

Annex no. 5

Functional Description / User Manual

Manual and Specification

SIR-2010 (STK-2010) **13.56 MHz Midrange Reader (-Modul)**



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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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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-2010 (STK-2010) 13.56 MHz Midrange Reader System" is hereafter referred to as "Reader."

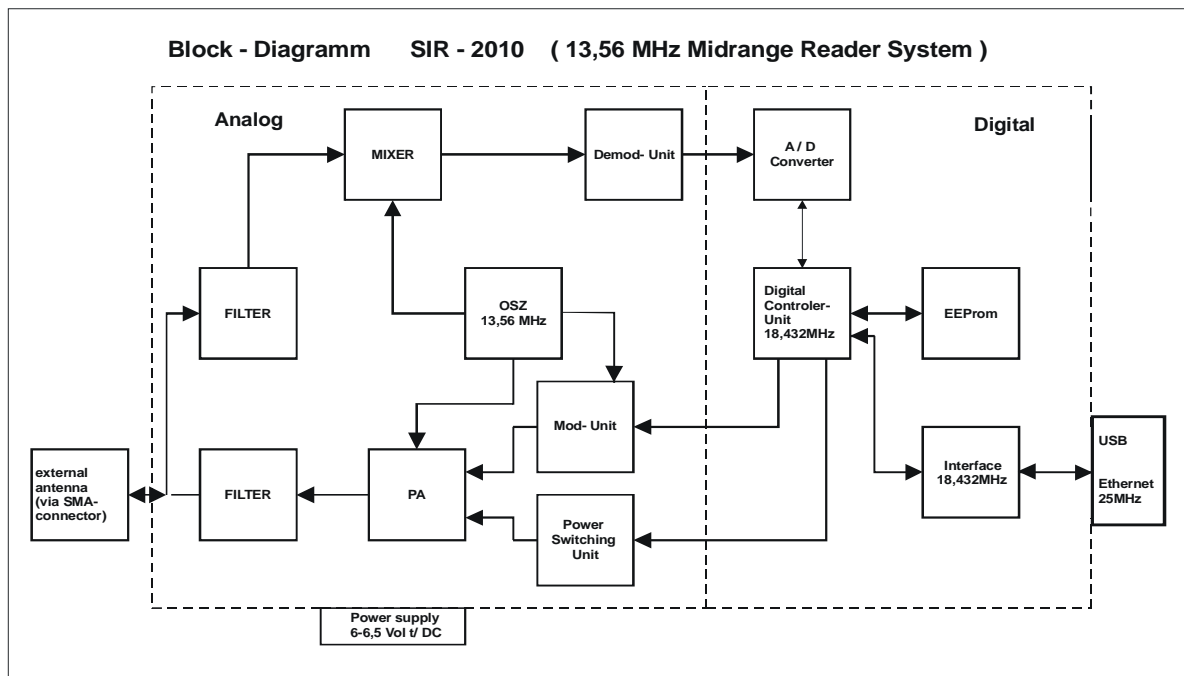
This manual describes the SIR-2010(STK-2010) 13.56 MHz Midrange Reader System, Reader for short.

This SIR-2010 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 550 mm depending on antenna system (mainly with larger externally attached antennas) and transponder -type and -size. This first generation of SIR-20xx Midrange Readers is based on the hardware developed by **scemtec Transponder Technology** featuring an RF transmitting power of nominal 500mW @ 50 Ω -load. The SIR-2010 13.56 MHz Midrange Reader System is the second product in the SIR-20xx product family. The transmission of data between the reader and a host computer via an 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 *PWR* 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 two 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.

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. 600 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-2010 reader in standard housing is designed for an input voltage range of 6-6,5 Volt / =DC and a tolerance of +/- 0,5 Volt . The following input voltage ranges are thus possible with the rated current consumptions in different operating modes:

Input voltage ranges:	
= DC / direct current	6-6,5 Volt
Input voltage - tolerance	+/- 0,5 Volt
Current consumption of the different operating modes:	
in <i>STANDBY</i> mode: @ 6 Volt / DC power supply	≤ 100 mA
while operating(carrier on):@ 6 Volt / DC power supply	≤ 550 mA

For the SIR-2010 reader system is a suitable wall plug 6 Volt =DC / 1000mA power supply also as optional accessory available and contactable to the SIR-2010 over a 2.1mm standard barrel connector.

5.2 HF Unit

The carrier frequency of 13.56 MHz is generated in the HF unit. The final stage generates an output of nominal 500mW @ a 50 Ω-load.

5.3 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 nominal 500mW @ a 50 Ω-load. 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 SMA plug connection located on the front of the cable inlet side (see port labeled "ANT" output). 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-2010 Midrange Reader System.

Recommended external antennas are scemtec antenna models:

SAT-A25/30-MR-P-13MHz	250 mm * 300 mm	loop antenna (acrylic glass-housing)
SAT-A40-LR-O-13MHz	400 mm * 400 mm	open loop antenna

5.3.1 Antenna connector (SMA-connector location)



5.4 Digital unit

5.4.1 Processor

An “ ATMEL ARM7 “ digital processor is utilized.

5.4.2 Memory

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

5.5 Interfaces

5.5.1 Location of interface-connectors



5.5.2 Ethernet

The SIR-2010 Midrange Reader System is equipped with a 10/100 T-Ethernet interface.

5.5.3 USB

The SIR-2010 Midrange Reader System is equipped with a USB 2.0 full speed (12 Mbits/sec) port.

6 Software

6.1 Firmware for the SIR-2010 Midrange Reader System

The firmware for the SIR-2010 13.56 MHz Midrange Reader System 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-2010 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.

6.3 List of supported STX/ETX Commands

6.3.1 Common:

- 1000: Reset Request
- 1001: Request Version Number
- 1002: Interface Test
- 1003: Change Baud Rate
- 1010: Request System Setting
- 1011: Edit System Setting
- 1019: Get Device Serial Number
- 1028: Get Processor Identification String
- 1029: Get Hardware Feature
- 102A: Request Interface Board Setting
- 102B: Edit Interface Board Setting
- 102C: Forward Command
- 102D: Request Interface Board Version Number
- 102E: Get Local Device Name
- 102F: Set Local Device Name
- 6010: Set Password Buffer
- E000: Recover Factory Settings
- E001: Recover User Settings
- E002: Freeze Current Settings
- E080: Read From EEPROM User Space
- E081: Write To EEPROM User Space
- E082: Get EEPROM User Space Size
- E083: Erase EEPROM User Space
- 100A: Request Supported Transponder Types
- F000: Switch on/off Oscillator
- F001: HF Reset

6.3.2 Code-1:

1A30: Request Setting
1A31: Edit Setting
4A14: Unselected Read
6A10: Anticollision / Select
4A10: Selected Read
5A10: Write
6A18: Halt
6A1A: Reset QUIET Bit
6A1C: EAS
6A20: Create Inventory
6A21: Get Inventory
6A22: Get ID Range from Inventory
6A23: Realtime Inventory
6A24: Create/Get Inventory
6A26: Select Individual
4A28: Looped Read
5A24: Direct Write
6A28: Direct Halt
6A29: EAS Alarm
6A2A: Request Write Protect State
6A2B: Set Write Protect
6A2C: Change EAS Bit
6A2D: Set QUIET Bit

6.3.3 ISO15693:

1C30: Request Setting
1C31: Edit Setting
1C34: Get ISO Tag Descriptor
1C35: Set ISO Tag Descriptor
1C36: Get ISO Tag Descriptor from ROM
1C38: Set Temporary Response Delay
6C10: Single Anticollision Round
6C12: Select
4C10: Read Single Block
4C12: Read Multiple Blocks
4C16: Get System Information
4C18: Get Security Status
5C10: Write Single Block
5C12: Write Multiple Blocks
5C16: Write AFI
5C17: Write DSFID
6C14: Lock Block
6C16: Lock AFI
6C17: Lock DSFID
6C18: Stay Quiet
6C1A: Reset To Ready
6C1E: Custom Read Command
6C1F: Custom Write Command
6C20: Create Inventory
6C21: Get Inventory
6C22: Get ID Range from Inventory
6C23: Realtime Inventory
6C24: Create/Get Inventory

4C20: Advanced Read Single Block
5C20: Advanced Write Single Block
6C26: Advanced Lock Single Block
4C24: Advanced Read Multiple Blocks
5C24: Advanced Write Multiple Blocks
6C28: Advanced Lock Multiple Blocks
5C26: Advanced Write AFI
5C27: Advanced Write DSFID
6C2A: Advanced Lock AFI
6C2B: Advanced Lock DSFID
4C2A: Looped Address Scan

6.3.4 ISO15693 / ICode-SLI(S):

6CA0: Inventory Read
6CA4: Create IR Inventory
6CA5: Get IR Inventory
6CA6: Get Single ID from IR Inventory
6CA7: Create/Get IR Inventory
6CA8: Change EAS Flag
6CA9: Lock EAS Flag
6CAA: EAS
6CAB: EAS Alarm

6.3.5 ISO15693 / ICode-SLIS:

6CAC: Password Protect EAS
6CAD: Write EAS ID
6CAE: Read EPC
6CE0: Inventory Page Read
6CE2: Get Random Number
6CE3: Set Password
6CE4: Write Password
6CE5: Lock Password
6CE6: Protect Page
6CE7: Lock Page Protection
6CE8: Get Protection Status
6CE9: Destroy
6CEA: Enable Privacy
6CEB: 64 Bit Password Protection
6CAF: Login
6CEC: Create IPR Inventory
6CED: Get IPR Inventory
6CEE: Get Single ID from IPR Inventory
6CEF: Create/Get IPR Inventory

6.3.6 ISO15693 / Tag-it HF-I:

5C82: Write Two Blocks

6.3.7 ISO15693 / My-D:

4C90: Read Block
5C90: Write Block
6C94: Lock Block

6.3.8 ISO15693 / EM4034:

6CC0: Login

6.3.9 ISO15693 / VarioSens:

6CD0: Init
6CD1: Set Log Mode
6CD2: Set Log Timer
6CD3: Set Custom
6CD4: Start Log
6CD5: Get Log State
6CD6: Set Passive
6CD7: Get Timer State
6CD8: Get State
6CD9: Get One Block
6CDA: Timer Sync
6CDB: Get Voltage
6CDC: Set Calibration
6CDD: Verify Password
6CDE: Set Password
6CDF: Verify Buffered Password (Schreiner e-Temp)
6CBA: Easy Init
6CBB: Get Config
6CBC: Get Progress
6CBE: Read Single Measurement
6CBF: Get Battery Voltage

6.3.10 ISO15693 / ScemTag Sensor Tag:

6CF0: Single Measurement
6CF1: Set Configuration
6CF2: Set Threshold Values
6CF3: Start Log
6CF4: Stop Log
6CF5: Get Log Status
6CF6: Get Configuration
6CF7: Get Threshold Values
6CF8: Read Log Value
6CF9: Get Version Information
6CFA: Read Sensor Configuration
6CFB: Write Sensor Configuration
4CF0: Read EEPROM
5CF0: Write EEPROM

7 Diagnosis

7.1 Self-Test (POST)

A selftest **POST** (**P**ower **O**n **S**elf **T**est) 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-2010 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>PWR</i>	The voltage supply for the CPU is ensured
2	YELLOW	<i>Tag</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-2010 MHz Midrange Reader System features a system label that provides information about the specific scemtec system number "220.2010" and the consecutive serial number (four digits), e.g. "0001" of the production lot.

 SIR-2010 Syst.-Nr.: 220.2010 Serial-Nr.: 0000	U _{in} : 6-6,5 Volt / DC f _{Rf} : 13,56 MHz P _{Rf} : 500mW @ 50Ohm T _{amb} : -10 to 60°C CE
	FCC ID : WVUSIR-2010

System-Label on bottom of the housing



Type-Plate on top of the housing

8 Mechanical Data / Housing

A plastic housing protection type IP 20 (in acc. with DIN EN 60529) is used.

Case dimensions (exterior)	
Length	160 mm
Width	85 mm
Height	40 mm

9 Electrical Data

Absolute Max. Parameters				
No. :	Parameter	Symbol	Value	Unit
1	Min. DC input voltage	V_{min}	6,0	Volt
2	Max. DC input voltage	V_{max}	7,5	Volt
3	Max. current consumption / @ 6Volt DCin	I_{max}	600	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	500	+ 1db	mW	X	X
8	RF input sensitivity	$P_{out}=500mW$ $T_{amb}=25°C$		-	tbd	-	dBm		
9	Current consumption at $U_{in} = 6$ Volt	$RF_{out}=500mW$ $T_{amb}=25°C$	I_{in}	470	520	570	mA	X	X
11	Current consumption at $U_{in} = 6$ Volt	Idle - mode $T_{amb}=25°C$	I_{in}	80	100	120	mA	X	X

10 Conformity

10.1 CE Conformity

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

SIR-2010

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)

EN 301 489-1, -3

EN 60950

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-2010 reader system is a suitable wall plug 6 Volt =DC / max.1000mA power supply as optional accessory available and contactable to the SIR-2010 over a 2.1mm standard barrel connector.

Two standard antenna models are sold by scemtec:

SAT-A25/30-MR-P-13MHz
SAT-A40-LR-O-13MHz

12 Datasheet

See additional document : datasheet " **SIR-2010** "

13 Related Documents / Document History

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	11.04.2011	Radermacher	Initial Version