

## SIMATIC Sensors

### RFID systems SIMATIC RF640T Gen 2

#### Operating Instructions

## 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.

<b>⚠ DANGER</b>
indicates that death or severe personal injury <b>will</b> result if proper precautions are not taken.
<b>⚠ WARNING</b>
indicates that death or severe personal injury <b>may</b> result if proper precautions are not taken.
<b>⚠ CAUTION</b>
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
<b>CAUTION</b>
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
<b>NOTICE</b>
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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

### Qualified Personnel

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

### Proper use of Siemens products

Note the following:

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

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### 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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## SIMATIC RF640T Gen 2


### 1.1 Characteristics

The SIMATIC RF640T Gen 2 transponder is a passive (i.e. battery-free) and maintenance-free, round-shaped data carrier. 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 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, smart, and rugged, suitable for industrial applications with degree of protection IP68. It is resistant to mineral oils, lubricants and detergents.

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	Characteristics		
	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	
	Read/write range	Typically 4.0 m in connection with: <ul style="list-style-type: none"> <li>• RF660R readers and</li> <li>• RF660A antennas</li> </ul>	
		Typically 2.0 m in connection with: <ul style="list-style-type: none"> <li>• RF630R readers and</li> <li>• RF660A antennas</li> </ul>	
Typically 2.0 m in connection with: <ul style="list-style-type: none"> <li>• RF620R with integrated antenna</li> </ul>			
Installation	Suitable for direct mounting on conductive materials (preferably metal)		

## 1.2 Ordering data

Ordering data	Order no.
SIMATIC RF640T Gen 2 (Europe) <ul style="list-style-type: none"> <li>• Frequency 865 MHz to 868 MHz</li> <li>• EPC 96 bits/240 bits</li> <li>• 64-byte user memory</li> <li>• -25 °C to +85 °C operating temperature</li> <li>• Dimensions (D x H) 50 mm x 8 mm</li> </ul>	6GT2810-2DC00
SIMATIC RF640T Gen 2 (USA/Canada) <ul style="list-style-type: none"> <li>• Frequency 902 MHz to 928 MHz</li> <li>• EPC 96 bits/240 bits</li> <li>• 64-byte user memory</li> <li>• -25 °C to +85 °C operating temperature</li> <li>• Dimensions (D x H) 50 mm x 8 mm</li> </ul>	6GT2810-2DC10

## 1.3 Planning the use

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

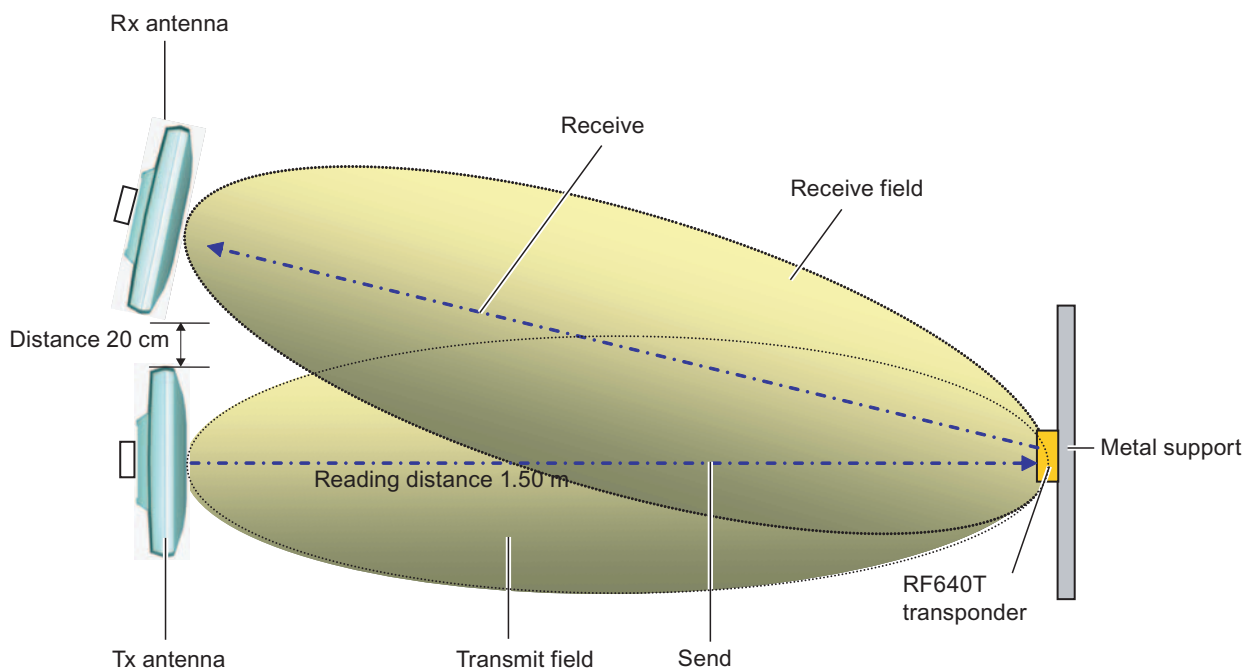


Figure 1-1 Example of optimum antenna/transponder positioning

### 1.3.2 Reading range 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.

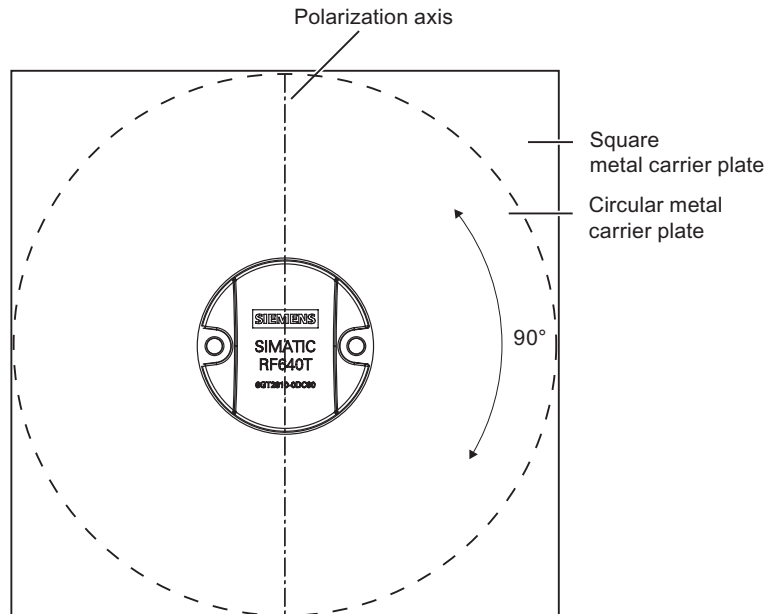


Figure 1-2 Optimum positioning of the transponder on a (square or circular) metal plate

Table 1- 1 Reading range on flat metallic carrier plates

Carrier plate material	Reading range
Metal plate of at least $\varnothing$ 150 mm	100%
Metal plate $\varnothing$ 120 mm	Approx. 80%
Metal plate $\varnothing$ 85 mm	Approx. 55%
Metal plate $\varnothing$ 65 mm	Approx. 40%

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

### 1.3.3 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 1- 2 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.



### 1.3.4 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 orthogonal to the conducting wall.

#### Reading range: One conducting wall

Influence on reading range when positioned against one conducting wall				
<p style="text-align: center;">Top view</p>				
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				
<p style="text-align: center;">Top view      Side view</p>				
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 must be complied with.

### 1.3.5 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

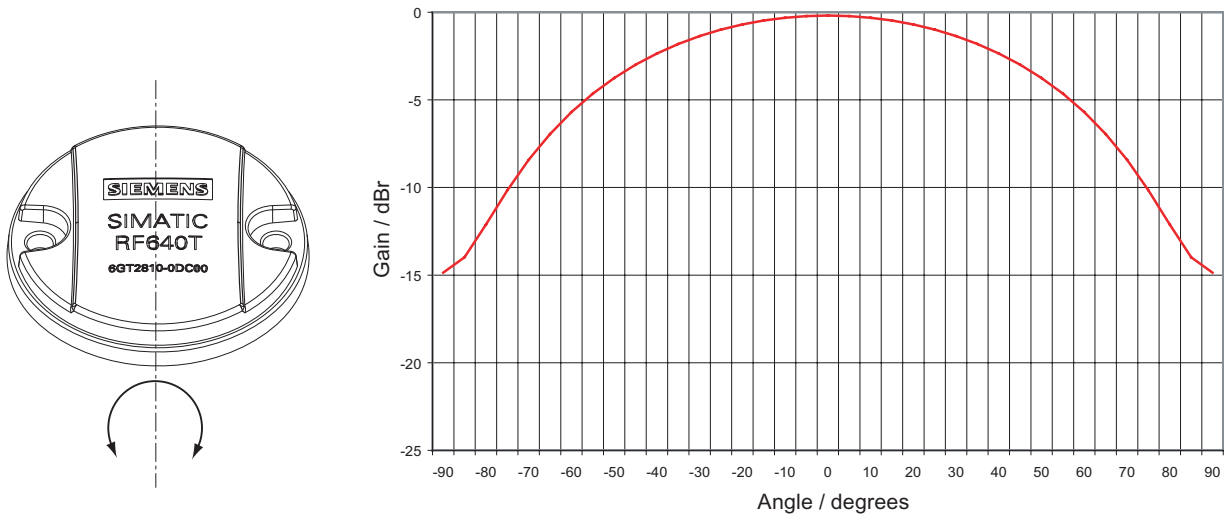


Figure 1-3 Transponder characteristics when rotated about the polarization axis

### Rotation orthogonal to the polarization axis

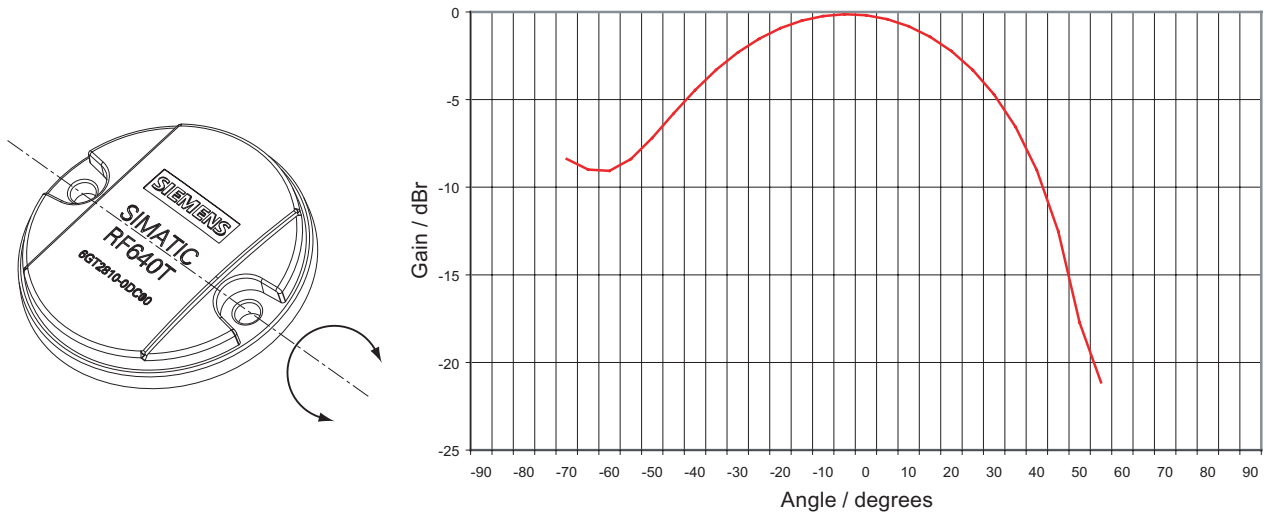


Figure 1-4 Transponder characteristics when rotated orthogonally to the polarization axis (within the tag plane)

### 1.3.6 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 EN 60079-0:2004, EN 50020:2002, 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

### 1.3.7 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.

### 1.3.8 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

 <b>WARNING</b>
<p><b>Ignitions of dust-air mixtures</b></p> <p>When using the RF640T transponder, check to ensure that the temperature values are complied with in connection with the requirements of the application area.</p> <p>Non-compliance with the permitted temperature ranges while using the transponder can lead to ignitions of dust-air mixtures.</p>

## 1.4 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

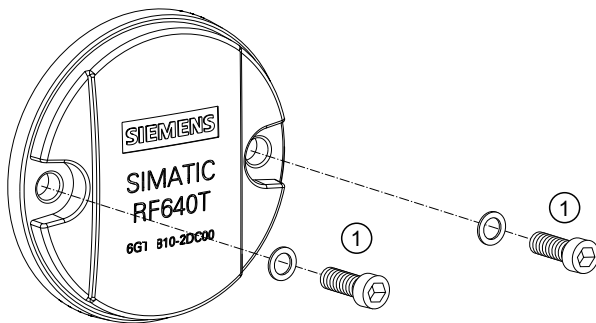
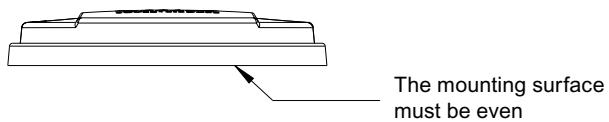


Figure 1-5 Screw mounting

### Note

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



## 1.5 Memory configuration

### 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.

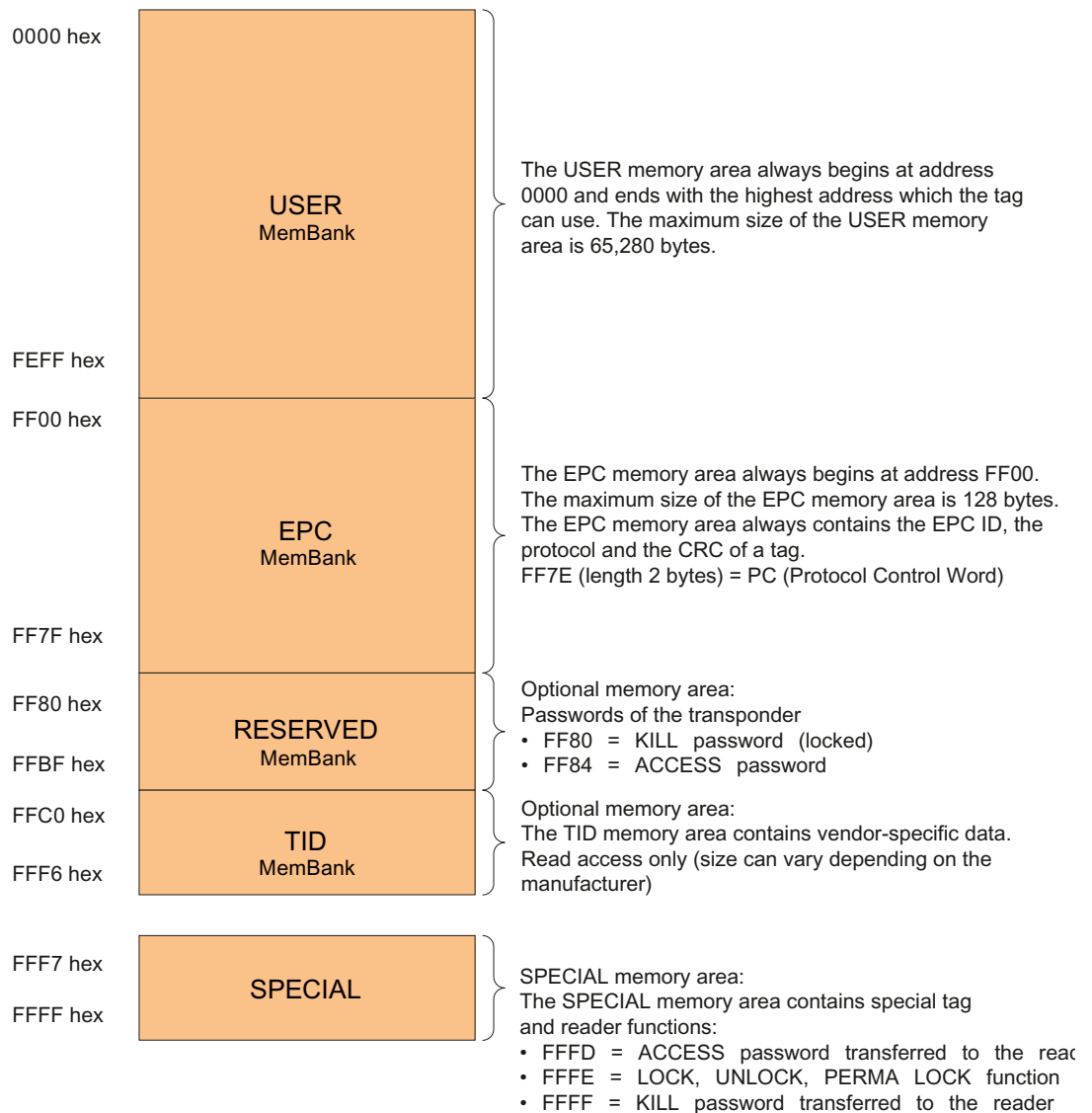


Figure 1-6 SIMATIC memory configuration

### Memory representation for RF640T Gen 2

Tags	User [hex]	EPC		TID	RESERVED (passwords)	special	
		Range	Access			KILL-PW	Lock function
RF640T Gen 2	00 - 3F	FF00-FF0B (240 Bit = FF00-FF1D)	read/ write	FFC0-FFC7	FF80-FF87	LOCKED	yes

### Memory representation according to EPC

The memory of the ISO 18000-6C EPC Class 1 Gen 2 chip is logically divided into four different memory banks:

Memory bank (decimal)	Memory type	Description
MemBank 11 <sub>2</sub>	USER	User-writable USER memory area
MemBank 10 <sub>2</sub>	TID	Is defined by the manufacturer, contains the class identifier and serial number of a tag
MemBank 01 <sub>2</sub>	EPC	Contains the EPC UID, the protocol and the CRC of a tag You can write to the EPC memory area. In the delivery condition, the memory contents can have the following states: <ul style="list-style-type: none"> <li>• empty</li> <li>• containing the same data</li> <li>• containing different data</li> </ul>
MemBank 00 <sub>2</sub>	RESERVED	Contains the access and kill password.



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

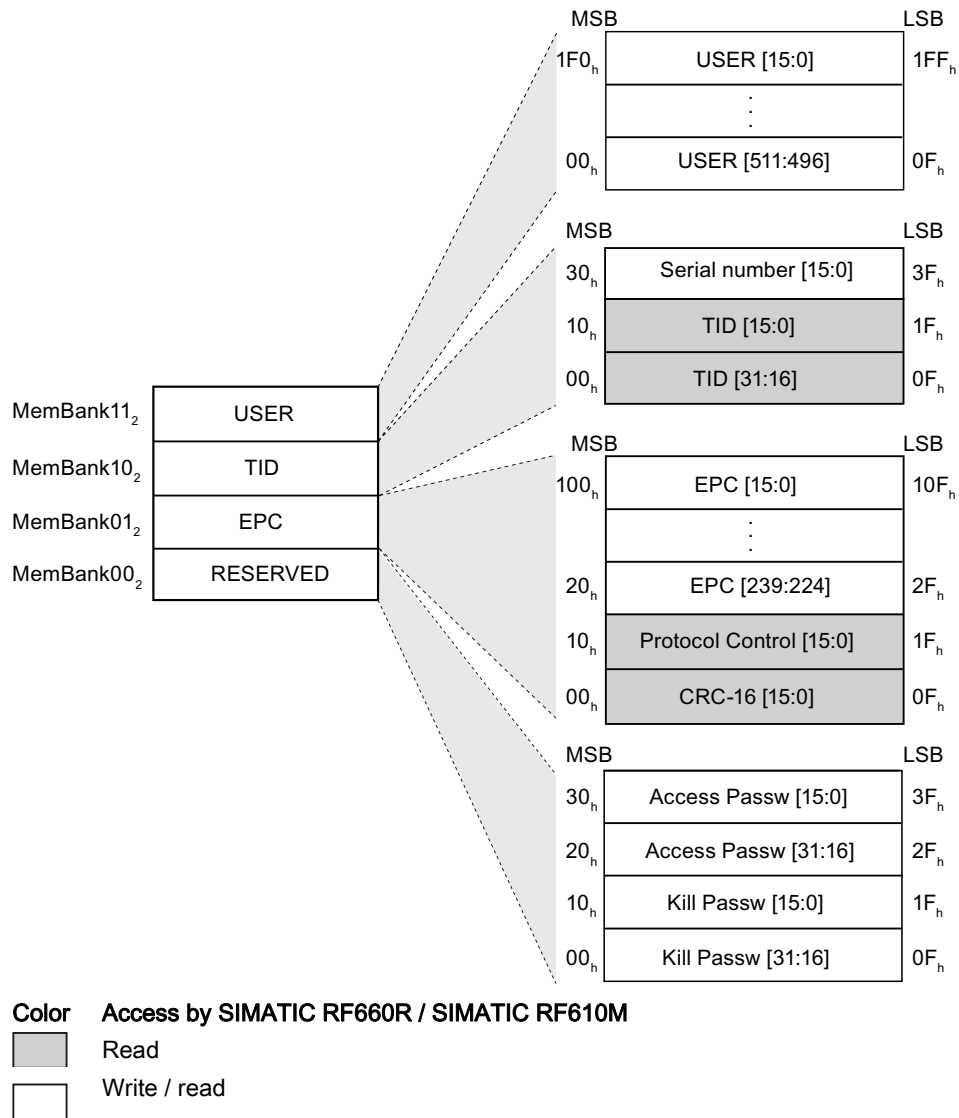


Figure 1-7 Representation of the memory configuration RF640T Gen 2 according to EPC (logical memory map)

## 1.6 Technical Specifications

### 1.6.1 Mechanical data

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

### 1.6.2 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 <sup>1)</sup>
Necessary transmit power	2 W (ERP)	4 W (EIRP)
Reading range Mounting on metal <sup>2)</sup>	at least 3 m typically 4.0 m	at least 3 m typically 4.0 m
Writing range Mounting on metal <sup>2)</sup>	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 $\geq 50$ mm <sup>3)</sup>	Yes, minimum distance between data carriers $\geq 50$ mm <sup>3)</sup>

<sup>1)</sup> 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.

<sup>2)</sup> Mounting on a flat surface with a diameter of at least 150 mm

<sup>3)</sup> 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 on flat metallic carrier plates (Page 7)

Directional radiation pattern of the transponder (Page 10)

### 1.6.3 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	

### 1.6.4 Environmental conditions

Property	Description
Temperature range when operating in non-hazardous areas	-25 °C ... 85 °C <sup>1)</sup>
Temperature range when operating in areas at risk of a gas explosion with temperature class T3-T6	See also Use of the transponder in hazardous areas for gases (Page 12) <sup>2)</sup>
Temperature range when operating in areas at risk of dust explosions with T140 °C	See also Use of the transponder in hazardous areas for dusts (Page 13) <sup>2)</sup>
Temperature range during storage	-40 °C ... 125 °C <sup>1)</sup>
Shock Vibration compliant with EN 60721-3-7 Class 7 M3	100 g, <sup>3)</sup> 20 g, <sup>3)</sup>
Torsion and bending load	Not permissible
Degree of protection	IP 68 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: <ul style="list-style-type: none"> <li>• Steam blaster nozzle distance 150 mm</li> <li>• 10 to 15 l of water per minute</li> <li>• Pressure 100 bar</li> <li>• Temperature 75 °C</li> <li>• Test time 30 seconds</li> </ul>
MTBF	1,54 x 10 <sup>7</sup> h

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

<sup>2)</sup> 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.

<p><b>⚠ WARNING</b></p> <p><b>Ignitions of gas-air or dust-air mixtures</b></p> <p>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.</p> <p>Non-compliance with the permitted temperature ranges while using the transponder can lead to ignitions of gas-air or dust-air mixtures.</p>
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<p><b>NOTICE</b></p> <p><b>Damage to the surface of the housing</b></p> <p>The values specified for the IP x9K test are maximum values and must not be applied continuously.</p> <p>Protracted loading of the transponder can lead to damage to the surface of the housing due to high pressures.</p>
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**1.6.5 Chemical resistance of the RF640T Gen 2 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
Acetic acid, w.	50	-	-
Ammonia gas		oooo	oooo
Ammonia, w.	conc.	oooo	oooo
	10	oooo	oooo
Battery acid	30	oo	-
Benzol		oooo	ooo
Bleach solution (12.5 % effective chlorine)		oo	-
Butane, gas, liquid		oooo	oooo
Butyl acetate (acetic acid butyl ester)		oooo	oooo
Calcium chloride, w.		oooo	ooo
Calcium nitrate, w.	k. g.	oooo	ooo
Carbon tetrachloride		oooo	oooo
Chlorine		-	-
Chrome baths, tech.		-	-
Detergent	High	oooo	oooo
Ethyl alcohol, w., undenaturated	96	oooo	ooo
	50	oooo	oooo
Formaldehyde, w.	30	ooo	-

	Concentration	20 °C	60 °C
	10	oooo	ooo
Formalin		ooo	-
Glycerine		oooo	oooo
Hydrochloric acid	10	o	-
Hydrogen sulphide	Low	oooo	oooo
Iron salts, w.	k. g.	oooo	oooo
Isopropanol		oooo	ooo
Lactic acid, w.	50	oo	-
	10	ooo	oo
Lysol		oo	-
Magnesium salts, w.	k. g.	oooo	oooo
Mercury		oooo	oooo
Methyl alcohol, w.	50	oooo	oooo
Nickel salts, w.	k. g.	oooo	oooo
Nitric acid	10	o	-
Nitrobenzol		ooo	oo
Phosphoric acid	10	o	V
Plasticizer		oooo	oooo
Potassium hydroxide, w.	50	oooo	oooo
Propane		oooo	oooo
Sodium carbonate, w. (soda)	k. g.	oooo	oooo
Sodium chloride, w.	k. g.	oooo	oooo
Sodium hydroxide		oooo	oooo
Sulphur dioxide	Low	oooo	oooo
Sulphuric acid	25	oo	-
	10	ooo	-
Toluene		oooo	ooo

Abbreviations	
oooo	Resistant
ooo	Virtually resistant
oo	Limited resistance
o	Less resistant
-	Not resistant
w.	Aqueous solution
k. g.	Cold saturated

## 1.7 Certificates and approvals

### 1.7.1 Certificates and approvals

Table 1- 3 6GT2810-2DC00 - RF640T Gen 2 UHF Tool Tag - Europe


Certificate	Description
	CE Approval to R&TTE directive For Directive 94/9/EC: EC type test certification no. TÜV 07 ATEX 346241 Acknowledgement of the quality assurance TÜV 96 ATEX 1125 Q

Table 1- 4 6GT2810-2DC10 - RF640T Gen 2 UHF Tool Tag - USA/Canada

Standards	
FCC Federal Communications Commission	Passive labels or transponders comply with the valid regulations; certification is not required.
	This product is UL-certified for the USA and Canada. It meets the following safety standard(s): UL 60950-1 - Information Technology Equipment Safety - Part 1: General Requirements CSA C22.2 No. 60950 -1 - Safety of Information Technology Equipment UL Report E 205089

### 1.7.2 Manufacturer's declaration RF640T Gen 2 UHF Tool Tag Version 1

The plant that manufactured the RF640T Gen 2 UHF Tool Tag Version 1 has an ATEX quality assurance system recognized by TÜV NORD with notification number TÜV 96 ATEX 1125 Q. The type test certification for the RF640T Gen 2 UHF Tool Tag Version 1 is stored by TÜV 07 ATEX 346241.

#### Manufacturer's address

Siemens AG  
Automation and Drives  
System Engineering A&D SE  
Würzburger Strasse 121  
90766 Fürth, Germany.

1.8 Dimension drawing

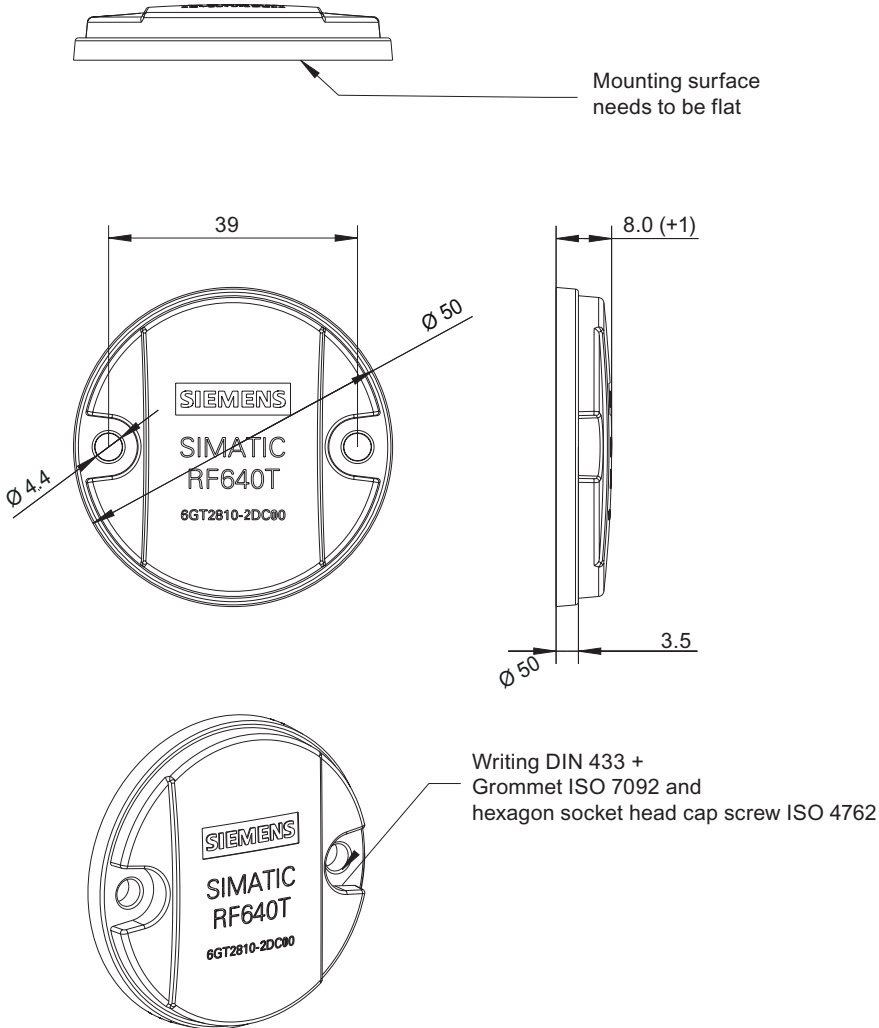


Figure 1-8 SIMATIC RF640T Gen 2 UHF Tool Tag Version 1

Units of measurement: All dimensions in mm

