

Annex no. 5

Functional Description / User Manual

Manual and Specification

SIR-2720 (13.56 MHz Midrange Reader)



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1 Introduction

As with all electronic systems, the system described hereafter may also not be used for any applications critical for maintaining safety. This means, the products may not be used in life support applications or any other life critical applications that could involve potential risk of death, personal injury or severe property or environmental damage.

The user/operator is solely responsible for any damages resulting from an improper or unintended utilization of the system.

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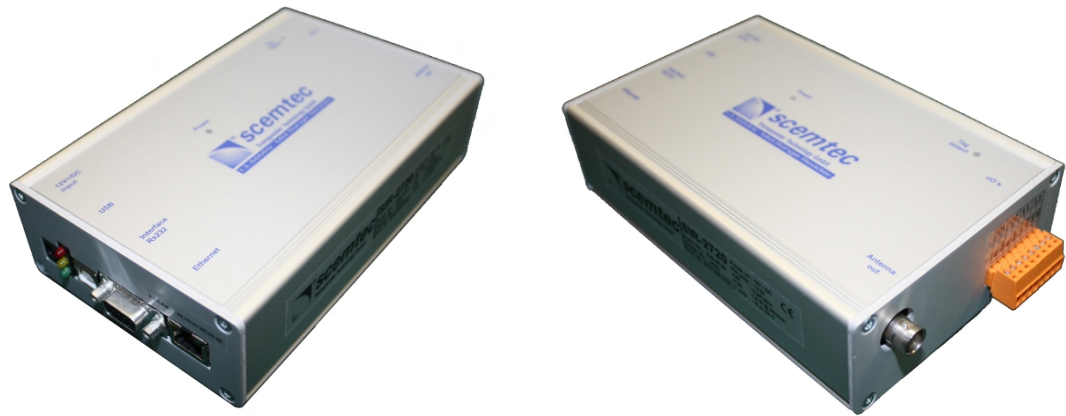
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General:

As this technology is based on radio frequency, one must exercise the following operational and mounting instructions to achieve best operation:

- Metal affects radio signals. Normally the antenna has to be as far away as possible from any metal object and its damping influence on the magnetic field. Only this leads to the best distribution of the magnetic field in the reading range. Very important as well is not to have “short circuits”, in the vicinity of the antenna, damping the magnetic field. A “short circuit” is any metal near the antenna, building a “metallic ring”, so that currents introduced by the RF-field can flow, destroying the energy needed for the tag to operate.
- Care must be exercised to reduce or eliminate unwanted signals (so called interference or noise) from external sources. The reading range may be reduced by following noise sources:
 - portable two way radio
 - cellular phones
 - switching power supplies
 - computer monitors
 - frequency converters (e.g. motor control systems)
- The read range is depending upon
 - performance of the reader
 - size of the antenna
 - size of the tag (the bigger the better)
 - orientation of the tag antenna plane to the reader antenna plane
 - quality of the tag
 - matching of reader antenna size and tag (-antenna) size
 - environmental, electrical noise
 - If influence of metal can not be fully avoided a tuning of the antenna is required and will improve reading range

2 System Description



The "SIR-2720 13.56 MHz Midrange Reader System" is hereafter referred to as "Reader."

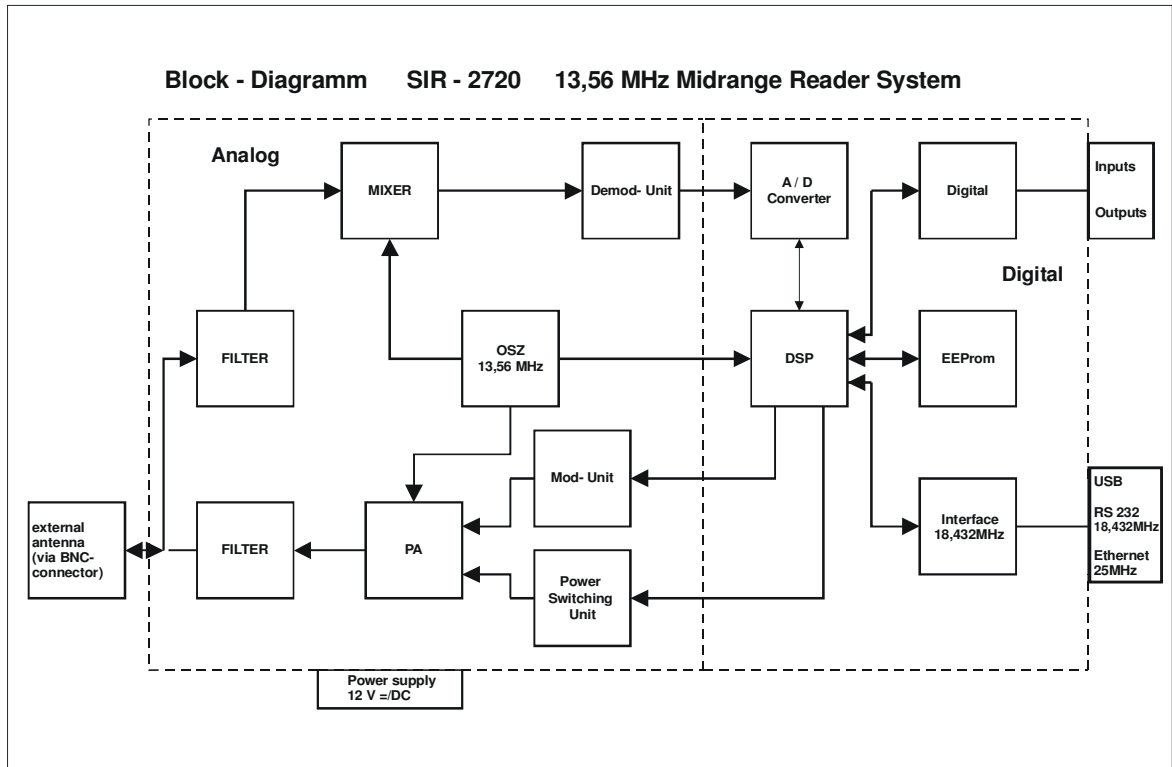
This manual describes the SIR-2720 13.56 MHz Midrange Reader System, Reader for short.

This SIR-2720 Midrange Reader System is designed as a multi-tag system to read and write information stored on transponders (tags). The operating frequency of 13.56 MHz yields a relatively wide reading range of up to 700 mm depending on antenna system (mainly with larger externally attached antennas) and transponder -type and -size. This first generation of SIR-27xx Midrange Readers is based on the hardware developed by **scemtec Transponder Technology** featuring an RF transmitting power of max. 1.4W @ 50 Ω -load. The SIR-2720 13.56 MHz Midrange Reader System is the second product in the SIR-27xx product family. The transmission of data between the reader and a host computer via the asynchronous RS232 interface can be up to 115200 baud. A USB 2.0 full speed compatible interface and an Ethernet port is available as well.

The reader is compatible with standards ISO/IEC 15693- 2 and ISO18000-3 "A."

3 Block Diagram

13.56 MHz Midrange Reader System:



4 Operating Modes

4.1 Self-Test (Diagnosis) and *STAND-BY* Operation

After the main power supply has been switched on, a green LED labeled *POWER* lights up, which also supplies power to the CPU unit. The reader is ready for operation after a short self-test. The reader carries out a short self-test each time it is switched on. This tests all key components and functions of the reader. Once the diagnosis routines have completed successfully, the software switches to *IDLE* mode, i.e. the program waits for input via one of the three described ports of the interface to switch to a different operating mode.

At this time, the antenna does not yet transmit since the carrier is still switched off. The hardware is in *STANDBY* operating mode, the carrier is not active, and the energy consumption of the reader is minimal. The carrier is automatically switched on once the reader receives a command from the host sent across the interface, which the reader can only carry out with activated carrier. If there is no input for a longer period of time after executing the command, the carrier is switched off again and the hardware enters the *STANDBY* mode again as well. The time until the carrier is switched off can be set with the software.

It is also possible to set the carrier to a stable on or off state using the software.

4.2 Reading / Writing Tags

Several tags in the field can be read or written simultaneously (**anti-collision**). The duration of the reading/writing process depends on the number of tags in the field. Generally, there is no max. number of tags that are permitted in the field at the same time.

4.3 EAS Antitheft

EAS is an abbreviation of **E**lectronic **A**rticle **S**urveillance. This operating mode serves to monitor items or articles electronically. The tags in the field are neither read nor written. The only thing determined is whether a tag is in the field with a set EAS mode flag. This mode allows for greater ranges than the read/write mode. When using an external antenna such as the **scemtec** SAT-A40-LR-O-13MHz with an edge length of 400 mm (available as optional equipment), the detection range can be expanded up to max. 700 mm.

Note: EAS mode is not supported by all silicon and transponder manufacturers.

5 Hardware

5.1 Voltage Supply

The standard version of the SIR-2720 reader in standard housing is designed for an input voltage range of 12 Volt / =DC and a tolerance of +/- 1Volt . The following input voltage ranges are thus possible with the rated current consumptions in different operating modes:

Input voltage ranges:	
= DC / direct current	12 volt
Input voltage - tolerance	+/- 1 volt
Current consumption of the different operating modes:	
in <i>STANDBY</i> mode: @12 V / DC power supply	≤ 150 mA
while operating(carrier on):@12 V / DC power supply	≤ 800 mA

For the SIR-2720 reader system is a suitable wall plug 12 volt =DC / 1000mA power supply also as optional accessory available and contactable to the SIR-2720 over a 2.1-mm standard barrel connector.

5.2 Safeguarding, fuse-requirements

Regarding the safety requirements for the SIR-2720 a standard TR5-fuse T1A / 250V (slow blow fuse) is used to protect the complete electronics inside against short circuits or overcurrent .

It is required that this fuse should only be changed by trained technician or skilled personnel !

5.3 HF Unit

The carrier frequency of 13.56 MHz is generated in the HF unit. The final stage generates an output of max. 1.4 watt on nominal $Z_F = 50 \Omega$.

5.4 External Antenna

The reader is only operational with an external antenna. The operating frequency f_0 amounts to 13.56MHz with a max. RF output of 1.4W on nominal $Z_F = 50 \Omega$. Some key parameters of the reader such as range, for example, depend on the used antenna, the used transponder type and size and quality, and the resulting magnetic coupling between the transponder resonant circuit and the transmission/receiver antenna.

Normally only one external antenna can be connected with a BNC plug connection located on the front of the cable inlet side (see port labeled "Antenna out"). Optional the SIR-2720 reader system can be delivered in the max. increment with two external antenna ports and cyclically multiplexed via software (host-controlled or autarc in combi-mode). When operating with the external antenna, this antenna should be configured for the optimal resonance frequency of 13.56MHz with ohmic adjustment (nominal $Z_F = 50 \Omega$) to ensure the best possible adjustment to the SIR-2720 13.56MHz Midrange Reader System.

Recommended external antennas are scemtec antenna models:

SAT-A11-LR-O-13MHz	600 mm diameter	Loop antenna
SAT-A40-LR-O-13MHz	400 mm * 400 mm	Loop antenna
SAT-A4-LR-P-13MHz	200 mm * 200 mm	Loop antenna

5.5 Digital Signal Processing

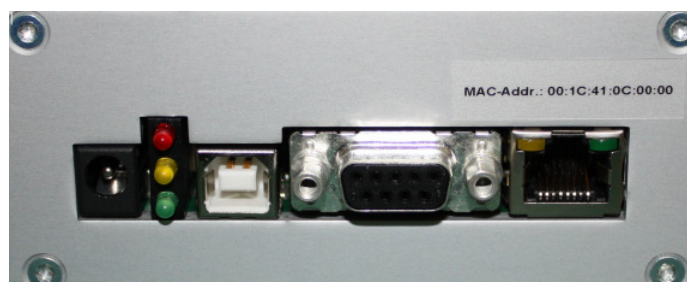
5.5.1 Processor

A Texas Instruments digital signal processor (DSP) is utilized.

5.5.2 Memory

The utilized memory consists of flash memory. The flash memory firmware can be updated at any time using one of the three interfaces to be activated. A serial EEPROM to store the configuration data is standard equipment.

5.6 Interfaces



Interface-connectors of the SIR-2720 13.56 MHz Mid-Range Reader System

5.6.1 RS232

The RS232 interface serves to connect the SIR-2720 13.56MHz Midrange Reader System with a host computer. The connection is made using the 9-terminal D-SUB plug labeled *RS232*. Each data transfer starts with a start bit followed by eight data bits and one stop bit. Parity is configured as *no parity*. Please consult the current *scemtec* STX/ETX protocol description and specification for additional information about the interface protocol.

The speed at which the entire reader system and the host computer are working is significantly affected by the data transfer between reader and host. This data transfer rate is adjustable using the software of the SIR-2720 13.56MHz Midrange Reader System. This involves a standard RS232 interface cable.

Configurable Data Transfer Rates
1200 bits/sec
2400 bits/sec
4800 bits/sec
9600 bits/sec
19200 bits/sec
38400 bits/sec
57600 bits/sec
115200 bits/sec

5.6.2 Ethernet

The 13.56MHz Midrange Reader System SIR-2720 is equipped with a 10/100 T-Ethernet interface.

5.6.3 USB

The SIR-2720 13.56MHz Midrange Reader System is equipped with a USB 2.0 full speed (12 Mbits/sec) port.

Please consult the separate SEC-1500 interface-specification for additional details!

5.7 Inputs / Outputs



Inputs/outputs of the SIR-2720 13.56 MHz Mid-Range Reader System

5.7.1 Binary Inputs

Two binary inputs are available for customer-specific tasks. Both inputs are accessible with indirect-connected optoisolators and screw terminals (see terminal description below). Both inputs pins (photodiode) of the optoisolator are direct routed to the screw terminals. This means the input current should amount to at least 5 mA and max. 10 mA with a defined input voltage of up to max. 24 VDC using a suitable dropping resistor. For example, this results in a dropping resistor value of approx. 4.7 kOhm, which must be still terminated externally, for an input voltage of 24 VDC and a required input current of the photodiode of 5 mA.

The state of both binary inputs must be imported unambiguously using the software; see software description STX/ETX protocol.

Terminal assignment:

Input designation:	Terminal designation:	Internal photodiode assignment:
Input 1	I 1 + (A)	Anode of the optoisolator input 1
	I 1 – (K)	Cathode of the optoisolator input 1
Input 2	I 2 + (A)	Anode of the optoisolator input 2
	I 2 – (K)	Cathode of the optoisolator input 2

All screw terminals are clearly marked with their specific terminal designation using a suitable label at the terminal. The screw terminals make possible contact via a wire cross section of max. 2.5mm².

Electrical data:

Parameter:	Input:	Symbol:	Min.	Typ.	Max.	Unit
Input voltage	Input 1	I1	5	-	24	Volt / DC
Input current	Input 1	I1	5	7,5	10	mA
Input voltage	Input 2	I2	5	-	24	Volt / DC
Input current	Input 2	I2	5	7,5	10	mA

5.7.2 Binary outputs

Two binary outputs in the form of potential-free contacts are available for customer-specific tasks. Both outputs are accessible with indirect-connected relays and screw terminals (see terminal description below). They are freely configurable with the software; see software description STX/ETX protocol. The following tables describes the terminal assignments and the electrical data (e.g. contact rating) of the individual contacts.

Terminal assignment:

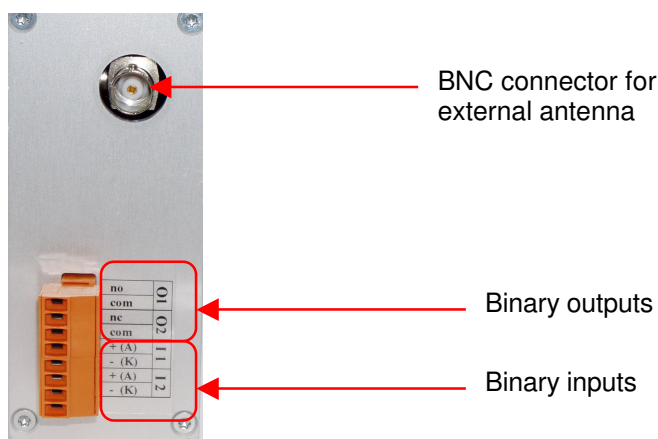
Input designation:	Terminal designation:	Internal photodiode assignment:
Output 1	O 1 (no)	Make contact output of the potential-free contact of output 1
	O 1 (com)	Ref. point for make contact output of the potential-free contact output 1
Output 2	O 2 (nc)	Break contact output of the potential-free contact of output 2
	O 2 (com)	Ref. point for break contact output of the potential-free contact output 2

All screw terminals are clearly marked with their specific terminal designation using a suitable label at the terminal. The screw terminals make possible contact via a wire cross section of max. 2.5mm².

Electrical data:

Parameter:	Output:	Symbol:	Min.	Typ.	Max.	Unit
Output switching voltage	Output 1	O 1	-	24	40	Volt AC / DC
Output switching current	Output 1	O 1	-	50	100	mA
Output switching voltage	Output 2	O 2	-	24	40	Volt AC / DC
Output switching current	Output 2	O 2	-	50	100	mA
Contact ratings of the output contacts	Output 1 / 2	O 1 / O 2	-	500	800	mWatt
Internal resistance of the output contacts	Output 1 / 2	O 1 / O 2	-	25	35	Ω /Ohm

Connection options for binary inputs/outputs and HF antenna:



6 Software

6.1 Firmware for the SIR-2720 13.56 MHz Midrange Reader

The firmware for the SIR-2720 13.56 MHz Midrange Reader contains all basic functions for reading and writing of tags of different manufacturers (air protocol), numerous control functions, as well as different diagnosis routines. These routines are used to test the key components and functions of the reader. A demo software for Windows is included on the CD-ROM delivered together with the device.

6.2 STX / ETX Interface Protocol

A special transfer protocol is available for the SIR-2720 13.56 MHz Midrange Reader System documented in the scemtec STX / ETX protocol. The required STX/ETX protocol description is included on the CD-ROM delivered together with the device.

7 Diagnosis

7.1 Self-Test (POST)

A selftest **POST** (Power On Self Test) is carried out automatically after turning on or connecting to the mains power supply. This also includes testing the key components and functions of the reader. Should a malfunction occur while using the SIR-2720 13.56 MHz Midrange Reader System, simply load the POST diagnosis by turning the unit (or the mains power supply) off and then on again. The displayed error message then helps in solving the problem quickly and reliably. Numerous software commands for a targeted diagnosis are available as well.

7.2 LEDs

7.2.1 External Diagnosis LEDs

Three external LEDs provide users with a diagnosis of the most important monitoring functions "Power", "Tag Detect" and "EAS"

Three external LEDs to indicate important operating states			
LED	Color	Designation	Description
1	GREEN	<i>Power</i>	The voltage supply for the CPU is ensured
2	YELLOW	<i>Tag Detect</i>	A read or write process for the transponders in the magn. field has concluded successfully
3	RED	<i>EAS</i>	EAS is an abbreviation of E lectronic A rticle S urveillance

7.3 Label / Type Plate

The SIR-2720 13.56 MHz Midrange Reader System features a system label that provides information about the specific scemtec system number "220.2720" and the consecutive serial number (four digits), e.g. "0001" of the production lot.

 scemtec Transponder Technology GmbH	SIR-2720		Power_in : 12V / DC	CE
	Syst.-Nr.: 220.2720	f Rf : 13,56 MHz	Pin_max. : 12 W	
	Serial- Nr.: 0001	P Rf : 1,5 W @ 50Ohm		
	FCC ID : WVU SIR-2720	T amb : -10 to 60°C		

8 Mechanical Data / Housing

An aluminum housing protection type IP 20 (in acc. with DIN EN 60529) is used. This housing is equipped with two lateral covers attached with screws. Four screw channels and two installed fastening rails (lugs) are used to mount the housing to the wall.

Case dimensions (exterior)	
Length	185 mm
Width	130 mm
Height	44 mm
Color	Natural matte aluminum

The following chapter lists the exact housing dimensions and detailed installation information.

9 Electrical Data

Absolute Max. Parameters				
No. :	Parameter	Symbol	Value	Unit
1	Min. DC input voltage	V_{min}	11	Volt
2	Max. DC input voltage	V_{max}	13	Volt
3	Max. current consumption / @12Volt DCin	I_{max}	850	mA
4	Operating (ambient) temperature range	T_{amb}	- 10 to 60	°C
5	Storage temperature range	T_{stg}	- 20 to 70	°C

General Parameters									
No.	Parameter	Test condition	Symbol	Min.	Typ.	Max.	Unit	Min / Max values	Typ. values
6	Operating frequency	Defined in ISO document	F_{RF}	-	13.56	-	MHz		X
7	RF output-power 50Ω	Terminal resistance 50Ω /25 °C	P_{out}	- 1db	1400	+ 1db	mW	X	
8	RF input sensitivity	$P_{out} = 1.4W$ $T_{amb} = 25 °C$		-	tbd	-	dBm		X
9	Current consumption at $U_{in} = 12$ Volt	RF $out = 1.4W$ $T_{amb} = 25 °C$	I_{in}	-	700	850	mA	(X)	X
11	Current consumption at $U_{in} = 12$ Volt	STANDBY mode $T_{amb} = 25 °C$	I_{in}	-	120	150	mA	(X)	X
12	Transmission rate RS232 interface	Defined in DIN 66020 $U_{in} = 12$ V/DC $T_{amb} = -10 °C - 60 °C$		1200	-	115200	bits/sec	X	
13	Input current binary inputs I1/ I2	$U_{in} = 24$ V/DC $R_{ext.} = 4.7kΩ$ $T_{amb} = -10 °C - 60 °C$	$I_{in-High}$	5	7.5	10	mA	X	see 5.7.1
14	Input current binary inputs I1/ I2	$U_{in} = 24$ V/DC $R_{ext.} = 4.7kΩ$ $T_{amb} = -10 °C - 60 °C$	I_{in-Low}	-	-	0,5	mA	X	see 5.7.1
15	Output switching voltage binary outputs O 1 / O 2	$U_{out} = 24$ V/DC $T_{amb} = -10 °C - 60 °C$	U_{out} (AC/DC)	-	24	40	V	X	see 5.7.2
16	Output switching current binary outputs O 1 / O 2	$U_{out} = 24$ V/DC $T_{amb} = -10 °C - 60 °C$	I_{out}	-	50	100	mA	X	see 5.7.2
17	Output switching output binary outputs O 1 / O 2	$U_{out} = 24$ V/DC $T_{amb} = -10 °C - 60 °C$	P_{out}	-	500	800	mW	X	see 5.7.2

10 Conformity

10.1 CE Conformity

The company **scemtec** Transponder Technology GmbH declares that the product device type **13.56 MHz Mid Range Reader** with the type designation

SIR-2720

complies with the basic requirements of Directive

1999/5/EC

of the European Council.

The following standards were used as the basis for this evaluation:

EN 300 330 (Part Radiated Spurious Emission)

Available soon: EN 301 489-1, -3

EN 60950

EN 50364

10.2 FCC Conformity: Information for USA

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.

Usually this is followed by the following FCC caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Professional Installation: 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.

11 Delivery Scope / Optional Equipment and Accessories

11.1 Manual, CD-ROM, Test Software, Protocol Description

11.2 Optional Accessories / External Antenna(s)

For the SIR-2720 reader system is a suitable wall plug 12 volt =DC / max.1000mA power supply as optional accessory available and contactable to the SIR-2720 over a 2.1-mm standard barrel connector.

Three standard antenna models are sold by scemtec:
 SAT-A40-LR-O-13MHz, SAT-A4-LR-P-13MHz, SAT-A11-LR-O-13MHz

12 Datasheet

See additional document : datasheet “ **SIR-2720** “

13 Related Documents / Document History

[STXETX]

STX/ETX Protocol description

Scemtec's STX/ETX Protocol description is distributed with every Reader on the product CD

13.1 Document History

Version	Date	Changed by	Description
0.01	26.11.2010	Radermacher	Initial Version
0.02	01.12.2010	Radermacher	added safeguarding/fuse-requirements (5.2)
0.03	17.01.2011	Radermacher	added new block diagram, new safeguarding-information and new FCC conformity-information for Class A digital device
0.04	31.01.2011	Radermacher	added professional installation-information under chapter 10.2 FCC conformity