Characteristic	Description
Energy source	Magnetic energy via antenna, without battery
Multi-tag capability	Yes, minimum distance between data carriers ≥ 50 mm

[1] Metallic surface approx. 30 x 30 cm

[2] For maximum read/write distances

See also

Reading range when mounted on ESD carrier materials (Page 304)

Reading range when mounted on flat metallic carrier plates (Page 301)

Reading range when mounted on non-metallic carriers (Page 297)

7.5.6.3 Memory specifications

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

7.5.6.4 Environmental conditions

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

7.5.6.5 Chemical resistance of the transponder RF620T

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

	Concentration	20 °C	50 °C
Emissions alkaline/containing hydrogen fluoride /carbon dioxide	Low	○○○○	○○○○
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		-	-
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.		–	–

	Concentration	20 °C	50 °C
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		○○○○	
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.	○○○○	○○○○

	Concentration	20 °C	50 °C
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	○○○○	○○○○
	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

7.5.7 Certificates and approvals

Table 7- 14 6GT2810-2HC00 - RF620T UHF container tag

Certificate	Description
CE	CE Approval to R&TTE

Table 7- 15 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

7.5.8 Dimension drawing

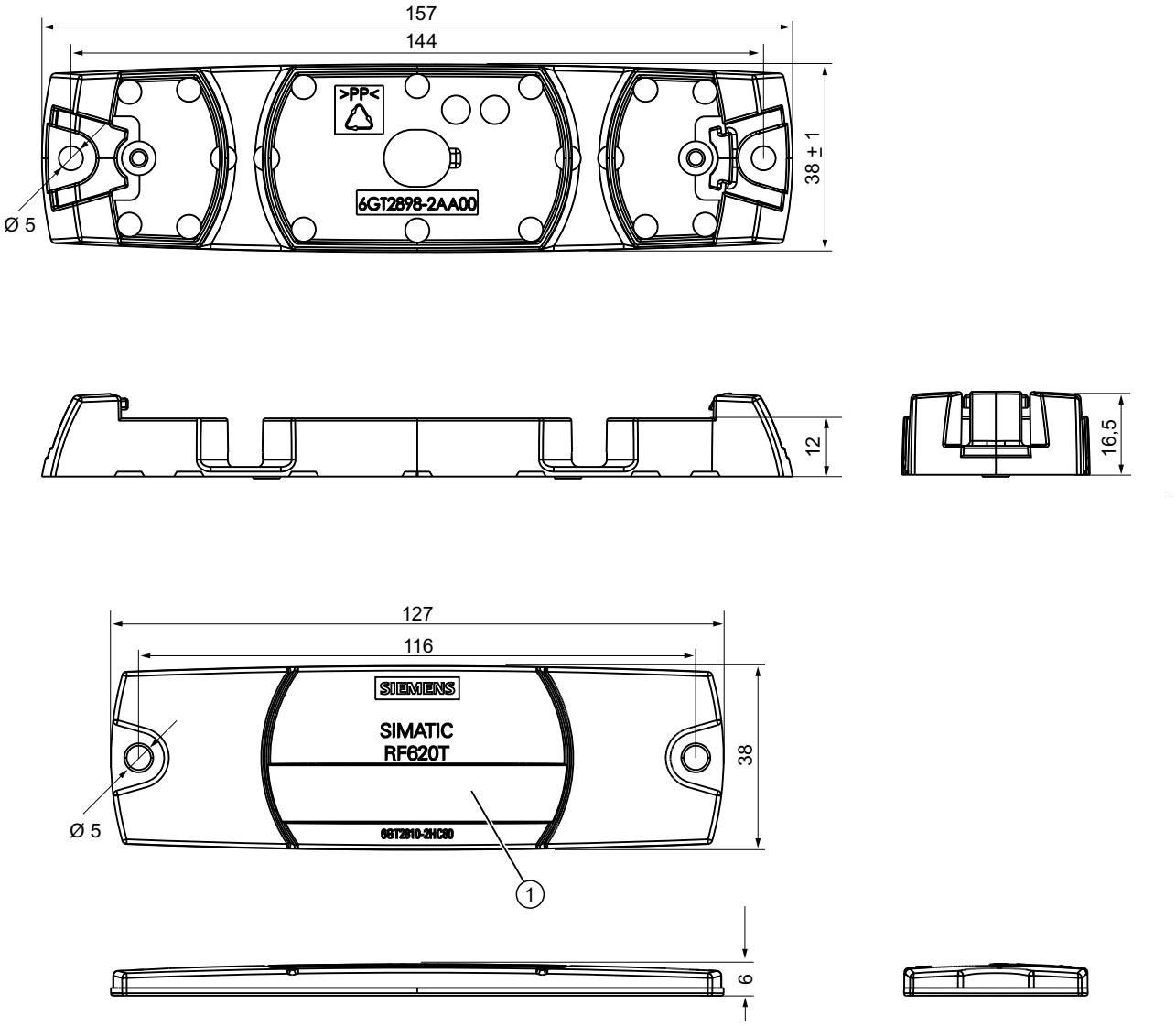


Figure 7-24 SIMATIC RF620T UHF container tag

Units of measurement: All dimensions in mm

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

① Labeling area, see Section Characteristics (Page 296)

7.6 SIMATIC RF625T

7.6.1 Characteristics

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

Fields 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	Features		
	Application	Identification tasks in rugged industrial environments	
	Frequency versions	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 Add-on-memory 64 bytes	
	Reading / writing range	typically 1.5 m in conjunction with: • RF640R/RF670R reader and RF660A antenna • RF640R reader with integrated antenna	
		typically 0.7 m in conjunction with: • RF620R/RF630R reader and RF660A antenna • RF620R reader with integrated antenna	
	Installation	Suitable for direct mounting on conductive materials (preferably metal)	

7.6.2 Ordering data

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

7.6.3 Planning the use

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

Example of optimum reader-transponder positioning with RF620R and RF640R

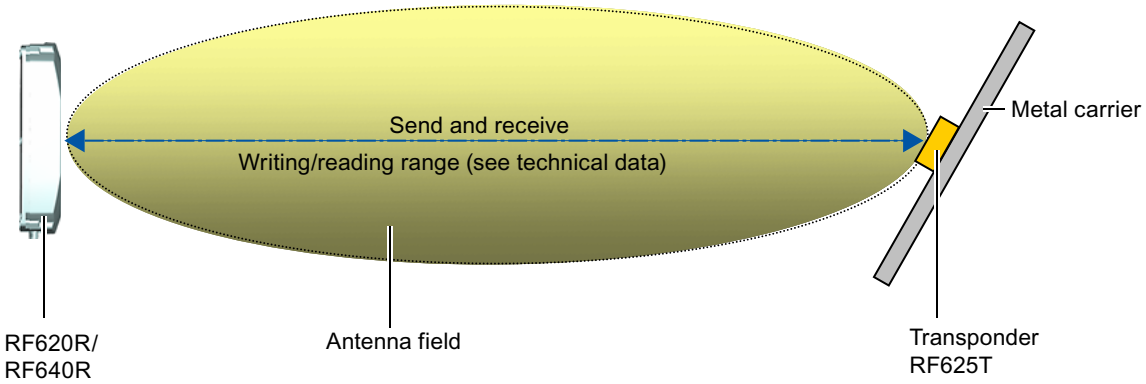


Figure 7-25 Example of optimum reader-transponder positioning with RF620R and RF640R via the internal reader antenna.

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

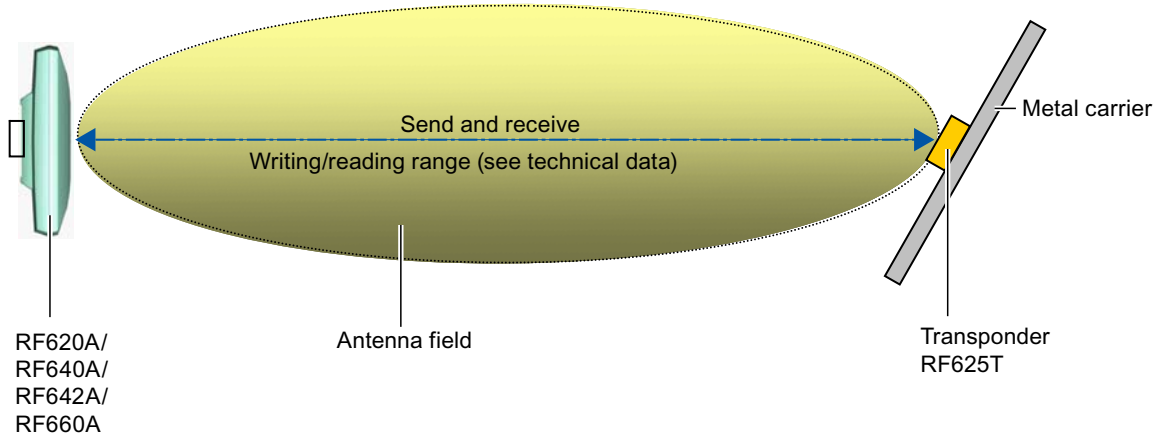


Figure 7-26 Example of optimum antenna-transponder positioning with the RF620R, RF630R, RF640R and RF670R readers in conjunction with the external antennas RF620A, RF640A, RF642A or RF660A.

7.6.3.2 Reading 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 centrically mounted on a flat metal plate, which may either be almost square or circular, it can be aligned in any direction since the transmitting and receiving RF660A antennas operate with circular polarization.

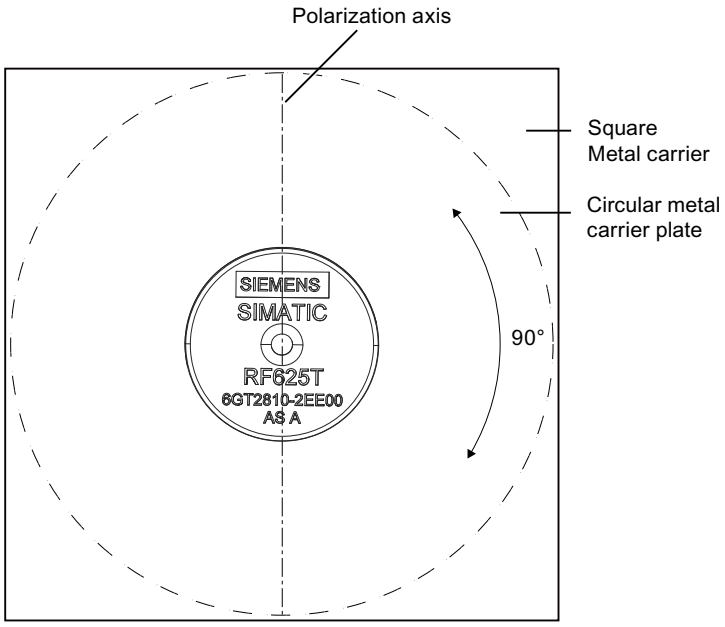


Figure 7-27 Optimum positioning of the transponder on a (square or circular) metal plate

Table 7- 16 Reading range on flat metallic carrier plates

Carrier plate material	Reading 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 reading range depends on the mounting orientation of the transponder You will find more detailed information on reading ranges in the section "Electrical data (Page 324)".

7.6.3.3 Reading 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- 17 Reading range on non-metallic carriers

Carrier plate material	Reading range [1]
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 %

[1] The maximum read range of 100 % is achieved by mounting the transponder on a flat metallic carrier with a diameter of at least 150 mm.

You will find more detailed information on reading ranges in the section "Electrical data (Page 324)".

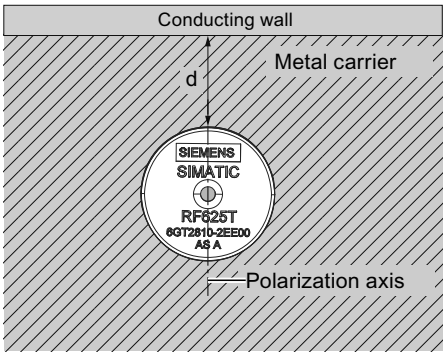
7.6.3.4 Influence of conducting walls on the reading range

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

Reading range: One conducting wall

Influence on reading range when positioned against one conducting wall

View from above

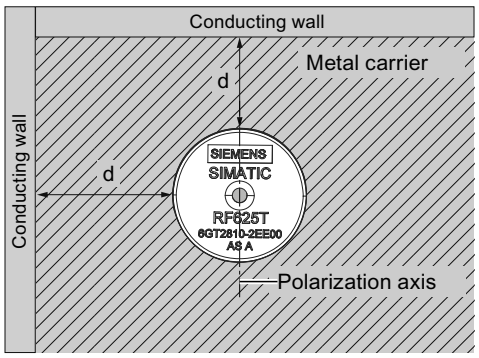


Distance d	20 mm	50 mm	100 mm	
Reading range	Approx. 100 %	Approx. 100 %	Approx. 100 %	Wall height 20 mm
	Approx. 100 %	Approx. 100 %	Approx. 100 %	Wall height 50 mm
	Approx. 80 %	Approx. 100 %	Approx. 100 %	Wall height 100 mm

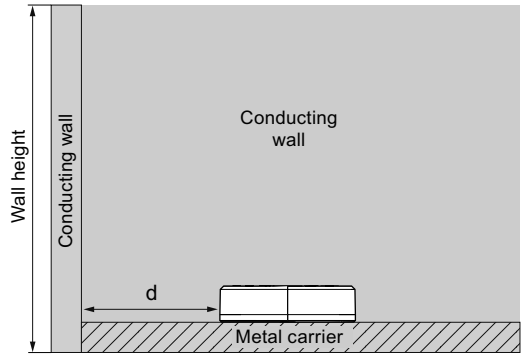
Reading range: Two conducting walls

Influence on reading range when positioned against two conducting walls

View from above



Side view

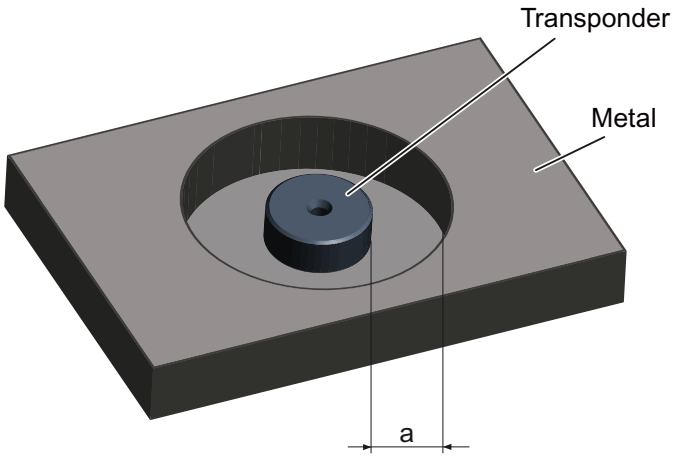


Distance d	20 mm	50 mm	100 mm	
Reading range	Approx. 70 %	Approx. 75 %	Approx. 100 %	Wall height 20 mm
	Approx. 70 %	Approx. 80 %	Approx. 100 %	Wall height 50 mm
	Approx. 70 %	Approx. 40 %	Approx. 50 %	Wall height 100 mm

The values specified in the tables above are guide values.

7.6.3.5 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 7-28 Flush-mounting of RF625T in metal

7.6.3.6 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.

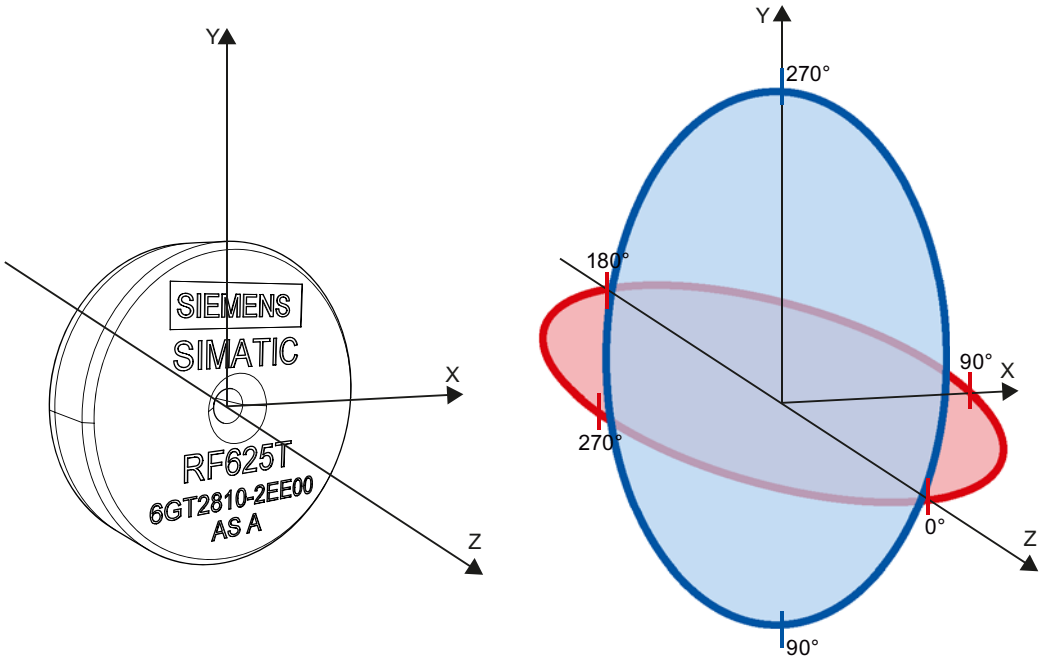


Figure 7-29 Reference system of the RF625T

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

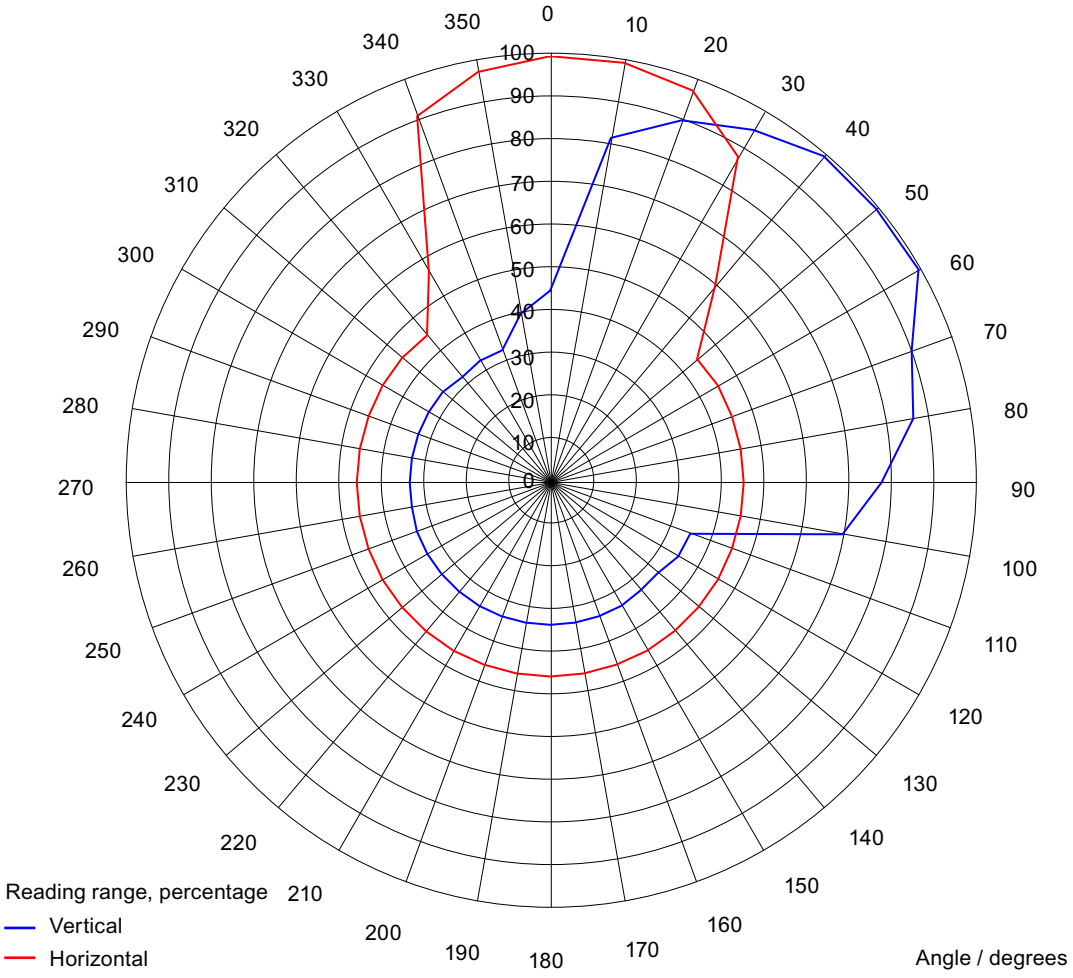


Figure 7-30 Directional characteristics of the RF625T on a metallic carrier depending on the angle of inclination in a vertical or horizontal direction

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

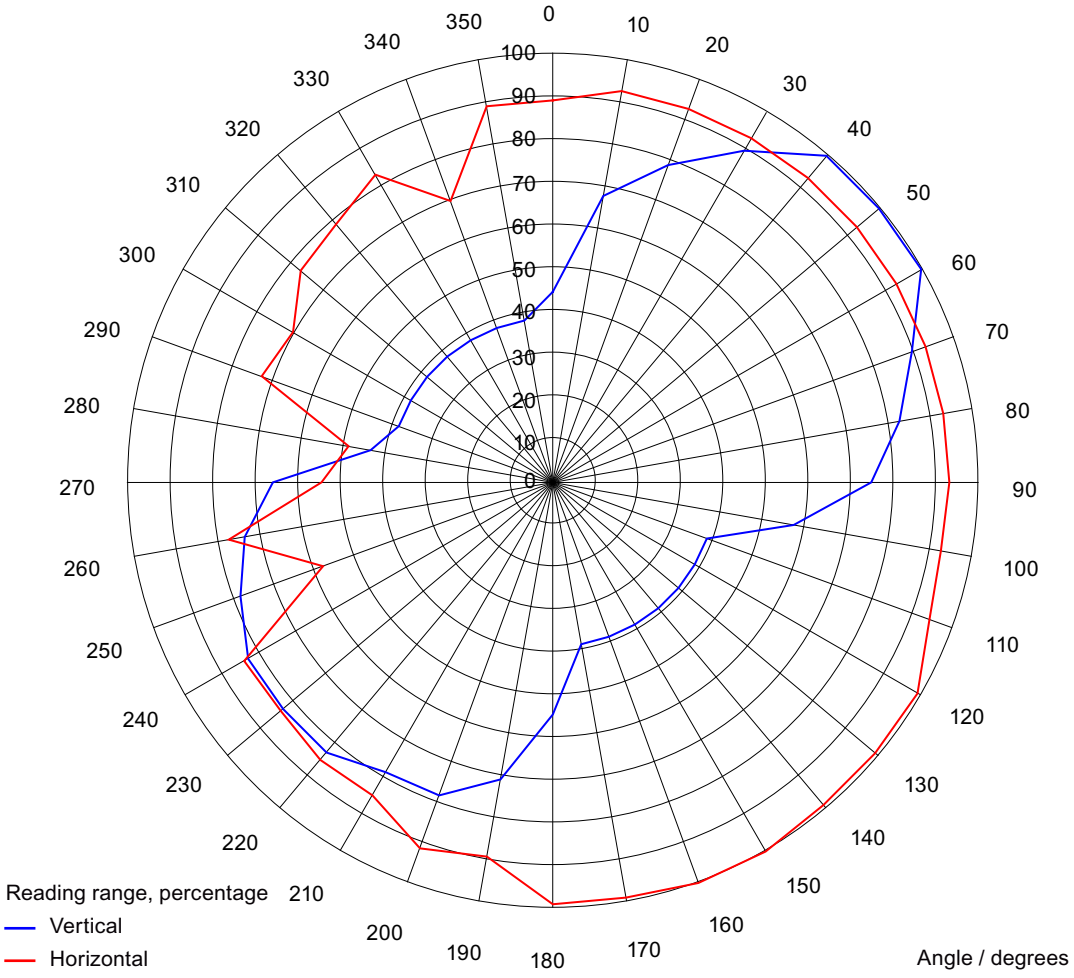


Figure 7-31 Directional characteristics of the RF625T on a non-metallic carrier depending on the angle of inclination in a vertical or horizontal direction

7.6.4 Mounting instructions

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

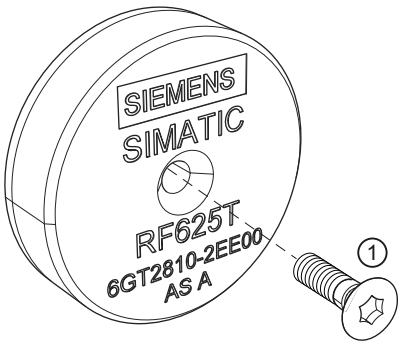


Figure 7-32 Screw mounting

Note

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

7.6.5 Memory configuration of the transponder

The memory configuration of the transponder is described in the section SIMATIC memory configuration of the RF600 transponders and labels (Page 270).

7.6.6 Technical Specifications

7.6.6.1 Mechanical data

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

7.6.6.2 Electrical data

Property	Description	
	Europe	USA / Canada
Air interface	According to ISO 18 000-6 C	According to ISO 18 000-6 C
Frequency range	865 MHz … 868 MHz	902 MHz ... 928 MHz [1]
Necessary transmit power	2 W (ERP)	4 W (EIRP)
Reading range [2] Mounting on non-metal Mounting on metal [3]	 typical 1.0 m min. 1.2 m; typical 1.5 m	 typical 1.0 m min. 1.2 m; typical 1.5 m
Writing range [2] Mounting on non-metal Mounting on metal [3]	 typical 0.7 m min. 1 m; typical 1.2 m	 typical 0.7 m min. 1 m; typical 1.2 m
Polarization type	Linear	Linear
Minimum distance to transmit antenna [4]	Approx. 0.2 m	Approx. 0.2 m
Energy source	Magnetic energy via antenna, without battery	Magnetic energy via antenna, without battery
Multi-tag capability	Yes, minimum distance between data carriers ≥ 50 mm [5]	Yes, minimum distance between data carriers ≥ 50 mm [5]

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

2) Tolerances of ±20% of the maximum acquisition ranges are permitted due to production and temperature conditions.

3) Mounting on a flat surface with a diameter of at least 150 mm

4) When using the RF620R and RF640R readers in conjunction with the antennas RF640A, RF642A and RF660A.

5) When these minimum clearances are not kept to, there is a reduction in the maximum possible read and write ranges of the transponders.

You will find more detailed information on reading range, directional characteristics and installation in the sections "Planning the use (Page 316)" and "Mounting instructions (Page 323)".

7.6.6.3 Information on memory

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

7.6.6.4 Environmental conditions

Property	Description
Temperature range during operation	-25 °C … +85 °C
Temperature range during storage	-40 °C … +125 °C
Shock resistant to EN 60068-2-27 Vibration to EN 60068-2-6	50 g, [1] 20 g, [1]
Torsion and bending load	Not permissible
Degree of protection	IP68 according to EN 60529: (45 minutes. immersion in water; water depth 1 m from top edge of housing at +20 °C)
	IPx9K to EN 60529: • Steam blaster nozzle distance 150 mm • 10 ... 15 l water per minute • Pressure 100 bar • Temperature 75 °C • Test time 30 seconds
MTBF	2 x 10 [5] hours

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

7.6.6.5 Chemical resistance of the RF625T transponder

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

Substance	Concentration
Mineral lubricants	■
Aliphatic hydrocarbons	■
Aromatic hydrocarbons	■
Petroleum spirit	■
Weak mineral acids	◪
Strong mineral acids	□
Weak organic acids	◪
Strong organic acids	□
Oxidizing acids	□
Weak alkalis	◪
Strong alkalis	□
Trichloroethylene	■
Perchloroethylene	■
Acetone	■

Substance	Concentration
Alcohols	■
Hot water (hydrolysis resistance)	◪
Abbreviations:	
■	Resistant
◪	Limited resistance
□	Not resistant

7.6.7 Certificates and approvals

Table 7- 18 SIMATIC RF625T UHF Disk Tag (Europe), 6GT2810-2EE00

Certificate	Description
CE	Conforms to R&TTE directive

Table 7- 19 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
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

7.6.8 Dimension drawing

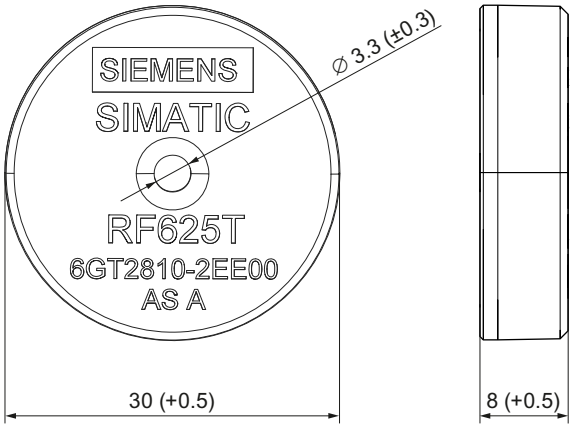


Figure 7-33 SIMATIC RF625T UHF Disk Tag

Units of measurement: All dimensions in mm

7.7 SIMATIC RF630T

7.7.1 Characteristics

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

Application areas 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 1.5 m.

SIMATIC RF630T transponder	Features		
	Application	Identification tasks in rugged industrial environments	
	Frequency versions	Europe	USA / Canada
		868 MHz	915 MHz
	Air interface	according to ISO°18000-6C	
	Polarization	Linear	
	Memory	EPC 96 bit/240 bit Add-on-memory 64 bytes	
	Reading / writing range	typically 1.2 m in conjunction with: • RF640R/RF670R reader and • RF660A antennas	
		typically 1.1 m in conjunction with: • RF640R with integrated antenna	
		Typically 0.8 m in connection with: • RF620R/RF630R reader and • RF660A antenna	
		typically 0.7 m in conjunction with: • RF620R with integrated antenna	
	Installation	Suitable for direct mounting on conductive materials (preferably metal)	

7.7.2 Ordering data

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

7.7.3 Planning application

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

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

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

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

RF630T application example

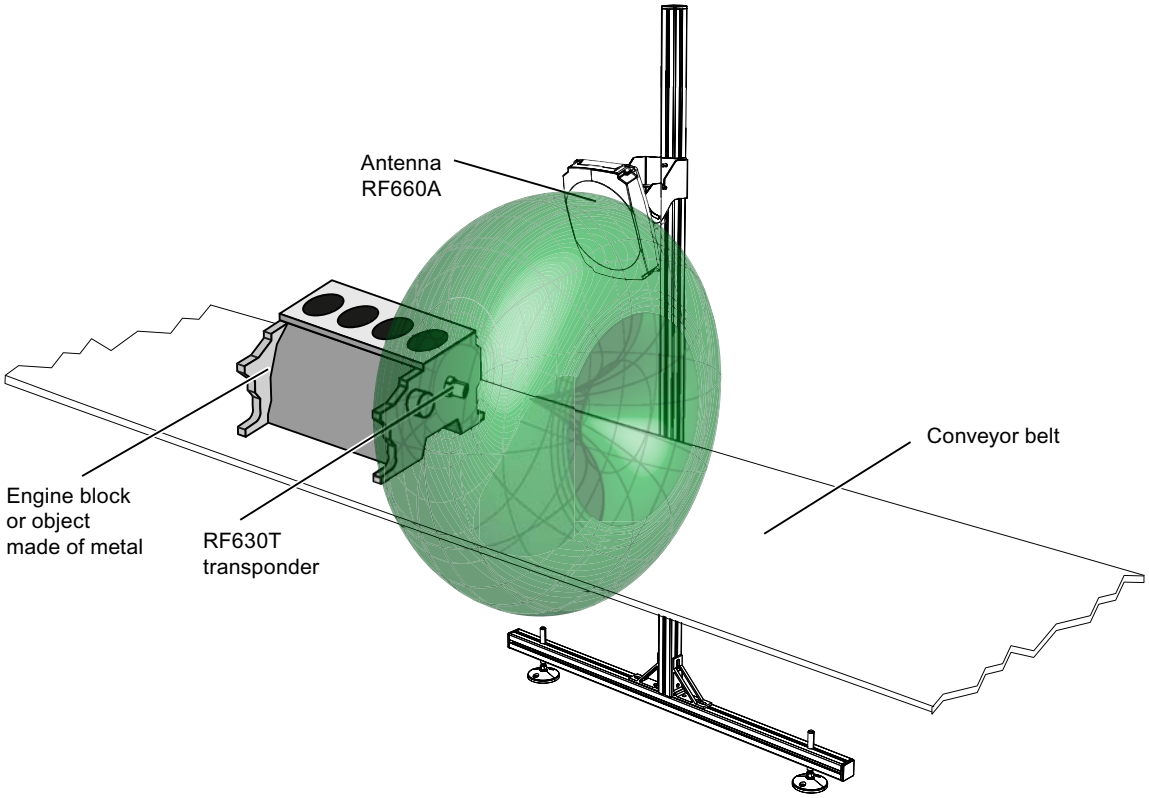


Figure 7-34 RF630T application example

Positioning of two RF660A antennas

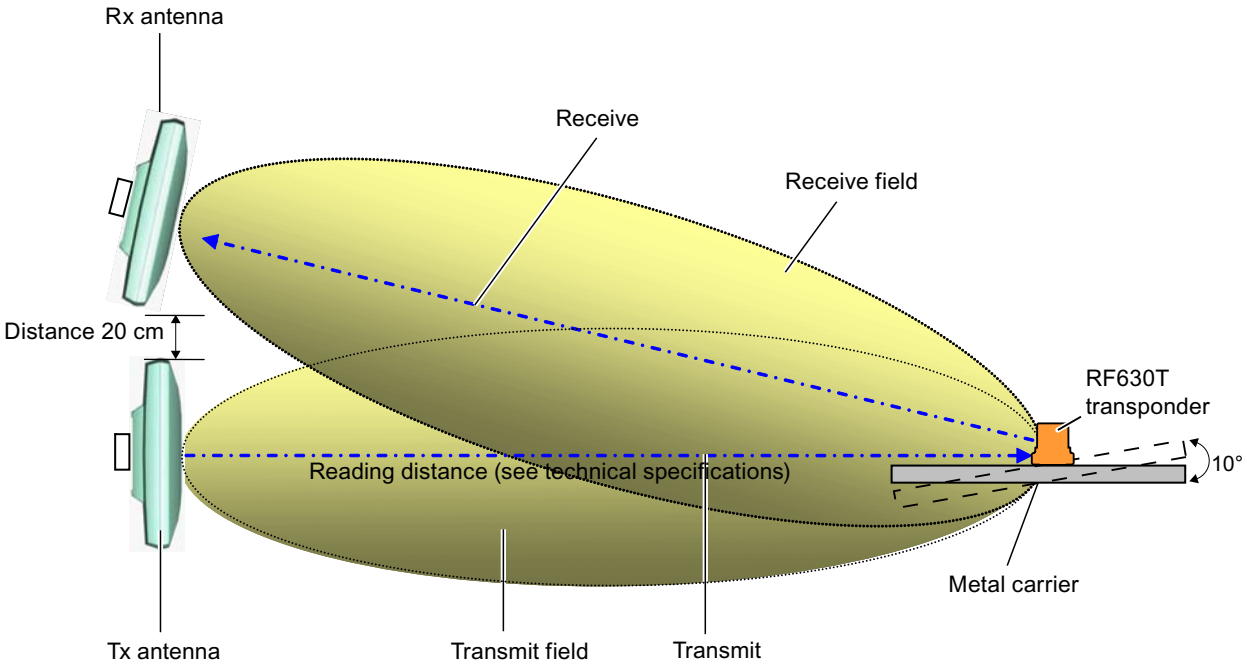


Figure 7-35 Example of optimum antenna/transponder positioning

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

Positioning of the RF620R reader

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

Please note the different reading ranges for the RF600 readers in SectionAuto-Hotspot

.

See also

Electrical data (Page 336)

7.7.3.2 Reading 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 centrally mounted on a flat metal plate, which may either be almost square or circular, it can be aligned in any direction since the transmitting and receiving RF660A antennas operate with circular polarization.

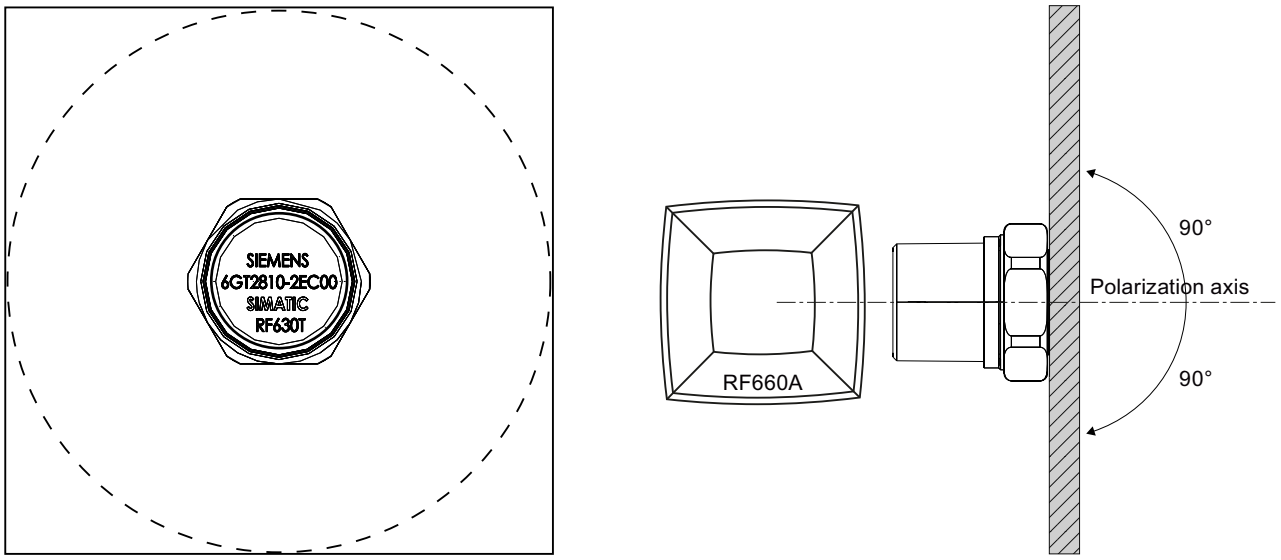


Figure 7-36 Optimum positioning of the transponder on a (square or circular) metal plate

Table 7- 20 Reading range on flat metallic carrier plates

Carrier plate material	Reading 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 %

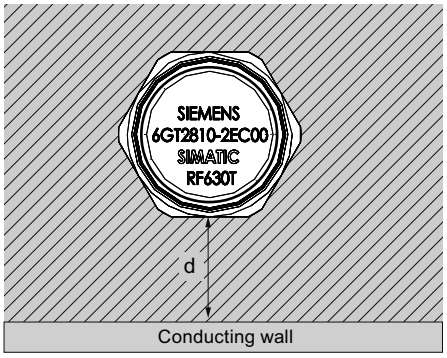
On rectangular carrier plates, the reading distance depends on the mounting orientation of the transponder

7.7.3.3 Influence of conducting walls on the reading range

If there are conducting walls or restrictions in the vicinity that could 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 vertical to the conducting wall.

Reading range: One conducting wall

Influence on reading range when positioned against one conducting wall

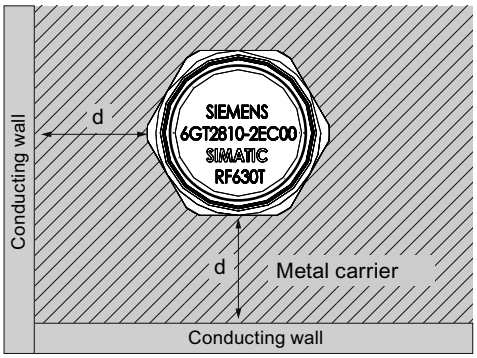


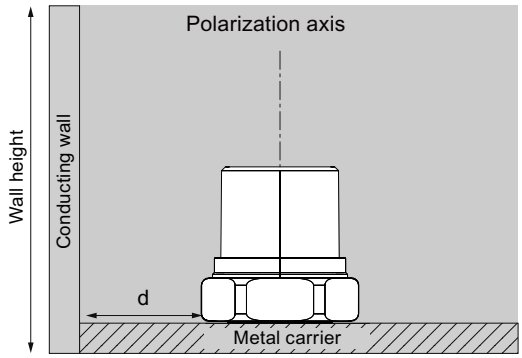
Top view

Distance d	20 mm	50 mm	100 mm	
Reading 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

Reading range: Two conducting walls

Influence on reading range when positioned against two conducting walls





Side view

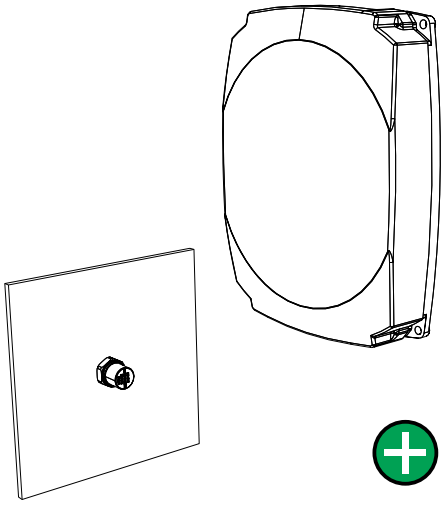
Distance d	20 mm	50 mm	100 mm	
Reading range	Approx. 90 %	Approx. 90 %	Approx. 90 %	Wall height 20 mm
	Approx. 25 %	Approx. 90 %	Approx. 90 %	Wall height 50 mm
	Approx. 25 %	Approx. 90 %	Approx. 90 %	Wall height 100 mm

The values specified in the tables above must be complied with.

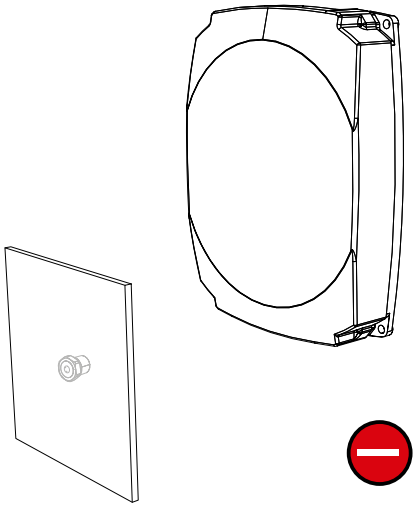
7.7.3.4 Directional radiation pattern of the transponder

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.

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

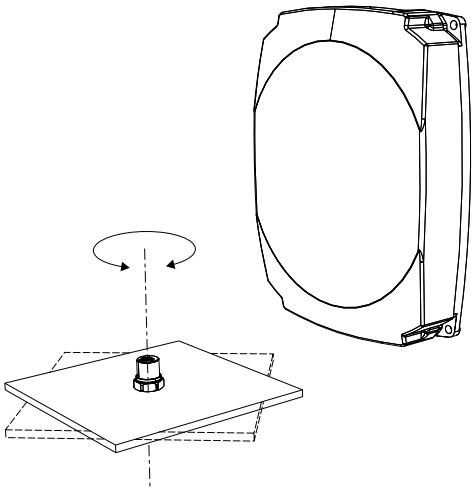


Optimum alignment of the transponder to the transmitting antenna



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

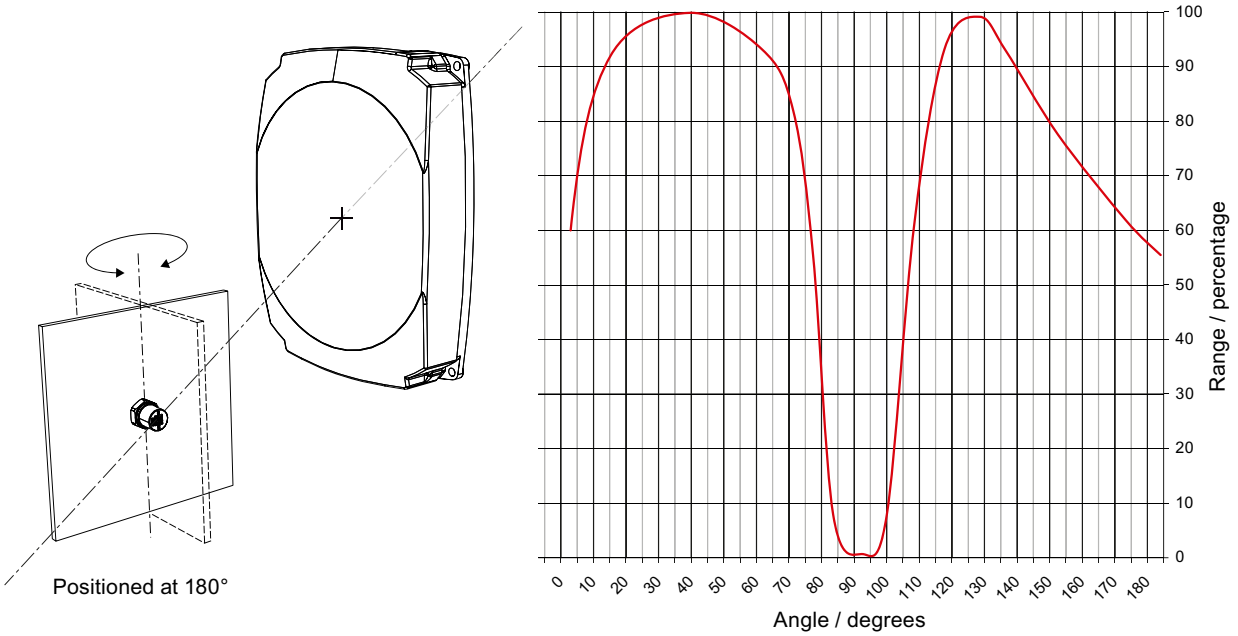


Figure 7-37 Characteristics of the transponder on rotation of the mounting plane

7.7.4 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.

7.7.5 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 270).

7.7.6 Technical specifications

7.7.6.1 Mechanical data

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

7.7.6.2 Electrical data

Property	Description	
	Europe	USA / Canada
Air interface	According to ISO 18 000-6 C	According to ISO 18 000-6 C
Frequency range	865 … 868 MHz	902 MHz ... 928 MHz [1]
Necessary transmit power	2 W (ERP)	4 W (EIRP)
Reading range Mounting on metal [2]	at least 1.2 m, typically 1.5 m	at least 1.2 m, typically 1.5 m
Writing range Mounting on metal [2]	at least 0.8 m typically 1.2 m	at least 0.8 m typically 1.2 m
Polarization type	Linear	Linear
Minimum distance to transmit antenna	Approx. 0.15 m	Approx. 0.15 m
Energy source	Energy via electro-magnetic field via antenna, no battery required	Energy via electro-magnetic field via antenna, no battery required
Multi-tag capability	Yes, minimum distance between data carriers ≥ 50 mm [3]	Yes, minimum distance between data carriers ≥ 50 mm [3]

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

[2] Mounting on a flat surface with a diameter of at least 150 mm and at room temperature.

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

7.7.6.3 Memory specifications

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

7.7.6.4 Environmental conditions

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

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

7.7.6.5 Chemical resistance of the transponder

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

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

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

1) Nothing specified for stainless steel

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

7.7.7 Certificates and approvals

Table 7- 21 6GT2810-2EC00 - RF630T UHF Tool Tag - Europe

Certificate	Description
CE	Conformity with R&TTE directive

Table 7- 22 6GT2810-2EC10 - RF630T Gen 2 UHF Tool Tag - USA / Canada

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

7.7.8 Dimension drawing

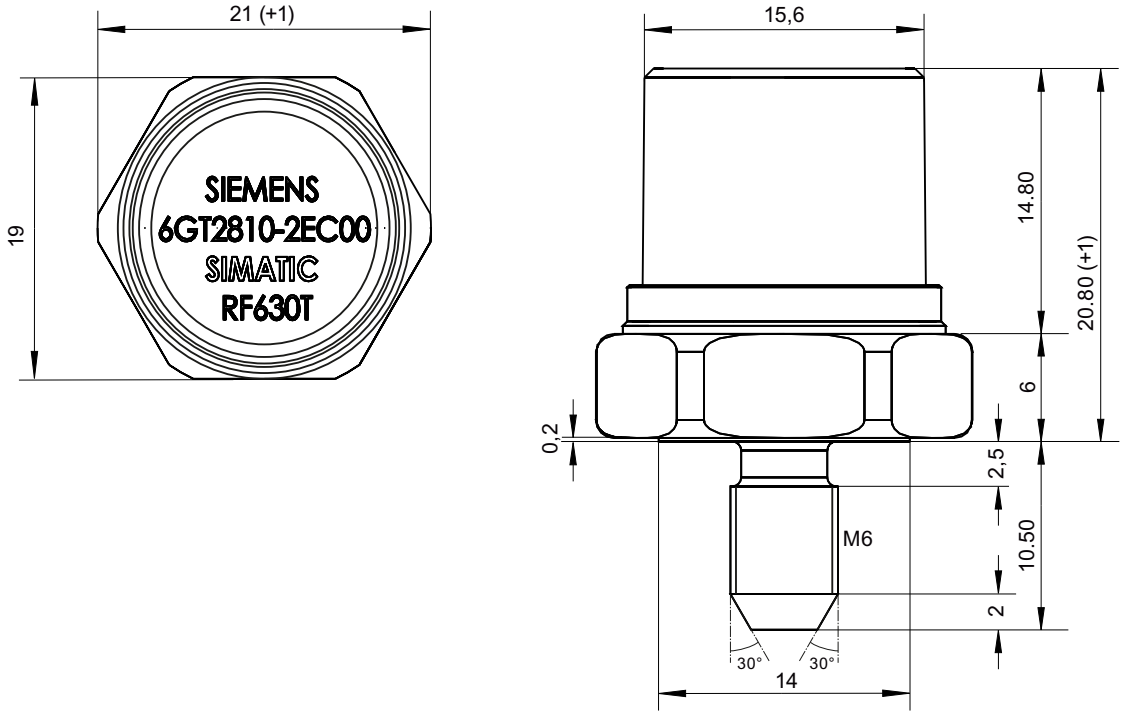


Figure 7-38 SIMATIC RF630T

Units of measurement: All dimensions in mm

General tolerances in accordance with DIN ISO 2768f.

7.8 SIMATIC RF640T Gen 2

7.8.1 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 the UHF Class 1 Gen 2 technology and is used to save the "Electronic Product Code" (EPC) of 96 bits/240 bits. The transponder also has a 512-bit user memory.

Fields 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 transponder	Features		
	Application	Identification tasks in rugged industrial environments	
	Frequency versions	Europe	USA / Canada
		868 MHz	915 MHz
	Air interface	according to ISO 18000-6C	
	Polarization	Linear	
	Memory	EPC 96 bit/240 bit Add-on-memory 64 bytes	
	Reading / writing range	Typically 4.0 m in connection with: • RF640R/RF670R reader and • RF660A antennas	
		typically 3.6 m in conjunction with: • RF640R with integrated antenna	
		Typically 2 m in connection with: • RF620R/RF630R reader and • RF660A antenna	
		Typically 2 m in connection with: • RF620R with integrated antenna	
	Installation	Suitable for direct mounting on conductive materials (preferably metal)	

7.8.2 Ordering data

Ordering data	Order number
SIMATIC RF640T Gen 2 (Europe) • Frequency 865 MHz to 868 MHz • EPC 96 bits/240 bits • 64-byte user memory • -25 °C to +85 °C operating temperature • Dimensions (D x H) 50 mm x 8 mm	6GT2810-2DC00
SIMATIC RF640T Gen 2 (USA/Canada) • Frequency 902 MHz to 928 MHz • EPC 96 bits/240 bits • 64-byte user memory • -25 °C to +85 °C operating temperature • Dimensions (D x H) 50 mm x 8 mm	6GT2810-2DC10

7.8.3 Planning the use

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

Example of optimum antenna/transponder positioning

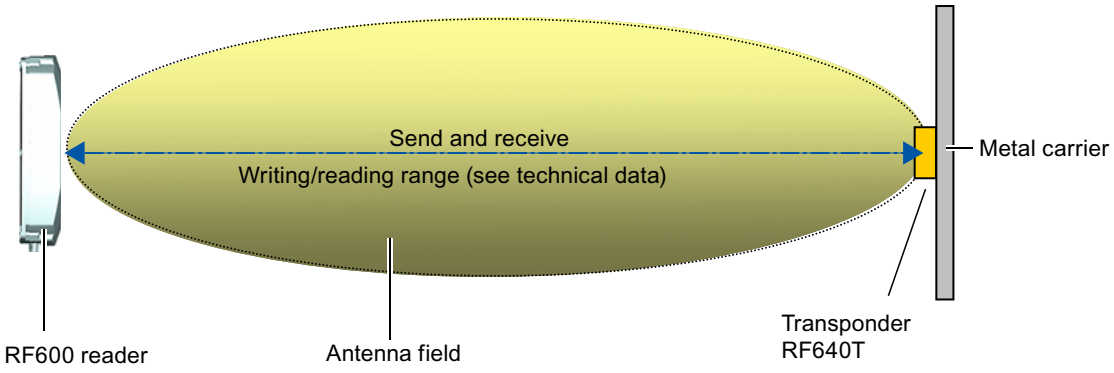


Figure 7-39 Example of optimum antenna/transponder positioning with RF600 readers and an RF600 antenna

7.8.3.2 Reading 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 centrically mounted on a flat metal plate, which may either be almost square or circular, it can be aligned in any direction since the transmitting and receiving RF660A antennas operate with circular polarization.

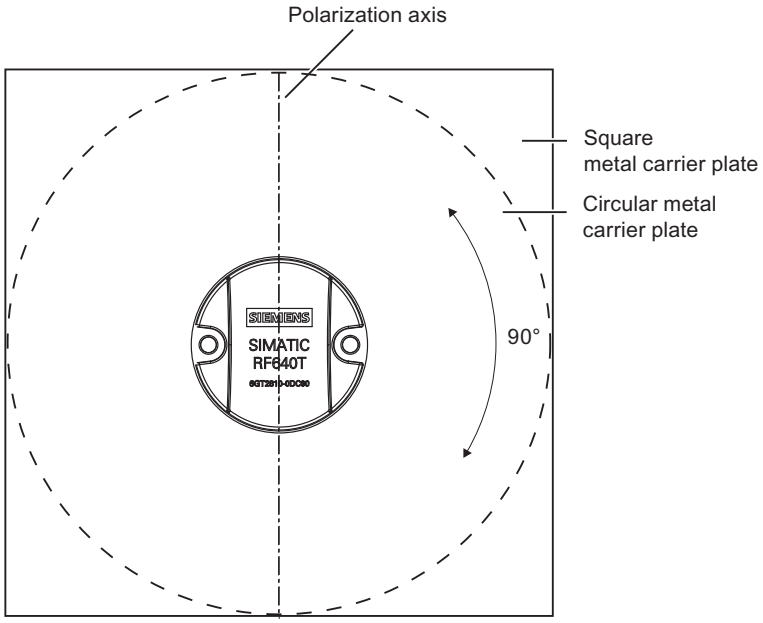


Figure 7-40 Optimum positioning of the transponder on a (square or circular) metal plate

Table 7- 23 Reading range on flat metallic carrier plates

Carrier plate material	Reading 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 reading distance depends on the mounting orientation of the transponder.

7.8.3.3 Reading range when mounted on non-metallic carriers

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

Table 7- 24 Reading range on non-metallic carriers

Carrier plate material	Reading 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%

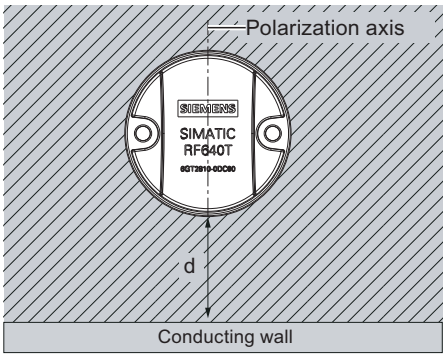
100% reading distance refers to a metal plate of at least 150 mm diameter.

7.8.3.4 Influence of conducting walls on the reading range

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

Reading range: One conducting wall

Influence on reading range when positioned against one conducting wall

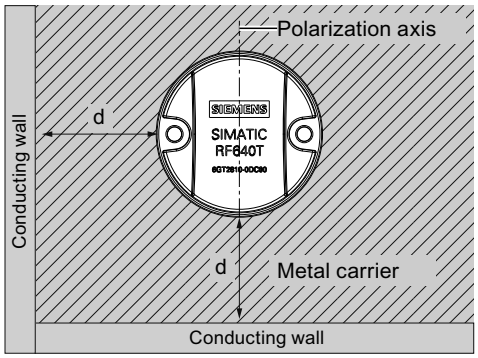


Top view

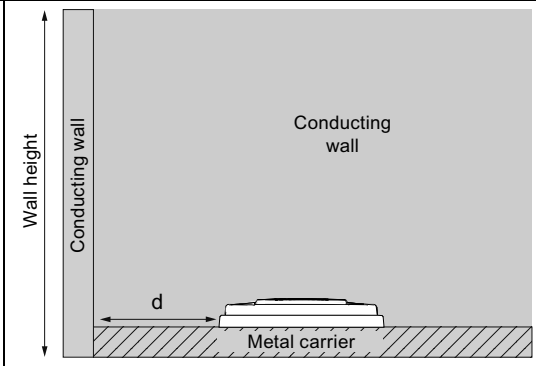
Distance d	20 mm	50 mm	100 mm	
Reading range	Approx. 90 %	Approx. 90 %	Approx. 95 %	Wall height 20 mm
	Approx. 80 %	Approx. 90 %	Approx. 90 %	Wall height 50 mm
	Approx. 70 %	Approx. 75 %	Approx. 90 %	Wall height 100 mm

Reading range: Two conducting walls

Influence on reading range when positioned against two conducting walls



Top view



Side view

Distance d	20 mm	50 mm	100 mm	
Reading 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.

7.8.3.5 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

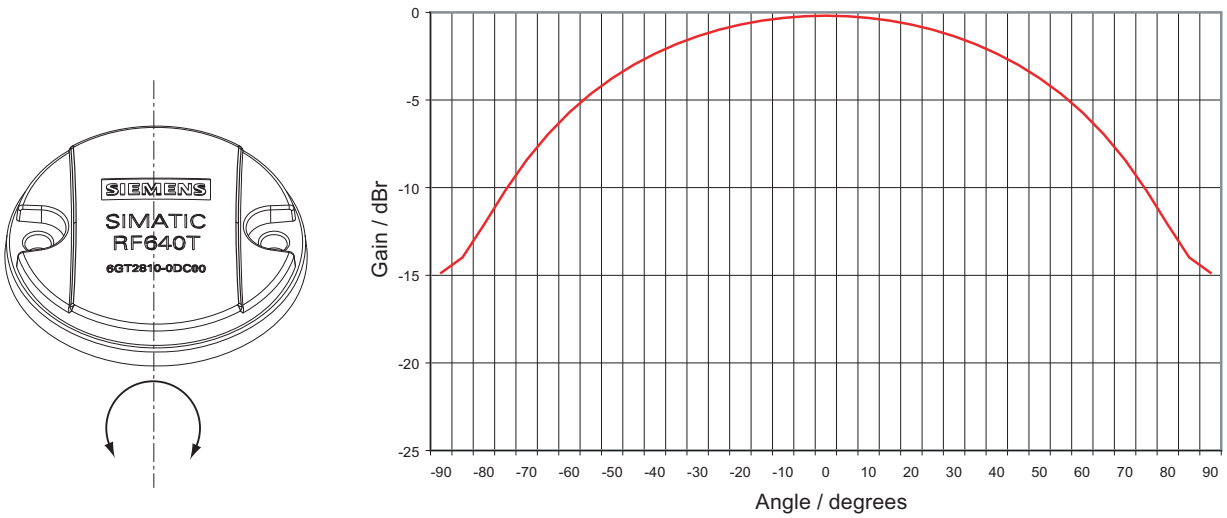


Figure 7-41 Transponder characteristics when rotated about the polarization axis

Rotation orthogonal to the polarization axis

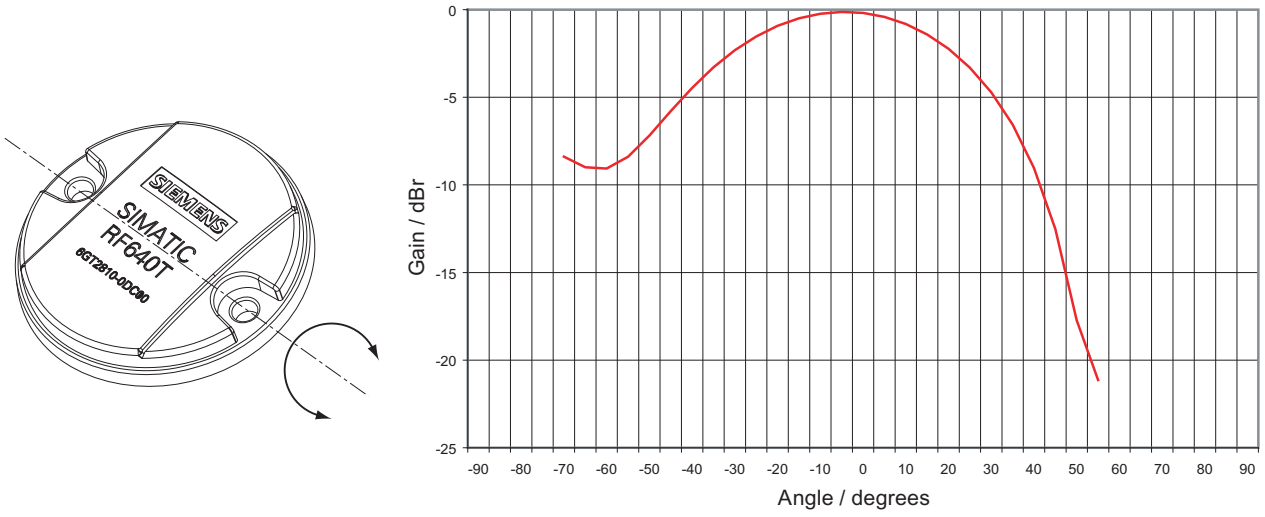


Figure 7-42 Transponder characteristics when rotated orthogonally to the polarization axis (within the tag plane)

7.8.3.6 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 EN 60079-0: 2004, EN 60079-11: 2007, IEC 61241-0: 2004 and IEC 61241-11: 2005.

Identification

The identification is as follows:

II 2 G Ex ib IIC T6 to T3 or

II 2 D Ex ibD 21 T140°C,
-25 °C < Ta°< +85 °C

7.8.3.7 Use of the transponder in hazardous areas for gases

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	T3
-25 °C to +60 °C	T4
-25 °C to +40 °C	T5
-25 °C to +30 °C	T6

⚠ 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.

7.8.3.8 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). With the ignition temperature specified according to IEC 61241-0 and IEC 61241-11 according to the type of ignition protection iD, the smoldering temperature of the dust layer is referenced in this case.

Temperature class delineation for dusts

Ambient temperature range	Temperature value
-25 °C < Ta < +85 °C	T140 °C

⚠ 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.

7.8.3.9 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 met in accordance with standards EN 60079-0: 2009, EN 60079-11: 2007 and IEC 61241-11: 2006.

This allows the RF640T transponder to be used in hazardous areas for gases, for the device category 2 G and equipment group IIC, or alternatively in hazardous areas for dusts, for the device category 2 D and equipment group IIIB.

NOTICE
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 or

II 2 D Ex ib IIIB T160°C, -25 °C < Ta°< +85 °C

7.8.3.10 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

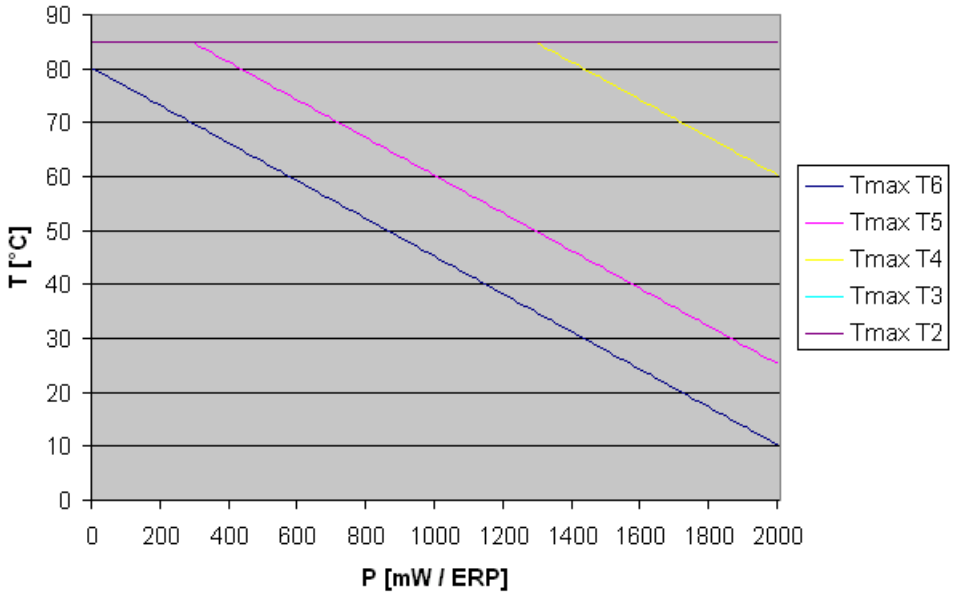


Figure 7-43 Maximum permitted ambient temperature depending on the radiated power

7.8.3.11 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 EN 60079-0 and EN 61241-11 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 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 < +85 °C	T160 °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 < +85 °C	T_{value} °C (see diagram)

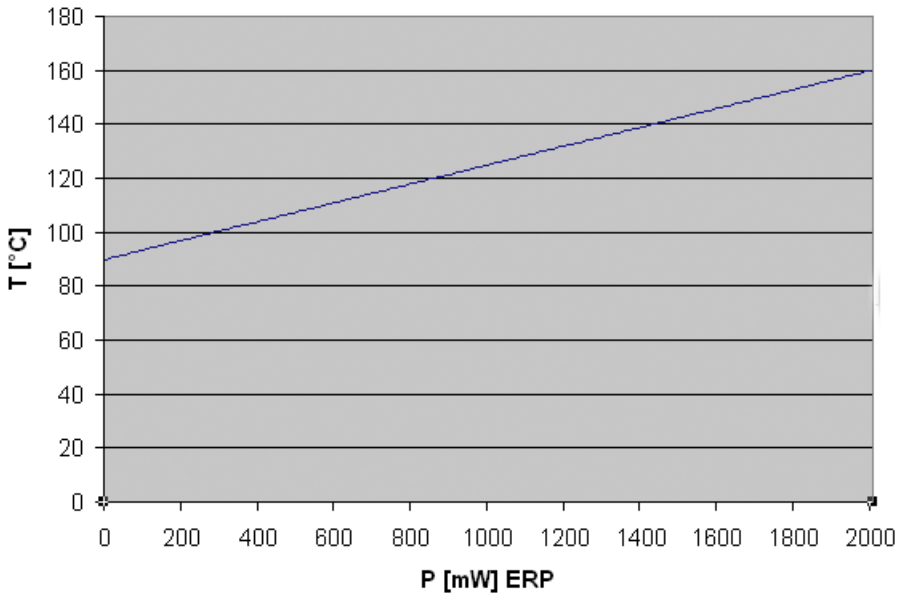


Figure 7-44 Maximum permitted ambient temperature depending on the radiated power

7.8.4 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

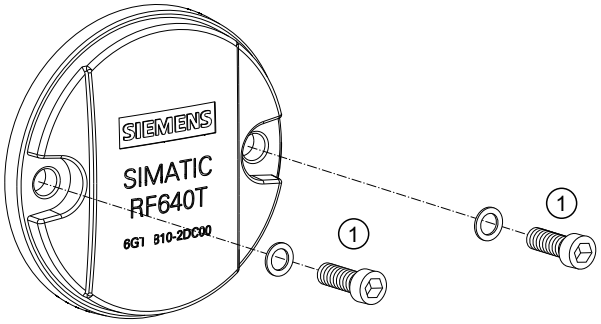
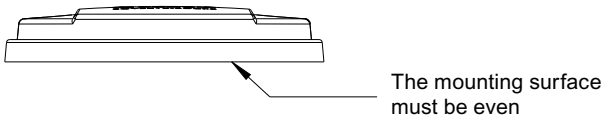


Figure 7-45 Screw mounting

Note

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



7.8.5 Memory configuration of the transponder

The memory configuration of the transponder is described in the section SIMATIC memory configuration of the RF600 transponders and labels (Page 270).

7.8.6 Technical Specifications

7.8.6.1 Mechanical data

Property	Description
Dimensions (D x H)	50 mm x 8 mm (+1 mm)
Design	PCB with integrated antenna
Design	Plastic enclosure (PA12), silicone-free
Weight	approx. 13 g
Mounting on metal	directly on metal without spacing

7.8.6.2 Electrical data

Property	Description	
	Europe	USA / Canada
Air interface	According to ISO 18 000-6 C	According to ISO 18 000-6 C
Frequency range	865 … 868 MHz	902 MHz ... 928 MHz [1]
Necessary transmit power	2 W (ERP)	4 W (EIRP)
Reading range Mounting on metal [2]	at least 3 m typically 4.0 m	at least 3 m typically 4.0 m
Writing range Mounting on metal [2]	at least 2 m typically 3 m	at least 2 m typically 3 m
Polarization type	Linear	Linear
Minimum distance to transmit antenna	Approx. 0.2 m	Approx. 0.2 m
Energy source	Magnetic energy via antenna, without battery	Magnetic energy via antenna, without battery
Multi-tag capability	Yes, minimum distance between data carriers ≥ 50 mm [3]	Yes, minimum distance between data carriers ≥ 50 mm [3]

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

[2] Mounting on a flat surface with a diameter of at least 150 mm

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

See also

Reading range when mounted on flat metallic carrier plates (Page 343)

Directional radiation pattern of the transponder (Page 345)

7.8.6.3 Memory specifications

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

7.8.6.4 Environmental conditions

Property	Description
Temperature range when operating in non-hazardous areas	-25 °C … 85 °C[1)]
Temperature range when operating in areas at risk of a gas explosion with temperature class T3-T6	See alsoUse of the transponder in hazardous areas for gases (Page 347) [2)]
Temperature range when operating in areas at risk of dust explosions with T140 °C	See alsoUse of the transponder in hazardous areas for dusts (Page 348) [2)]
Temperature range during storage	-40 °C … 125 °C[1)]
Shock Vibration compliant with EN 60721-3-7 Class 7 M3	100 g, [3)] 20 g, [3)]
Torsion and bending load	Not permissible
Degree of protection	IP68 according to EN 60529: (45 minutes. immersion in water; water depth 1 m from top edge of housing at +20 °C)
	IP x9K according to EN 60529: • Steam blaster nozzle distance 150 mm • 10 ... 15 l of water per minute • Pressure 100 bar • Temperature 75 °C • Test time 30 seconds

[1)] At temperatures above 70 °C the casing may distort slightly; this does not however cause any impairment of function (mechanical or electrical).

[2)] Directive 94/9/EC of the European Council of 23 March 1994 must be complied with, see also Chapter "Using the transponder in hazardous areas".

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

⚠ WARNING

Ignitions of gas-air or dust-air mixtures

When using the RF640T transponder, check to ensure that the temperature values are observed in respect of the requirements of the hazardous area of application.

Non-compliance with the permitted temperature ranges while using the transponder can lead to ignitions of gas-air or dust-air mixtures.

NOTICE

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.

7.8.6.5 Chemical resistance of the RF640T transponder

The following table gives an overview of the chemical composition of the data memory made from polyamide 12. The plastic housing has a notably high resistance to chemicals used in automobiles (e.g.: oil, grease, diesel fuel, gasoline) which are not listed separately.

	Concentration	20 °C	60 °C
Battery acid	30	○○	–
Ammonia gas		○○○○	○○○○
Ammonia, w.	conc.	○○○○	○○○○
	10	○○○○	○○○○
Benzol		○○○○	○○○
Bleach solution (12.5 % effective chlorine)		○○	–
Butane, gas, liquid		○○○○	○○○○
Butyl acetate (acetic acid butyl ester)		○○○○	○○○○
Calcium chloride, w.		○○○○	○○○
Calcium nitrate, w.	k. g.	○○○○	○○○
Chlorine		–	–
Chrome baths, tech.		–	–
Iron salts, w.	k. g.	○○○○	○○○○
Acetic acid, w.	50	–	–
Ethyl alcohol, w., undenaturated	96	○○○○	○○○
	50	○○○○	○○○○
Formaldehyde, w.	30	○○○	–
	10	○○○○	○○○
Formalin		○○○	–

	Concentration	20 °C	60 °C
Glycerine		○○○○	○○○○
Isopropanol		○○○○	○○○
Potassium hydroxide, w.	50	○○○○	○○○○
Lysol		○○	−
Magnesium salts, w.	k. g.	○○○○	○○○○
Methyl alcohol, w.	50	○○○○	○○○○
Lactic acid, w.	50	○○	−
	10	○○○	○○
Sodium carbonate, w. (soda)	k. g.	○○○○	○○○○
Sodium chloride, w.	k. g.	○○○○	○○○○
Sodium hydroxide		○○○○	○○○○
Nickel salts, w.	k. g.	○○○○	○○○○
Nitrobenzol		○○○	○○
Phosphoric acid	10	○	V
Propane		○○○○	○○○○
Mercury		○○○○	○○○○
Nitric acid	10	○	−
Hydrochloric acid	10	○	−
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