Manual
SIL/SHL-2300(-MUX4/8)

Product name	Version	
SIL/SHL-2300(-MUX4/8)	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 induced 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 13.56 MHz Long Range System SIL/SHL-2300(-MUX4/8), hereafter referred to as "Reader".

The 13.56 MHz Long Range System SIL/SHL-2300(-MUX4/8) 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 Reader is available with single antenna port (SIL-2300) or with integrated antenna multiplexer (SIL-2300-MUX4/8).

Furthermore industrial versions (SHL-2300-MUX4/8) in IP65 housings are available.

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 ISO/IEC 15693-2 and ISO 18000/3 "A" standards.
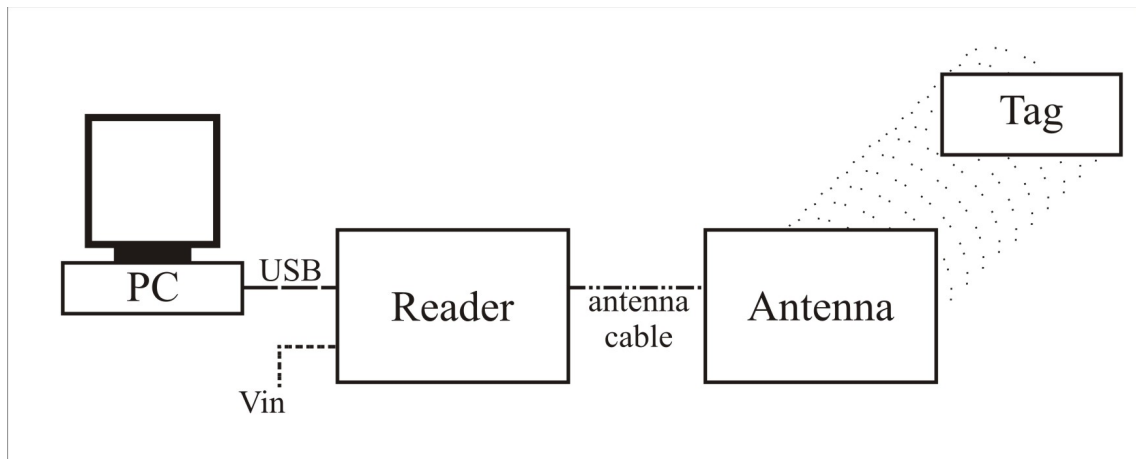
4   Quick Start

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 foreseen mounting equipment (mounting flanges on SIL-2300 versions; mounting kit for SHL-2300 versions) has to be used. Fixing to the wall/ceiling has to be done with appropriate installation material (not in-cluded) using all of the foreseen mounting points.

For safety reasons and to comply with the requirements regarding the regulations of the EN 62368-1 the Reader must be mounted to a wall/ceiling observing the following rules:

- The Reader should not be installed more than 2 m above the ground
- The Reader should be mounted to a wall/ceiling in a way, which guarantees, that the interface-side of the Reader is not directed to the upturned- or top-side. Most likely one of the longer cover-sides without any connectors should be directed upwards.

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 SmartRead 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
- SMan or SmartManager:
    - Utility for configuration and using the Reader in Stand alone mode (SmartRead).
- scemtec STX/ETX .NET Library

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

7.1.1 Single Antenna Port (SIL-2300)

The standard version has a single antenna Port equipped with a BNC antenna connector.

7.1.2 Internal Multiplexer (SIL-2300-MUX4/8)

In this version up to 4 or 8 antennas can be connected to the Reader. The user can select each connected antennas with software commands.

In contrast to the standard version the MUX version is equipped with SMA antenna connectors. For usage with BNC or N connectors, SMA-BNC or SMA-N adapters are available from *sttID*.

Furthermore a special version (SIL-2300-MUX8-ST) with antenna multiplexer and R-SMA connectors is available for connecting *sttID* so called smart tune (ST) antennas. Please conact *sttID* for details about this feature.

7.1.3 Industrial Versions SHL-2300

The above described SIL-2300 devices are also available in an industrial versions, called SHL-2300(-MUX4/8). For these devices the correspondent SIL-2300 version is mounted into a IP65 rated (acc. to EN 60529) steel-sheet enclosure with integrated power supply. Antennas are connectible via BNC connectors.

Note: On SHL-2300-MUX8 only the first 5 Antenna ports are connectible vie BNC connectors. When Antenna ports 6 – 8 has to be used, the antenna cables has to be inserted via the cable glance (marked AUX1) and connected directly to the SIL-2300-MUX8 device inside.

Note: The above mentioned SIL-2300-MUX8-ST variant is not available as SHL version.

7.2 Voltage Supply

7.2.1 SIL-2300 versions

The SIL-2300 versions are designed for a voltage supply connectible via a standard 2.1-mm barrel connector.

Polarity of connector	$-\!\!\bigcirc\!\!\!\!\bullet\!\!\!\!\bigcirc\!\!-\ +$

The Reader may only be connected to a power supply with a minimum output current of 1 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.

7.2.2 SHL-2300 versions

The SHL-2300 versions is designed for a voltage supply direct from the grid connectable via an Schuko plug (two-pin grounded plug).

7.3   Safeguarding, fuse-requirements

Regarding the safety requirements for the SIL/SHL-2300(-MUX4/8) a standard TR5-fuse T1A / 250V (slow blow fuse) is used to protect the complete electronics inside against short circuits or over-current .

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

7.4   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.

7.4.1   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. Configuration can be done via a simple integrated web server, which can be reached by typing the actual IP Address in the address line of browser. After Login, a configuration page for of network settings is available.

Default Login Settings: Username: admin

                               Password: scemtec

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 also be configured by using STX/ETX commands. For details please refer to STX/ETX protocol description.

7.4.2   USB

The Reader is equipped with a USB 2.0 full speed (12 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.

7.4.3   RS 232 Interface

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 also made via the 9 pin SUB D connector. Please contact *sttID* for further Information regarding usage of the second RS232 in your application.

Terminal designation:	SUB-D Connector Pin	Terminal Function
TxD2	8	Transmit Data Secondary RS232
RxD2	7	Receive Data Secondary RS232
GND	5	Ground

Special adapter cables for connecting external devices to the secondary RS232 are available from *sttID*.

7.5   External antenna(s)

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

Some key parameters 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 connected antenna(s) should be configured for the optimal resonance frequency of 13.56MHz with ohmic adjustment (nominal ZF = 50 Ohm) to ensure the best possible system performance.

When using antennas not provided by *sttID*, please make sure that the antenna quality factor is in the range between 20 and 50 and the antenna is optimally tuned. The resulting SWR value should be well below 2.

Antenna tuning should be checked at the final installation. Furthermore antenna detuning caused by heating of the antenna matching unit should also be observed.

For an estimation of the SWR of the attached antenna(s), the Reader incorporates a simple SWR measurement circuits. The value(s) can be read out via STX/ETX commands.

However, the internal SWR measurement provides only limited accuracy and therefore can only give a rough estimation of the actual SWR. It is strongly recommended to additionally use a dedicated SWR measurement tool for antenna tuning and checking.

Furthermore the internal SWR measurement is used to signal antenna tuning errors via the red AUX LED (default function: SWR error). Blinking of the LED means, that the SWR warn-

ing level is exceeded (antenna tuning should be checked), LED on means, that the SWR error level is exceeded (carrier is switched off automatically to avoid damage)[1].

7.6 Inputs and Outputs

7.6.1 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'.

7.6.2 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:
Output 1 (normally open)	O1 no	Contact 1 of the potential-free Output-port 1
	O1 com 1	Contact 2 of the potential-free Output-port 1
Output 2 (normally open)	O2 no	Contact 1 of the potential-free Output-port 2
	O2 com 2	Contact 2 of the potential-free Output-port 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'.

7.6.3 IO connection example

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

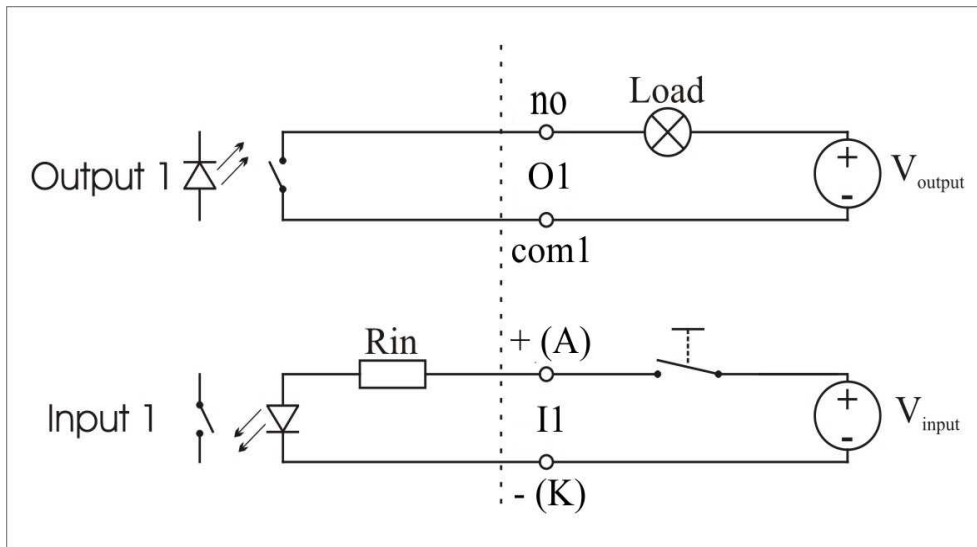1   SWR warning and error level may be changed in the Reader settings (s. STX/ETX command '1011')

figure 2: IO connection example

7.7 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	AUX	User defined (default function: SWR error; LED blinking → SWR warning level exceeded, LED on → SWR error level exceeded

* only present at SIL-2300 versions

7.8 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 (SIL-2300 versions)	—	V_{in}	18	24	30	V
AC input voltage (SHL-2300 Versions)	—	V_{AC}	110	—	240	V AC
Current consumption (SIL-2300 versions)	Carrier on V_{in} = 24 V @ 4.5 W	I_{in}	—	600	850	mA
Current consumption (SIL-2300 versions)	Idle - mode V_{in} = 24 V	I_{in}	—	90	130	mA
Operating frequency	—	f_{RF}	—	13.56	—	MHz
RF power	@ 50 Ohm	P_{RF}	- 1db	4500	+ 1db	mW
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	Ii_{input}	—	11	—	mA
Series resistors binary inputs I1/I2	—	R_{in}	950	1000	1050	Ohm
Output switching voltage binary outputs O1/O2	—	V_{output} (AC/DC)	—	—	60	V AC/DC
Output switching current binary outputs O1/O2	—	I_{output}	—	—	500	mA
Output power dissipation binary outputs O1/O2	—	P_{output}	—	—	800	mW
On resistance binary outputs O1/O2	—	R_{on}	—	0.83	2.5	Ohm
Operating (ambient) temperature range	—	T_{amb}	0	—	50	°C
Storage temperature range	—	T_{stg}	-20	—	70	°C

8.2 RF Power steps

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

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, cable and antenna.

Power step	Output power conducted [mW] @ 50 Ohm load (typical values @ 20° C)
4	4500
3	3000
2	1500
1	750

8.3 Dimensions

Dimensions	SIL-2300	SHL-2300
Length	230 mm	420 mm
Width	130 mm	200 mm
High	38 mm	120 mm
Color	Natural matte aluminium	Blue, RAL5002

Weight	SIL-2300	SHL-2300
Without package	0,7 kg	6 kg

Environment	SIL-2300	SHL-2300
Protective Systems	IP 20 (acc. EN 60529)	IP 65 (acc. EN 60529)

9 Delivery Scope & optional Accessories

9.1 Delivery Scope

SIL-2300 versions:

- Long-Range Reader system

SHL-2300 versions:

- Long-Range Reader system
- Mounting kit

9.2 Optional Accessories

For the SIL/SHL-2300(-MUX4/8) system a suitable wall plug 24 V DC / max. 2000 mA power supply as optional accessory is available.

For connecting *sttID* standard antennas (normally equipped with BNC Connectors) to the MUX versions suitable SMA-BNC adapter cables are available.

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 special-ists 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	M.Radermacher	27.09.16	− Initial Version
0.2	M.Radermacher	24.10.16	− Added Simple Demo under 7.1 "software utilities"
0.3	B. Bröhl	17.04.18	− Minor corrections and typo edit − block diagram revised/MUX added
0.4	B. Bröhl	17.08.2020	− Power steps added − Minor corrections and typo edit − adapted to new template
0.5	B. Bröhl	17.02.2022	− Internal SWR measurement explanation added
0.6	B. Bröhl	02.06.2022	− SHL-2300 versions added
			−