sttID

scemtec Transponder Technology GmbH

Manual

SIL-93x0-MUX8

Product name	Version	
SIL-93x0-MUX8	3.0	
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Contents

1 General

scemtec Transponder Technology GmbH (*sttID*) reserves the right to make changes or to discontinue its products or services at any time without notice.

sttID takes no responsibility for customer applications, products, or performance relating to systems or applications incorporating with *sttID* products.

Please note, that the user is responsible for conformity with regulation issues (e.g. radio approval), when using antennas not provided by *sttID* or using the system in countries, where the conformity with local regulations is not tested by *sttID*.

sttID assumes no liability and is not responsible for infringement of patents and/or any other intellectual or industrial property rights of third parties, which may result from assistance provided by *sttID*.

All other products mentioned in this document might be brands or brand names of the different suppliers.

1.1 Care and Maintenance

- Keep the device dry. Humidity and liquids contain minerals will corrode electronic circuits and tarnish transparent plastic parts. The device is not waterproof and should not be exposed to rain or moisture. Under extreme conditions, water may enter the circuitry.
- Avoid mechanical shocks. Handle the device with care. Shocks may break internal circuit boards.
- Take care not to scratch the device. Keep the device clean. When working with the device, use only *sttID*-approved accessories.
- Do not store or use the device in any location that is extremely dusty, dirty, damp or wet.
- Do not store in hot areas. High temperatures can shorten the life of electronic devices, damage batteries and warp or melt certain plastics. Protect the device from extreme temperatures. For example, do not place the device in a windowed area where the sun may cause extreme temperatures, and keep it away from heaters and other heat sources.
- Do not store in cold areas. When the device warms up (to its normal temperature), moisture can form inside the device, which may damage electronic circuit boards.
- Do not attempt to open the device during operation, outside installation and maintenance periods. Non-professional handling of the device may damage it.
- Do not paint the device. Paint prevent proper operation. Paint with metallic contents may limit device performances.
- If the device or any accessory are not working properly, take it to your nearest *sttID*-Partner.

1.2 RFID Systems

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

- Metal affects radio signals. Normally the antenna has to be as far away as possible from any metal object and it's 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, absorbing the energy needed for the tag to operate.
- Care must be taken 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)

  Generally all cabling should be placed in sufficient distance from every potential noise source. However, in case of any problems additional noise suppression may be necessary (e.g. ferrites on cables). If needed, don't hesitate to contact ***sttID*** for additional installation guidance.
- 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

1.3 RoHS and WEEE Directives

1.3.1 RoHS

sttID certifies that this product is compliant with the European Directive 2011/65/EU (RoHS II) for the restriction in Electrical and Electronic Equipment's (RoHS) of the use of the following hazardous substances:

- Cadmium
- Hexavalent Chromium
- Lead
- Polybrominated biphenyl flame retardants
- Polybrominated diphenyl ether flame retardants

- Mercury

This declaration is based on information provided by our suppliers and subcontractors.

1.3.2 WEEE (Waste Electrical and Electronic Equipment)

This product bears the selective sorting symbol for waste electrical and electronic equipment (WEEE). This means that this product must be handled pursuant to European Directive 2011/65/EU in order to be recycled or dismantled to minimize its impact on the environment. For further information, please contact your local or regional authorities

2 Safety Informations

As with all electronic systems, the system described hereafter may not be used for any applications critical for maintaining safety. This means, the products may not 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.

3 System Description

This manual describes the 868 MHz Longrange Reader System SIL-93x0-MUX8, hereafter referred to as "Reader".

The 868 MHz Long range Reader System SIL-93x0-MUX8 is designed as a multi-tag system for reading and writing information stored on transponders (TAGs). The operating frequency of 13,56 MHz permits a reading range up to 1 meter depending on antenna system and transponder type and size.

The operating frequency of 868 MHz permits a reading range up to 12 meters depending on antenna system and transponder type and size.

The Reader is available in two versions, which differs in terms of RF output power.

The SIL-9300-MUX8 has a maximum Rf output of typical 1,0 W conducted at 50 Ohm load, The SIL-9320-MUX8 has a maximum RF output power of typical 1,7 W at 50 Ohm load.

Both versions are equipped with an integrated octuple antenna multiplexer.

The Reader is designed for indoor usage only.

Transfer of data between the Reader and a host computer is possible via Ethernet, USB and an asynchronous RS232 interface. Furthermore a configurable “stand-alone” operation via so called Smart Read Feature is possible.

The Reader is compatible with the standards EPC Class1 Gen.2 (ISO/IEC 18000-6c).

4 Quick Start

4.1 Connection via USB

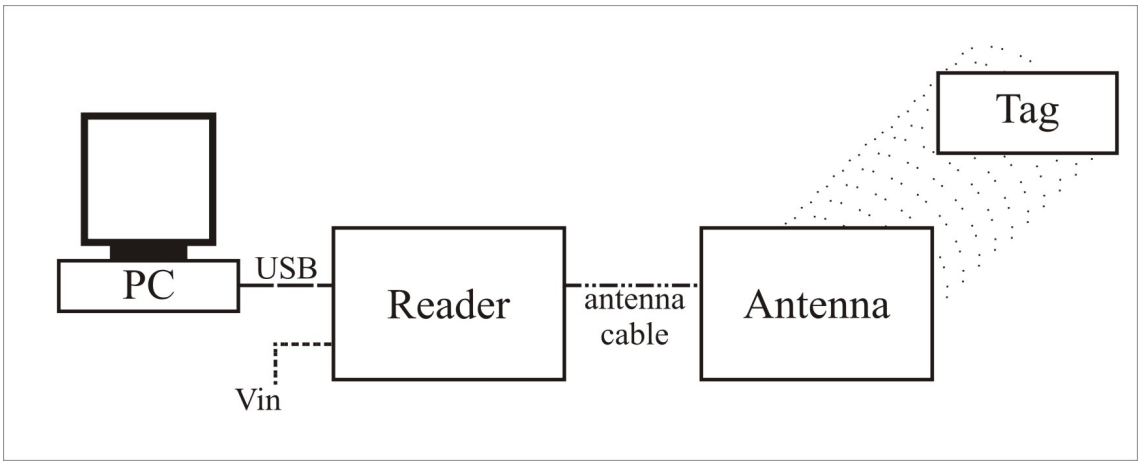

figure 1: System connection example

For example you can use the *sttID* antenna “SAT-A40-LR-O(F)-13MHz” [400.4020].

Now you can use a Software like “UniDemo” to control the Reader. For more details please refer to “Quick Start Guide read”. This Guide is available for download on www.stt-rfid.com.

4.2 Mounting

When mounting the Reader on a wall or ceiling, only the provided screw-holes has to be used. Fixing to the wall/ceiling has to be done with appropriate installation material (not included) using all of the foreseen mounting points.

For safety reasons the Reader must not be installed more than 2 m above the ground.

When installing the Reader, please make sure that the maximum ambient temperature is not exceeded at any time. Therefore the Reader should only be installed in places where sufficient ventilation is assured. Any kind of possible heat accumulation should be avoided (e.g. the Reader should not be mounted in an additional housing or cabinet).

5 Operating Modes

5.1 Standard (Host) Mode

In standard mode the Reader is completely controlled by a Host system connected to one of the available Interfaces via STX-ETX commands. For further information, please refer to the STX-ETX protocol description, which can be downloaded from www.stt-rfid.com.

5.2 Stand alone Mode (Smart Read)

In addition to controlling the Reader with a host system via one of the interfaces, it can also be configured for stand alone operation. Therefore the “Smart Read” feature is implemented.

For further Information about Smart Read please refer to the correspondent Smart Read-manual, which can be downloaded from www.stt-rfid.com.

6 Software

6.1 Software utilities

Various software utilities for Windows for the Reader are available for download on www.stt-rfid.com . Linux Versions are available on request.

Available Software utilities:

- SimpleDemo
  - Demo Software for easily controlling the Reader with a Host system.
- UniDemo:
  - Universal Demo Software for extended controlling the Reader with a Host system.
- STXTerm:
  - Terminal program for controlling the Reader with a Host system by directly submitting STX-ETX commands. For submitting multiple STX-ETX commands a comprehensive Script utility is implemented
- Flasher:
  - Utility for updating firmware on the incorporated Microprocessor
- SmartManager:
  - Utility for configuration and using the Reader in Standalone mode (Smart Read).

6.2 Firmware

The firmware of the Reader contains all basic functions for reading and writing tags of different manufacturers (air protocol), numerous control and configuration functions, as well as different diagnosis routines.

Firmware can be updated by the user via USB Interface or RS232 Interface. Therefore the latest Firmware files are available for download on www.stt-rfid.com.

6.3 STX-ETX Interface protocol

For communication with the Reader *sttID*s STX-ETX protocol is used. The required STX/ETX protocol description can be downloaded from www.stt-rfid.com .

A list of supported STX-ETX commands can be read out from the Reader via the STX-ETX command ‘100E’ or via STX-ETX script ‘Get Fn List.stx’ (which will be installed together STX-Term software).

7 Hardware

7.1 Versions

The Reader is available in two versions, which differs in terms of RF output power.

The SIL-9300-MUX8 has a maximum Rf output of typical 1,0W conducted at 50 Ohm load, The SIL-9320-MUX8 has a maximum RF output power of typical 1,7 W at 50 Ohm load.

Both versions are equipped with an integrated octuple antenna multiplexer with SMA antenna connectors. For usage with BNC or N connectors, SMA-BNC or SMA-N adapters are available from *sttID*.

7.2 Voltage Supply

The Reader is designed for a voltage supply connectable via a standard 2.1-mm barrel connector.

Polarity of connector	

The Reader may only be connected to a power supply with a minimum output current of 3 A, which is tested for safety according to appropriate standard (e.g. EN60950)

A suitable wall plug power supply is available as optional accessory. For best performance and safety, *sttID* strongly recommends to use only this power supply.

7.3 Interfaces

For communication with a host device (e.g. PC), the Reader provides three interfaces (RS232, USB, Ethernet). The Reader can also be configured to operate in stand-alone mode, so called Smart Read feature.

The interfaces are intended to be used only with connection cables not longer than 3m.

7.3.1 Ethernet

The Reader is equipped with a 10/100 T-Ethernet interface.

By default the Reader gets its IP Address via DHCP.

Nevertheless the Reader can also be configured with a static IP Address.

The actual assigned IP address of the Reader can be determined using Scemtec Demo Software (e.g. UniDemo). Clicking the “Search” Button in Ethernet connection window of the STX/ETX connector will show the actual IP address as well as MAC address of all *sttID* devices available in the local network.

Network settings may be configured by using STX-ETX commands. For details please refer to STX-ETX protocol description.

7.3.2 USB

The Reader is equipped with a USB 2.0 high speed (480 Mbits/sec) port. The connection is made via a standard USB-B connector.

Supported profiles	CDC-ACM (virtual COM-Port), HID (Keyboard emulation)

Appropriate drivers for Windows are available for download on www.stt-rfid.com.

7.3.3 RS 232

The Reader is equipped with a RS232 interface. The connection is made via a standard 9 pin D-Sub connector.

Terminal designation	SUB-D Connector Pin	Terminal Function
TxD	2	Transmit Data
RxD	3	Receive Data
GND	5	Ground

The data transfer rate is adjustable via STX-ETX commands.

Configuration	8 Data Bits, 1 Stop Bit, no Parity, no flow control
Supported Data Rates [baud]	1200, 2400, 4800, 9600 (default), 19200, 38400 57600, 115200, 230400

In addition to the primary RS232 Interface described above, the Reader provides a secondary RS232 Interface, intended to be used in stand alone mode as interface for connecting auxiliary equipment (e.g. additional RFID, bar code scanner, …). The connection to the secondary RS232 is made via the 3 pin plug-able screw terminal. Please contact *sttID* for further Information regarding usage of the second RS232 in your application.

Port designation	Terminal designation	Terminal Function
2nd RS232	Tx	Transmit Data Secondary RS232
	Rx	Receive Data Secondary RS232
	GND	Ground

7.4 External Antenna

The Reader is only operational with external antenna(s).

Some key parameters of the such as reading range for example depends on the used antenna, the used transponder type, size and quality, and the resulting magnetic coupling between the transponder resonant circuit and the transmission/receiver antenna.

The Reader has an integrated octuple antenna multiplexer, so up to 8 antennas can be connected to the Reader. The user can select each connected antennas via software commands.

The Reader is equipped with SMA antenna connectors. For using with N connectors, SMA-N Adapters are available from *sttID*.

7.4.1 Calculating radiated power

The radiated power according to ETSI standard EN 302 208 of a system consisting of reader, cable and antenna can be calculated using the following equation:

$P_{e.r.p._dBm} = 10 \cdot \log (P_{conducted}) - D_{cable} + G_{ant\_dBd}$

with

$P_{e.r.p\_dBm.}$: Radiated power relative to a half-wave dipole [dBm]

$P_{conducted}$: Conducted output power of the Reader [mW]

D_{cable}: Damping of the antenna connection cable [dB]

G_{ant_dBd}: Antenna gain relative to half wave dipole [dBd]

Remark:

Antenna gain is usually specified relative to an isotropic antenna in dBi (G_{ant_dBi}).

The antenna gain relative to half wave dipole can be derived by the following equation:

$G_{ant\_dBd} = G_{ant\_dBi} – 2{,}15$ dB

Since the measurement of the radiated power defined in EN 302 208 is based on linear antennas, the radiated power of a circular polarized antenna measured with a linear test-antenna according to EN 302 208 will be 3 dB less.

Therefore an additional amount of 3 dB can be added in the calculation when using a circular polarized antenna.

Example:

Calculating the permitted power step for usage in ETSI region for a system consisting of the following STT devices:

- Reader SIL-9320-MUX8
- Antenna SAT-A12/12-P-868MHz: (gain 5,5 dBi, beam width 100°, circular polarized)
- Cable CABLE-UHF-12m-SMA-N (damping typ. 3,2 dB)

For this system setup the permitted radiated power $P_{e.r.p.}$ according to EN 302 208 would be 1 W = 30 dBm.

This leads to:

$P_{conducted\_max} = 10^{(30\ dBm + 3{,}2\ dB - 5{,}5\ dBi + 2{,}15\ dB + 3\ dB)/10} = 1927$ mW

For this example the maximum permitted conducted power is higher than the highest power step of the SIL-9320-MUX8 so the maximum power step may be selected.

Using the shorter 6m CABLE-UHF-6m-SMA-N with a typical damping of 1,6 dB instead of 12 m cable, the analogue calculation would give a permitted output power:

$P_{conducted\_max} = 10^{(30\ dBm + 1{,}6\ dB - 5{,}5\ dBi + 2{,}15\ dB + 3\ dB)/10} = 1333$ mW

In this case the output power of the SIL-9320-MUX8 has to adjusted to at least power step 13 to meet the restrictions of EN 302 208. With respect to system tolerance it is recommended to add some margin, so power step 12 would be a good compromise in this case.

Nevertheless the SIL-9300-MUX8 could still be used with maximum power step in this setup.

7.5 Inputs and Outputs

7.5.1 Binary Inputs

Two binary inputs are available for customer-specific tasks. Both inputs are accessible with indirect-connected opto-couplers and screw terminals (see terminal description below).

The state of both binary inputs must be imported unambiguously via software command.

In stand alone mode (Smart Read) the behaviour of the Inputs can be configured freely (e.g. trigger Read event).

Terminal assignment:

Input designation	Terminal designation	Internal opto-coupler assignment
Input 1	I1 + (A)	Anode of the opto-coupler input 1
	I1 – (K)	Cathode of the opto-coupler input 1
Input 2	I2 + (A)	Anode of the opto-coupler input 2
	I2 – (K)	Cathode of the opto-coupler input 2

All screw terminals are clearly marked with their specific designation at the terminal. The screw terminals accepts wires of maximum conductor cross-section of 2.5mm².

The electrical data can be found in the table 'electrical specification'.

7.5.2 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 via software commands.

In stand alone mode (Smart Read) the behaviour of the outputs can be configured freely (e.g. Change state when TAG is read).

Terminal assignment:

Output designation	Terminal designation	Internal assignment
O1	—	Contacts of the potential-free Output-port 1
O2	—	Contacts of the potential-free Output-port 2
O3	—	Contacts of the potential-free Output-port 3
O4	—	Contacts of the potential-free Output-port 4

All screw terminals are clearly marked with their specific designation at the terminal. The screw terminals accepts wires of maximum conductor cross-section of 2.5mm².

The electrical data can be found in the table 'electrical specification'.

7.5.3 *IO connection example*

The following schematic is an example how to connect the Inputs and Outputs.

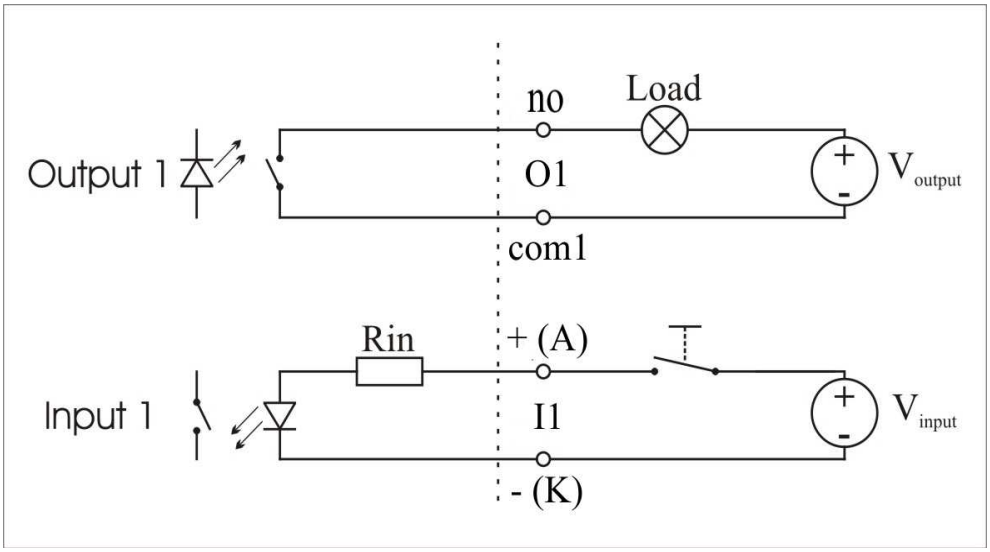

figure 2: IO connection example

7.5.4 *Voltage output port*

For simplifying connection of the binary in- and outputs to external circuits, the Reader provides a voltage output port right beside the I/O connectors. On this port the input voltage delivered by the external power supply is looped in. It is protected with an internal, resettable fuse.

The port is accessible with screw terminals (see terminal description below).

Output designation	Terminal designation	Internal assignment
U_{out}	+	Positive pole of the output voltage
	–	Negative pole of the output voltage

All screw terminals are clearly marked with their specific designation at the terminal. The screw terminals accepts wires of maximum conductor cross-section of 2.5mm².

The electrical data can be found in the table 'electrical specification'.

Attention: Care should be taken, that the attached power supply is capable of handling the additional current. which is added to the current consumption of the Reader itself.

7.6 *Diagnosis LEDs*

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

Three LEDs to indicate important operating states			
Led	Color	Designation	Description
1	green	Power	The voltage supply for the CPU is ensured
2	yellow	Tag	A read or write process for the transponders has concluded successfully
3	red	EAS (Aux)	User defined (default: Error)

7.7 Memory

The firmware of the incorporated microprocessor is stored in a flash memory. It can be updated at any time via the USB or RS232 interface.

The configuration is stored in a non volatile memory.

8 Specification

8.1 Electrical specification

Electrical specification (Ambient temperature: 25°C)						
Parameter	Test condition	Symbol	Min.	Typ.	Max.	Unit
DC input voltage	—	V_{in}	12	—	24	V
Current consumption	V_{in} = 24 V Cyclic scan, I_{out} = 0	I_{in}	—	400	—	mA
Operating frequency	—	f_{RF}	865	—	868	MHz
Maximum RF power @ 50 Ohm load	SIL-9300	$P_{conducted}$	- 1db	1000	+ 1db	mW
	SIL-9320			1700		
Input voltage binary inputs I1/I2	—	V_{input}	6.5	12	30	V/DC
Input current binary inputs I1/I2	V_{input} = 12 V/DC	I_{input}	–	11	–	mA
Series resistors binary inputs I1/I2	—	R_{in}	950	1000	1050	Ohm
Output switching voltage binary outputs O1 - O4	—	V_{output} (AC/DC)	—	—	60	V AC/DC
Output switching current binary outputs O1 - O4	—	I_{output}	—	—	500	mA
Output power dissipation binary outputs O1 - O4	—	P_{output}	—	—	800	mW
On resistance binary outputs O1 - O4	—	R_{on}	—	1	—	Ohm
Voltage @ voltage output port	—	U_{out}	—	V_{IN}	—	V
Maximum Current @ voltage output port	—	$I_{out\ max}$	—	—	500	mA
Operating (ambient) temperature range	—	T_{amb}	-10	—	50	°C
Storage temperature range	—	T_{stg}	-20	—	70	°C

8.2 Power steps

The output power of the Reader can be set in 15 steps.

Power step	Output power conducted [mW] @ 50 Ohm load (typical values @ 20 C)	
	SIL-9300	SIL-9320
15	1000	1700
14	800	1500

13	600	1000
12	500	800
11	400	600
10	300	500
9	250	400
8	200	300
7	150	250
6	120	200
5	100	150
4	70	120
3	60	100
2	50	70
1	40	60

Attention: National regulations regarding radiated power has to be considered, when setting the output power. The user is solely responsible to observe legal restrictions for the radiated power for the combination of reader, cable and antenna.

For example: In countries in which the ETSI standard EN 302 208 is applicable, the permitted radiated power depends on the characteristics of the attached UHF-antenna

Antenna beam width	Permitted max. radiated power according to EN 302208 [W e.r.p.]*
> 180 degrees	0,5
180 – 90 degrees	1
< 90 degrees	2

*** values without engagement, please refer to actual versions of EN 302 208 currently valid limits**

Please refer to chapter 7.4.1 for details on calculating the radiated power.

8.3 Dimensions

An aluminium housing protection type IP 20 (in acc. with DIN EN 60529) is used. This housing is equipped with two lateral covers attached with screws. For mounting the mounting latches can be used.

Dimensions	
Width	185 mm (without connectors 160mm)
Height	131 mm (without flanges 105)
Depths	38 mm

Weight	
Without package	550 g

Environment	
Temperature Range	0 – 50°C
Protective Systems	IP20

9 Delivery Scope & optional Accessories

9.1 Delivery Scope

SIL-93x0 Long-Range system

9.2 Optional Accessories

For the SIL-93x0-MUX8 system a suitable wall plug 24 V =DC power supply as optional accessory is available and contactable to the SIL-93x0-MUX8 over a 2.1-mm standard barrel connector.

9.2.1 Antennas

SAT-A12/12-P-868MHz 120*120 mm circular 5,5 dBi, 100° [order-no.: 400.2018]

SAT-A26/26-LR-P-UHF-cir 260*260 mm circular 9,0 dBi, 70° [order-no.: 400.2626]

9.2.2 Antenna-holders

MOUNT-A12/12-P-UHF [order-no.: 999.0129]

MOUNT-A25/25-LR-P-UHF [order-no.: 999.0467]

9.2.3 Connecting-cables

CABLE-UHF-3m-SMA-N length 3 meters [order-no.: 999.0346]

CABLE-UHF-6m-SMA-N length 6 meters [order-no.: 999.0132]

CABLE-UHF-12m-SMA-N length 12 meters [order-no.: 999.0153]

10 Related Documents

- QuickStart Guide read
  - Short introduction for using the with UniDemo
- Quick guide to STXETX-protocol
  - Short introduction of basic structure of STX-ETX protocol
- STX/ETX Protocol description
  - Detailed Description of command structure and available commands for controlling the with a Host system
- SmartRead Manual
  - Description of functionality for stand alone operation
- SmartManager Manual
  - Description for using the SmartManager to configure a for stand alone operation
- C# Demo with source code
  - Example code for integrating the in your own application software

All documents are available for download on www.stt-rfid.com.

11 Contact *sttID*

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If you have any questions about our products, please do not hesitate to call us. Our specialists are always available for you and will provide professional support to find a solution to your specific problem.

12 History

Rev.	Changed by	Date	Description
0.1	B. Bröhl	22.03.18	– Initial Version
0.2	B. Bröhl	03.04.18	– Chapter 6.4.2 “Calculating radiated power” revised
0.3	B. Bröhl	28.09.18	– Chapter 6.3.1: Table Power steps updated
0.4	B. Bröhl	06.12.18	– Minor corrections and typo edit – adapted to new template