in mm

7.9 SIMATIC RF620T

7.9.1 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).

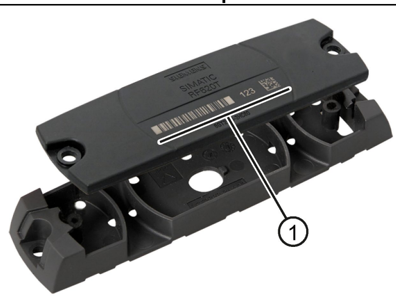
The transponder also has a 64-byte user memory.

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	**Characteristics**	
	Area of application	Transponder for rugged, industrial requirements such as RF identification in warehouses and the logistics and transport area.
	Frequency band	860 to 960 MHz
	Polarization	Linear
	Memory	EPC 96 bit/128 bit 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 375)".

7.9.2 Ordering data

Ordering data	Article 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

7.9.3 Planning the use

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

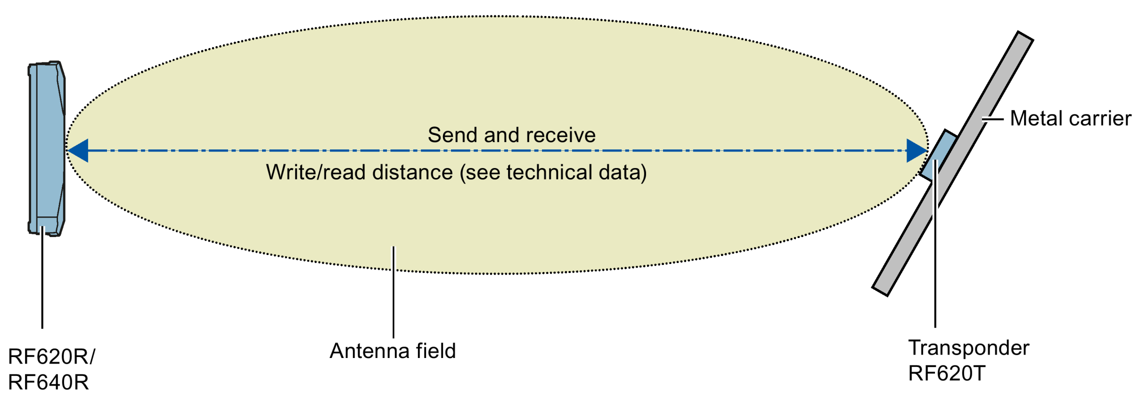


Figure 7-32 Example of optimum reader-transponder positioning with RF620R and RF640R via the internal reader antenna.

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.

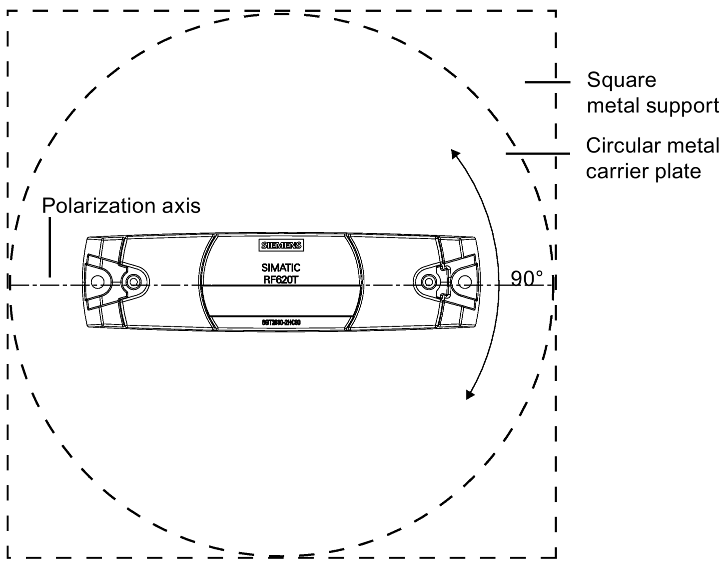


Figure 7-33 Optimum positioning of the transponder on a (square or circular) metal surface

Table 7- 21 Range with metallic, flat carriers without spacers

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

Table 7- 22 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.

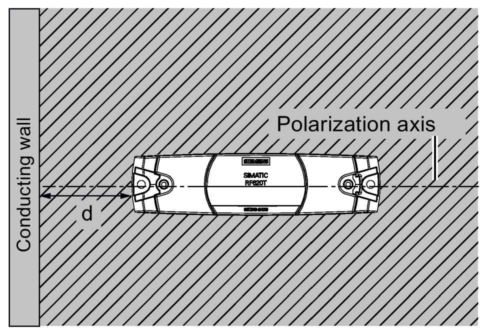
You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 375)".

7.9.3.3 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 orthogonal to the wall. A spacer must be used in any case.

Range: One conducting wall

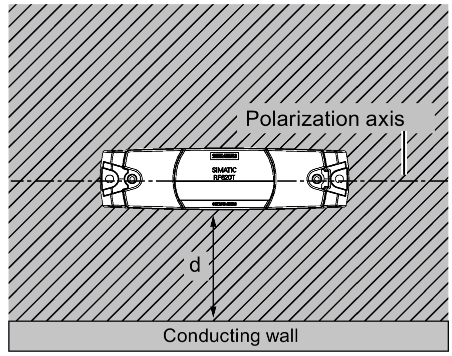
Influence on the range when positioned orthogonally to the conducting wall



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

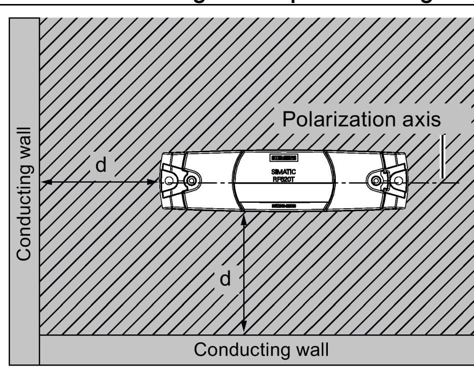


View from above

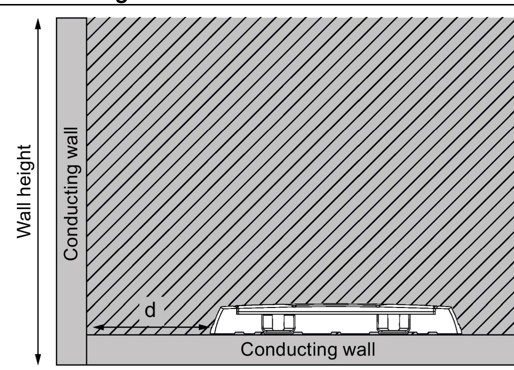
Distance d	20 mm	50 mm	100 mm	
Range	approx. 70%	approx. 100%	approx. 100%	Wall height 20 mm
	approx. 60%	approx. 90 %	approx. 100%	Wall height 50 mm
	approx. 30%	approx. 70%	approx. 100%	Wall height 100 mm

Range: Two conducting walls

Influence on the range when positioned against two conducting walls



View from above



Side view

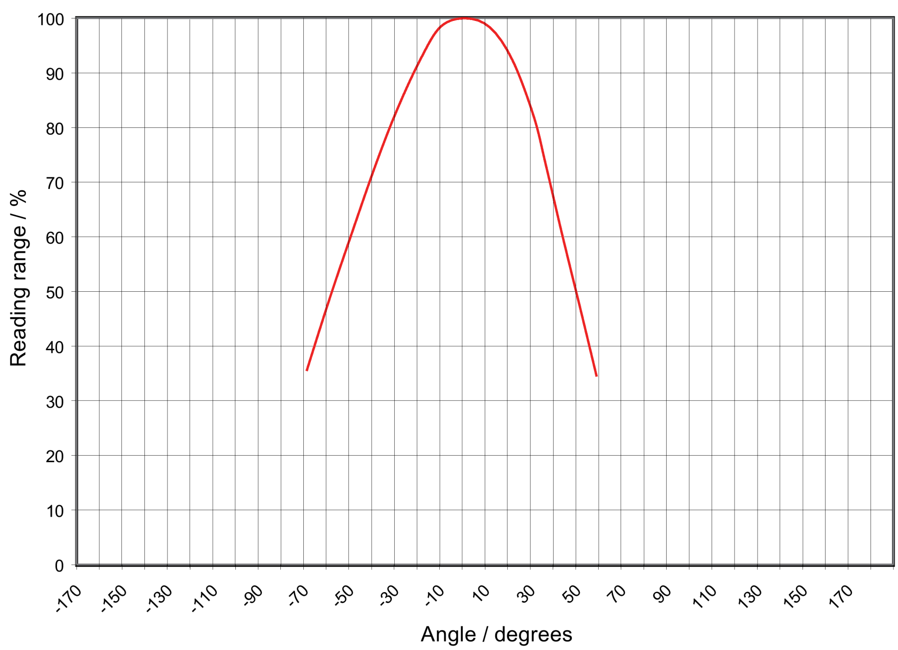
Distance d	20 mm	50 mm	100 mm	
Range	approx. 70%	approx. 100%	approx. 100%	Wall height 20 mm
	approx. 60%	approx. 90 %	approx. 100%	Wall height 50 mm
	approx. 30%	approx. 70%	approx. 100%	Wall height 100 mm

The values specified in the tables above are guide values.

7.9.3.4 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



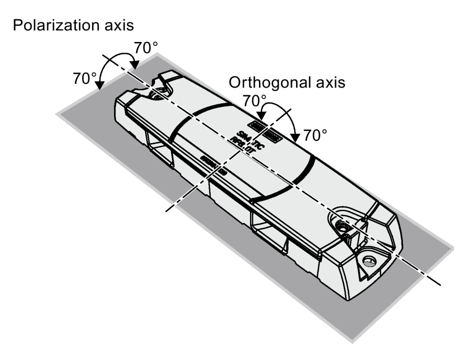


Figure 7-34 Characteristic of the transponder when rotated about the polarization axis or orthogonally to the polarization axis

7.9.3.5 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- 23 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 375)".

7.9.3.6 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

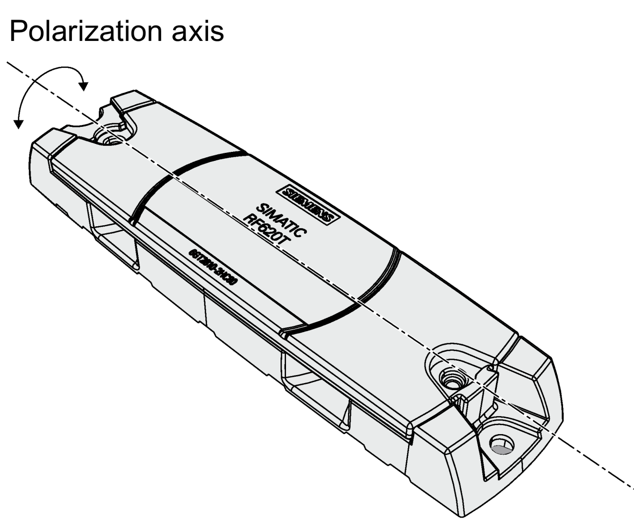


Figure 7-35 Rotation of the transponder about the polarization axis

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

Rotation orthogonal to the polarization axis

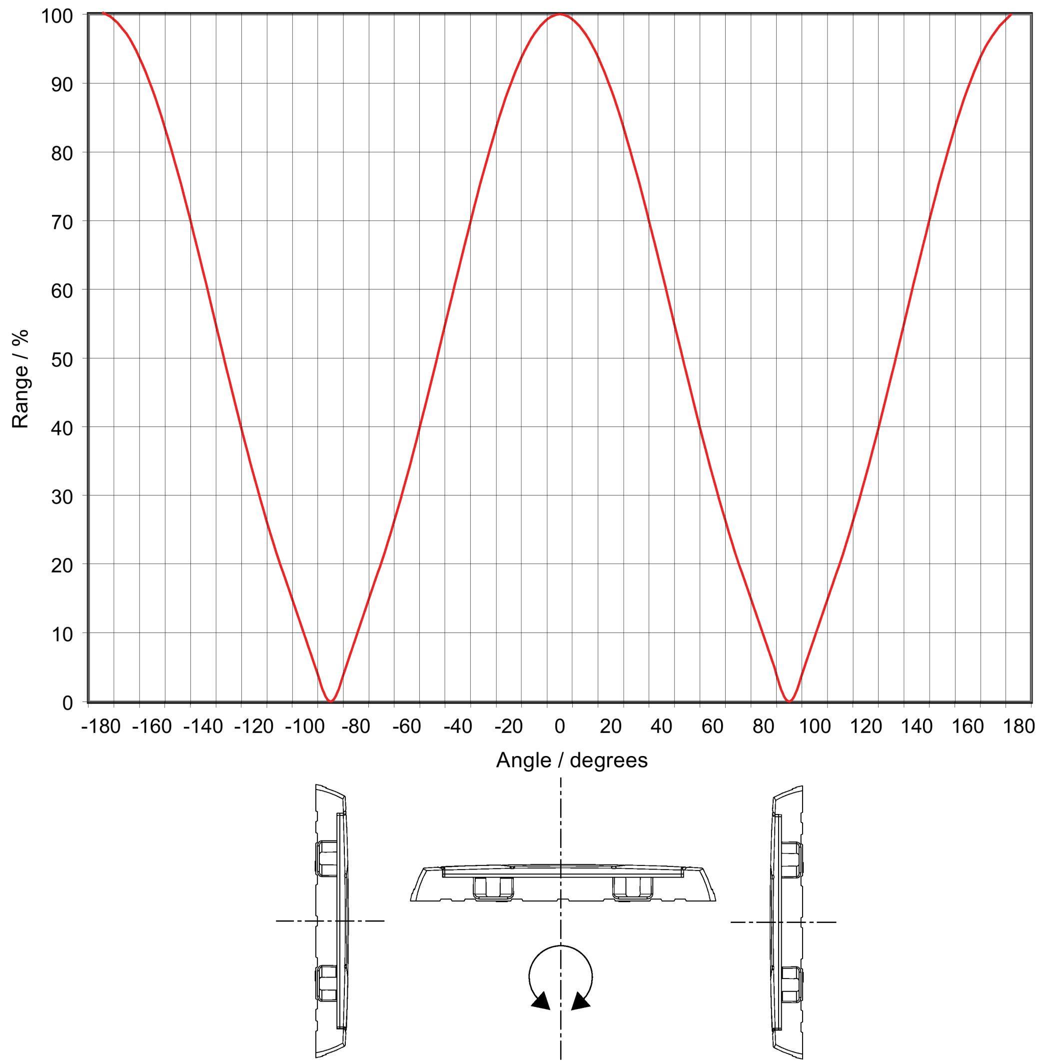


Figure 7-36 Transponder characteristics when rotated orthogonally to the polarization axis (within the tag plane)

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.

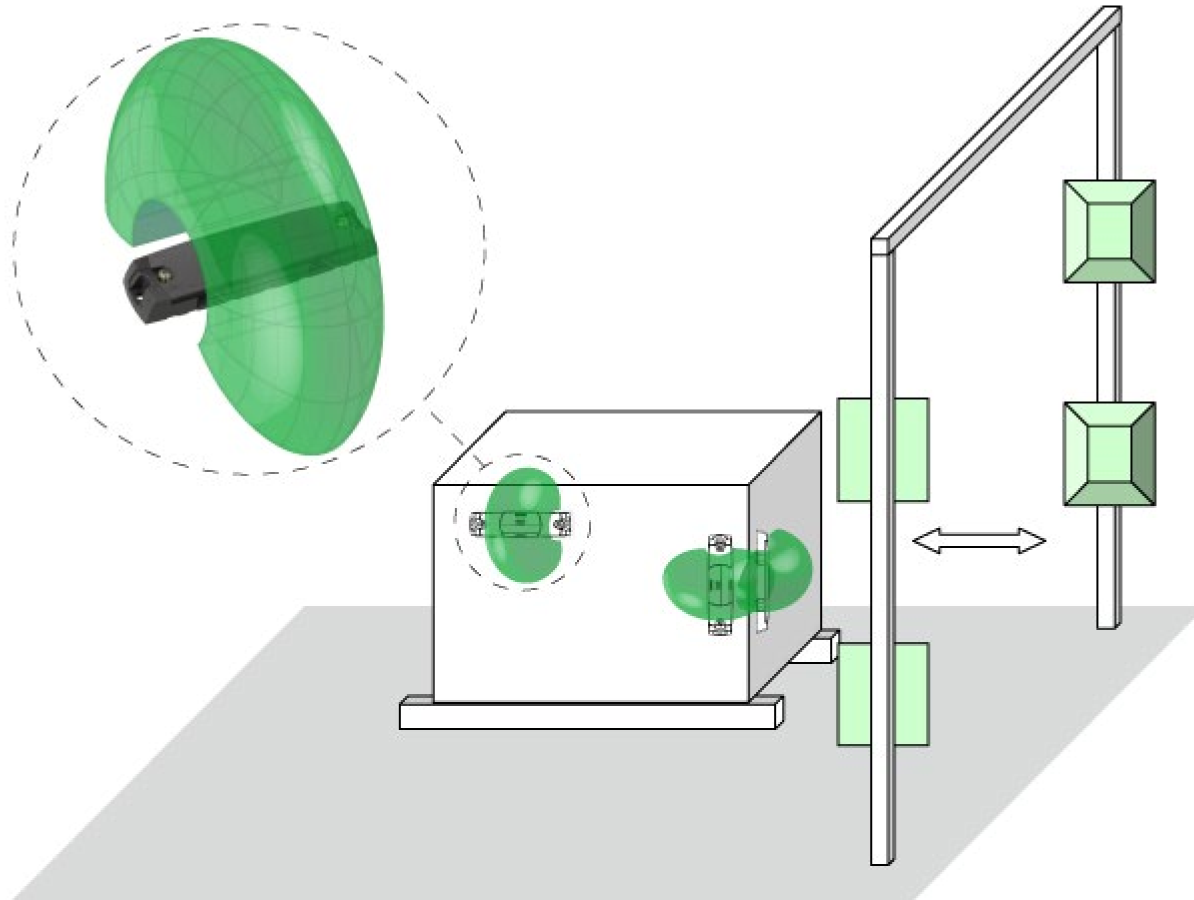


Figure 7-37 Application example for possible orientations of the transponder.

7.9.3.7 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 x 10^5 to 1 x 10^{11} ohm and conductive materials with 1 x 10^3 to 1 x 10^5 ohm are available.

Table 7- 24 Limited range with ESD materials

Carrier material	Range
Transponder on electrostatic dissipative materi-als, dimensions 60°x°40 cm (surface resistance 2 x 10^9 ohm)	approx. 50%
Transponder on electrostatically conductive mate-rials, 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.

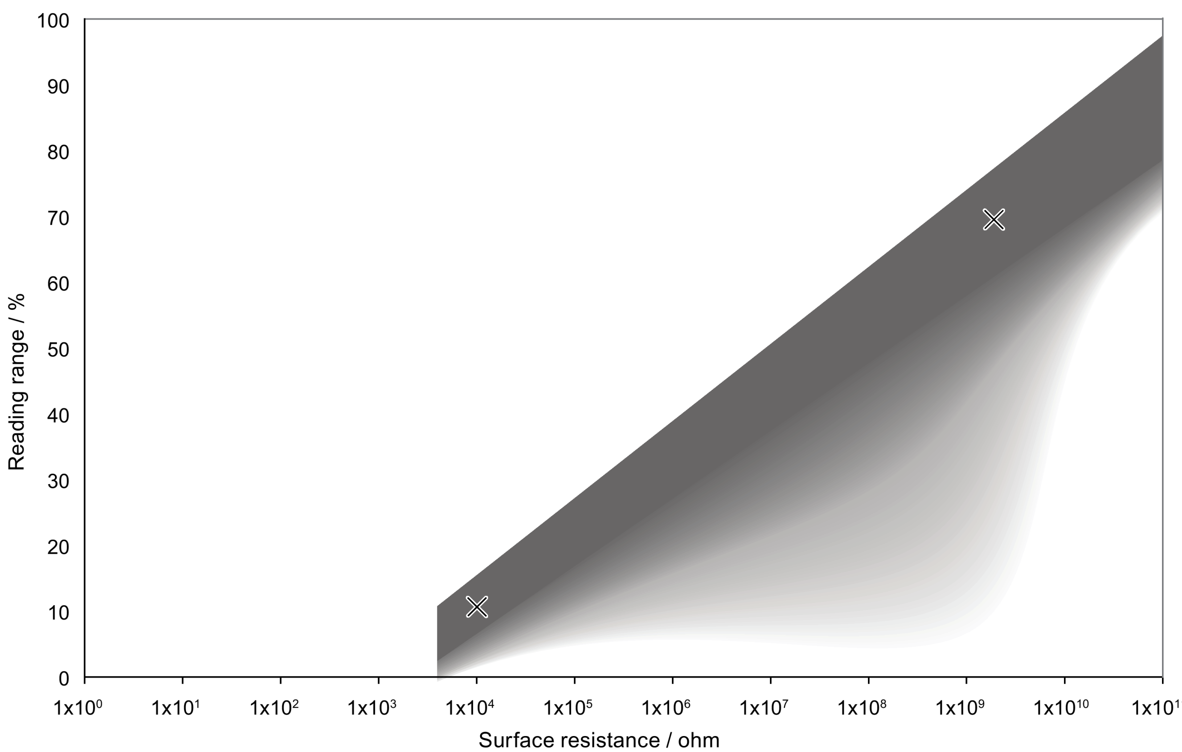


Figure 7-38 Schematic representation of how the range depends on the surface resistance of the ESD material

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.

7.9.3.8 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.

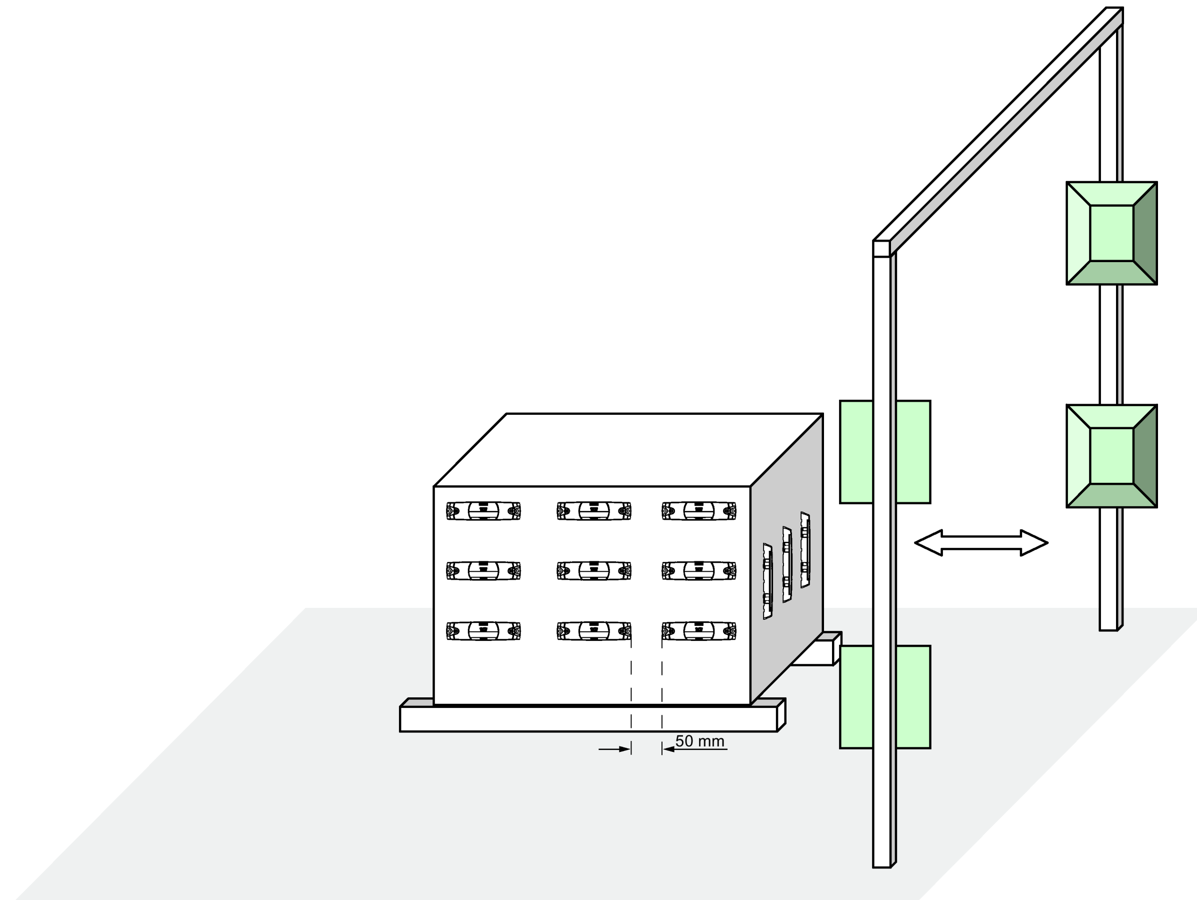


Figure 7-39 Multitag reading

7.9.4 Mounting instructions

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

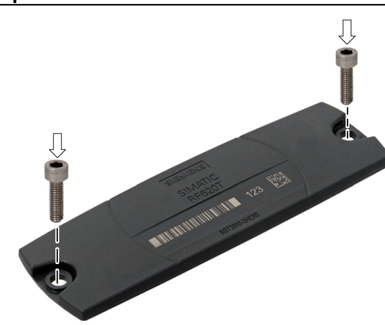
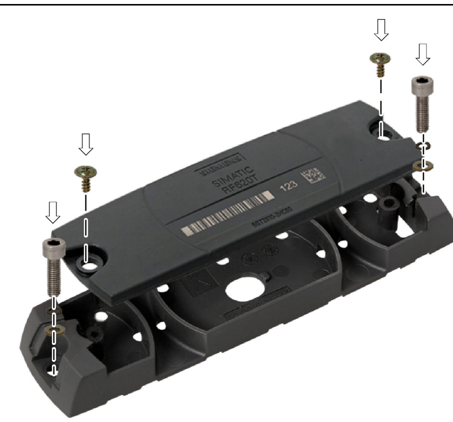
NOTICE

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	

7.9.5 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 366).

7.9.6 Technical specifications

Table 7- 25 Technical specifications of SIMATIC RF620T

	6GT2810-2HC81
Product designation	SIMATIC RF620T
Memory	
Memory configuration	
• EPC	• 96/128 bits
• User memory	• 64 bytes
• TID	• 96 bits
Type	EPC Class 1 Gen 2
Read cycles (max., at < 40 °C)	10^{14}
Write cycles (min., at > 22 °C)	10^5
Data retention (at < 40 ℃)	10 years
Mechanical specifications	
Material	Plastic enclosure (PP; food safe)
Color	Anthracite
Printing	No
Silicone-free	Yes
Electrical data	
Air interface	according to ISO°18000-6C
Polarization direction	Linear
Frequency band	860 ... 960 MHz
Range 1)	max. 8 m
Energy source	Field energy via antenna, without battery
Multitag capability	Yes, minimum distance between data carriers ≥ 50 mm
Permitted ambient conditions	
Ambient temperature	
• During operation	• -25…+85 ℃
• During transportation and storage	• -40…+85 ℃
Distance from metal	Preferably with spacer
Torsion and bending load	not permitted
Shock resistant to EN 60068-2-27	100 g 2)
Vibration resistant to EN 60068-2-6	50 g 2)
Degree of protection	IP67

	6GT2810-2HC81
Design, dimensions and weight	
Dimensions (L x W x H)	
• Transponder	• 127 mm x 38 mm x 6 mm
• Spacer	• 157 mm x 39 mm x 12 mm
Weight	
• Transponder	• approx. 18 g
• Spacer	• Approx. 22 g
• Transponder with spacer	• Approx. 40 g
Type of mounting	Adhesive, cable tie, screws

1) The information relates to the maximum read range. You will find more information on ranges in the section "Minimum clearances and maximum distances (Page 375)".

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

7.9.7 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	○○○○	○○○○
Emissions containing hydrochloric acid		○○○○	○○○○
Emissions containing sulphuric acid		○○○○	-
Battery acid	38	○○○○	○○○○
Aluminum acetate, w.		○○○○	○○○○
Aluminum chloride	10	○○○○	○○○○
Aluminum nitrate, w.		○○○○	○○○○
Aluminum salts		○○○○	○○○○
Formic acid	50	○○○○	-
Aminoacetic acid (glycocoll, glycine)	10	○○○○	○○○○
Ammonia gas		○○○○	○○○○
Ammonia	25	○○○○	○○○○
Ammonia, w.	conc.	○○○○	○○○○
	10	○○○○	○○○○
Arsenic acid, w.		○○○○	○○○○
Ascorbic acid, w.		○○○○	○○○○
Petroleum spirit		-	-

	Concentration	20 °C	50 °C
Benzene		○○	-
Prussic acid, w.		○○○○	○○○○
Sodium hypochlorite solution	diluted / 20	○○○○	○○
	50	○○	○○
Borax		○○○○	○○○○
Boric acid, w.	10	○○○○	○○○○
Brake fluid		○○○○	○○○○
Bromine		-	-
Butane, gas, liquid	techn. pure	○○○○	○○○○
Butyl acetate (acetic acid butyl ester)		○○	-
Calcium chloride, w./ alcoholic		○○○○	○○○
Calcium chloride,		○○○○	○○○○
Calcium nitrate, w.		○○○○	○○○○
	50	○○○○	○○○○
Chlorine		–	–
Chloroacetic acid		○○○○	○○○○
Chloric acid	20	○○○○	-
Chrome baths, tech.		–	–
Chromium salts		○○○○	○○○○
Chromic acid	10	○○○○	○○○○
	20 / 50	○○	○○
Chromic acid, w		○○○○	○○
Chromosulphuric acid	conc.	-	-
Citric acid	10	○○○○	○○○○
Diesel fuel		○○○○	
Diesel oil	100	○○○○	
Diglycole acid	30	○○○○	○○○○
Iron salts, w.	k. g.	○○○○	○○○○
Vinegar		○○○○	○○○○
Acetic acid	5 / 50	○○○○	○○○○
Ethanol	50 / 96	○○○○	○○○○
Ethyl alcohol	96 / 40	○○○○	○○○○
Fluoride		○○○○	○○○○
Formaldehyde	10	○○○○	○○○○
	40	○○○○	○○○
Formaldehyde solution	30	○○○○	○○○○
Glycerin	any	○○○○	○○○○
Glycol		○○○○	○○○○
Uric acid		○○○○	
HD oil, motor oil, without aromatic compounds		○○○○	

	Concentration	20 °C	50 °C
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.		○○○○	○○○○
Nitric acid		-	-
	50	○○	
	1-10	○○○○	○○○○
Hydrochloric acid	1-5 / 20	○○○○	○○○○

	Concentration	20 °C	50 °C
	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

7.9.8 Certificates and approvals

Table 7- 26 6GT2810-2HC00 - RF620T UHF container tag

Certificate	Description
CE	CE Approval to R&TTE

Table 7- 27 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 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

7.9.9 Dimension drawing

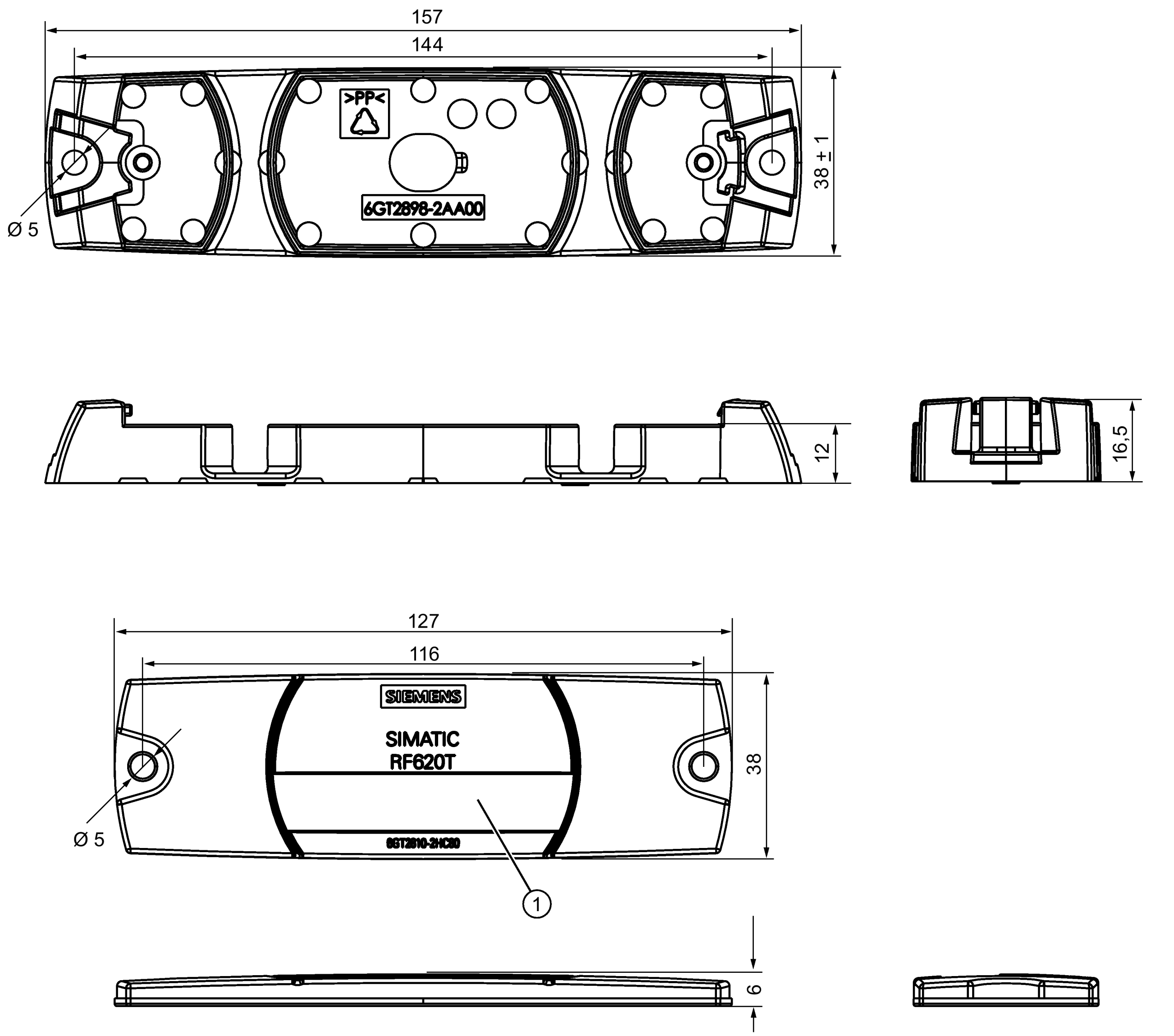


Figure 7-40 SIMATIC RF620T UHF container tag

Units of measurement: All dimensions in mm

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

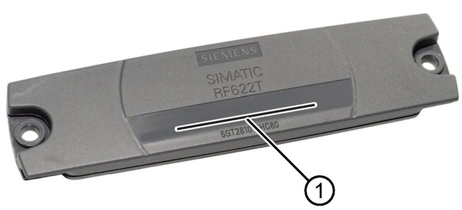
① Labeling area, see Section Characteristics (Page 423)

7.10 SIMATIC RF622T

7.10.1 Features

The SIMATIC RF622T is a passive and maintenance-free data carrier. It operates on the basis of the UHF Class 1 Gen 2 technology and has a fast FRAM user memory of 3,424 bytes.

The SIMATIC RF622T achieves a read range of up to 3 m on a non-metallic surface and 1 m on metallic containers with a spacer. This means that the RF622T allows numerous uses in the widest range of applications.

SIMATIC RF622T	Characteristics	
	Area of application	Industrial plant management, RFID identification of tools and containers.
	Frequency band	860 ... 960 MHz
	Air interface	according to ISO°18000-6C
	Memory	EPC 496 bits User memory: 3424 bytes
	Write range	• Up to 3 m on a non-metallic surface [1)] • Up to 1 m on metal with spacer [1)]
	Read range	• Up to 3 m on a non-metallic surface [1)] • Up to 1 m on metal with spacer [1)]
	Mounting	2 x M4 screws
	Labeling area ①	Possible types of labeling: • Barcode • Data matrix code • Labeling in plain text It can be labeled with an adhesive label or by laser.

[1)] Depending on the environment

7.10.2 Ordering data

Table 7- 28 Ordering data RF622T

	Article number
SIMATIC RF622T Packaging unit: 10 per pack	6GT2810-4HC80

Table 7- 29 Ordering data for RF622T

	Article number
Spacer for SIMATIC RF622T Packaging unit: 10 per pack	6GT2898-3AA00

7.10.3 Presetting of the EPC memory

The first 12 bytes of the EPC memory ("0x00 - 0x0B") are preset. As of byte 13 ("0x0C") the EPC memory is not preset.

Table 7- 30 Presetting of the EPC memory

Address UID	0x00	...	0x04	0x05	0x06	0x07	0x08	0x09	0x0A	0x0B
Address with FB (UID)	0xFF00	...	0xFF04	0xFF05	0xFF06	0xFF07	0xFF08	0xFF09	0xFF0A	0xFF0B
Value	0x00	...	0x00	Tran-sponder type (0x5E) 1)	Year pro-duced 1)	Month pro-duced 1)	Day pro-duced 1)	Consecutive no. 1)		

1) In the following table, these values are described in greater detail.

Table 7- 31 Explanation of the values

Transponder type	**Year produced**	**Month produced**	**Day produced**	**Consecutive no. 1)**		
RF622T = 0x5E	2015 = 0x0F	Jan. = 0x01	01 = 0x01	0x00	0x00	0x01
--	2016 = 0x10	Feb. = 0x02	02 = 0x02	0x00	0x00	0x02
--	...	...	...	...	...	...
--	...	Dec. = 0x0C	31 = 0x1F	0xFF	0xFF	0xFF

1) The consecutive number is counted absolutely and is therefore unique.

7.10.4 Technical specifications

Table 7- 32 Technical specifications of SIMATIC RF622T

	6GT2810-4HC80
Product designation	SIMATIC RF622T
Memory	
Chip (manufacturer/type)	Fujitsu MB97R803
Memory configuration	
• EPC	• 496 bits
• User memory	• 3424 bytes
• TID	• 256 bits [1)]
Write cycles (min., at 22 °C)	> 10^{10}
Data retention (at 55 °C)	10 years
Mechanical specifications	
Material	Plastic PA12, silicone-free
Color	Anthracite
Antenna material	Aluminum
Type of antenna	Shortened dipole
Electrical data	
Air interface	ISO 18000-6C
Polarization direction	Linear
Frequency band	860 ... 960 MHz
Write/read distance	
• Write	• Up to 3 m on a non-metallic surface [2)] • Up to 1 m on metal with spacer [2)]
• Read	• Up to 3 m on a non-metallic surface [2)] • Up to 1 m on metal with spacer [2)]
Permitted ambient conditions	
Ambient temperature	
• In operation, during write/read access	• -20 ... +85 °C
• In operation, outside write/read access	• -40 ... +85 °C
• During transportation and storage	• -40 ... +85 °C
Distance from metal	Secured with spacer (6GT2898-3AA00)
Torsion and bending load	not permitted
Degree of protection	IP67

	6GT2810-4HC80
Design, dimensions and weight	
Dimensions (L x W x H)	
• Transponder	• 120 × 30 × 6.5 mm
• Spacer	• 130 × 31.5 × 12 mm
• Transponder with spacer	• 130 × 31.5 × 15 mm
Weight	
• Transponder	• 14 g
• Spacer	• 8 g
Type of mounting	2 x M4 screws
Tightening torque	≤ 1 Nm at room temperature

1) In the current chip version of the transponder, the TID can be written to. It is not recommended that you use the TID as user memory.

2) Depending on the environment

7.10.5 Dimension drawing

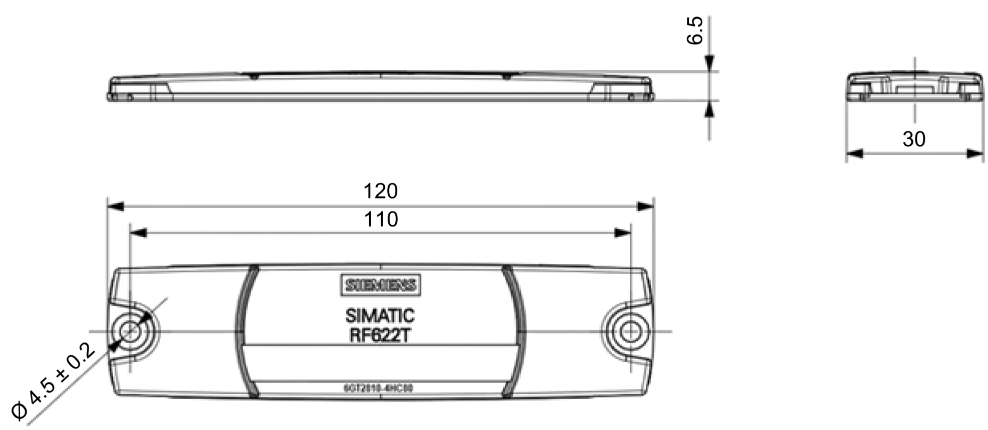


Figure 7-41 Dimension drawing RF622T

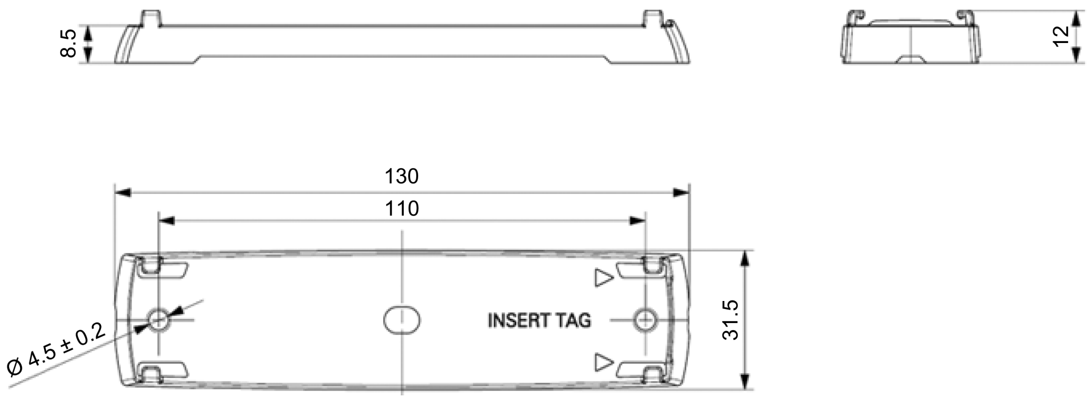


Figure 7-42 Dimension drawing spacer RF622T

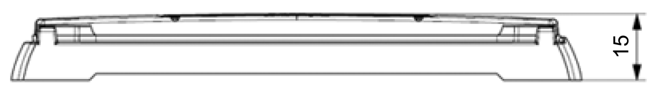


Figure 7-43 Dimension drawing RF622T mounted

All dimensions in mm; tolerances unless indicated otherwise ±0.5 mm.

7.11 SIMATIC RF625T

7.11.1 Characteristics

The SIMATIC RF625T transponder is a passive, maintenance-free data carrier with a round design. It operates based on 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.

SIMATIC RF625T	Characteristics		
	Area of application	Identification tasks in rugged industrial environments	
	Frequency variants	Europe	USA/Canada
		865 MHz ... 868 MHz	902 MHz ... 928 MHz
	Air interface	according to ISO°18000-6C	
	Polarization	Linear	
	Memory	EPC 96 bits/128 bits User memory: 64 bytes	
	Range [1)]	max. 1.5 m	
	Mounting	for direct mounting on conductive materials (preferably 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 375)".

7.11.2 Ordering data

Ordering data	Article number
SIMATIC RF625T (Europe), frequency range 865 MHz ... 868 MHz	6GT2810-2EE00
SIMATIC RF625T (USA / Canada), frequency range 902 MHz ... 928 MHz	6GT2810-2EE01

7.11.3 Planning the use

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

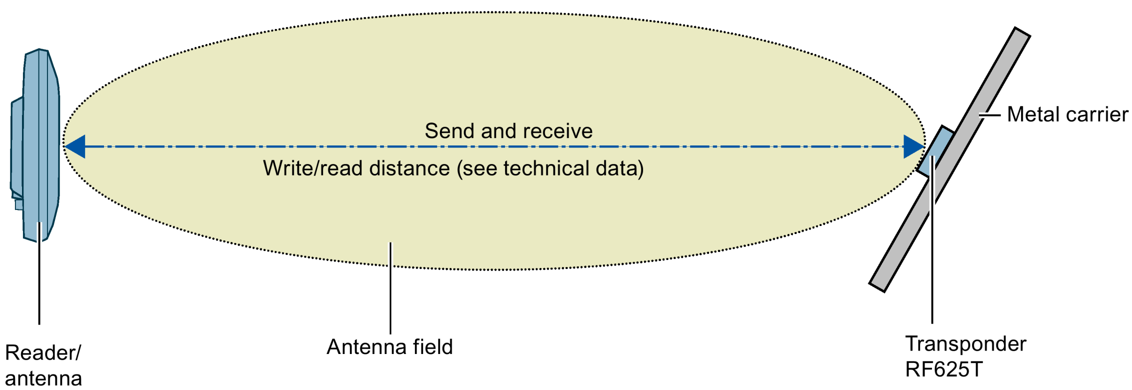


Figure 7-44 Example of optimum reader/antenna transponder positioning

The graphic shows an example of optimum positioning of the transponder relative to the reader or the antenna. This positioning is regardless of whether you are working with the internal reader antenna or with one of the external RF600 antennas.

7.11.3.2 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.

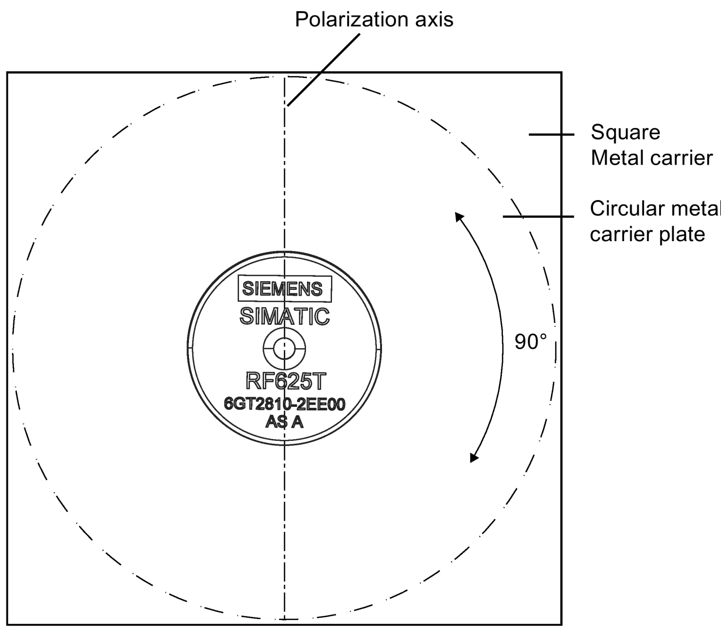


Figure 7-45 Optimum positioning of the transponder on a (square or circular) metal surface

Table 7- 33 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 375)".

7.11.3.3 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- 34 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 375)".

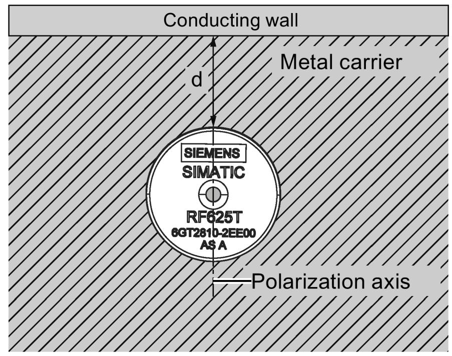
7.11.3.4 Influence of conducting walls on the range

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

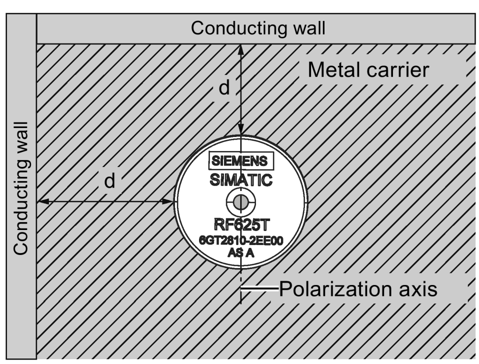


Distance d	20 mm	50 mm	100 mm	
Range	approx. 100%	approx. 100%	approx. 100%	Wall height 20 mm
	approx. 100%	approx. 100%	approx. 100%	Wall height 50 mm
	approx. 80%	approx. 100%	approx. 100%	Wall height 100 mm

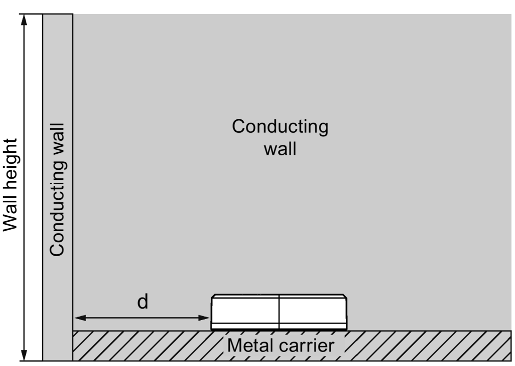
Range: Two conducting walls

Influence on the range when positioned against two conducting walls

View from above



Side view

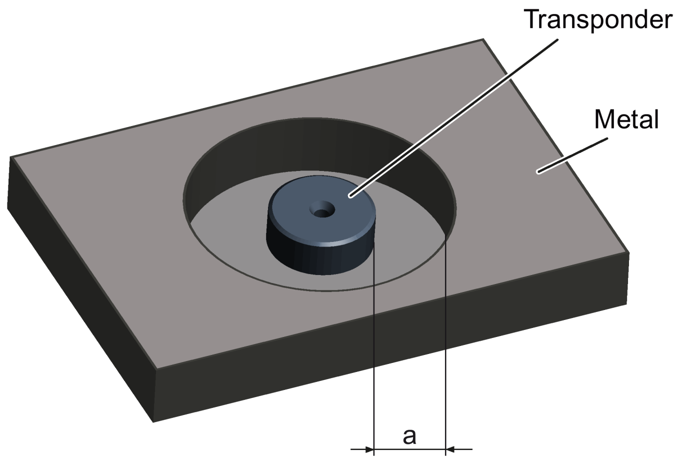


Distance d	20 mm	50 mm	100 mm	
Range	approx. 70%	approx. 75 %	approx. 100%	Wall height 20 mm
	approx. 70%	approx. 80%	approx. 100%	Wall height 50 mm
	approx. 70%	approx. 40%	approx. 50 %	Wall height 100 mm

The values specified in the tables above are guide values.

7.11.3.5 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 7-46 Flush-mounting of RF625T in metal

7.11.3.6 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.

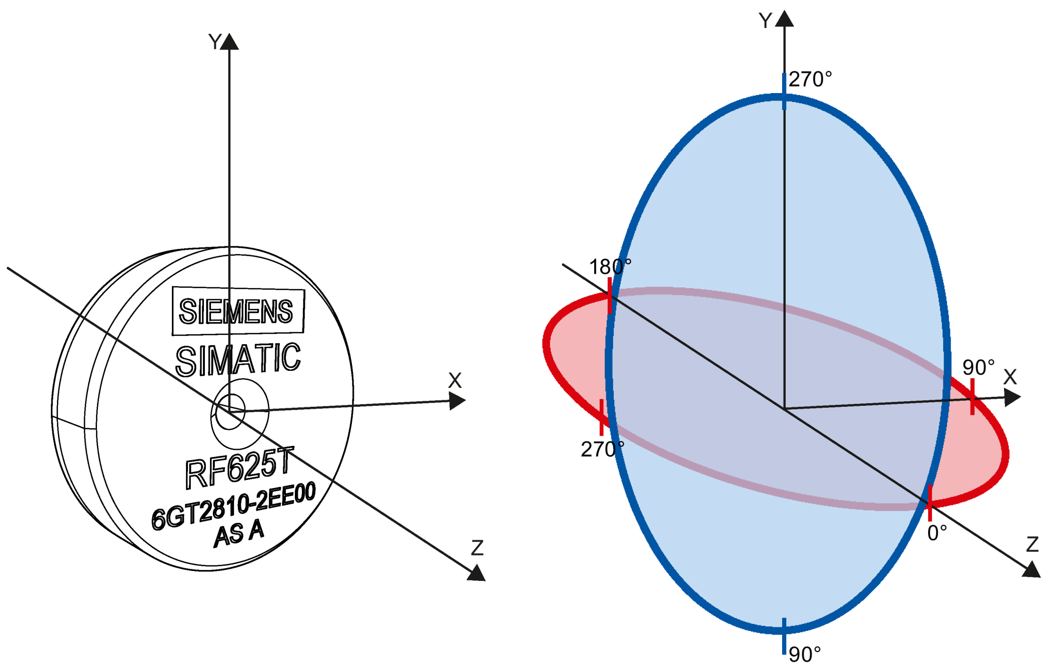


Figure 7-47 Reference system of the RF625T

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

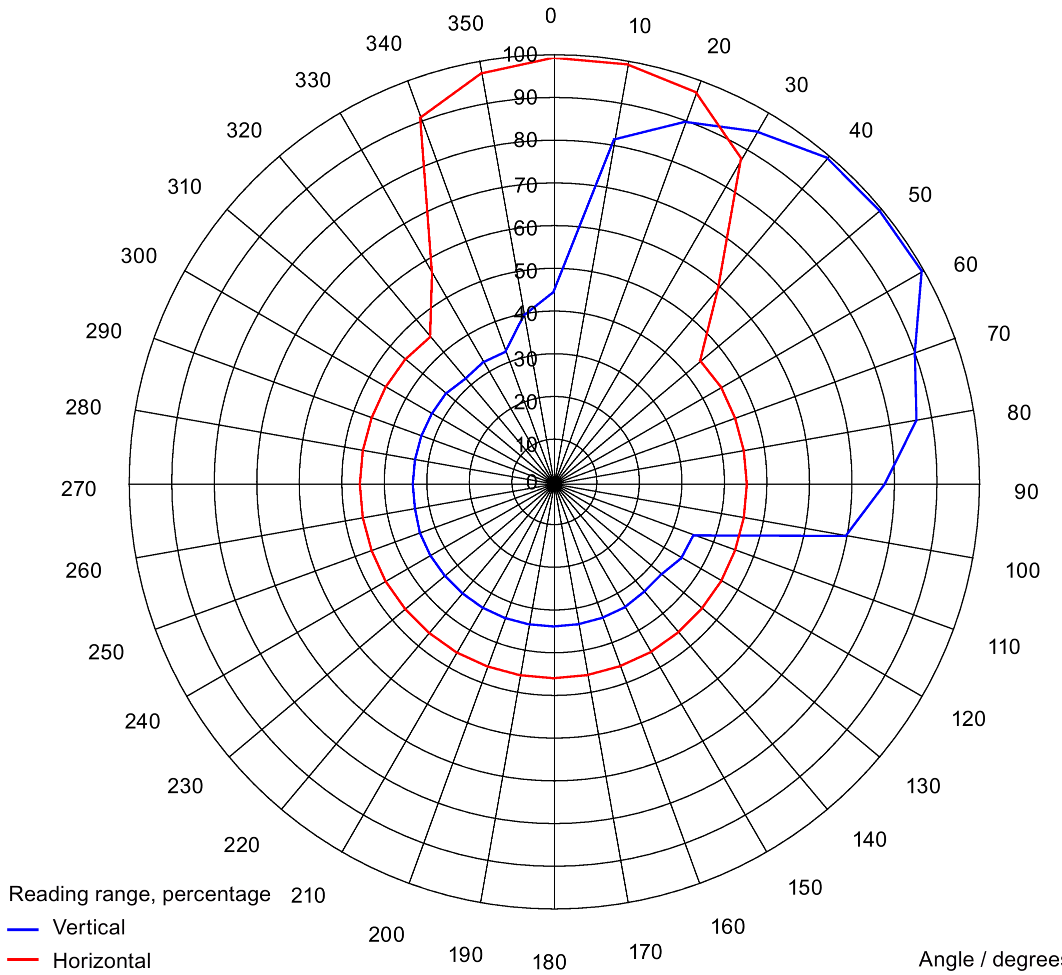


Figure 7-48 Directional characteristics of the RF625T on a metallic carrier depending on the angle of inclination in a vertical or horizontal direction

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

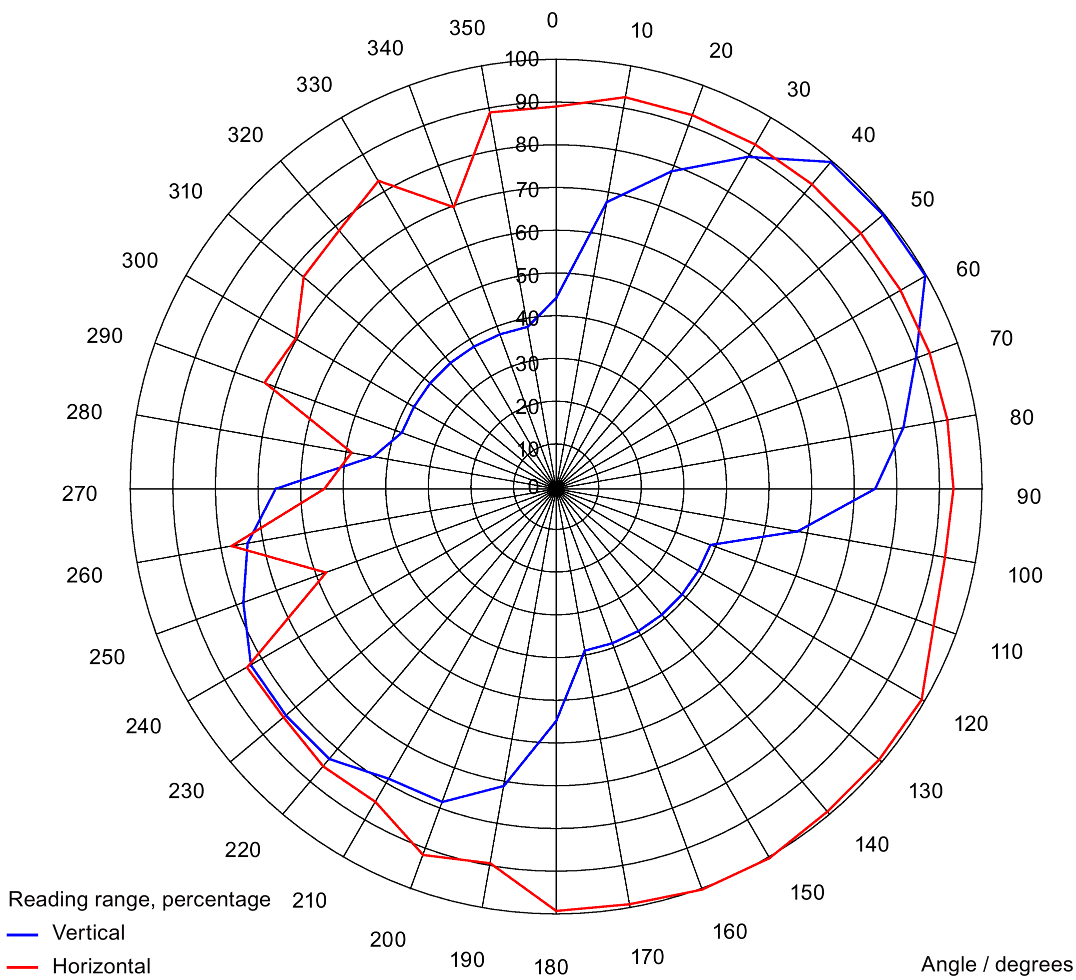


Figure 7-49 Directional characteristics of the RF625T on a non-metallic carrier depending on the angle of inclination in a vertical or horizontal direction

7.11.4 Mounting instructions

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

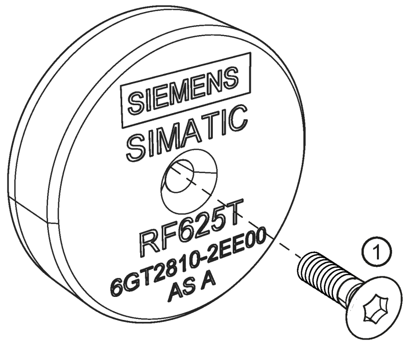


Figure 7-50 Screw mounting

Note

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

7.11.5 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 366).

7.11.6 Technical specifications

Table 7- 35 Technical specifications of SIMATIC RF625T

	6GT2810-2EE00 **6GT2810-2EE01**
Product designation	SIMATIC RF625T
Memory	
Memory configuration	
• EPC	• 96/128 bits
• User memory	• 64 bytes
• TID	• 96 bits
• Reserved (passwords)	• 64 bits
Type	EPC Class 1 Gen 2
Read cycles (max., at < 40 °C)	10^{14}
Write cycles (min., at > 22 °C)	10^{5}
Data retention (at < 40 °C)	2 x 10^{5} hours

	6GT2810-2EE00 6GT2810-2EE01
Mechanical specifications	
Material	Plastic housing (PA6.6)
Color	Black
Printing	No
Silicone-free	Yes
Electrical data	
Air interface	according to ISO°18000-6C
Polarization direction	Linear
Frequency band	• Europe 865 … 868 MHz • USA/Canada 902 ... 928 MHz 2)
Necessary transmit power	• Europe 2 watts ERP • USA/Canada 4 watts EIRP
Range 1)	max. 1.5 m
Energy source	Field energy via antenna, without battery
Multitag capability	Yes, minimum distance between data carriers ≥ 50 mm 3)
Permitted ambient conditions	
Ambient temperature	
• During operation	• -25…+85 ℃
• During transportation and storage	• -40…+125 ℃
Distance from metal	directly on metal without spacing
Torsion and bending load	not permitted
Shock resistant to EN 60068-2-27	100 g 4)
Vibration resistant to EN 60068-2-6	50 g 4)
Degree of protection	IP68 acc. to EN60529 IPx9K acc. to EN 60529
Design, dimensions and weight	
Dimensions (D × H)	30 mm x 8 mm
Weight	approx. 6 g
Type of mounting	Adhesive, cable tie, screws

1) 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 distance. You will find more information on ranges in the section "Minimum clearances and maximum distances (Page 375)".

2) 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.

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

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

7.11.7 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

7.11.8 Certificates and approvals

Table 7- 36 SIMATIC RF625T UHF Disk Tag (Europe), 6GT2810-2EE00

Certificate	Description
	Conforms to R&TTE directive

Table 7- 37 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

7.11.9 Dimension drawing

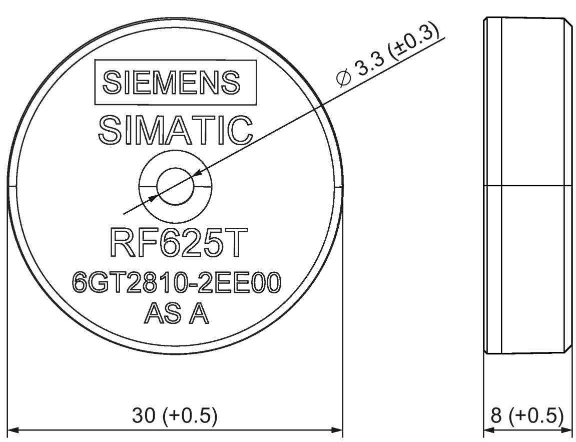


Figure 7-51 SIMATIC RF625T UHF Disk Tag

Units of measurement: All dimensions in mm

7.12 SIMATIC RF630T

7.12.1 Characteristics

The SIMATIC RF630T transponder is a passive (i.e. battery-free) and maintenance-free, cylindrical 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.

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.

SIMATIC RF630T	**Characteristics**		
	Area of application	Identification tasks in rugged industrial environments	
	Frequency variants	Europe	USA/Canada
		868 MHz	915 MHz
	Air interface	according to ISO°18000-6C	
	Polarization	Linear	
	Memory	EPC 96 bits/240 bits User memory: 64 bytes	
	Range [1)]	max. 1.2 m	
	Mounting	for direct mounting on conductive materials (preferably 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 375)".

7.12.2 Ordering data

Ordering data	Article number
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

7.12.3 Planning application

7.12.3.1 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 with the RF630R/RF670R/RF680R reader

The RF630R, RF670R and RF680R readers can operate with an RF660A antenna which can be positioned as shown.

RF630T application example

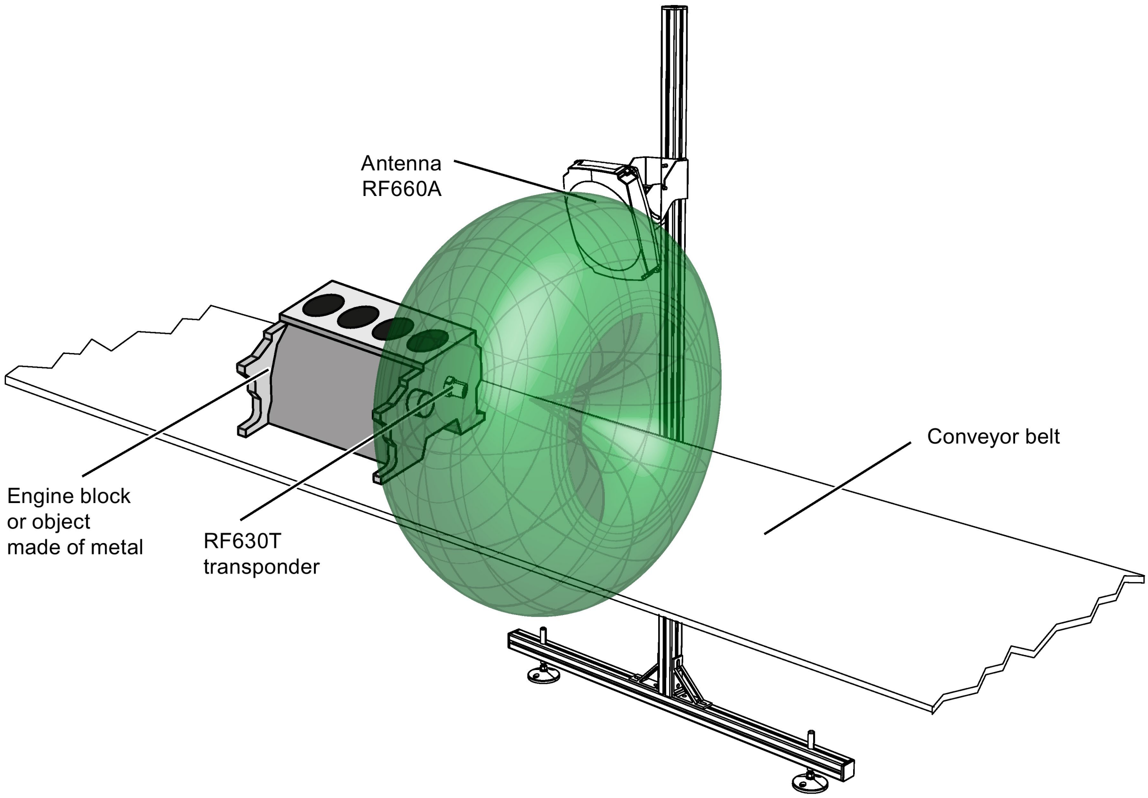


Figure 7-52 RF630T application example

Positioning of two RF660A antennas

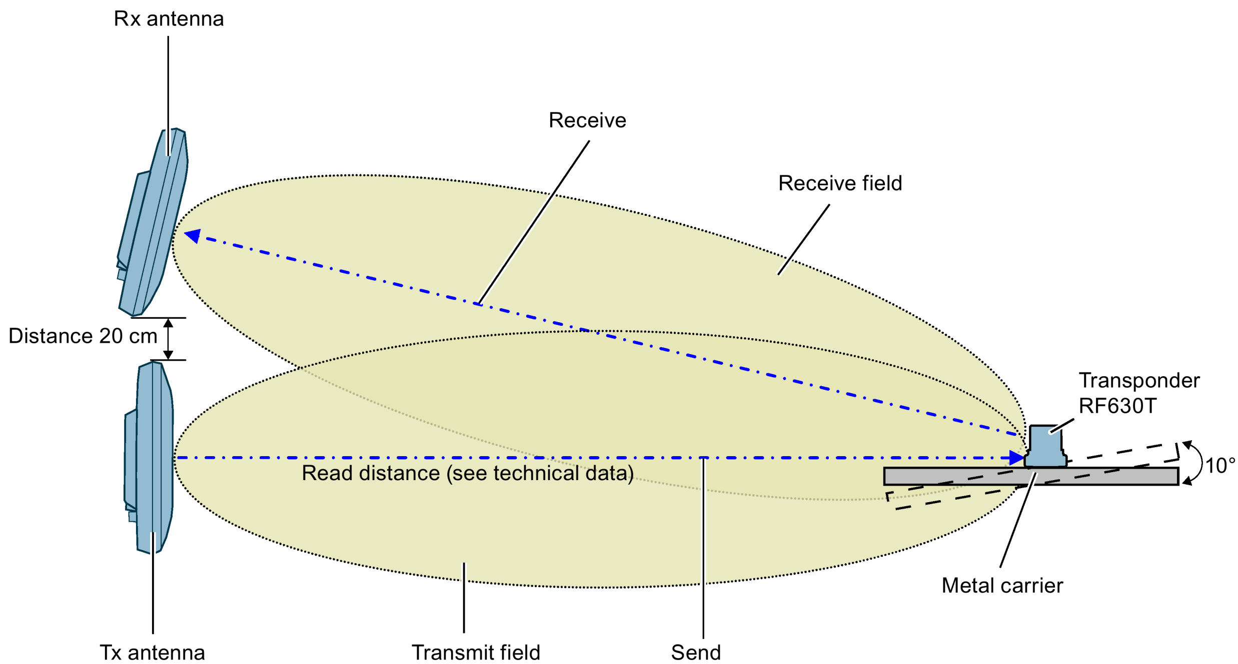


Figure 7-53 Example of optimum antenna/transponder positioning

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/RF685R reader

The RF620R reader with an integrated circular polarized antenna or the RF685R reader can be placed in the same position relative to the RF630T transponder as the RF660A antennas.

Please note the different reading ranges for the RF600 readers in the section Maximum read/write ranges of transponders (Page 378)

7.12.3.2 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.

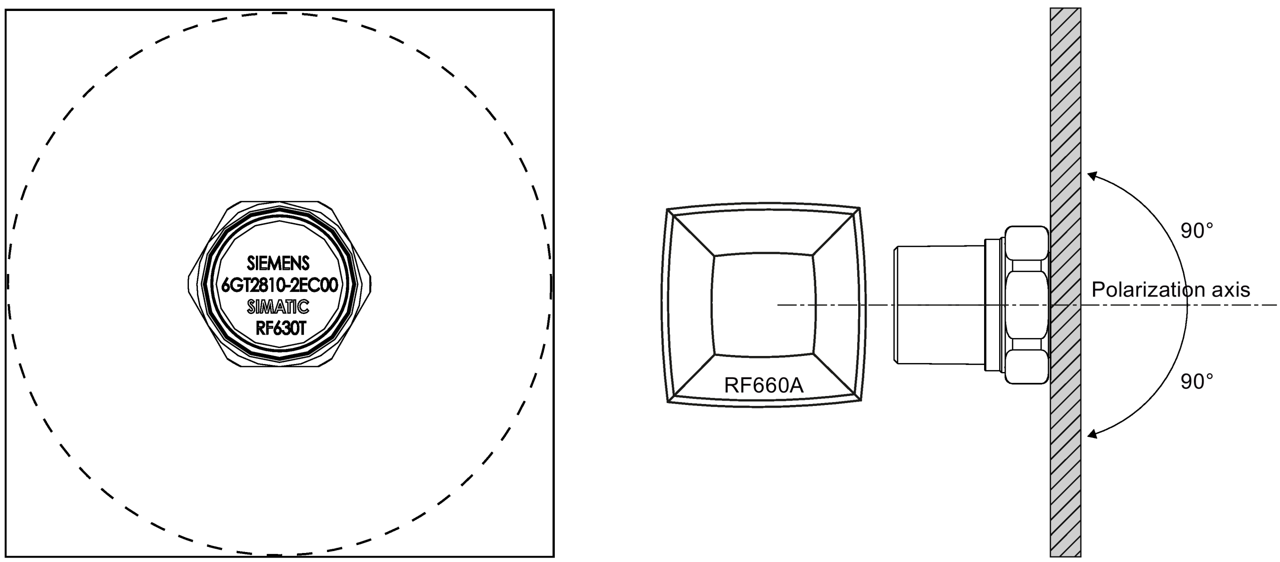


Figure 7-54 Optimum positioning of the transponder on a (square or circular) metal surface

Table 7- 38 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

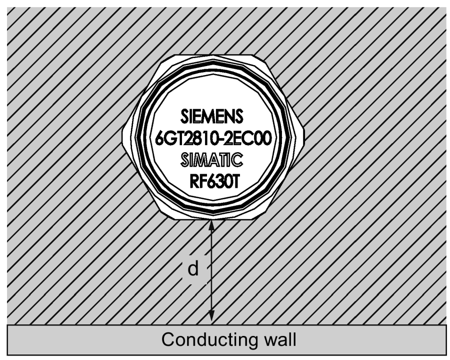
You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 375)".

7.12.3.3 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

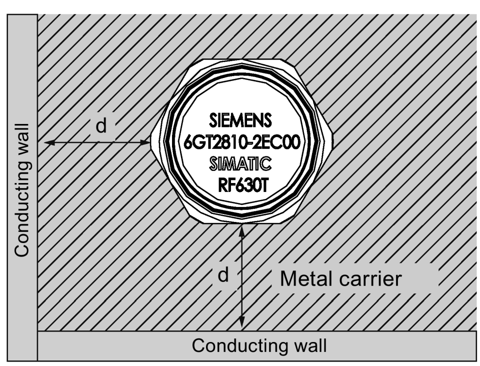


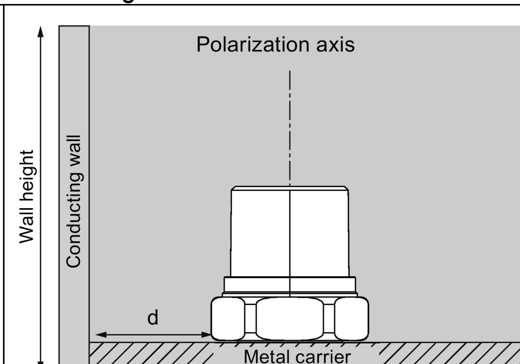
View from above

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.

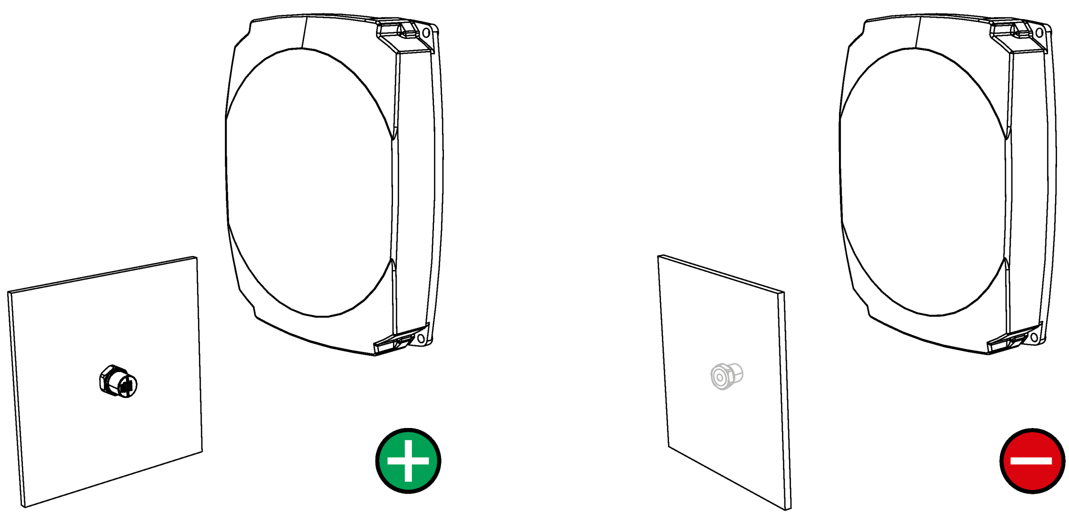
7.12.3.4 Directional radiation pattern of the transponder

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

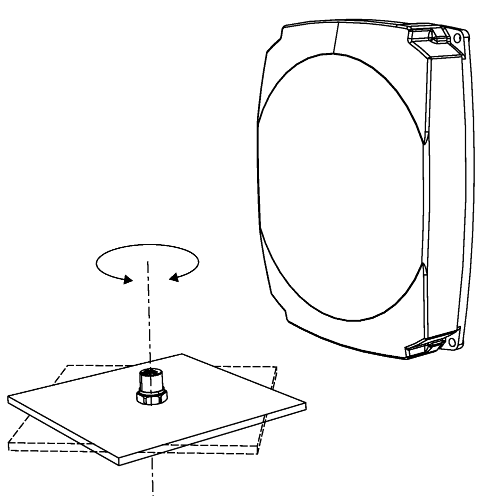
Incorrect alignment of the transponder

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

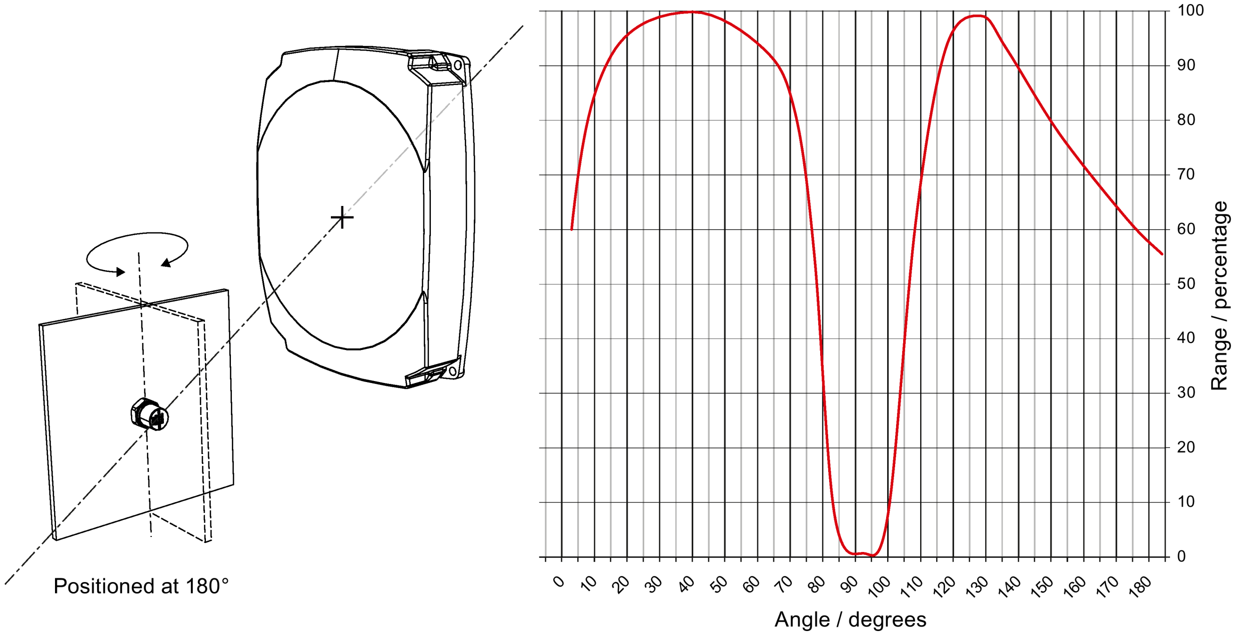


Figure 7-55 Characteristics of the transponder on rotation of the mounting plane

7.12.4 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.

7.12.5 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 366).

7.12.6 Technical specifications

Table 7- 39 Technical specifications of SIMATIC RF630T

	6GT2810-2EC00 **6GT2810-2EC01**
Product designation	SIMATIC RF630T
Memory	
Memory configuration	
• EPC	• 96/240 bits
• User memory	• 64 bytes
• TID	• 64 bytes
Type	EPC Class 1 Gen 2
Read cycles (max., at < 40 °C)	10^{14}
Write cycles (min., at > 22 °C)	10^5
Data retention (at < 40 ℃)	2 x 10^5 hours
Mechanical specifications	
Material	Plastic housing (PA6.6 GF) Thread stainless steel
Color	black/silver
Printing	No
Silicone-free	Yes
Electrical data	
Air interface	according to ISO°18000-6C
Polarization direction	Linear
Frequency band	• Europe 865 … 868 MHz • USA/Canada 902 ... 928 MHz 2)
Necessary transmit power	• Europe 2 watts ERP • USA/Canada 4 watts EIRP
Range 1)	max. 1.5 m
Energy source	Field energy via antenna, without battery
Multitag capability	Yes, minimum distance between data carriers ≥ 50 mm 3)

	6GT2810-2EC00 6GT2810-2EC01
Permitted ambient conditions	
Ambient temperature	
• During operation	• -25…+85 °C
• During transportation and storage	• -40…+125 °C
Distance from metal	directly on metal without spacing
Torsion and bending load	not permitted
Shock resistant to EN 60068-2-27	100 g [4)]
Vibration resistant to EN 60068-2-6	20 g [4)]
Degree of protection	IP68 acc. to EN60529 IPx9K acc. to EN 60529
Design, dimensions and weight	
Dimensions (D × H)	21 mm x 20 mm Wrench size 19 mm
Weight	approx. 22 g
Type of mounting	M6 screws

[1)] 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 distance. You will find more information on ranges in the section "Minimum clearances and maximum distances (Page 375)".

[2)] 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.

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

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

7.12.7 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	-	-
Propane		+	Nothing specified

	Concentration	20 °C	60 °C
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

7.12.8 Certificates and approvals

Table 7- 40 6GT2810-2EC00 - RF630T UHF Tool Tag - Europe

Certificate	Description
	Conformity with R&TTE directive

Table 7- 41 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.
	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

7.12.9 Dimension drawing

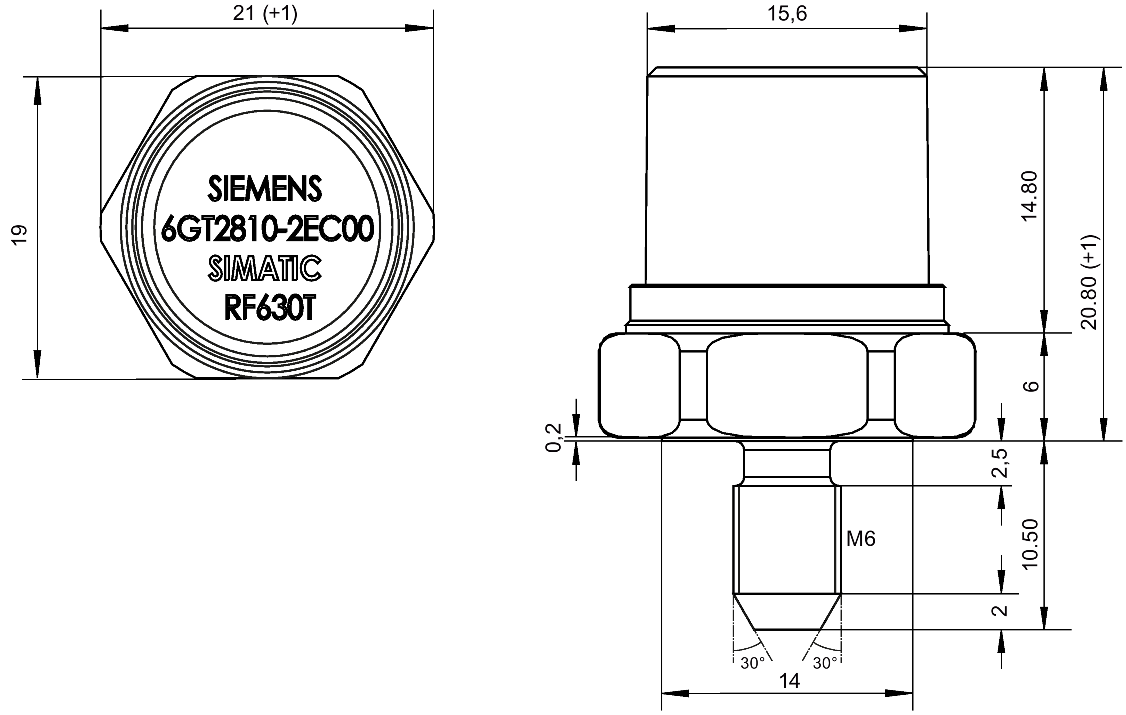


Figure 7-56 SIMATIC RF630T

Units of measurement: All dimensions in mm

General tolerances in accordance with DIN ISO 2768f.

7.13 SIMATIC RF640T Gen 2

7.13.1 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.

SIMATIC RF640T Gen 2	**Characteristics**		
	Area of application	Identification tasks in rugged industrial environments Suitable for use in hazardous areas.	
	Frequency variants	Europe	USA/Canada
		865 ... 868 MHz	902 ... 928 MHz
	Air interface	according to ISO°18000-6C	
	Polarization	Linear	
	Memory	EPC 96 bits/240 bits User memory: 64 bytes	
	Range [1]	max. 4.0 m	
	Mounting	for direct mounting on conductive materials (preferably 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 375)".			

7.13.2 Ordering data

Ordering data	Article 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

7.13.3 Planning the use

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

Example of optimum antenna/transponder positioning

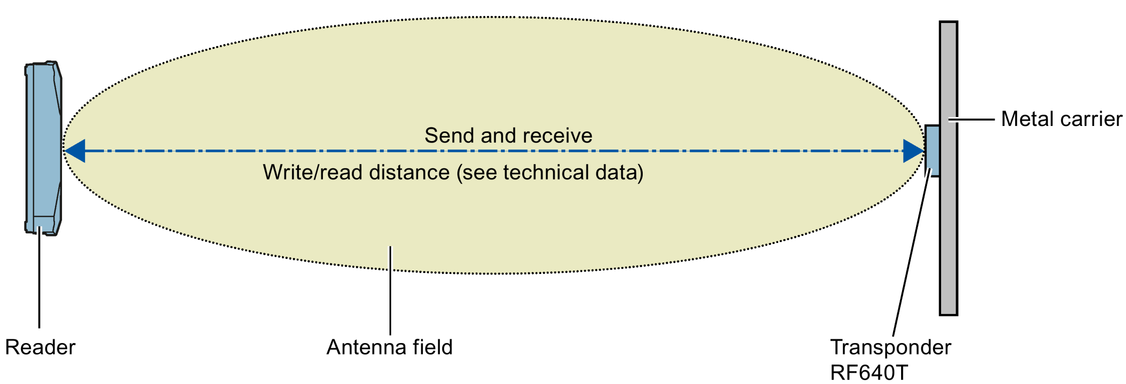


Figure 7-57 Example of optimum antenna/transponder positioning with RF600 readers and an RF600 antenna

7.13.3.2 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.

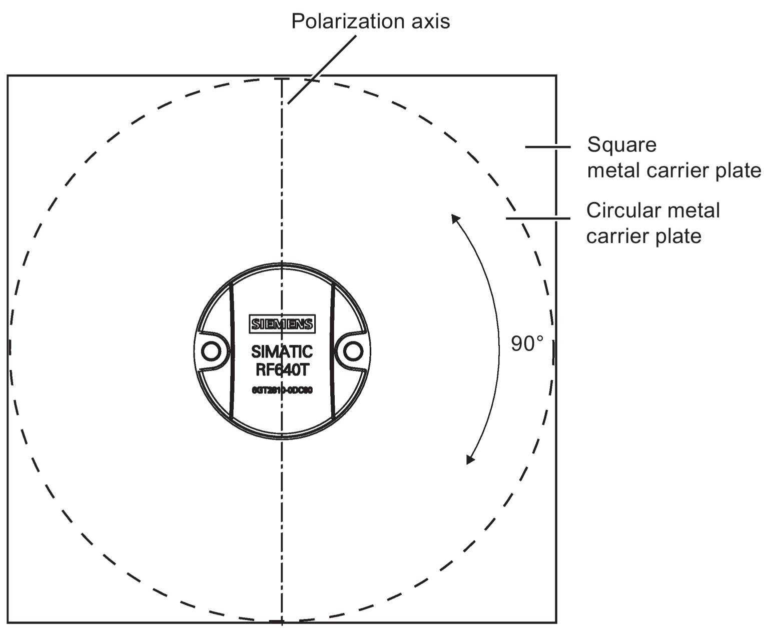


Figure 7-58 Optimum positioning of the transponder on a (square or circular) metal surface

Table 7- 42 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 375)".

7.13.3.3 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- 43 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.

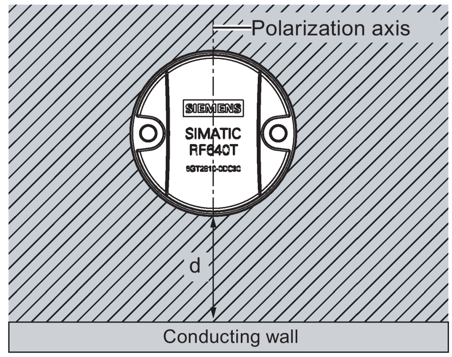
You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 375)".

7.13.3.4 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

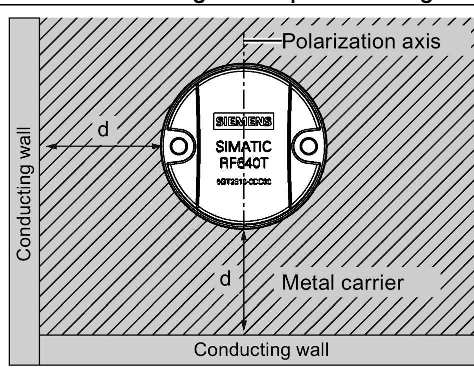


View from above

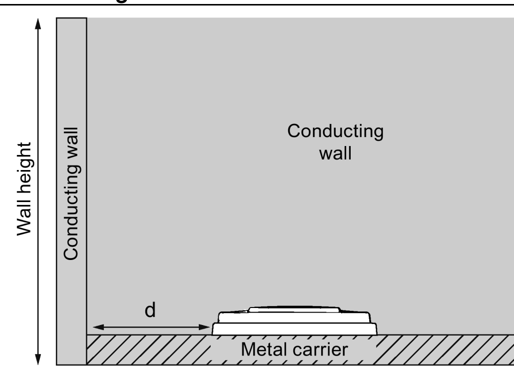
Distance d	20 mm	50 mm	100 mm	
Range	approx. 90 %	approx. 90 %	approx. 95 %	Wall height 20 mm
	approx. 80%	approx. 90 %	approx. 90 %	Wall height 50 mm
	approx. 70%	approx. 75 %	approx. 90 %	Wall height 100 mm

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.

7.13.3.5 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

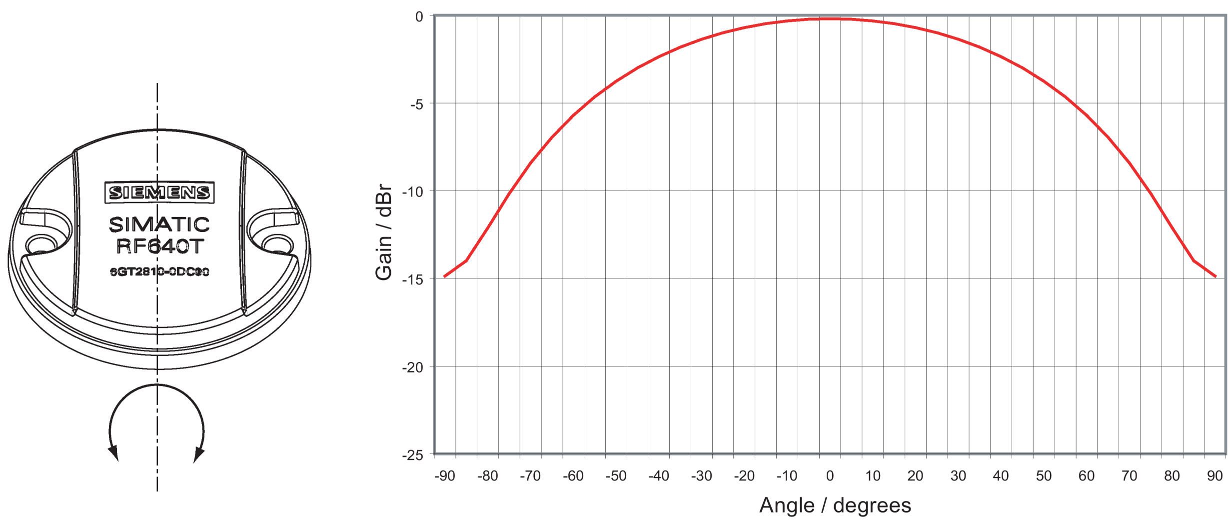


Figure 7-59 Transponder characteristics when rotated about the polarization axis

Rotation orthogonal to the polarization axis

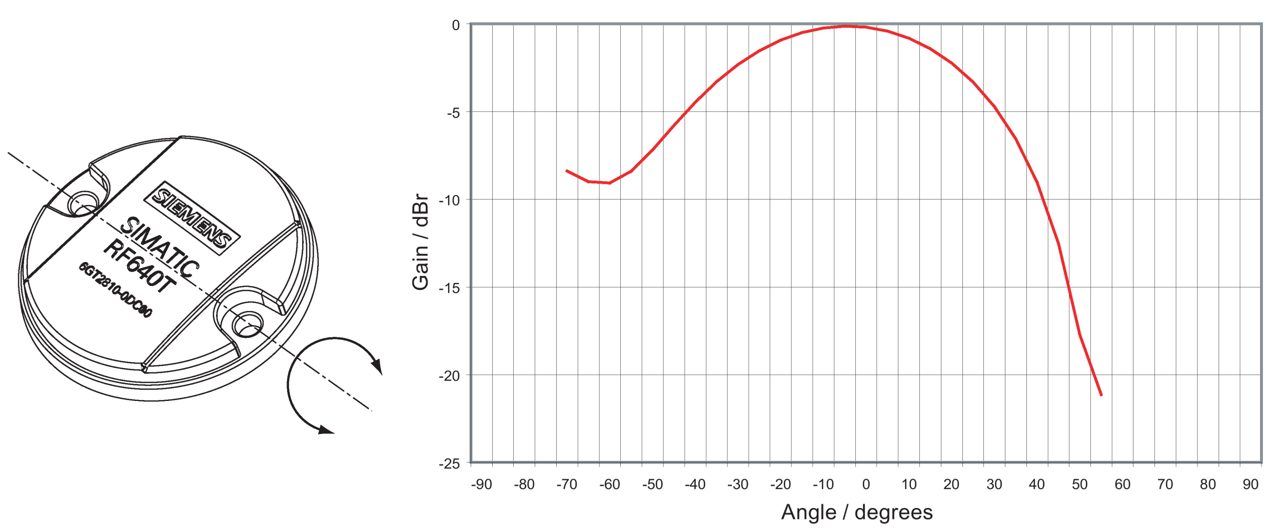


Figure 7-60 Transponder characteristics when rotated orthogonally to the polarization axis (within the tag plane)

7.13.3.6 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

7.13.3.7 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

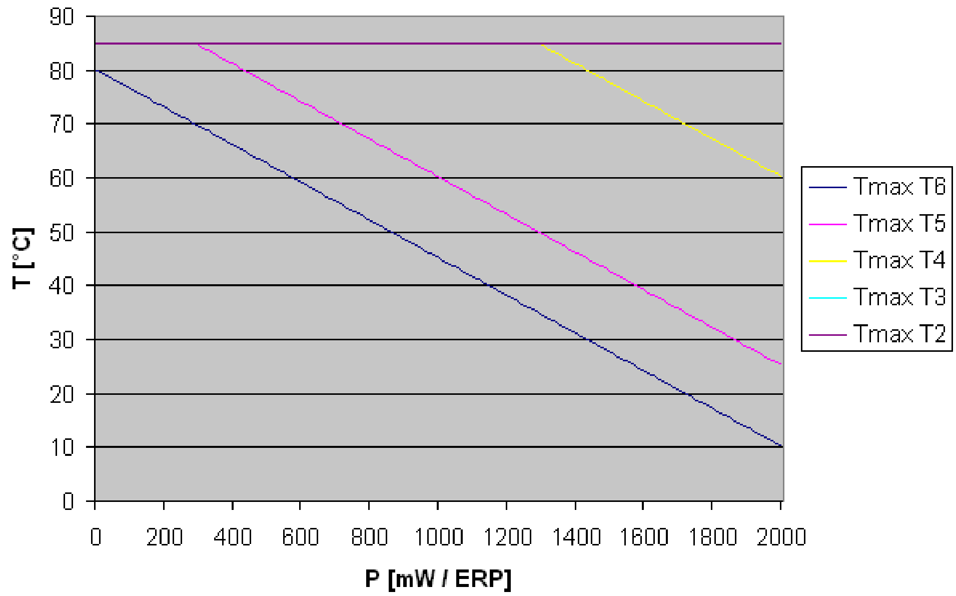


Figure 7-61 Maximum permitted ambient temperature depending on the radiated power

7.13.3.8 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

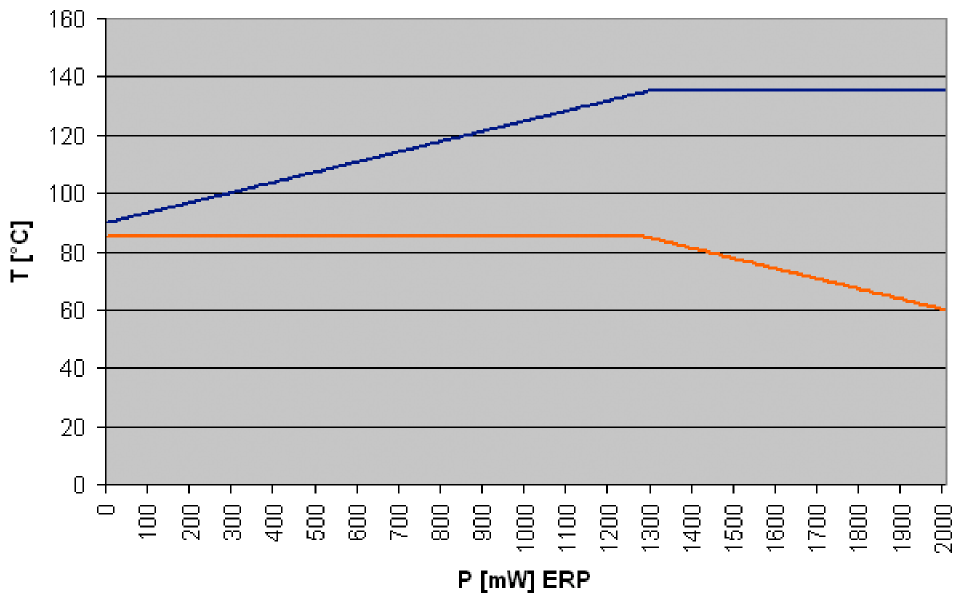
WARNING

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:



Temperature value

Ambient temperature

Figure 7-62 Temperature value and maximum permitted ambient temperature in relation to the radiated power

7.13.4 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

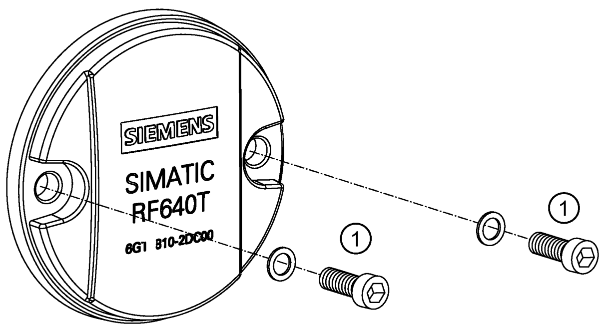
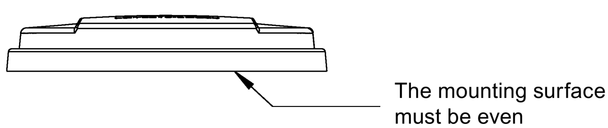


Figure 7-63 Screw mounting

Note

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



7.13.5 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 366).

7.13.6 Technical specifications

Table 7- 44 Technical specifications of SIMATIC RF640T Gen 2

	6GT2810-2DC00 6GT2810-2DC10
Product designation	SIMATIC RF640T Gen 2
Memory	
Memory configuration	
• EPC	• 96/240 bits
• User memory	• 64 bytes
• TID	• 64 bits
• Reserved (passwords)	• 64 bits
Type	EPC Class 1 Gen 2
Read cycles (max., at < 40 °C)	10^{14}
Write cycles (min., at > 22 °C)	10^{5}
Data retention (at < 40 ℃)	2 x 10^{5} hours
Mechanical specifications	
Material	Plastic housing (PA12)
Color	Anthracite
Printing	No
Silicone-free	Yes
Electrical data	
Air interface	according to ISO°18000-6C
Polarization direction	Linear
Frequency band	• Europe 865 … 868 MHz • USA/Canada 902 ... 928 MHz 2)
Necessary transmit power	• Europe 2 watts ERP • USA/Canada 4 watts EIRP
Range 1)	max. 4 m
Energy source	Field energy via antenna, without battery
Multitag capability	Yes, minimum distance between data carriers ≥ 50 mm 3)

	6GT2810-2DC00 6GT2810-2DC10
Permitted ambient conditions	
Ambient temperature	
• During operation	• -25 … +85 °C[4]
• During transportation and storage	• -40 … +125 °C[5]
Distance from metal	directly on metal without spacing
Torsion and bending load	not permitted
Shock-resistant to DIN EN 60721-3-7, Class 7 M3	100 g [6]
Vibration-resistant to DIN EN 60721-3-7, Class 7 M3	20 g [6]
Degree of protection	IP68 acc. to EN60529 IPx9K acc. to EN 60529
Design, dimensions and weight	
Dimensions (D × H)	50 mm x 8 mm
Weight	approx. 13 g
Type of mounting	2 x M4 screws

1) 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 distance. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 375)".

2) 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.

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

4) To use the transponder in hazardous areas, directive 94/9/EC of the European Council of 23 March 1994 must be complied with. Note the information in the section "Use of the transponder in the Ex protection area (Page 479)".

5) At temperatures above 70 °C the casing may distort slightly; this does not however cause any impairment of function (mechanical or electrical).

6) 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.

7.13.7 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.	○○○○	○○○○

	Concentration	20 °C	60 °C
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	○	−
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

7.13.8 Certificates and approvals

Table 7- 45 6GT2810-2DC00 - RF640T Gen 2 UHF Tool Tag - Europe

Certificate	Description
CE	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- 46 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.
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

7.13.8.1 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

7.13.9 Dimension drawing

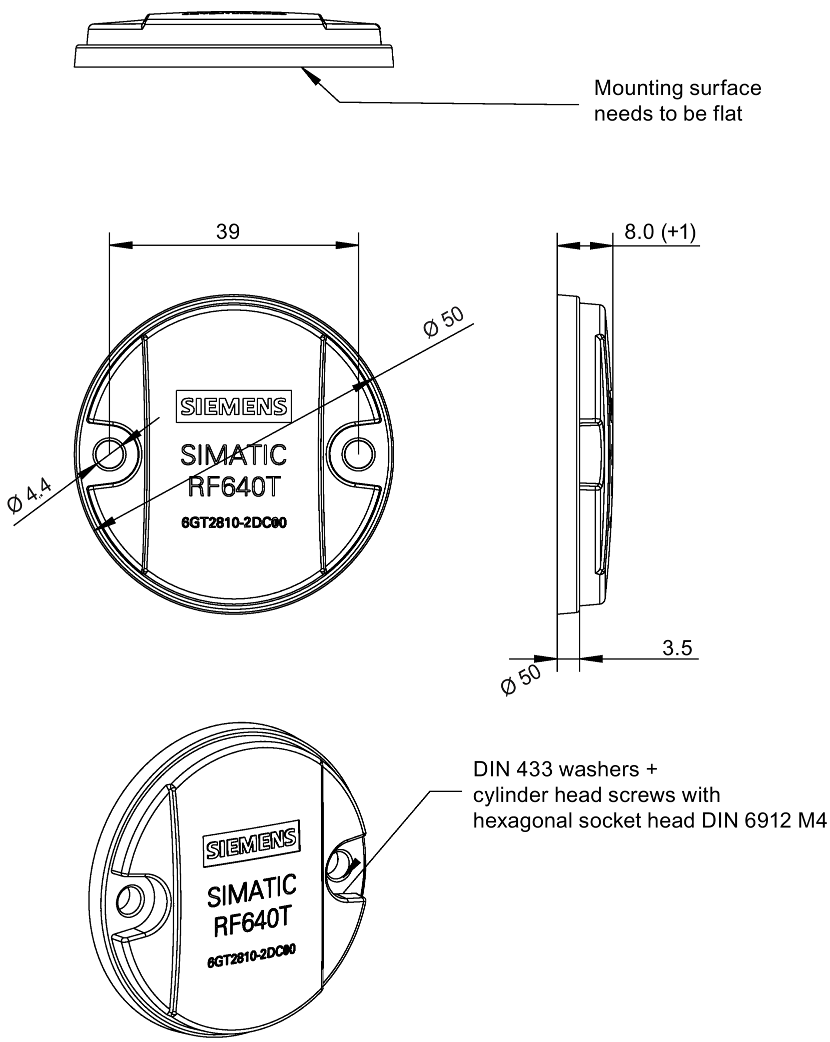


Figure 7-64 SIMATIC RF640T Gen 2 UHF Tool Tag Version 1

Units of measurement: All dimensions in mm

7.14 SIMATIC RF680T

7.14.1 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	Characteristics	
	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 band	Europe: 865 ... 868 MHz USA/Canada: 902 ... 928 MHz
	Air interface	according to ISO°18000-6C
	Polarization	Linear
	Temperature range	up to 220 °C
	Memory	EPC 96 bits/240 bits User 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 375)".		

7.14.2 Ordering data

Ordering data	Article number
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

7.14.3 Planning the use

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

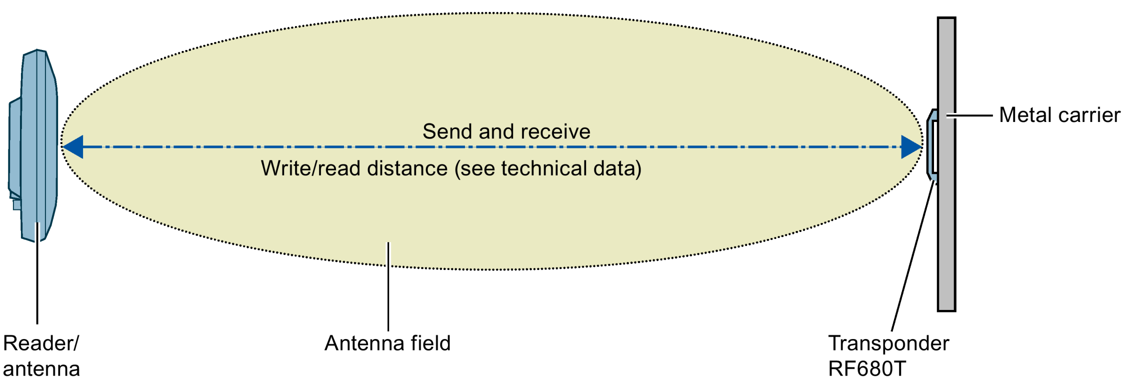


Figure 7-65 Example of optimum antenna/transponder positioning

7.14.3.2 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 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).

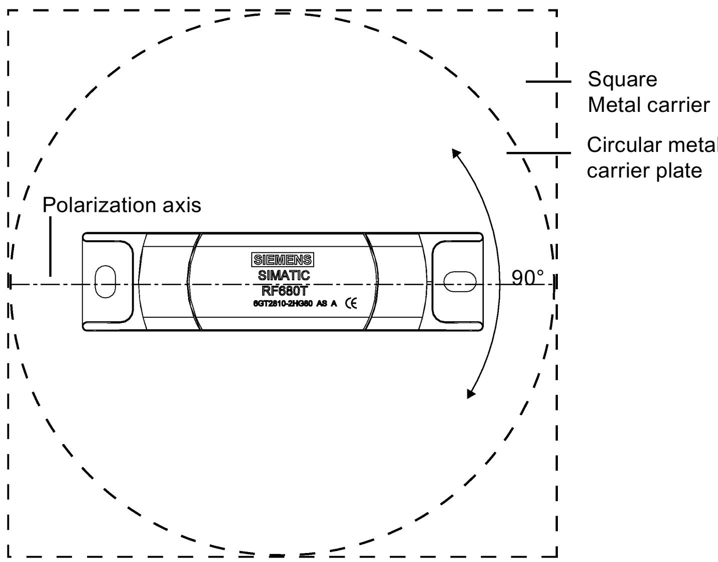


Figure 7-66 Optimum positioning of the transponder on a (square or circular) metal surface

Table 7- 47 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.

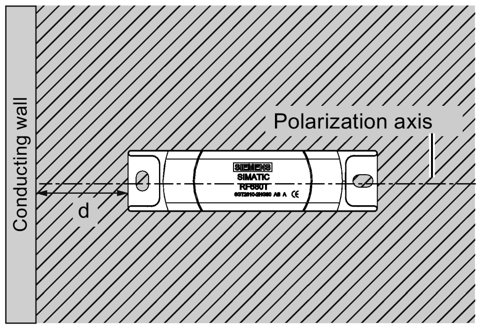
You will find more detailed information on the range in the section "Minimum distances and maximum ranges (Page 375)".

7.14.3.3 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

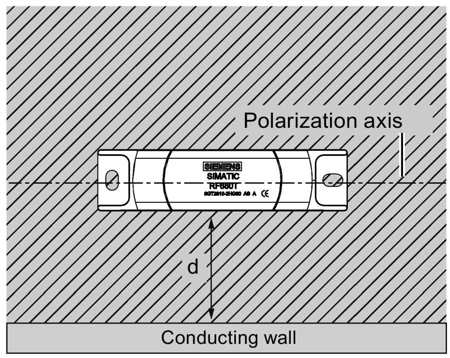
Influence on the range when positioned orthogonally to the conducting wall



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

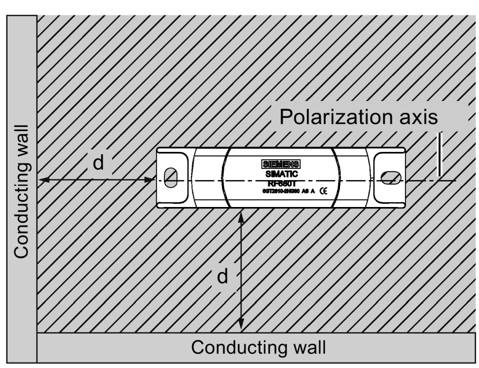


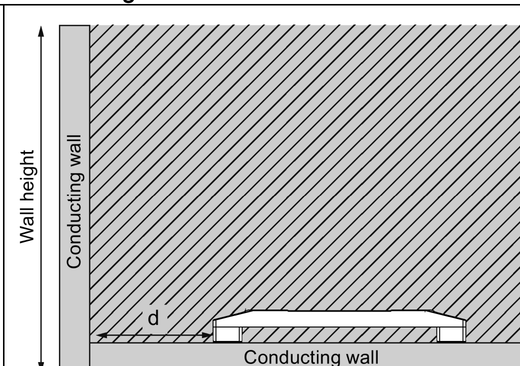
View from above

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

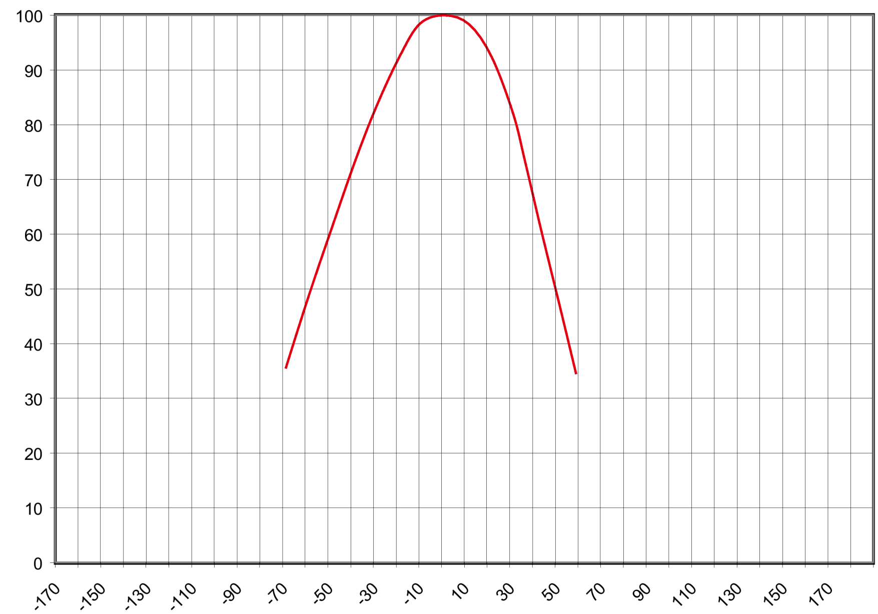
Distance d	20 mm	50 mm	100 mm	
Range	approx. 50%	approx. 70%	approx. 90%	Wall height 20 mm
	approx. 30%	approx. 60%	approx. 90%	Wall height 50 mm
	approx. 25%	approx. 50%	approx. 90%	Wall height 100 mm

The values specified in the tables above are guide values.

7.14.3.4 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



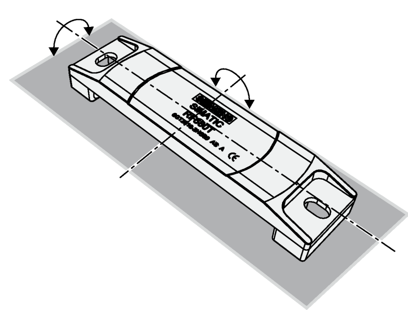


Figure 7-67 Characteristic of the transponder when rotated about the polarization axis or orthogonally to the polarization axis

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.

7.14.3.5 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- 48 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 375)".

7.14.3.6 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

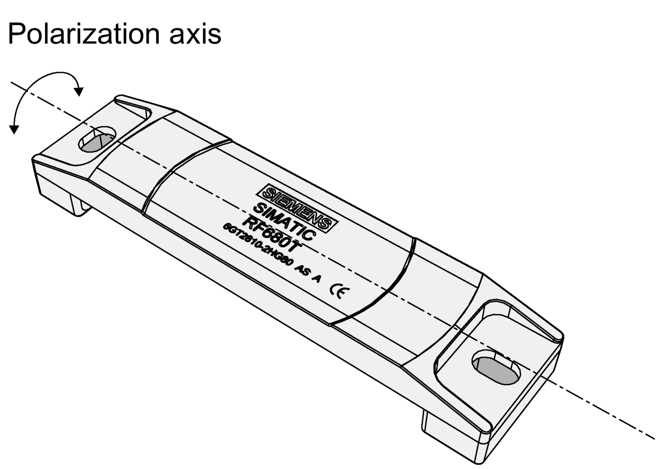


Figure 7-68 Rotation of the transponder about the polarization axis

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

Rotation orthogonal to the polarization axis

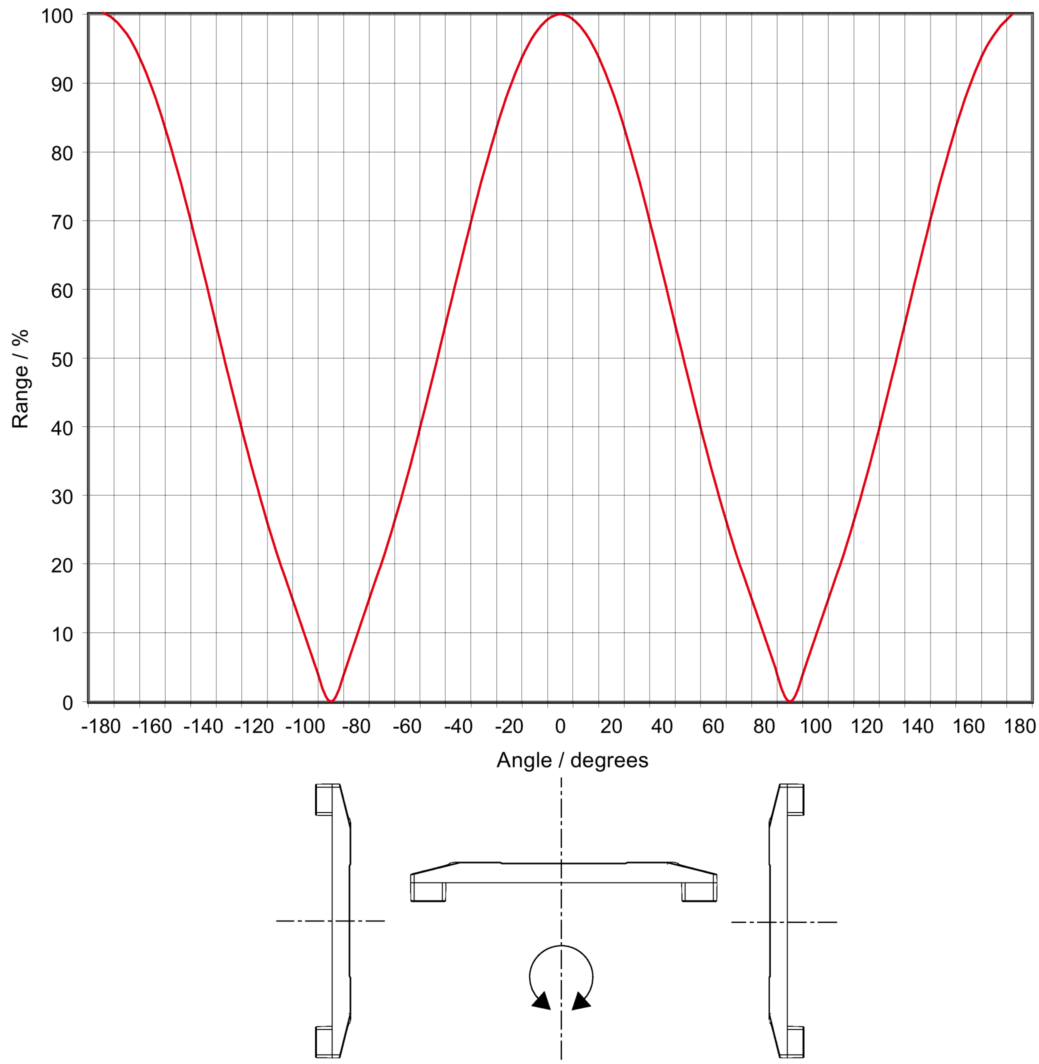


Figure 7-69 Transponder characteristics when rotated orthogonally to the polarization axis (within the tag plane)

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.

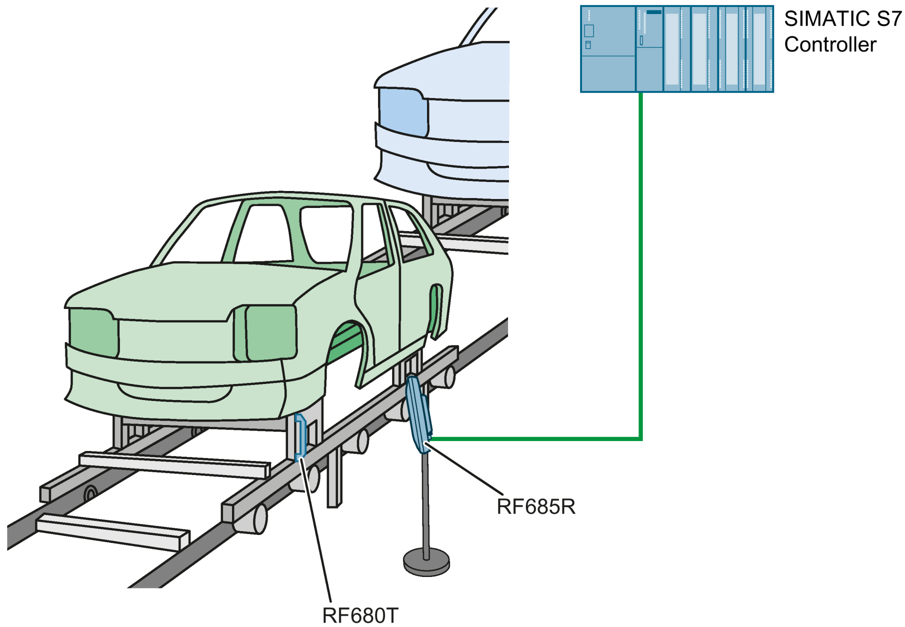


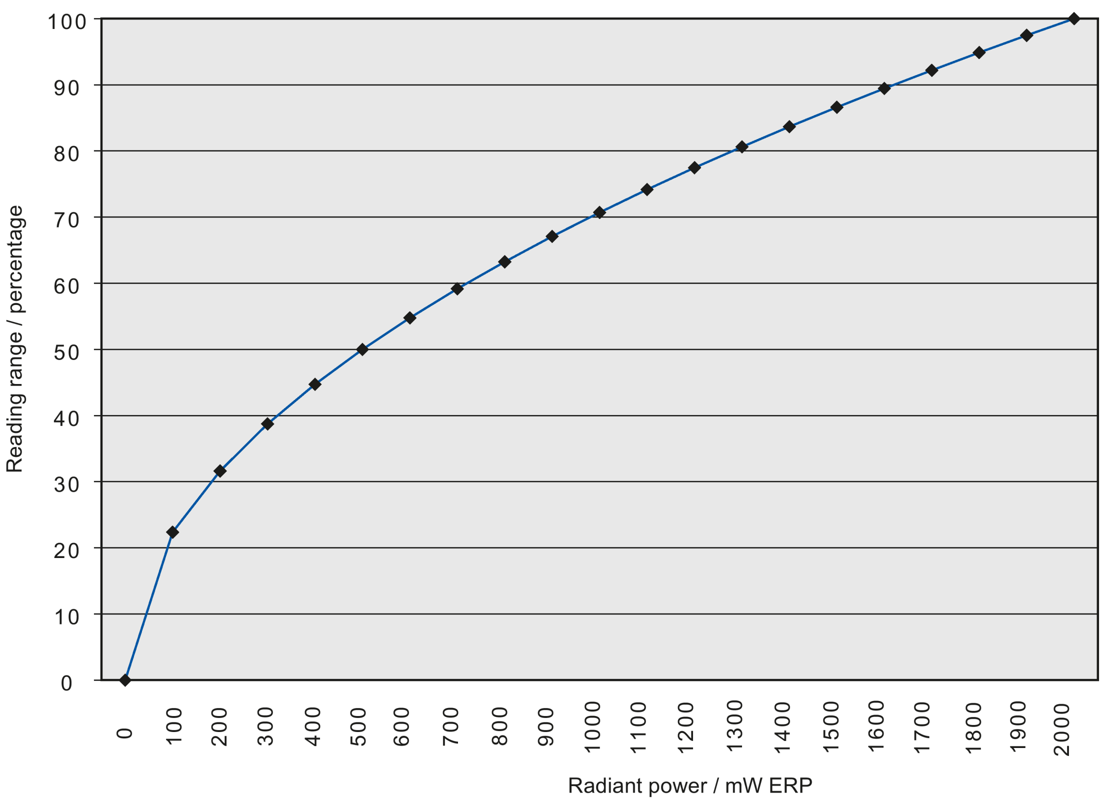
Figure 7-70 Application example

7.14.3.7 Relationship between performance and reading range

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



7.14.3.8 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.

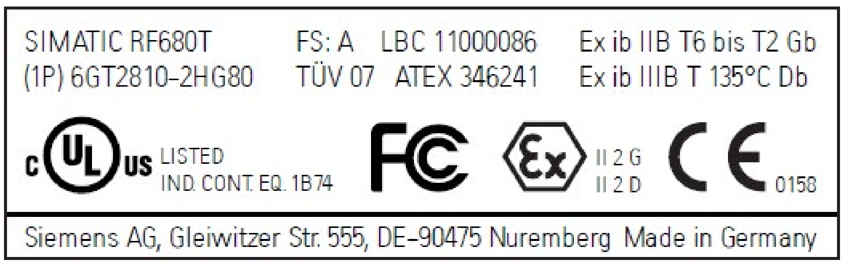
Identification

The identification is as follows:

II 2G Ex ib IIB T6 to T2 Gb or

II 2D Ex ib IIIB T135 °C Db

7.14.3.9 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

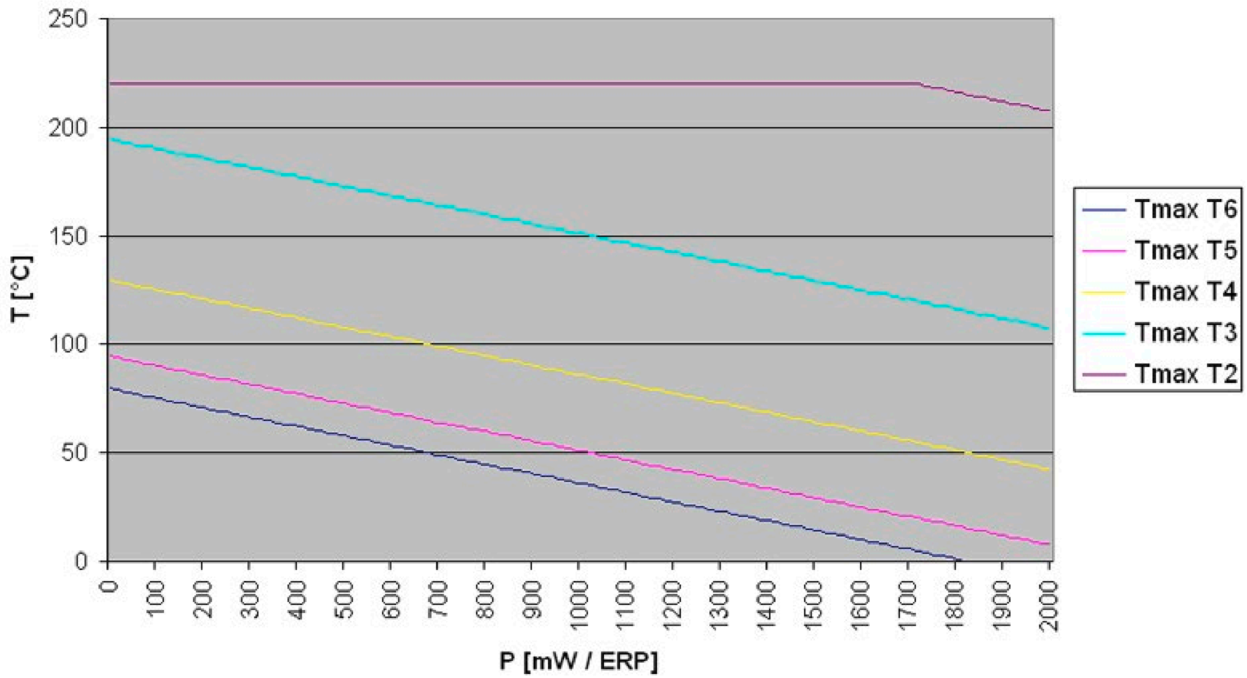


Figure 7-71 Maximum permitted ambient temperature depending on the radiated power

7.14.3.10 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:

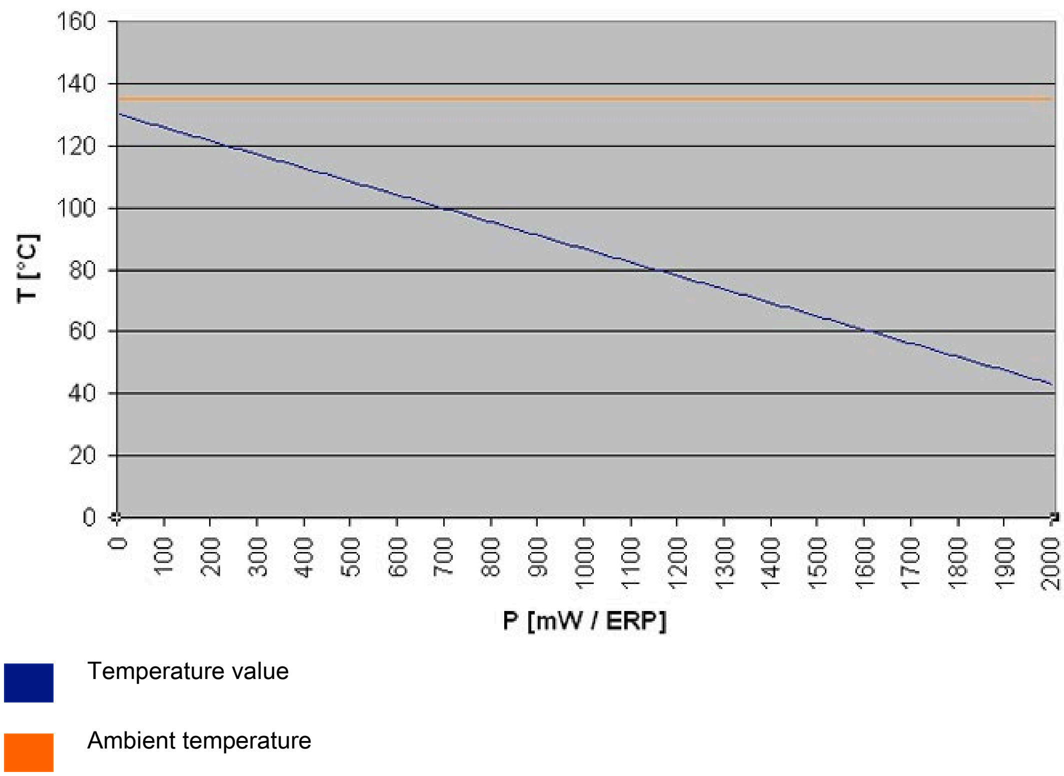


Figure 7-72 Temperature value and maximum permitted ambient temperature in relation to the radiated power

7.14.4 Mounting instructions

Mount the SIMATIC RF680T transponder on the base using two M6 screws.

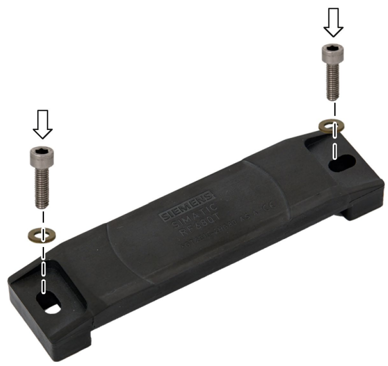


Figure 7-73 Mounting SIMATIC RF680T

Properties	Description
Type of installation	M6 screw mounting
Tightening torque (at room temperature)	≤ 1 Nm (Note the expansion coefficients of the materials used at higher temperatures!)

Note

Reduction of the read/write distance

When mounting on metal or conductive material, ensure that the space below the transponder remains empty.

NOTICE

Cleaning the transponder

Do not clean the transponder with mechanical tools, sand-blasting or high pressure hose. These cleaning methods result in damage to the transponder.

Clean the transponder only with the chemical cleansing agents listed in the section Chemical resistance of the RF680T transponder (Page 511).

7.14.5 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 366).

7.14.6 Technical specifications

Table 7- 49 Technical specifications of SIMATIC RF680T

	6GT2810-2HG80
Product designation	SIMATIC RF680T
Memory	
Memory configuration	
• EPC	• 96/240 bits
• User memory	• 64 bytes
• TID	• 64 bytes
Type	EPC Class 1 Gen 2
Read cycles (max., at < 40 °C)	10^{14}
Write cycles (min., at 40 ℃)	10^{6}
Data retention (at < 40 ℃)	2 x 10^{5} hours
Mechanical specifications	
Material	Plastic housing (PPS)
Color	Black
Printing	No
Silicone-free	Yes
Electrical data	
Air interface	according to ISO°18000-6C
Polarization direction	Linear
Frequency band	• Europe 865 … 868 MHz • USA/Canada 902 ... 928 MHz [2)]
Necessary transmit power	• Europe 2 watts ERP • USA/Canada 4 watts EIRP
Range [1)]	max. 4 m
Energy source	Field energy via antenna, without battery
Multitag capability	Yes, minimum distance between data carriers ≥ 50 mm [3)]

	6GT2810-2HG80
Permitted ambient conditions	
Ambient temperature	
• During operation	• -25 to +100 °C permanently
	• +100 to +140 °C 20 % reduction of the limit distance
	• As of +140 °C No processing possible
	• +200 °C: Tested up to 5000 hours or 3000 cycles
	• +220 °C: Tested for up to 2000 hours or for 1500 cycles
	• Use in hazardous areas 5)
• During transportation and storage	• -40…+100 °C
Distance from metal	directly on metal without spacing
Torsion and bending load	not permitted
Shock-resistant to DIN EN 60721-3-7, Class 7 M3	100 g 6)
Vibration-resistant to DIN EN 60721-3-7, Class 7 M3	20 g 6)
Degree of protection	IP68 acc. to EN60529 IPx9K acc. to EN 60529
MTBF	1.6 x 10^7 hours
Design, dimensions and weight	
Dimensions (L x W x H)	130 mm x 32 mm x 15 mm
Weight	50 g
Type of mounting	2 x M6 screws

1) 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 distance. You will find more information on ranges in the section "Minimum distances and maximum ranges (Page 375)".

2) Reduction of range to about 70% at the band limit of 928 MHz; identification is guaranteed at 915 MHz due to frequency hopping procedure.

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

4) Note that no processing is possible at temperatures of +140 °C or higher.

5) To use the transponder in hazardous areas, directive 94/9/EC of the European Council of 23 March 1994 must be complied with. Note the information in the section "Use of the transponder in hazardous areas (Page 501)".

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

7.14.7 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

7.14.8 Certificates and approvals

Table 7- 50 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- 51 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

7.14.8.1 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

7.14.9 Dimension drawing

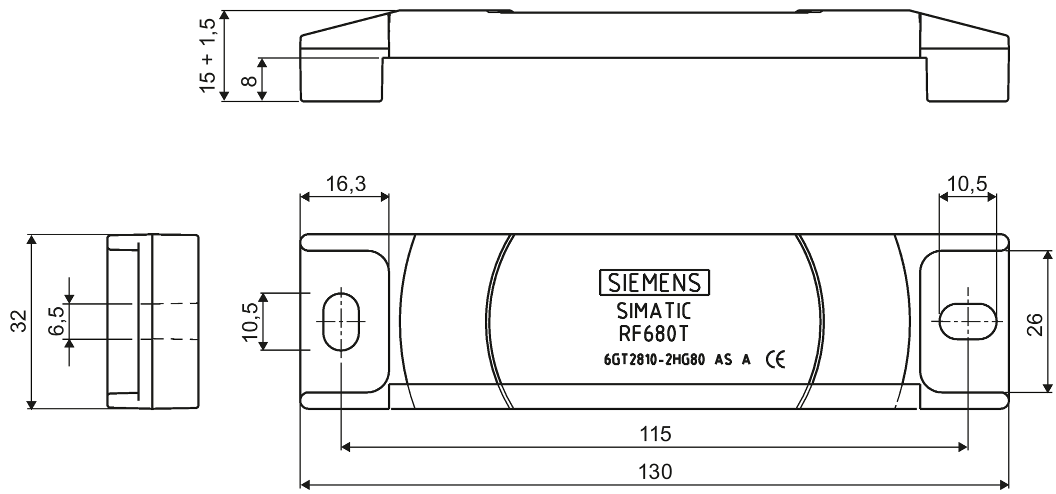


Figure 7-74 Dimension drawing of SIMATIC RF680T

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

Reader	SIMATIC command messages	RF-MANAGER Basic	XML commands	RFID reader interface
RF620R/ RF630R:	"Configuration Manual RF620R/RF630R", chapter "Overview of commands"	--	--	--
RF640R/ RF670R	--	Online help > chapter "Working with RFID objects"	SIMATIC RF Function Manual, Chapter "Standard Configuration Messages"	--
RF650R	--	--	"Configuration manual RF650R/RF680R/RF685R" section "XML interface"	--
RF680R/ RF685R	"Configuration manual RF650R/RF680R/RF685R" section "Interface to the SIMATIC controller"	--	"Configuration manual RF650R/RF680R/RF685R" section "XML interface"	--
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 information about XML commands, refer to the "SIMATIC RF Function Manual" .

Connecting the readers RF650R/RF680R/RF685R using XML

If you want to create your own applications for the RF650R/RF680R/RF685R reader, you can do this using the XML-based demo application of the reader. You will find information on the XML commands in the configuration manual "SIMATIC RF650R/RF680R/RF685R".

8.3 Integration in control networks

Connecting the readers RF620R/RF630R

RF620R and RF630R readers are connected to the SIMATIC controller via the following communications modules:

- SIMATIC RF120C
- SIMATIC RF160C
- SIMATIC RF170C
- SIMATIC RF180C
- ASM 456
- ASM 475
- RFID 181EIP

The RF182C communications module is connected with the PC directly over Ethernet.

Connecting the RF680R/RF685R readers

The RF680R/RF685R readers can be connected to a SIMATIC controller via PROFINET directly or via PROFIBUS and the following communications modules.

- ASM 456

Note

Connecting via communications modules

A PROFIBUS connection via further communications modules is currently being planned.

Options for connecting via communications modules

Table 8- 1 Option of connecting the RF620R/RF630R readers via communications modules

Function blocks	Communications modules							
	ASM 456 1)	RF120C	RF170C	RF180C	ASM 475	RF182C 2)	RF160C 1) 2)	RFID 181EIP 2)
FB 45	1 - 2 readers	N/A	1 - 2 readers	1 - 2 readers	1 - 2 readers	N/A	N/A	N/A
FB 55	1 - 2 readers	N/A	1 - 2 readers	1 - 2 readers	1 - 2 readers	N/A	N/A	N/A
FC 44	N/A	N/A	N/A	N/A	N/A	N/A	1 - 2 readers	N/A
Ident profile	N/A	1 reader	N/A	N/A	N/A	N/A	N/A	N/A
XML	N/A	N/A	N/A	N/A	N/A	1 - 2 readers	N/A	N/A
Ethernet/IP	N/A	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 a CM/ASM, the CM/ASM may only be operated at a maximum ambient temperature of 35 °C.

2) The communications modules do not currently support multitag operation.

Table 8- 2 Option of connecting the RF680R/RF685R readers via communications modules

Function blocks	Communications modules					
	ASM 456	RF120C	RF170C	RF180C	ASM 475	RF160C
Ident profile	1 reader	N/A	N/A	N/A	N/A	N/A

Interfaces and blocks of the communications modules/readers

Table 8- 3 Interfaces and blocks of the communications modules/readers

ASM/CM	Interfaces to the application (PLC)	Interfaces to the reader	Blocks	Reader connections
ASM 456	PROFIBUS DP-V1	2 x 8-pin connection socket, M12	FB 45 FB 55 RFID standard profile Ident profile	2 (simultaneously)[1)]
SIMATIC RF120C	S7-1200 backplane bus	9-pin D-sub female connector	Ident profile	1
SIMATIC RF170C	PROFIBUS DP-V1 PROFINET IO	2 x 8-pin connection socket, M12	FB 45 FB 55	2 (parallel)
SIMATIC RF180C	PROFINET IO	2 x 8-pin connection socket, M12	FB 45 RFID standard profile	2 (parallel)
ASM 475	S7-300 backplane bus	loose wiring	FB 45 FB 55	2 (parallel)
SIMATIC RF182C	TCP/IP	2 x 8-pin connection socket, M12	--	2 (parallel)
SIMATIC RF160C	PROFIBUS DP-V0	2 x 8-pin connection socket, M12	FC 44	2 (parallel)
RFID 181EIP	Ethernet/IP	2 x 8-pin connection socket, M12	-- (Application blocks)	2 (parallel)
RF680R/RF685R	PROFINET IO	--	Ident profile	--

1) When connecting the RF680R/RF685R, only one reader can be connected.

The following configuration graphics show which readers can be connected to which interface modules/communications modules.

Example configurations

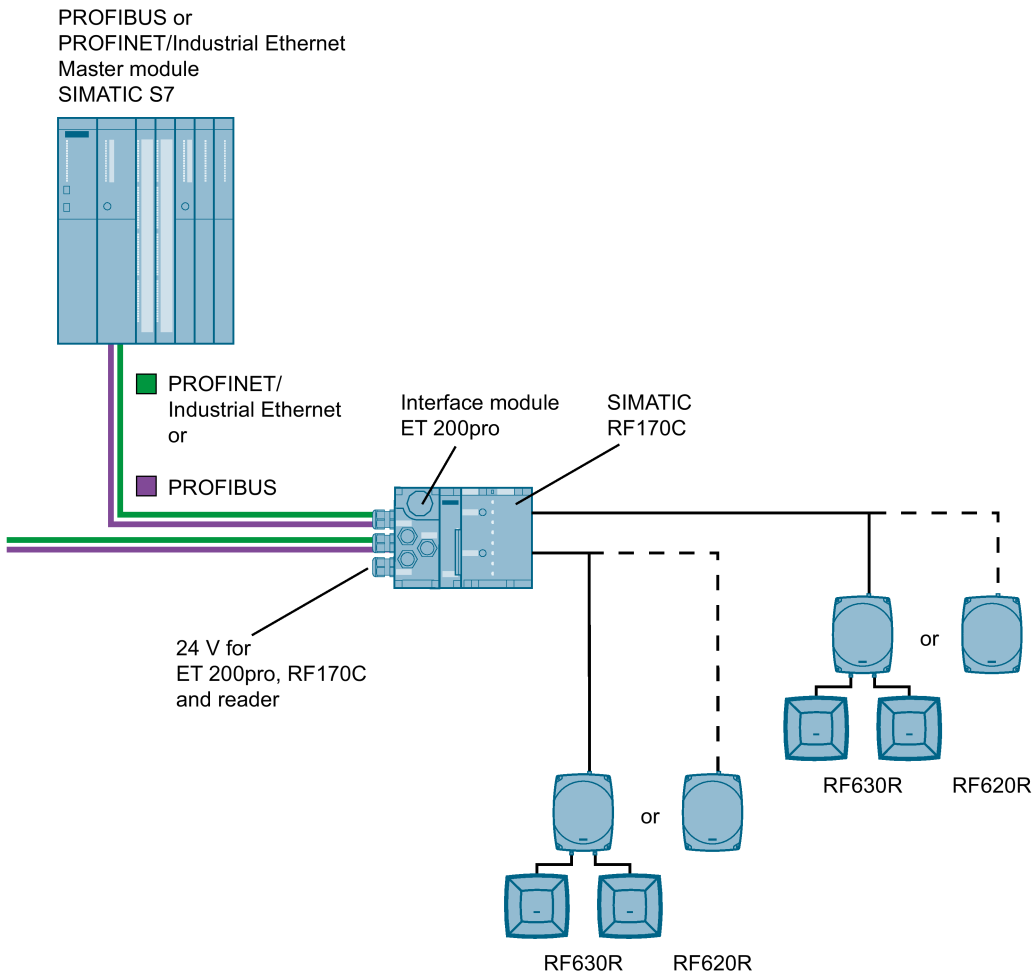


Figure 8-1 Configuration with SIMATIC RF170C

For more detailed information, refer to SIMATIC RF170C Operating Instructions (https://support.industry.siemens.com/cs/ww/en/view/32622825).

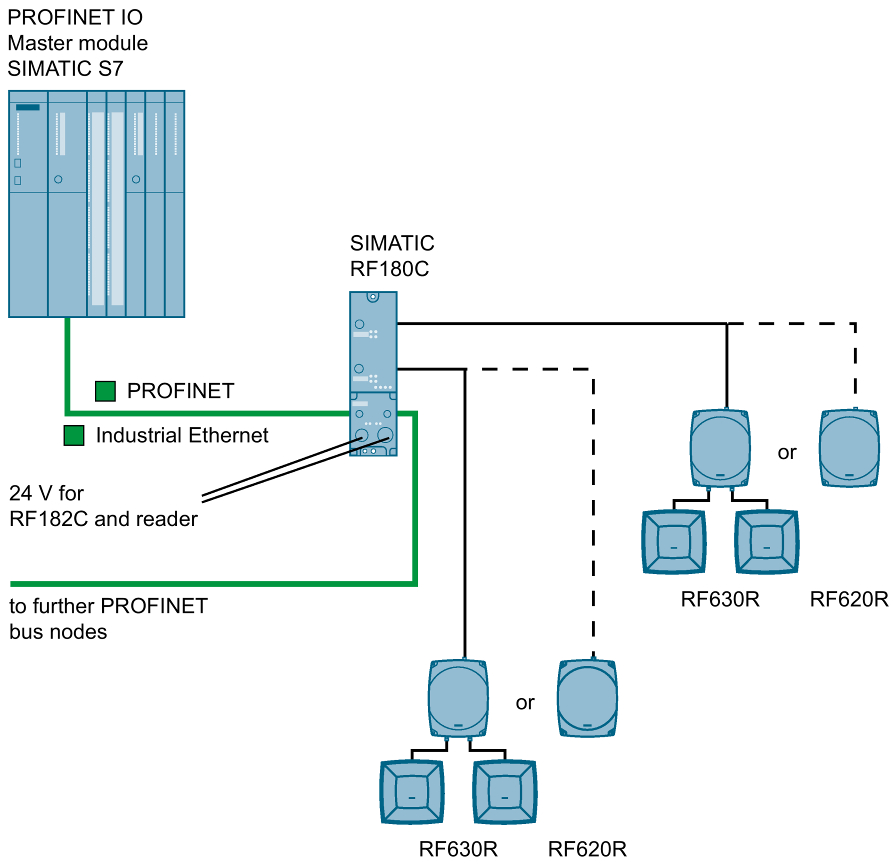


Figure 8-2 Configuration with SIMATIC RF180C

For more detailed information, refer to SIMATIC RF180C Operating Instructions (https://support.industry.siemens.com/cs/ww/en/view/30012157).

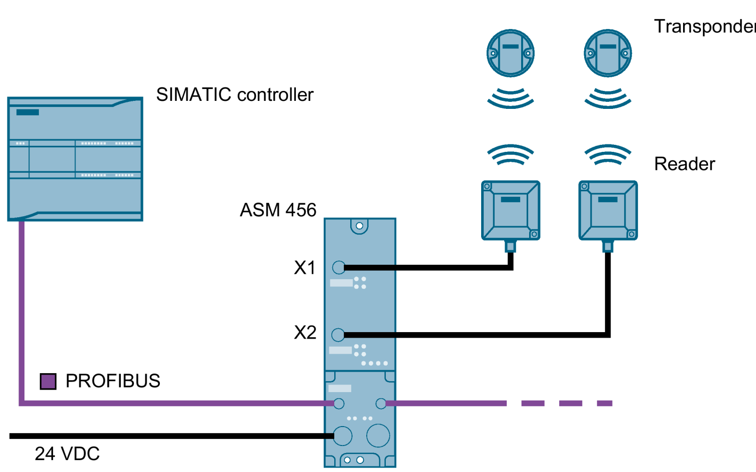


Figure 8-3 Configuration with ASM 456

For more detailed information, refer to ASM 456 Operating Instructions (https://support.industry.siemens.com/cs/ww/en/view/32629442).

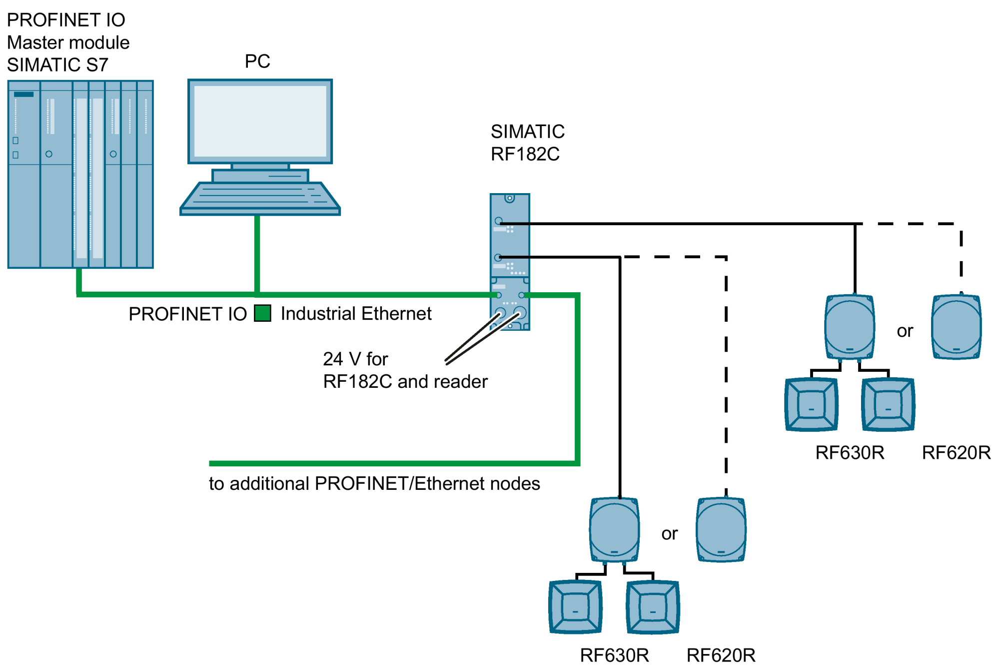


Figure 8-4 Configuration with SIMATIC RF182C

For more detailed information, refer to SIMATIC RF182C Operating Instructions (https://support.industry.siemens.com/cs/ww/en/view/38507897).

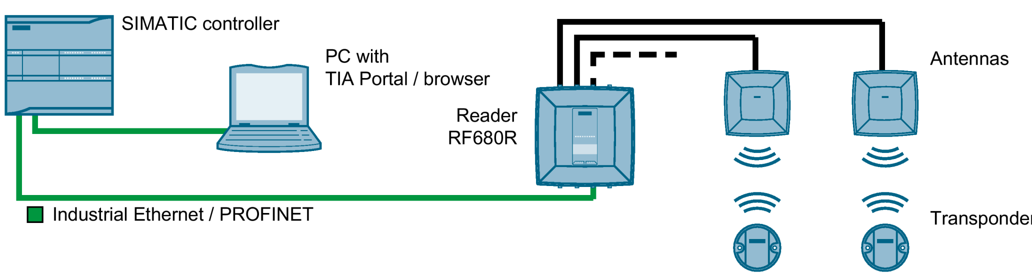


Figure 8-5 Configuration graphic with SIMATIC RF680R and PROFINET connection

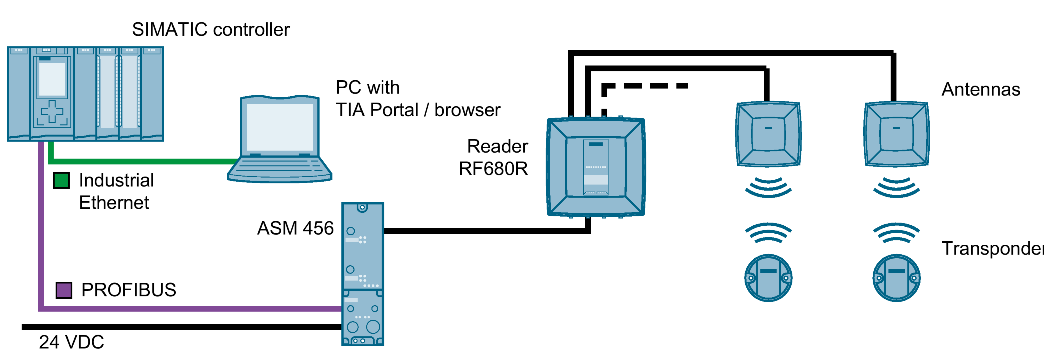


Figure 8-6 Configuration graphic with SIMATIC RF680R and PROFIBUS connection

9 System diagnostics

9.1 Error messages and flash codes for RF620R/RF630R with FB45/FB55

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"

<table>
<tr><th>Error code (B#16#...)</th><th>Description</th></tr>
<tr><td>00</td><td>No error; default value if everything is ok</td></tr>
<tr><td>01</td><td>"Params_DB" is not available in SIMATIC</td></tr>
<tr><td>02</td><td>"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</td></tr>
<tr><td>03</td><td>The DB after the "command_DB_number" pointer is not available in the SIMATIC controller.</td></tr>
<tr><td>04</td><td>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</td></tr>
<tr><td>05</td><td>Invalid command type
Check the "command_DB_number/command_DB_address" command pointer
Check the actual values in the "command_DB"
"init_run" needs to be executed</td></tr>
<tr><td>06</td><td>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</td></tr>
<tr><td>07</td><td>The "MOBY_mode" or "MDS_control" parameter (defined in UDT 10) has an invalid value</td></tr>
<tr><td>08</td><td>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</td></tr>
</table>

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 the manual "System and standard functions S7-300/400, volume 1/2 (https://support.industry.siemens.com/cs/ww/en/view/44240604)".

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.

9.2 Flashing codes RF640R/RF670R

Flashing of ERR LED		Error description
Number	Repetitions	
Lit constantly	Permanent	Reader inactive, no configuration data
3	Permanent	Antenna 1 not connected or defective
4	Permanent	Antenna 2 not connected or defective
5	Permanent	Antenna 3 not connected or defective
6	Permanent	Antenna 4 not connected or defective
11	3 times	Reading of user-defined memory has failed
12	3 times	Writing of user-defined memory has failed
13	3 times	The "SendCommand" function has failed
14	3 times	Wrong or missing password
15	3 times	Writing the transponder ID failed
16	3 times	LOCK has failed
17	3 times	KILL has failed
18	3 times	Access to impermissible memory areas
19	3 times	Too many transponders in the antenna field
20	Permanent	General software errors
29	3 times	Invalid frame; Bad frame parameters
30	3 times	Incorrect message frame format
31	3 times	The "SetReadProtect" NXP function has failed
32	3 times	The "ResetReadProtect" NXP function has failed
33	3 times	General error during identification of transponders (inventory)

The LED states are described in the section Status display (Page 196).

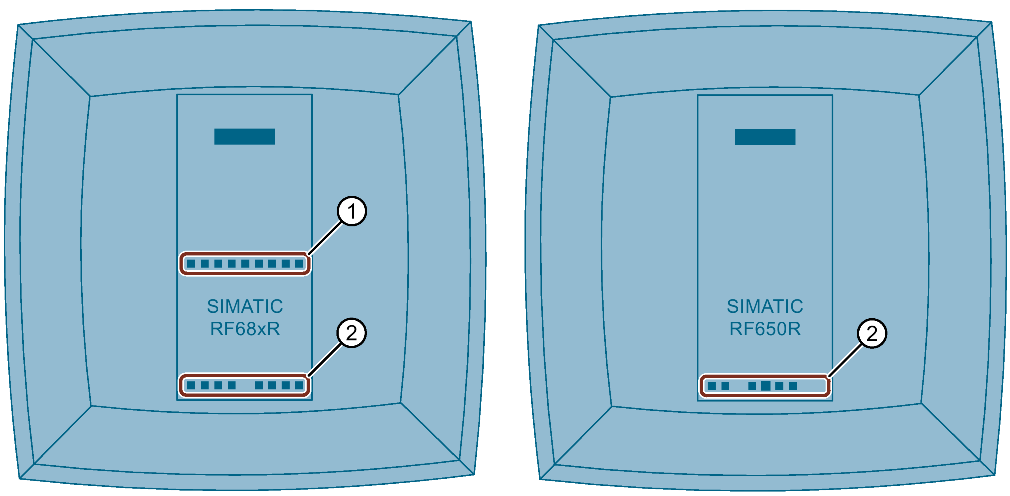
9.3 Error messages RF640R/RF670R

A description of the RF640R/RF670R error codes can be found in the "SIMATIC RF Function Manual".

9.4 LED displays RF650R/RF680R/RF685R

Note that the RF650R reader does not provide an LED status display. With the help of the LED displays, you can read out the status and the error messages of the RF680R/RF685R readers.

The LED status display is in the middle on the front of the reader. The LED operating display is at the bottom on the front of the reader.



① LED status display (ST1 - ST9) - RF680R/RF685R only

② LED operating display

• RUN/STOP (R/S)	Shows whether the reader is ready for operation.
• ERROR (ER)	Indicates whether an error has occurred.
• MAINTENANCE (MAINT) - RF680R/RF685R only	Shows whether the reader needs maintenance.
• POWER (PWR)	Shows whether the reader is supplied with power.
• PRESENCE (PRE) - RF650R only	Among other things, indicates whether or not there are multiple transponders in the antenna field. With the RF680R/RF685R readers, this is indicated by the status display.
• LINK 1 (LK1)	Indicates that there is a connection via Ethernet interface "1".
• RECEIVE/TRANSMIT 1 (R/T1)	Indicates that data is being sent and/or received via Ethernet interface "1".
• LINK 2 (LK2) - RF680R/RF685R only	Indicates that there is a connection via Ethernet interface "2".

• RECEIVE/TRANSMIT 2 (R/T2) - RF680R/RF685R only	Indicates that data is being sent and/or received via Ethernet interface "2".

Figure 9-1 LED displays of the reader

Functions of the LED status bar (RF680R/RF685R)

With the LED operating display, you can read out the various operating statuses of the readers. The LED status display of the RF680R and RF685R readers has several functions. Among other things, the status display provides the following functions:

- Startup of the reader

  The startup process of the reader is displayed by a status bar lit yellow. As soon as the startup is completed, the reader requires several seconds before it is operational. This phase is indicated by a by a status bar flashing yellow. During a firmware update, the startup takes longer.

  The reader is ready for operation when the "R/S" LED is lit/flashes green. If the "R/S" LED is flashing, the reader is waiting for a connection. If the "R/S" LED is lit constantly, the reader is connected to the controller or PC.

- Error display

  If there is an error, the actual error is indicated by the lighting/flashing pattern. The "ER" LED of the LED operating display also flashes. You will find more information on error messages in the section "RF650R/RF680R/RF685R error messages (Page 537)".

- Display of RF activity

  Indicates whether or not the reader is sending via the antenna (constant green), whether or not transponders were detected by the reader (flashing yellow) and whether or not a transponder was sent to the user application (constant yellow).

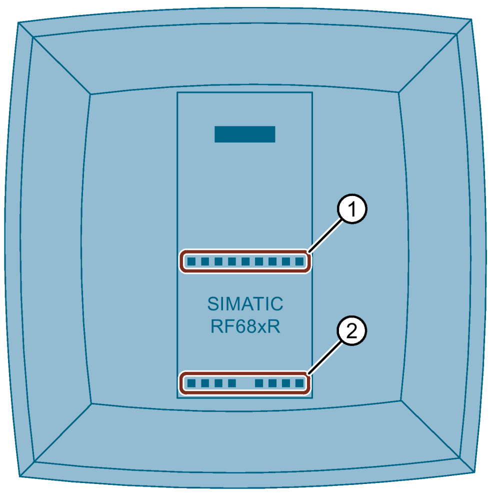
- Indication of the quality of the antenna alignment (RSSI)

  When aligning the antenna, using the WBM, the status display indicates the RSSI value with which the transponder was detected. You will find further information on antenna alignment in the "SIMATIC RF650R/RF680R/RF685R" configuration manual.

9.4.1 How the LED status display works

Note that the RF650R reader does not provide an LED status display. The LED status display displays the error messages of the RF680R/RF685R readers.

The LED status display is in the middle of the front of the reader. The LED operating display it is at the bottom on the front of the reader.



① LED status display (ST1 - ST9)

② LED operating display

Figure 9-2 LED displays of the RF680R/RF685R readers

Error messages are indicated by red flashing status LEDs and the red flashing "ER" LED. A distinction is made between hardware errors (faults) and normal errors. With hardware errors, the LEDs flash with a fast frequency of 4 Hz. With all other errors, the LEDs flash with a slow frequency of 2 Hz.

The detailed LED error display described here is enabled as default. If required, you can disable this in the "Settings - General" menu item of the WBM. If the LED error display is enabled, a separate LED pattern is assigned to every error in the LED status display. The displayed LED patterns are based on the error code of the hexadecimal error message converted to binary.

Example

The error "0x12" (XML error message) is displayed. Converted to binary, this results in the value "0001 0010". This converted value is displayed in the LED status display. The value "0" means that the corresponding LED does not light up, whereas the value "1" means that the corresponding LED is lit red. The middle (5th LED) of the LED status display serves as a "delimiter" and is always lit yellow.

XML error message hexadecimal	Error message binary	LED fault display
0x12	0001 0010	

9.5 RF650R/RF680R/RF685R error messages

Note that if there are error messages, the error LED ("ER") of the reader flashes. You can read out the error using the XML or STEP 7 block error codes. As an alternative, you can also read out the error using the LED status display of the RF680R and RF685R readers as described in the section "How the LED status display works (Page 536)".

The following table lists only the STEP 7 block error codes specific to the RF680R.

Table 9- 4 Error messages of the RF650R, RF680R and RF685R readers

"ER" LED	XML/ LED (hex)	Bloc (hex)	Error description
2 Hz	0x11	0xE1FE01	Memory of the transponder cannot be written to • Transponder memory is defective. • Transponder EEPROM was written too frequently and has reached the end of its service life • RF620R/RF630R: Transponder is write protected (Memory Lock)
2 Hz	0x12	0xE1FE02	Presence error The transponder is no longer within the transmission window of the reader. The command was not or only partially executed. Read command: There is no valid data in "IDENT_DATA". Write command: The transponder that has just left the antenna field contains an incomplete data record. Possible causes: • Operating distance between reader and transponder is not being maintained. • Configuration error: The data record to be processed is too large (in dynamic mode).
2 Hz	0x13	0xE1FE03	Address error The address area of the transponder has been exceeded. Possible causes: • Start address of the command start has been incorrectly set. • Wrong transponder type • The area to be written to is write-protected.
2 Hz	0x1A	0xE1FE0A	The transponder is read/write-protected.
2 Hz	0x91	0xE1FE81	The transponder is not responding.
2 Hz	0x92	0xE1FE82	The transponder password is incorrect. Access is denied.
2 Hz	0x93	0xE1FE83	The verification of the written transponder data has failed.
2 Hz	0x94	0xE1FE84	General transponder error
2 Hz	0x95	0xE1FE85	The transponder has too little power to execute the command.
2 Hz	0x22	0xE2FE02	More transponders are located in the transmission window than can be processed at the same time by the reader.
2 Hz	0xA1	0xE2FE81	There is no transponder with the required EPC-ID in the transmission window or there is no transponder at all in the antenna field.
2 Hz	0xA2	0xE2FE82	The requested data is not available.
2 Hz	0xA3	0xE2FE83	The transponder signals a CRC error.

"ER" LED	XML/ LED (hex)	Bloc (hex)	Error description
2 Hz	0xA4	0xE2FE84	The selected antenna is not enabled.
2 Hz	0xA5	0xE2FE85	The selected frequency is not enabled.
2 Hz	0xA6	0xE2FE86	The carrier signal is not activated.
2 Hz	0xA7	0xE2FE87	There is more than one transponder is in the transmission window.
2 Hz	0xA8	0xE2FE88	General radio protocol error
4 Hz	0x41	0xE4FE01	Error in power supply The power supply is very close to the low limit.
4 Hz	0x43	0xE4FE03	Antenna error • The antenna or the antenna cable is defective. • Error in the connection to the reader; the reader is not answering (in PROFIBUS operation). – The cable between the communications module and reader is wired incorrectly or there is a cable break – The 24 V supply voltage is not connected or is turned off or has failed briefly – Automatic fuse on the communications module has blown – Hardware defect – Another reader is in the vicinity and is active – Execute "init_run" after correcting the error
2 Hz	0x44	0xE4FE04	The buffer on the communications module or reader is not adequate to store the command temporarily.
2 Hz	0x45	0xE4FE05	The buffer on the communications module or reader is not adequate to store the data temporarily.
2 Hz	0x46	0xE4FE06	The command is not permitted in this status or is not supported. Possible cause: • "INIT" was chained.
2 Hz	0x47	0xE4FE07	Startup message from reader/communications module The reader or communications module was off and has not yet received a "Reset_Reader" ("WRITE-CONFIG") command. • Execute "INIT" • The same physical address in the "IID_HW_CONNECT" parameter is being used more than once. Check your "IID_HW_CONNECT" parameter settings. • Check connection to the reader • The baud rate was switched over but power has not yet been cycled
2 Hz	0xC1	0xE4FE81	The specified tag field of the transponder is unknown.
2 Hz	0xCA	0xE4FE8A	General error
2 Hz	0xCB	0xE4FE8B	No or bad configuration data/parameters were transferred. Possible cause: • You are accessing an unconfigured read point.

"ER" LED	XML/ LED (hex)	Bloc (hex)	Error description
--	0xCC	0xE4FE8C	• Communication error between Ident profile and communications module. Handshake error. – UDT of this communications module is overwritten by other program sections – Check parameter settings of communications module in the UDT – Check the Ident profile command that caused this error – Start "INIT" after correcting the error • Backplane bus / PROFIBUS DP / PROFINET error occurred This error is only indicated when access monitoring has been enabled in the PROFIBUS configuration. – Backplane bus / PROFIBUS DP / PROFINET bus connection was interrupted (wire break on the bus; bus connector on the communications module was briefly unplugged) – Backplane bus / PROFIBUS DP / PROFINET master no longer addressing communications module – Execute "INIT" – The communications module has detected a frame interruption on the bus. The backplane bus, PROFIBUS or PROFINET may have been reconfigured (e.g. with HW Config or TIA Portal)
2 Hz	0xCD	0xE4FE8D	• Firmware error Possible cause: The firmware update was not run completely. • Internal communications error of the communications module/reader – Connector contact problem on the communications module / reader – Hardware of the communications module / reader has a defect; → Send in communications module / reader for repair – Start "INIT" after correcting the error • Internal monitoring error of the communications module/reader – Program execution error on the communications module / reader – Turn the power supply of the communications module/reader off and on again – Start "INIT" after correcting the error
2 Hz	0xCE	0xE4FE8E	The current command was aborted by the "WRITE-CONFIG" ("INIT" or "SRESET") command for the bus connector was pulled. Possible causes: • Communication with the transponder was aborted by "INIT". • This error can only be reported if there is an "INIT" or "SRESET".
2 Hz	0x51	0xE5FE01	Incorrect sequence number order (SN) on the reader/communications module.
--	0x52	0xE5FE02	Incorrect sequence number order (SN) in the Ident profile
2 Hz	0x54	0xE5FE04	Invalid data block number (DBN) on the reader/communications module
--	0x55	0xE5FE05	Invalid data block number (DBN) in the Ident profile
2 Hz	0x56	0xE5FE06	Invalid data block length (DBL) on the reader/communications module
--	0x57	0xE5FE07	Invalid data block length (DBL) in the Ident profile

"ER" LED	XML/ LED (hex)	Bloc (hex)	Error description
2 Hz	0x58	0xE5FE08	The previous command is still active or the buffer is full. A new command was sent to the reader or communications module although the last command is still active. • The active command can only be aborted with "INIT". • Before a new command can be started, "DONE bit = 1" must be set (exception: "INIT"). • Two Ident profile calls had the same "HW_ID", "CM_CHANNEL" and "LADDR" parameter settings. • Two Ident profile calls are using the same pointer. • After eliminating the error, an "INIT" must be executed. • When working with command repetition (e.g., fixed code transponder), no data is being fetched from the transponder. The data buffer on the reader/communications module has overflowed. Transponder data has been lost.
--	0x59	0xE5FE09	The reader/communications module runs a hardware reset ("INIT_ACTIVE" set to "1"). The Ident profile expects an "INIT" (bit 15 in the cyclic control word).
--	0x5A	0xE5FE0A	The "CMD" command code and the relevant acknowledgement do not match. This can be a software error or synchronization error that cannot occur in normal operation.
--	0x5B	0xE5FE0B	Incorrect sequence of acknowledgement frames (TDB / DBN)
--	0x5C	0xE5FE0C	Synchronization error (incorrect increment of AC_H / AC_L and CC_H / CC_L in the cyclic control word). "INIT" had to be executed.
--	--	0xE5FE81	Communications error between reader and communications module Access denied
--	--	0xE5FE82	Communications error between reader and communications module Resource is occupied
--	--	0xE5FE83	Communications error between reader and communications module Functional error of the serial interface
--	--	0xE5FE84	Communications error between reader and communications module Other faults/errors
2 Hz	0x61	0xE6FE01	Unknown command An uninterpretable XML command was sent to the reader or the Ident profile sends an uninterpretable command to the reader. Possible causes: • The "AdvancedCmd" block was supplied with an incorrect "CMD". • The "CMD" input of the "AdvancedCmd" block was overwritten.
--	0x62	0xE6FE02	Invalid command index (CI)

<table>
<tr><th>"ER" LED</th><th>XML/ LED (hex)</th><th>Bloc (hex)</th><th>Error description</th></tr>
<tr><td>2 Hz</td><td>0x63</td><td>0xE6FE03</td><td>

A parameter of an XML command has an invalid value or the parameter assignment of the communications module or the reader was incorrect.
Possible causes / action to be taken:
– Check the parameters in the Ident profile.
– Check the relevant XML command.
– Check the parameter assignment in HW Config / STEP 7 (TIA Portal).
– The "WRITE-CONFIG" command has incorrect parameter settings.
– After a startup, the reader or communications module has still not received an INIT".
The parameter assignment of the reader or communications module on PROFIBUS/PROFINET was incorrect and the command cannot be executed.
Possible causes / action to be taken:
– Length of the input/output areas is too small for the cyclic I/O word.
– Check whether you have used the correct GSD file.
– The command (e.g. "READ") applied to the user data with too great a length.
Error when processing the command.
Possible causes / action to be taken:
– Bad data in the "AdvancedCmd" or "IID_CMD_STRUCT" (e.g. "WRITE" command with length = 0).
Check "AdvancedCmd" or "IID_CMD_STRUCT" and execute an "INIT".
– The hardware of the reader/communications module is defective. The reader or communications module receives bad data with an "INIT".
– The AB byte does not match the user data length.
The wrong reset block was selected.
Possible causes / action to be taken:
– Regardless of the selected reader system, use the "Reset_Reader" function block.
</td></tr>
<tr><td>--</td><td>0x64</td><td>0xE6FE04</td><td>Presence error
A transponder has passed through the transmission window of a reader without being processed.

This error message is not reported immediately. Instead, the reader or communications module waits for the next write / read command. This command is replied to immediately with this error and the write/read command is not executed. The next command is executed normally again by the reader/communications module.
You can reset this error status using an "INIT".
Bit 2 is set in the "OPT1" parameter and there is no transponder in the transmission window.
</td></tr>
<tr><td>--</td><td>0x65</td><td>0xE6FE05</td><td>An error has occurred that makes a Reset_Reader ("WRITE-CONFIG" with "Config = 3") necessary.
Possible causes / action to be taken:

The "WRITE-CONFIG" command is incorrect.
After eliminating the error, execute an "INIT".
Check the "IID_HW_CONNECT" parameter.
</td></tr>
</table>

"ER" LED	XML/ LED (hex)	Bloc (hex)	Error description
--	0x66	0xE6FE06	The reset timer has expired.
2 Hz	0xE1	0xE6FE81	A parameter is missing.
2 Hz	0xE2	0xE6FE82	The parameter has an invalid format.
2 Hz	0xE3	0xE6FE83	The parameter type is invalid.
2 Hz	0xE4	0xE6FE84	Unknown parameter.
2 Hz	0xE5	0xE6FE85	The command or the frame has an invalid format.
2 Hz	0xE6	0xE6FE86	The inventory command failed.
2 Hz	0xE7	0xE6FE87	Read access to the transponder has failed.
2 Hz	0xE8	0xE6FE88	Write access to the transponder has failed.
2 Hz	0xE9	0xE6FE89	Writing the EPC-ID on the transponder has failed.
2 Hz	0xEA	0xE6FE8A	Enabling write protection on the transponder has failed.
2 Hz	0xEB	0xE6FE8B	The "Kill" command failed.
2 Hz	0x71	0xE7FE01	In this status, only the "Reset_Reader" command ("WRITE-CONFIG") is permitted.
--	0x72	0xE7FE02	The "CMD" command code is not permitted.
--	0x73	0xE7FE03	The "LEN_DATA" parameter of the command is too long and does not match the global data reserved within the send data buffer (TXBUF).
--	0x74	0xE7FE04	The receive data buffer (RXBUF) or the send data buffer (TXBUF) is too small, the buffer created at TXBUF/RXBUF does not have the correct data types or the parameter "LEN_DATA" as a negative value. Possible cause / action to be taken: • Check whether the buffers TXBUF/RXBUF are at least as large as specified in LEN_DATA. • With S7-1200/1500: – In the Ident profile, only an "Array of Byte" may be created for TXBUF and RXBUF. – In the "Reader_Status" block, only an "Array of Byte" or the corresponding data types ("IID_TAG_STATUS_XX_XXX" or "IID_READER_STATUS_XX_XXX") may be created
--	0x75	0xE7FE05	Error message that informs you that only an "INIT" command is permitted as the next command. All other commands are rejected.
--	0x76	0xE7FE06	Wrong index Permitted index is in the ranges "101 ... 108" and "-20401 ... -20418".
--	0x77	0xE7FE07	The reader or communications module does not respond to "INIT" ("INIT_ACTIVE" is expected in the cyclic status message). The next steps: • Check the address parameter "LADDR".
--	0x78	0xE7FE08	Timeout during "INIT" (60 seconds according to "TC3WG9")
--	0x97	0xE7FE09	Command repetition is not supported.
--	0x7A	0xE7FE0A	Error during the transfer of the PDU (Protocol Data Unit).

"--" means that the error is not displayed by the LEDs.

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><th colspan="2">Features</th></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

Please not that you require different 24°V connecting cables for the RF660R 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

Application und use of the wide-range power supply unit

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 V DC, 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

NOTICE
Liability 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.

NOTICE
Restriction to the approval of the wide-range power supply 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.

NOTICE
Warranty 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

> **NOTICE**
>
> **Restriction to the approval of the wide-range power supply**
>
> 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 unit (24 VDC / 3 A). This power supply unit must meet the requirements of the application field and have a KETI approval. You also need the connecting 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 550). You can find the pin assignment of the DC inputs for the reader in sections Pin assignment for power supply (Page 150) and Pin assignment for power supply (Page 202).

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	IP 65	

Table 10- 2 Technical specifications for the input

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

Table 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 up to 130 % I_{nom}
Settling time t_R load variations	I_{out} = 10...90...10 %	< 5 ms
Temperature coefficient ε	T_A = -25 °C to +70 °C	0.01 %/K
Overload behavior P_{over}		Constant current
Short-circuit protection/ No-load response		Continuous/no-load stability
Derating	T_A > +50 °C to +70 °C	max. 2 %/K
Connector type	Flanged connector Binder, Order No.: 09-3431-90-04	4 pins

Table 10- 4 Output configurations

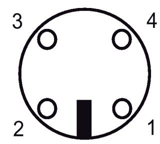
Input	Outputs U1 = U2	ILoad = I1 + I2	Efficiency (%)	Remarks
110 V AC	24 V DC	0 A		No-load stability
110 V AC	24 V DC	3 A	≥ 88	
220 V AC	24 V DC	0 A		No-load stability
220 V AC	24 V DC	3 A	≥ 90	

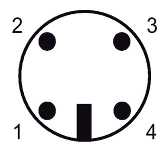
Table 10- 5 Compliance with standards

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

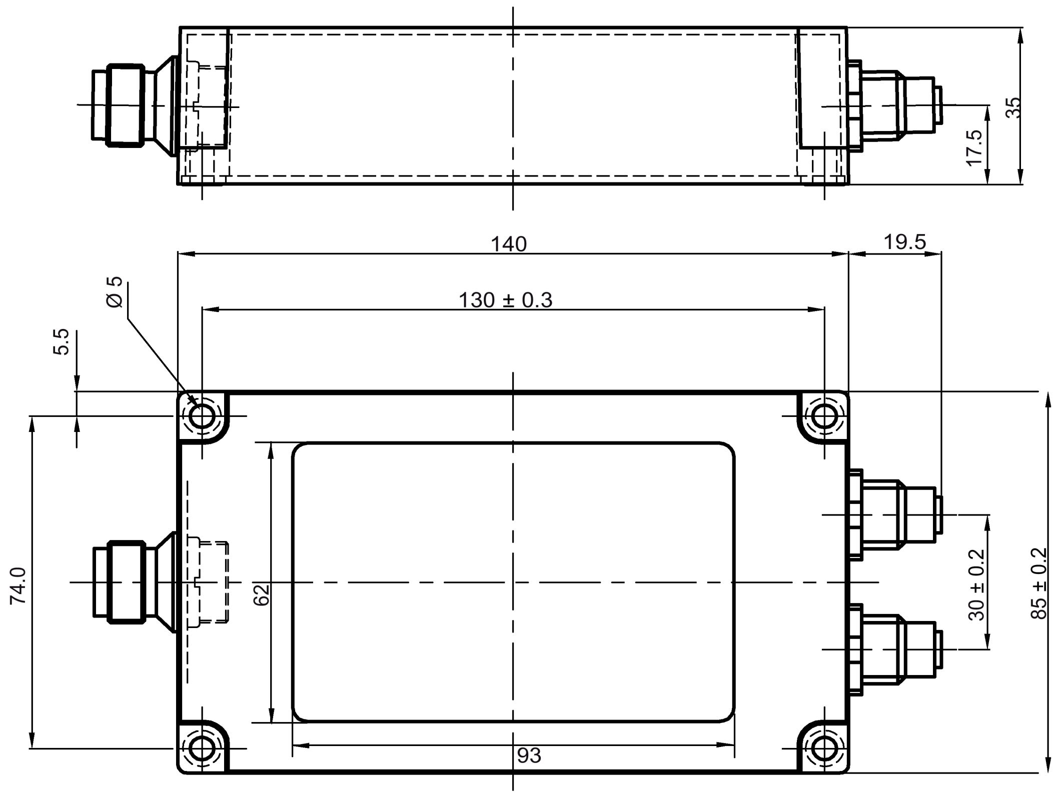
All values are measured at full-load and at an ambient temperature of 25 °C (unless specified otherwise).

10.1.7 Pin assignment of DC outputs and mains connection

<table>
<tr><th>DC outputs</th><th>Assignment</th></tr>
<tr><td rowspan="4">
</td><td>(1) Ground (0V)</td></tr>
<tr><td>(2) +24 V DC</td></tr>
<tr><td>(3) +24 V DC</td></tr>
<tr><td>(4) Ground (0V)</td></tr>
</table>

<table>
<tr><th>Mains connection</th><th>Assignment</th></tr>
<tr><td rowspan="4">
</td><td>(1) 100 to 240 V AC</td></tr>
<tr><td>(2) n.c.</td></tr>
<tr><td>(3) 100 to 240 V AC</td></tr>
<tr><td>(4) n.c.</td></tr>
</table>

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	
	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 Components of the product and ordering data

Components of SIMATIC RF-DIAG

- CD with software SIMATIC RF-DIAG, USB driver and documentation
- PC adapter for SIMATIC RF-DIAG for connecting the SIMATIC RF readers to SIMATIC RF-DIAG software
- RS-422 cable, length 2 m
- USB connecting cable (USB 2.0 standard A at PC end to USB 2.0 mini-B at adapter end), length 1.8 m

Ordering data

Table 10- 8 SIMATIC RF-DIAG ordering data

	Article number
SIMATIC RF-DIAG	6GT2080-3GA00

Table 10- 9 SIMATIC RF-DIAG accessories ordering data

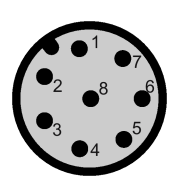
	Article number
Adapter cable for wide-range power supply 24 VDC connecting cable for PC adapter for SIMATIC RF-DIAG, length 5 m	6GT2891-0PH50
Adapter cable for firmware download for RF200/RF300 systems	6GT2891-8FE50
RS-422 cable, length 2 m (spare part)	6GT2891-4FH20
Wide-range power supply unit for SIMATIC RFID 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

10.2.3 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

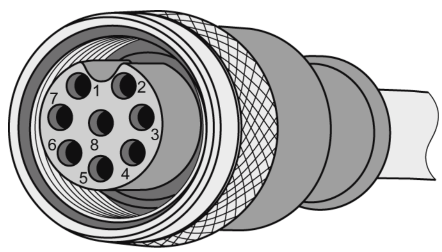
Table 10- 10 RS-422 interface of the PC adapter (male connector)

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

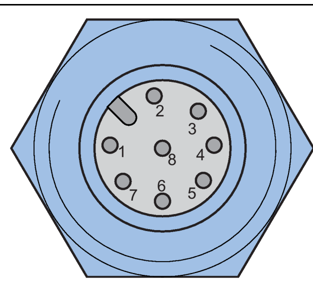
Table 10- 11 RS-422 connecting cable

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

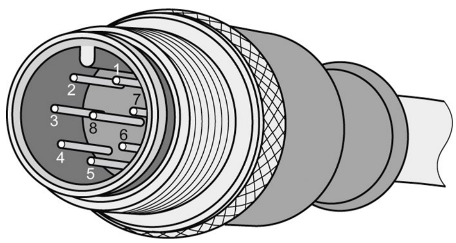
Table 10- 12 RS-422 interface of the PC adapter (female connector)

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- 13 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- 14 USB 2.0 mini-B connector socket of the PC adapter

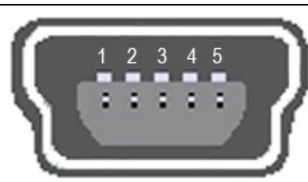
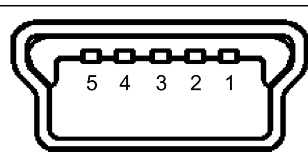
View of connection socket	Pin Device side	Assignment
	1	+ 5 V
	2	Data -
	3	Data +
	4	ID (not used)
	5	GND

Table 10- 15 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

10.2.4 Technical specifications

Table 10- 16 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- 17 Software interfaces

Property	Description
Software – RS-422	SIMATIC S7 / TIA
Software – USB • RF600	 • 3964R & RF-DIAG

Table 10- 18 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- 19 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.

10.2.5 Dimension drawing

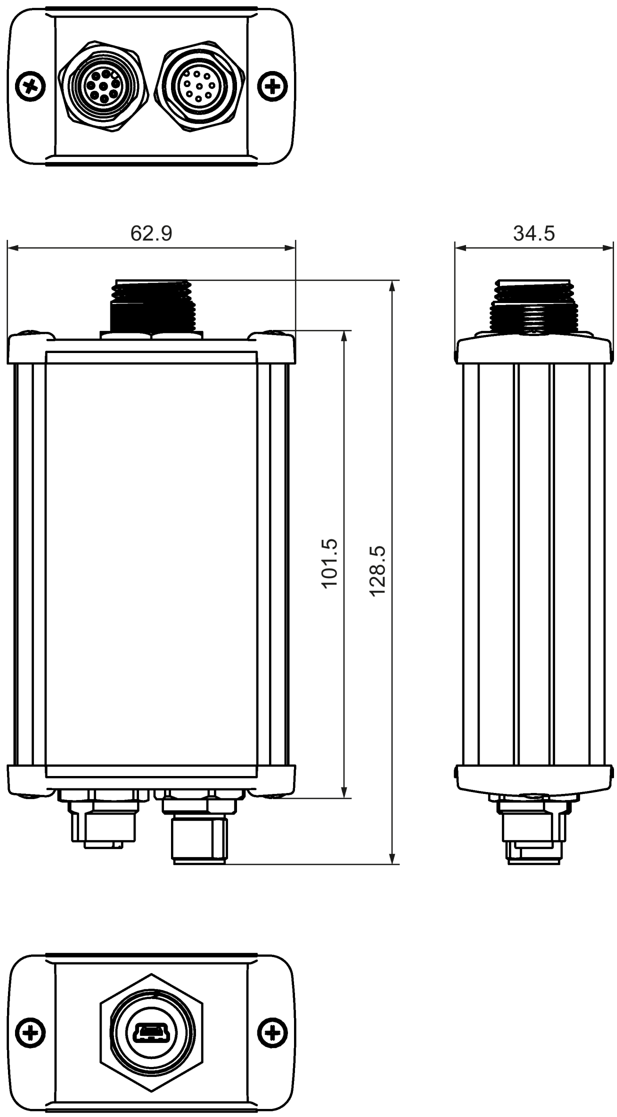


Figure 10-1 Dimension drawing of the PC adapter for SIMATIC RF-DIAG (all dimensions in mm)

When the USB protective cap is screwed on, the length of the adapter is 134 mm. The tolerances are +/- 1 mm.

10.2.6 Certificates and approvals

Table 10- 20 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

10.3 Power splitter for RF600 systems

10.3.1 Characteristics

Using the power splitter, two antennas can be connected to one antenna connector of a reader. The power fed in at the input (S) is split over two outputs (1, 2).

Power splitter	Characteristics	
	Application	Designed for distributed mounting of antennas in warehouses, logistics and distribution
	Connectable readers	All readers of the RF600 system
	Connectable antennas	• SIMATIC RF620A • SIMATIC RF640A • SIMATIC RF642A • SIMATIC RF660A
	Degree of protection	IP40

10.3.2 Ordering data

Table 10- 21 Power splitter ordering data

	Article number
Power splitter	6GT2890-0BC00

Table 10- 22 Power splitter ordering data for accessories

		Article number
Antenna cable	1 m, 0.5 dB	6GT2815-0BH10
	3 m, 1 dB	6GT2815-0BH30
	5 m, 1.5 dB	6GT2815-2BH50
	10 m, 2 dB	6GT2815-1BN10
	10 m, 4 dB	6GT2815-0BN10
	15 m, 4.5 dB	6GT2815-2BN15
	20 m, 4 dB	6GT2815-0BN20
	40 m, 5 dB	6GT2815-0BN40

10.3.3 Example of a configuration

The following example of a configuration shows a setup with one RF680R reader, one power splitter and two RF640A antennas.

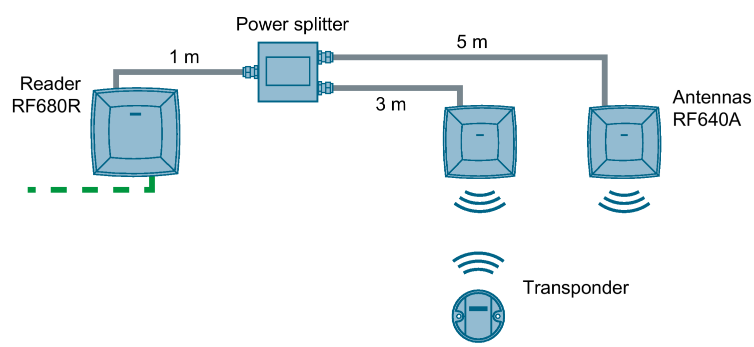


Figure 10-2 Example of a configuration with an RF600 system with a power splitter

The link between the reader and the power splitter (3.2 dB attenuation) is via a cable 1 m in length (0.5 dB cable attenuation). Between the power splitter and the antennas a cable with a length of 3 m (1 dB cable attenuation) and a cable with a length of 5 m (1.5 dB cable attenuation) are used.

To calculate the total attenuation made up of the cable attenuation and the attenuation of the power splitter, the branch with the lowest cable attenuation must be considered. For the configuration shown above, the total attenuation is as follows:

0.5 dB + 3.2 dB + 1 dB = 4.7 dB

The total attenuation of 4.7 dB must be stored in the configuration of the reader as user-defined cable attenuation. When using several different antennas, the antenna gain of the antenna with the highest gain must be specified. This ensures that the maximum permitted transmit power is not exceeded.

Note that when using different antenna cable lengths, the radiated power of the antenna with the longer cable is lower.

10.3.4 Technical specifications

Table 10- 23 Technical specifications

	6GT2890-0BC00
Product type designation	Power splitter
Electrical data	
Transmission frequency	500 ... 1000 MHz
Max. input power	10 W
Impedance	50 Ω
Attenuation between input and outputs	3.2 dB
Connector (input/outputs)	RTNC plug
Mechanical specifications	
Housing	
• Material	• Aluminum
• Color	• Silver
Permitted ambient conditions	
Ambient temperature	
• During operation	• -40 to +85 °C
• During transportation and storage	• -40 to +100 °C
Degree of protection to EN 60529	IP40
Design, dimensions and weights	
Dimensions (L × W × H)	
• Without plug	• 50.8 × 50.8 × 19.05 mm
• With plug	• 74.7 × 50.8 × 19.05 mm
Weight	170 g

10.3.5 Dimension drawing

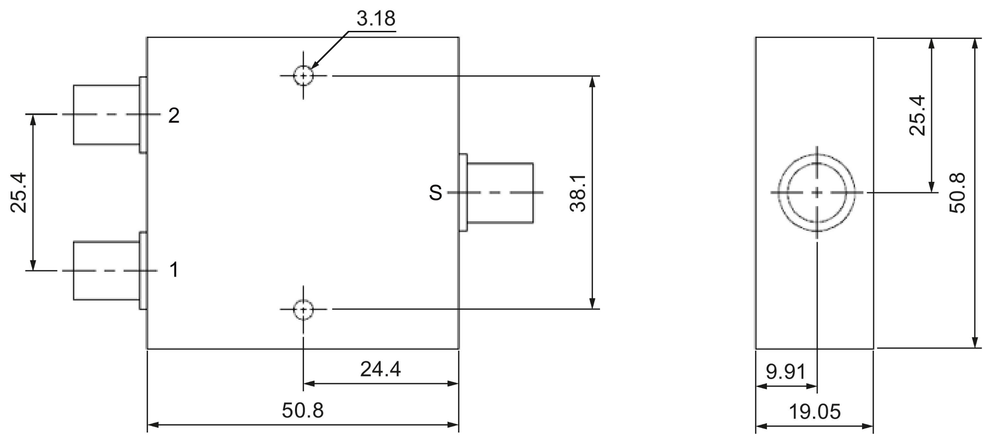


Figure 10-3 Power splitter dimension drawing

All dimensions in mm

Appendix

A

A.1 Certificates and approvals

All the latest RFID radio approvals are available on the Internet (http://www.siemens.com/rfid-approvals).

Certificate	Description
CE	Conformity with R&TTE directive

Notes on CE marking

The following applies to the system described in this documentation:
The CE mark on a device indicates the corresponding approval.

DIN ISO 9001 certificate

The quality assurance system for the entire production 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	
FC Federal Communications Commission	FCC Title 47, Part 15.sections 15.247 Radio Frequency Interference Statement This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules.
Industry Canada Radio Standards Specifications	RSS-210 Issue 6, Sections 2.2, A8
c UL us	This product is UL-certified for the USA and Canada. It meets the following safety standard(s): UL 60950-1 - Information Technology Equipment Safety - Part 1: General Requirements CSA C22.2 No. 60950 -1 - Safety of Information Technology Equipment UL Report E 205089

Country-specific approvals

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) according to the standard C22.2. No. 60950 (LR 81690) or acc. to C22.2 No. 142 (LR 63533)
	Canadian Standard Association (CSA) per American Standard UL 60950 (LR 81690) or per UL 508 (LR 63533)
	This product meets the requirements of the AS/NZS 3548 standard.
FCC ID: NXW-RF...	USA (FCC) This device complies with Part 15 of the FCC Rules.
IC: 267X-RF...	Canada (IC) This device complies with Industry Canada licence-exempt RSS standard(s).
CMIIT ID: XXXXYYZ ZZZ	China (CMIIT)
	Brazil (ANATEL)
	South Korea (KCC)
	Japan (VCCI)
	South Africa (ICASA)

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.

A.2 Service & support

Technical Support

You can reach technical support for all PD projects as follows:

- Phone: + 49 (0) 911 895 7222
- Fax: + 49 (0) 911 895 7223
- Web form for support request (https://support.industry.siemens.com/My/ww/en/requests)
- Internet: E-mail (mailto:support.automation@siemens.com)

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://w3.siemens.com/aspa_app)
- In Catalog CA 01
- In the catalog ID 10 specially for Industrial Identification Systems

Service & Support for Process Industries and Drives

On the Internet, on the Support home page (https://support.industry.siemens.com/cs/de/en/) of Process Industries and Drives (PD), you will find various services.

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 PD.
- 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 home page (http://w3.siemens.com/mcms/identification-systems/).

Online catalog and ordering system

The online catalog and the online ordering system can also be found on the Industry Mall home page (https://mall.industry.siemens.com).

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 home page (http://sitrain.automation.siemens.com/sitrainworld/).

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

See active field

Active surface

See active field

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 **B**onding **S**trip

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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