14.6 GPIO Functions

Readers with GPIO functionality[1] offer the possibility to set up small controls which trigger the reader, for instance by means of a light barrier, or which trigger an action at the outputs of the reader by reading specific tags. Such an action can switch an output to control the flow of goods.

The GPIO tab allows the reader to interact with its environment. The GPIO function tab allows the user to manually read or switch inputs and outputs of the respective application. For more complex procedures, it is possible to create action lists which execute a sequence of commands on the reader. This list can then be linked to various inputs.
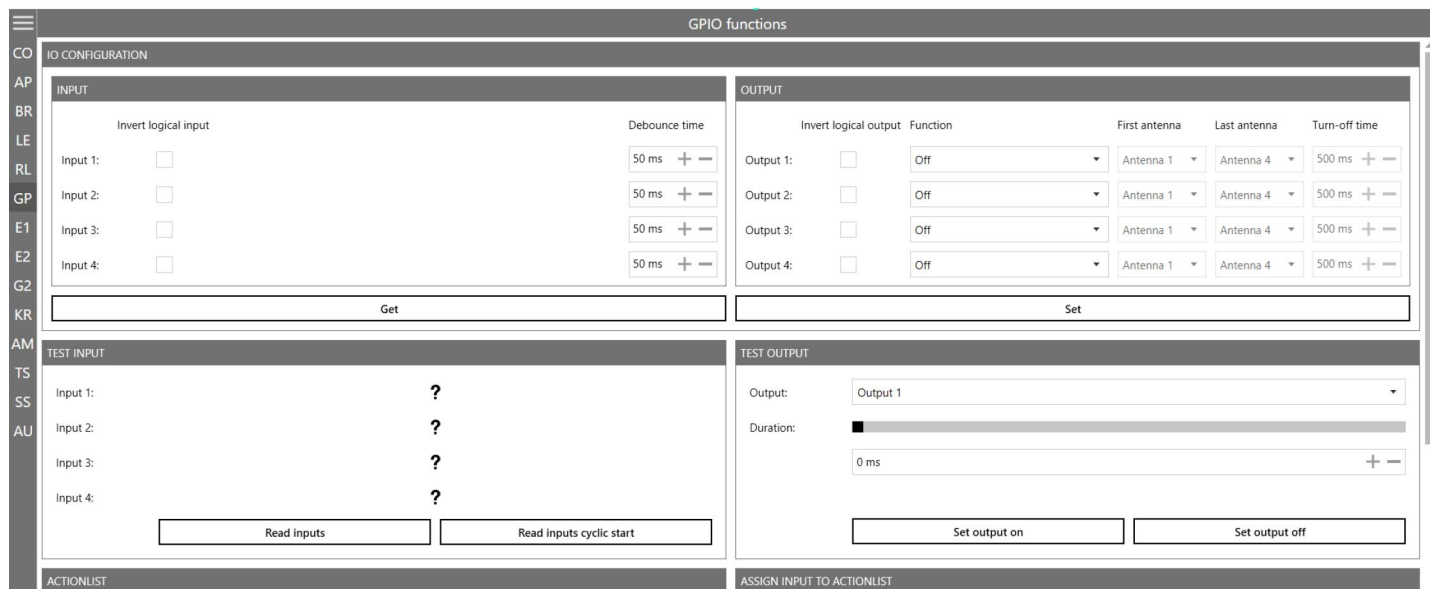

Fig. 51: GPIO

The GPIO tab is divided into 3 sections, *IO Configuration*, consisting of *Input* and *Output*, *Test Input* and *Test Output*, *Action List* and *Assign Input to Action List* which are described in the following chapters.
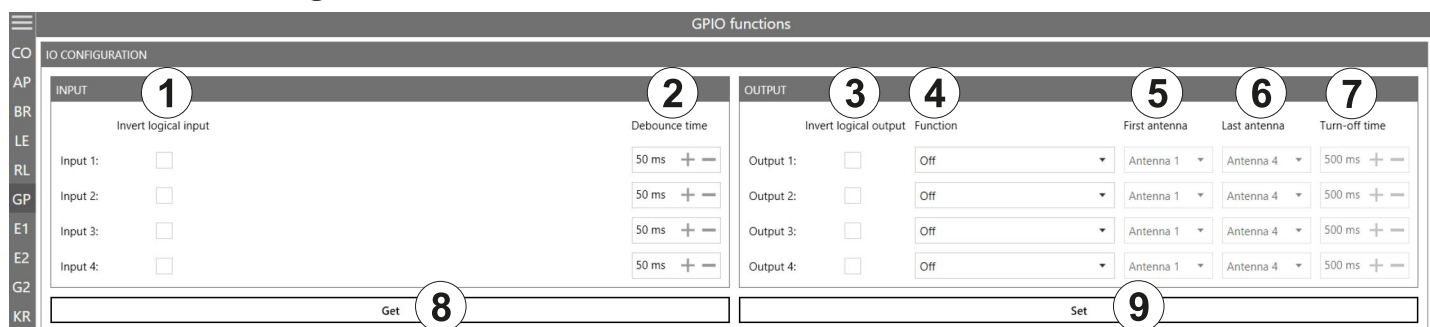
14.6.1 IO Configuration

Fig. 52: GPIO: IO Configuration

①	*Invert logical input*	negates the electrical input signal and uses this state for processing in the reader; if the parameter is not checked, the signal is used
②	*Debounce time*	assigns a debounce time in milliseconds to each channel depending on the sensor being used (mechanical or electrical switch)
③	*Invert logical output*	negates the electrical output signal
④	*Function*	selects between the functions described in *Selecting Functions, p. 87*
⑤	*First antenna*	the first antenna for the selected function

[1] All Generation 3 readers have GPIO.

⑥	*Last antenna*	the last antenna for the selected function
⑦	*Turn-off time*	sets the time for how long the output is on for the *Tag found* and *Tag operation successful* function
⑧	*Get*	reads the current IO configuration settings
⑨	*Set*	sets the output settings

14.6.2 Test Input and Output
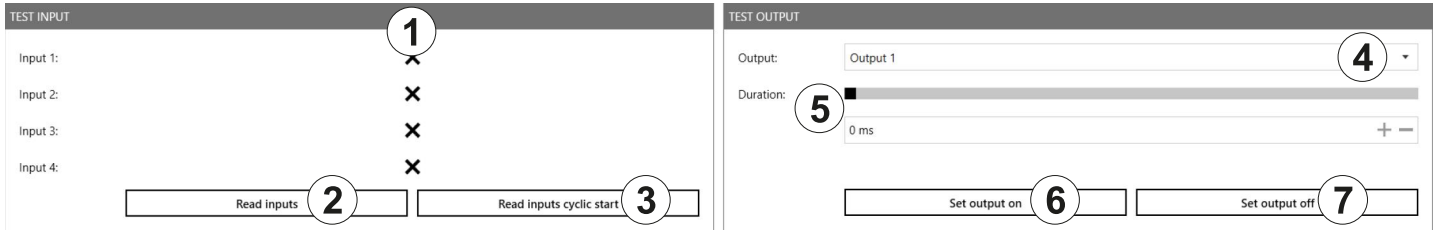

Fig. 53:   GPIO: Test Input and Test Output

Test Input

Each input channel has two configuration parameters available:

①	*Input 1–4*	shows logical input 1–4; will only be shown if *Invert logical input* for the respective input has been checked at *IO Configuration* (① in *Fig. 52, p. 89*)
②	*Read inputs*	reads the inputs once
③	*Read inputs cyclic start/stop*	reads the inputs in a loop/stops the reading

Test Output

④	*Output*	selects output 1–4 by means of the drop-down menu ▶ In order to use this function, select the *Protocol access* function for the respective output (see *IO Configuration, p. 89* and *Selecting Functions, p. 87*).
⑤	*Duration*	sets time in ms after which the output automatically returns to its idle mode either by moving the bar or by entering the value If the duration is set to its maximum value (65535), the output is permanently on.
⑥	*Set output on*	switches on the output
⑦	*Set output off*	switches off the output

14.6.3 Action List and Assign Input to Action List

To automate the processes, it is possible to store command sequences on the reader in the form of action lists. These are triggered by a change of edge at the selected input.
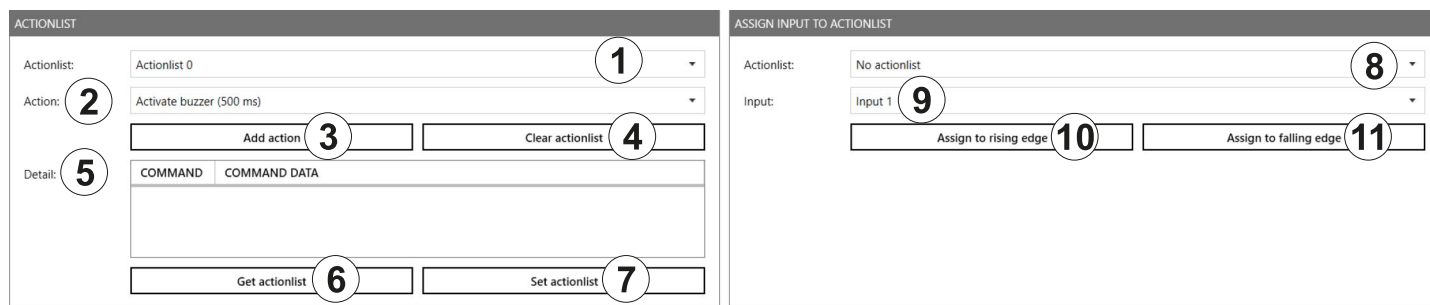

Fig. 54: GPIO: Action List and Assign Input to Action List

Action List

Each input channel has two configuration parameters available:

①	*Action list*	selects an action list (0–127) from the drop-down menu to save the action in
②	*Action*	selects an action from the drop-down menu, e.g. **Activate buzzer (500 ms), SyncGetEPCs, ASyncGetEPCs, ASyncStopCommand**; see also *Adding Actions to the Programme, p. 92* ► To see the commands contained in the current action list, type in %userprofile%\Documents\KATH-REIN Solutions GmbH\ReaderStart v3 into the Windows search field.
③	*Add action*	adds action; the action is shown under *Details* (⑤)
④	*Clear action list*	deletes actions; no actions are seen under *Details* (⑤) **Tip** **To remove only one action from the list:** 1. Select an action from the list shown under *Details.* 1. Right-click on the selected action. ⇨ The pop-up message *Remove entry* appears. 2. Click on *Remove entry* to delete the action. ⇨ The action is deleted from the list.
⑤	*Details*	shows added actions in the chronological order as they have been selected
⑥	*Get action list*	shows the current action list
⑦	*Set action list*	saves the set action list (flashes blue after having added an action to the *Details* (⑤)

Assign Input to Action List

⑧	*Action list*	selects an action list (0–127) from the drop-down menu to assign to the input in (⑨)
⑨	*Input*	assigns the action list to input 1–4 from the drop-down menu
⑩	*Assign to rising edge*	assigns the action list to the rising edge
⑪	*Assign to falling edge*	assigns the action list to the falling edge

> **Tip** ► If you would like to assign the action list to both the rising and the falling edge, click *Assign to rising edge* and then *Assign to falling edge*.
>
> To cancel the assignment:
>
> ► Restart/reset the reader or select *No action list* under *Action list* (⑧).

Adding Actions to the Programme

The action lists consist of a sequence of individual actions which can be loaded in the form of an XML file in the *Action* context menu:
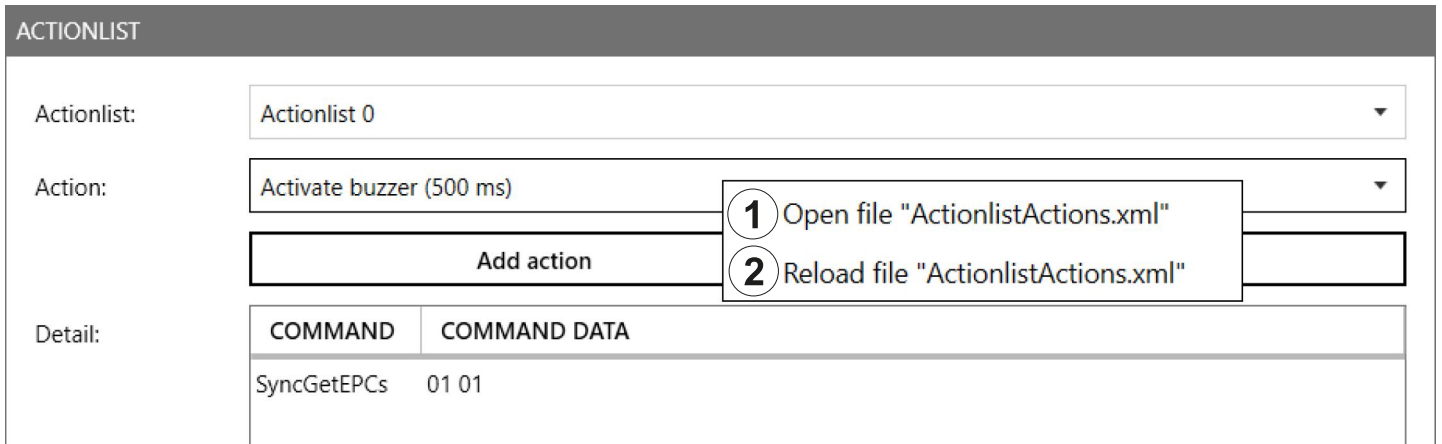

Fig. 55: GPIO: action list, action context menu

①	*Open file "ActionlistActions.xml"*	opens the actions list in the XML format in a text editor
②	*Reload file "ActionlistActions.xml"*	reloads the action list; it is necessary to reload the action list after a new action has been added to the XML file containing the actions or some changes have been made in it

The ReaderStart creates a directory in which the system variables are stored in the folder %userprofile%\Documents\KATHREIN Solutions GmbH\ReaderStart v3. It is possible to edit the ActionlistActions.xml file manually using a text editor.

► To see the individual actions, refer to the *Configuration Protocol*.

The approximately 150 reader commands with corresponding variance of the parameters do not allow for a uniform list. A selection of all options is extensive. Therefore, it is recommended to only list commands required in the application.

The following example demonstrates the syntax of the actions:

```
<ActionlistActions>
        <!--Activate buzzer for 500 ms, CommandID: 0x0045, Parameter: 0x01F4-->
        <Action>
                <Description>Activate buzzer (500 ms)</Description>
                <CommandID>0045</CommandID>
                <!--LSB first-->
                <Parameter>F4</Parameter>
                <Parameter>01</Parameter>
        </Action>
```

```
<!--Get EPCs, CommandID: 0x0101-->
<Action>
            <Description>Get EPCs</Description>
            <CommandID>0101</CommandID>
            <!--LSB first-->
</Action>
</ActionlistActions>
```

The example above shows the *Activate buzzer 500 ms* and *Get EPCs* actions.

14.7   Expert Settings 1

The ReaderStart software is a powerful tool for the reader configuration. It allows the reader to be customised to any application. The *Expert settings 1* and *2* allow the reader's RF interface and communications profile to be optimised to the tag so that the reader is optimally customised to the application.

There are eight parameter sets available for saving the reader configuration. It is possible to save all settings for the transmission power, the antenna multiplex configuration, the RF settings and the air interface parameters.

Other parameters can be changed in *Expert settings 2*.

► For more information about the individual parameters, refer to *Reader Configuration Manual for Kathrein RFID UHF Readers*.

Fig. 56:   Expert settings 1

①	*Parameter Set*	selects a parameter set
②	*Get*	reads the current settings of the selected parameter set in the system
③	*Set*	sets the parameters
④	*Enabled*	activates/deactivates the possibility to make changes in the port
⑤	*Power*	changes the power on the port (ERP)
⑥	*dBm/W*	switches between *dBm* and *W*
⑦	*Port power*	shows the selected power on the port
⑧	*Cable attenuation*	selects cable attenuation in the range between 0 and 63.75 dB

⑨	*Antenna type*	selects the antenna type between pre-defined and custom antennas If the pre-defined antenna is selected, the programme sets the antenna gain to the maximum value permitted for this antenna. If **Custom antenna** is selected, it is possible to freely set the gain and power.
⑩	*Gain*	selects the antenna gain between –32.00 dBiC and 31.75 dBiC
⑪	*ERP/EIRP*	switches between **ERP** and **EIRP**
⑫	*Port*	selects the antenna port or deactivates it If the antenna is not activated, the system proceeds to the next antenna in the **Port Multiplex Configuration**. ► For more details, refer to the Chapter MultiplexingAntennaport1...8 in the *Reader Configuration Manual*.
⑬	*Exposure time*	specifies the exposure time on the antenna; only used for asynchronous operation ► For more details, refer to the Chapter MultiplexingExposureTime1...8 in the *Reader Configuration Manual*.
⑭	*Communication Standard*	selects a country-specific communication standard; the device version determines which communication standard is permitted
⑮	*Communication Profile*	selects the profile for the data rate and read reliability This option allows the technician to directly influence the performance of the reader and the spectrum of the signal. The profile names contain basic orientation on the transmission and reception data rates.
⑯	*Available channels* (only available for ETSI-readers)	selects the channel for the reader to use Depending on the region, the reader transmits in the frequency range 865–868 MHz for Europe or 902–928 MHz for USA/Canada. In Europe, the number of channels to be used can be limited. For this reason, it is necessary to check the related check box for each channel the reader is to use. This way, it is possible to avoid using specific channels on which there is interference.
⑰	*Initial Q*	reflects the number of tags expected in the field; see also Chapter InitialQ in **Reader Configuration Manual**
⑱	*Sel*	specifies whether other parameters are of interest for an inventory of the tag population or not; see also Chapter QuerySel in *Configuration Manual for Kathrein RFID UHF Readers*
⑲	*Session*	sets which session the reader is to work with; see also Chapter Sessions in **Reader Configuration Manual**
⑳	*Target*	specifies which tags in the population should take part in the inventory; see also Chapter QueryTarget in *Configuration Manual for Kathrein RFID UHF Readers*

> **!** To operate the reader in accordance with the related national standards, it is necessary to take into account the antenna gain and the cable attenuation in the transmission power setting.
>
> ► Do not exceed the permitted transmission power. Failure to observe this instruction can result in non-compliant operation of the reader leading the termination of the type approval.

14.7.1   Port Power

In Europe, the radiated power is limited in accordance with ETSI 302208 to 2 W ERP. In the FCC/IC region, max. 1 W connected RF power applies with an antenna gain of 6 dBi. If the antenna gain is greater than 6 dBi, it is necessary to reduce the RF power accordingly. While the European standard refers to a half-wave dipole, FCC part 15/RSS 210 refers to an isotropic radiator.

To set the port power, it is necessary to include the length-dependent cable attenuation and the antenna gain into the calculation of the port power. An example for the calculation of the port power for Europe and FCC/IC is given below.

The following applies to the European approval region:

$P_{port} = P_{ERP} + D_{cable} - G_{HW}$,

where P_{port} is the port power of the reader in dBm; P_{ERP} is the port power based on a half-wave dipole in dBm; D_{cable} is the cable attenuation in dB; G_{HW} is the antenna gain based on a half-wave dipole.

The cable attenuation is the length-dependent attenuation of the cable at the related frequency:

$D_{cable} = l * D_{dB/m}$,

where D_{cable} is the cable attenuation in dB; l is the length in m; $D_{dB/m}$ is the attenuation in dB/m at frequency.

The antenna gain is stated in various different units. These units include dBi and dBic. The units dBi and dBic refer to an isotropic (spherical) radiator, where dBic refers to a circularly polarised isotropic radiator and dBi to a linearly polarised isotropic radiator.

In the European approval area, the radiated power must not exceed 2 W ERP. This figure refers to a half-wave dipole. The relationship shown below exists between an isotropic radiator (dBi) and a half-wave dipole.

$G_{HW} = G_{isot} - 2.14$ dB,

where G_{HW} is gain-based on a half-wave dipole and G_{isot} is gain-based on an isotropic radiator in dBi

If the gain of the antenna is referred to the polarisation of a circular isotropic antenna (dBic), the linear gain of the antenna is 3 dB lower. As a result ,the port power can be increased by 3 dB.

$G_{HW} = G_{isot} - 2.14$ dB $- 3$dB,

where G_{HW} is gain-based on a half-wave dipole and G_{isot} is gain-based on an isotropic radiator in dBi

In the FCC/IC approval region, the RF power connected at the antenna input must not exceed 1 W. If the gain of the antenna is higher than 6 dBi, it is necessary to reduce the RF power correspondingly. The reader's port power is then:

$P_{port} = P_{cond} + D_{Kabel}$ with $P_{cond} \le 1$W and $G_{isot} \le 6$dB,

where P_{port} is the port power of the reader in dBm; P_{cond} is the power on antenna output in dBm; D_{cable} is the cable attenuation in dBm; G_{HW} is the antenna gain in dBi.

If the antenna gain is stated in dBic, the reader's transmission power can be increased by 3 dB.

The port power for the European variant can be set in 0.25-dB steps from 6 dBm to 33 dBm.

14.8   Expert Settings 2

The Expert settings 2 tab is divided into four sections for further configuration of the reader. In this tab, it is possible, for example, to change the default parameter set, copy one parameter set into another, read reader parameters to determine their ID and configure *Select Filter Settings*.
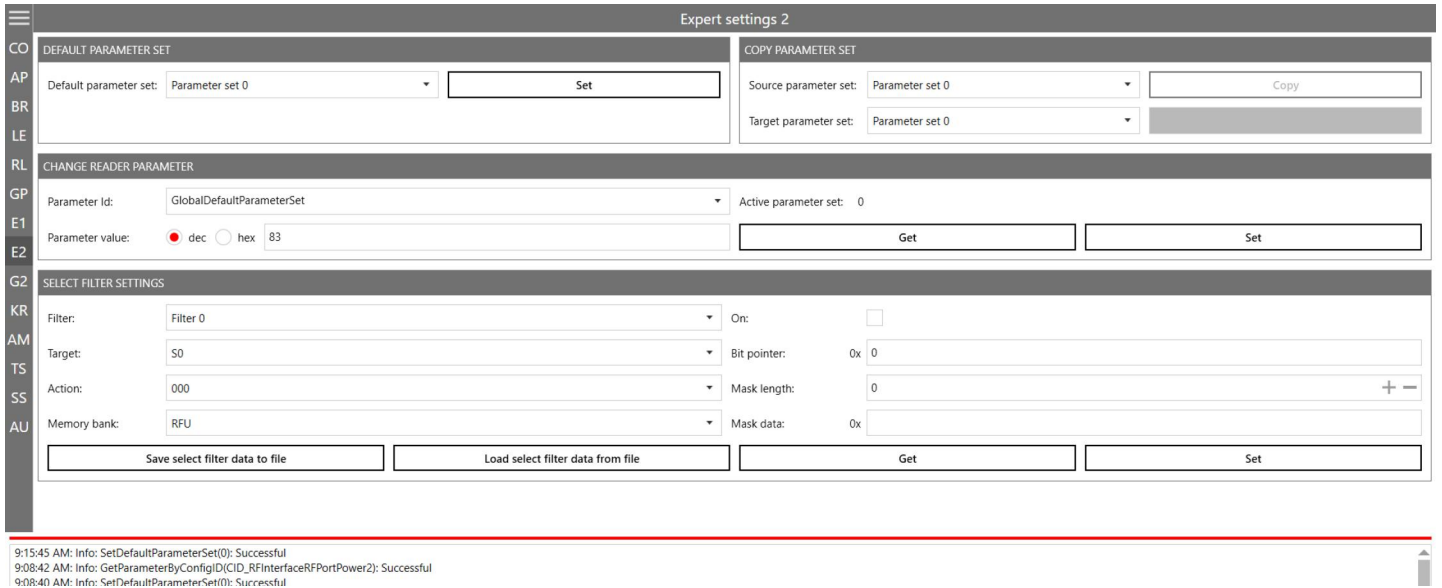

Fig. 57:   Expert settings 2

14.8.1   Default Parameter Set

The *Default parameter set* allows configuration of the parameter set that is loaded from the Flash into the RAM when the reader is started.
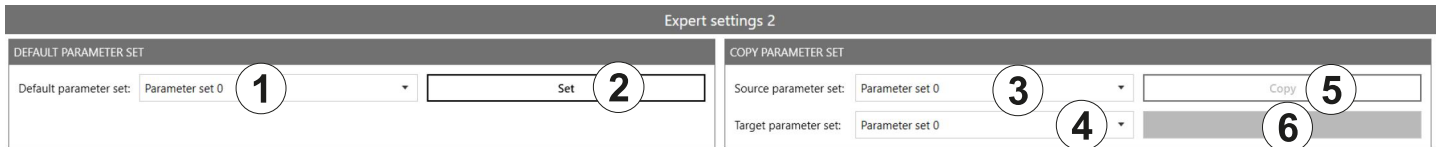
Fig. 58:   Expert settings 2: default parameter set and copy parameter set

①	*Default Parameter Set*	selects a default parameter set
②	*Set*	sets the selected default parameter set in the reader

14.8.2   Copy Parameter Set

The *Copy parameter set* allows one parameter set to be copied into another.

③	*Source parameter set*	selects the parameter set to be copied
④	*Target parameter set*	selects the parameter set into which the source parameter set is to be copied

⑤	*Copy*	copies the parameter set
		
		► Click *Copy*.
		    ⇨ On successful completion of the copy operation, the *Copy* button briefly glows green and a corresponding message is displayed in the status field.
		    ⇨ If there is an error, the *Copy* button glows red, an error pop-up message appears and a warning is shown in the status field.

⑥		shows the progress of the copying process

14.8.3 Change Reader Parameter

Change reader parameter allows to change all reader settings using their respective configuration IDs.

Fig. 59:   Expert settings 2: change reader parameter

①	*Parameter ID*	selects the parameter ID
②	*Parameter value*	shows or sets the parameter value The value is either decimal or hexadecimal, it is possible to switch between *dec* and *hex*.
③	*Active parameter set*	shows the current active parameter set
④	*Get*	reads the value of the current parameter set of the reader and shows it at ②
⑤	*Set*	writes the parameter value (②) into the selected parameter ID (①)

14.8.4 Select Filter Settings

By means of these settings, it is possible to filter certain tags, e.g. to only read tags with the defined data in the respective memory banks. It is possible to set up to 32 filters.

Fig. 60:   Expert settings 2: select filter settings

①	*Filter*	selects a filter
②	*Target*	selects the tag target session ► Make sure the target matches the session set in ⑲ *Fig. 57, p. 96*.
③	*Action*	selects the action; see also *EPCglobal Gen 2 Specification* (p. 73) Tip ► To see the description of an action, hover over the *Action* field. ⇨ The description of the action appears in the tooltip:
④	*Memory bank*	selects the memory bank (*RFU/EPC/TID/User*)
⑤	*Save select filter data to file*	saves the select filter data to file
⑥	*Load select filter data to file*	loads the select filter data from file
⑦	*On*	activates or deactivates the select filter
⑧	*Bit pointer*	sets from which memory address the filter compares the mask data
⑨	*Mask length*	sets the mask length (0–255)

⑩	*Mask data*	sets the data to be filtered
⑪	*Get*	reads the data of the filter selected at ①
⑫	*Set*	sets the select filter

> **Tip** In Generation 3 readers, select filter data are permanently stored in the reader, e.g. if the select filter has been activated, it is active after a reader restart.

14.8.5 Applying a Select Filter (Example)

You have the following results of the basic reading but you would like only the tags with the *FC28* in the memory address to take part in the inventory:

Fig. 61:   Basic reading: select filter required

To do so, it is necessary to create a select filter. The advantage of this process is that the filtering takes place already at the air interface level.

To create the select filter as shown in the figure below:

1. Select the filter you would like to save the filtering settings to under *Filter* (①).
2. Select the target (②). Make sure the target matches the session set in ⑲ *Fig. 57, p. 96*.
3. Select an action (③). In the example, the action is set to *100*; see also *EPCglobal Gen 2 Specification*.
4. Select the *EPC* memory bank (④).
5. Activate the select filter (⑤).
6. Refer to the *EPCglobal Gen 2 Specification* to check from which bit pointer the filter will search for the value according to which you would like to filter the tags (*FC28* in the example); see pp. 44–46 in the *EPCglobal Gen 2 Specification V 2.0.*1. In the example, *FC28* is the third word in the EPC memory bank (bit pointer 0x00 is the CRC, bit pointer 0x10 is the PC, bit pointer 0x20 is the first EPC word). Therefore, *FC28* corresponds to the bit pointer 0x40.
7. Enter *40* at *Bit pointer* (⑥).
8. Enter the mask length at ⑦. In the example, *FC28* is one word, therefore, the value is *16*.
9. Enter the value (*FC28*) at ⑧.
10. Click *Set* (⑨).
11. Go to *Expert settings 1*.
12. In Selection Parameters, set the value at target to *B*; see also *EPCglobal Gen 2 Specification*.
13. Start the reading in the *Basic reading* tab:

⇨ The reader only reads the tags with the filtered value (marked green). The tag without the filtered value is not read (marked red).

14.9 Test Gen 2 Functions

This tab makes it possible to access individual tag functions. In addition to the functionality in accordance with the EPC Gen2 standard, it is possible, for example, to read and write tags as well as set and change tag passwords.

The user interface consists of the fields *Get all Tags*, *Password for Operation*, *Write EPC*, *Read data*, *Write data*, *Change Password*, *Lock* and *Kill* that are described in the following chapters.

Fig. 62:   Test Gen2 functions

14.9.1 Get All Tags

Fig. 63:   Test Gen2 functions: Get all EPCs

①	*Refresh*	updates the tags read in the field ▶ For EPC-specific operations, click on a tag to select it from the list.

②	Info	shows the information about the tag manufacturer and the chip type
		
		► Click on the information symbol.
		    ⇨ The information about the tag is shown:
		
		3034 F792 FC1A 31C0 0000 047F
		  Manufacturer: Impinj
		  Type: Monza R6
		3034 F792 FC28 1B00 001B CE7A
		  Manufacturer: NXP
		  Type: UCODE 7 SL3S1204
		3034 F792 FC28 1B00 001B CE7C

14.9.2 Password for Operation

PASSWORD FOR OPERATION

Password: 0x 0 **①**

Fig. 64: TestGen2: password for operation

①	*Password*	sets the password for the tag operation in the hexadecimal format

14.9.3 Write EPC

In this tab, it is possible to change the EPC of the tag.

WRITE EPC

New EPC: 0x **①**   Write EPC to selected tag **③**

Auto increment: ☐ **②**   **④** Write EPC to tag in field
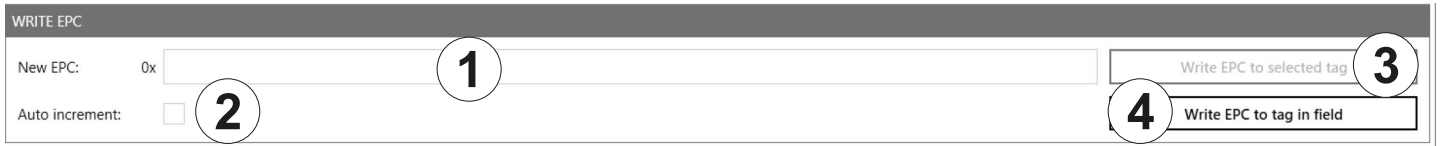
Fig. 65: TestGen2: write EPC

①	*New EPC*	enters an EPC in the hexadecimal format **!** Make sure to comply with the maximum EPC length supported by the tag. If the maximum length is exceeded, the tag will return an error.
②	*Auto increment*	activates or deactivates increasing the EPC by one with each successful writing process
③	*Write EPC to selected tag*	writes the EPC on the selected tag
④	*Write EPC to tag in field*	writes the EPC entered in 1 to a single tag ► When using this command, make sure there is only one tag in the field. Otherwise, an error message is displayed in the status field.

14.9.4   Read Data

This group supplies detailed access to all the data areas of the tag. Access is obtained by entering the selected memory bank, the address within the memory bank and the number of words.

Fig. 66:   TestGen2: read data

①	*Memory bank*	enters the selected memory bank
②	*Memory address*	enters the address within the memory bank
③	*Word count*	enters the number of words to read
④	*Data (UTF8)*	shows the data in the UTF8 format
⑤	*Data (ISO 17367)*	shows the data in the ISO 17367 format
⑥	*Read data of selected tag*	reads data from the selected tag
⑦	*Read complete memory bank of selected tag*	reads the complete memory bank of the selected tag; up to 255 words
⑧	*Read data of all tags*	reads data from all tags in the field **!** If the tags in the field have different passwords and are configured differently, it is necessary to read the data from each tag individually.
⑨	*Read complete memory bank of all tags*	reads the complete memory bank of all tags in the field; up to 255 words

14.9.5 Write Data

Fig. 67:   TestGen2: write data

①	*Memory bank*	enters the selected memory bank
②	*Memory address*	enters the address within the memory bank
③	*Data*	enters data to write in the hexadecimal format
④	*Data (UTF8)*	enters data to write in the UTF8 format
⑤	*Data mask*	enters the data mask The data mask allows only individual bits on the tag to be changed.
⑥	*Write data to selected tag*	writes data to the selected tag in the field
⑦	*Write masked data to selected tag*	writes the masked data to the selected tag
⑧	*Write data to all tags*	write data to all tags in the field ❗ ▸ If the data are written to all tags in the field, make sure all the tags have the same configuration (lock and password).
⑨	*Write masked data to all tags*	writes the masked data to the all tags in the field

14.9.6 Change Password

To change the password, enter the current password at ① in *Fig. 64, p. 100*. If no password has yet been set, the default value is 0.

Fig. 68:   TestGen2: change password

①	*New password*	sets the new password in the hexadecimal format for the selected tag
②	*New kill password*	sets the new password to deactivate the selected tag
③	*Set password on selected tag*	replaces the old password by the new password for the selected tag
④	*Set kill password on selected tag*	replaces the old deactivation password by the new deactivation password for the selected tag

14.9.7 Lock

The *EPC Gen2* standard provides security mechanisms for the tag data areas. This allows individual memory areas and functionalities of the tags to be provided with a password to protect it against access and/or changes.

Under *Lock*, it is possible to lock the memory banks.

Fig. 69: TestGen2: Lock

①	Kill password	specifies how the kill password is accessible ► Select one of the following options from the drop-down menu:

	No change	the current setting for the kill password remains unchanged
	Accessible	the kill password is readable and writeable from either the open or secured state
	Accessible with permalock	the kill password is permanently readable and writeable from either the open or secured states and may never be locked
	Accessible with password	the kill password is readable and writeable from the secured state but not from the open state
	Not accessible with permalock	the kill password is not readable or writeable from any state

► For more details, see *EPCGlobal Gen2 Specification*.

②	Access password	specifies how the access password is accessible ► Select an option from the drop-down menu; see the options at ①. ► For more details, see *EPCGlobal Gen2 Specification*.

③	EPC memory bank	specifies how the EPC memory bank is accessible ► Select one of the following options from the drop-down menu:

	No change	the EPC memory remains unchanged
	Writeable	the EPC memory bank is writeable from either the open or secured states
	Writeable with permalock	the EPC memory bank is writeable from either the open or secured states and may never be locked
	Writeable with password	the EPC memory bank is writeable from the secured state but not from the open state
	Not writable with permalock	the EPC memory bank is not writeable from any state

④	TID memory bank	specifies how the TID memory bank is accessible ► Select an option from the drop-down menu; see the options at ③.
⑤	User memory bank	specifies how the User memory bank is accessible ► Select an option from the drop-down menu; see the options at ③.
⑥	Lock selected tag	locks the selected tag with the settings from ①–⑤

		locks all the tags with the settings from ①–⑤
⑦	*Lock all tags*	❗ ► To lock all the tags, make sure that all the tags have the same password.

14.9.8   Kill

❗ ► To deactivate a tag, set a deactivation password that is not 0; see ② in *Fig. 68, p. 103*.

After a kill command, the tag will be unusable!

Fig. 70:   TestGen2: kill

①	*Kill selected tag*	executes a kill command on the selected tag
②	*Kill all tags*	executes a kill command on all tags in the field

14.10   @KRAI

This tab allows changing KRAI-specific settings. The *@KRAI* tab is divided into several sections. *Port* and *Port Info* are always available, other sections depend on the antenna connected to the reader, e.g. *Polarisation, Direction* etc.

The Reader recognises the connected antennas at boot up, but it is also possible to manually recognise a single port or all ports under *Port*. *Port Info* displays the information about the antenna.
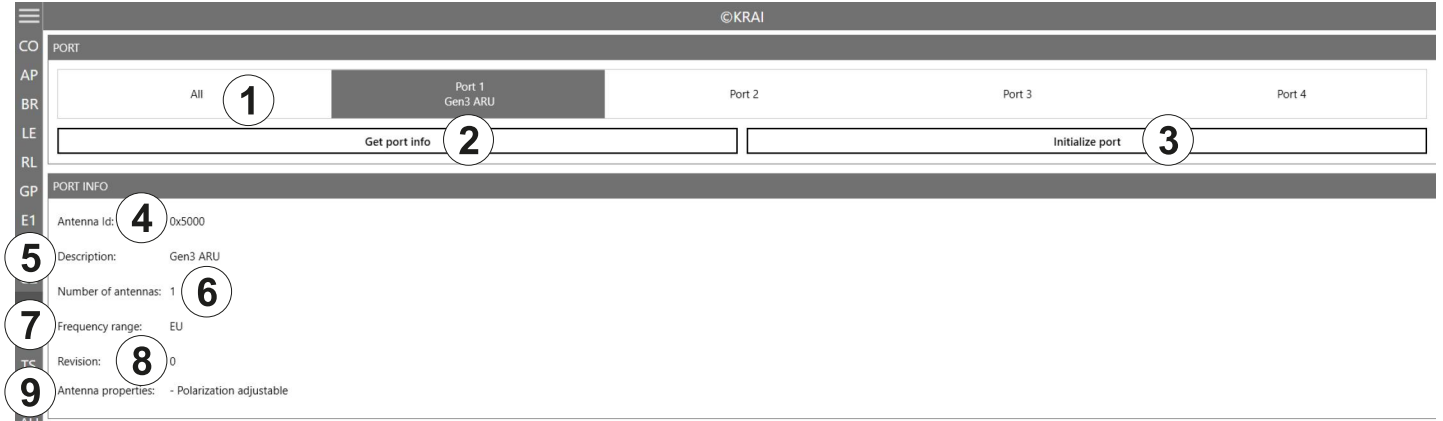

Fig. 71:   @KRAI: polarisation

①	*All/Port 1–4*	selects either one or all antennas for *Initialise port* (③)
②	*Get port info*	retrieves port information for a selected @KRAI antenna
③	*Initialise port*	runs a query of the antennas on this port/these ports
④	*Antenna Id*	shows the antenna ID
⑤	*Description*	shows the description of the antenna
⑥	*Number of antennas*	shows the number of the antennas connected to the port
⑦	*Frequency range*	shows the frequency range the antenna operates in (*Global/EU/FCC*)
⑧	*Revision*	shows the hardware version of the antenna
⑨	*Antenna properties*	shows antenna properties, e.g. *polarisation adjustable, LEDs available*

Different configuration options are displayed, depending on the types of the connected antennas. The category *Polarisation* is shown for antennas with polarisation switching, the *Jumper Cable Attenuation* is available for smart shelf antennas, e.g. SMSH-30-30KRAI, *LED* is shown for @KRAI WIRA 70 and *Direction* for CSB KRAI antennas, e.g. WiRa 30°.
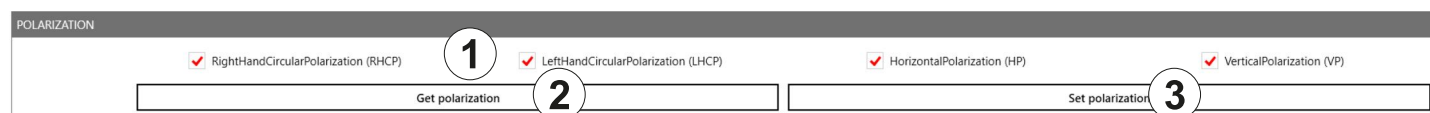
14.10.1 Polarisation

Fig. 72: @KRAI: polarisation

①		sets the polarisation of the antenna If there are several types of polarisation selected at the same time, the antenna configuration changes after every inventory.
②	*Get polarisation*	reads the current polarisation information of the antenna
③	*Set polarisation*	sets the polarisation on the antenna

14.10.2 LED

Depending on the features that are integrated in the antennas, it is possible to control/configure the LEDs.
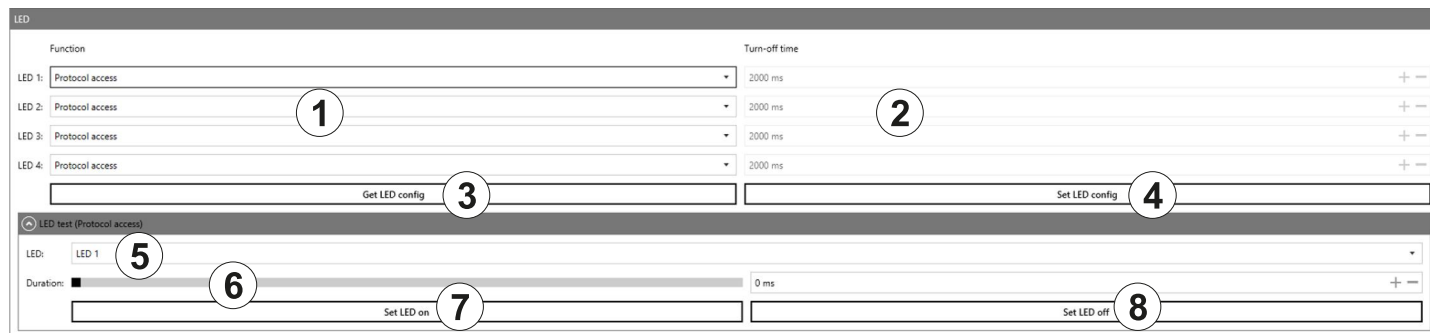

Fig. 73: @KRAI: LED

|		
①	*LED 1–4*	selects the function of the LED 1–4 ► For functions, see Chapter *Selecting Functions, p. 87*
②	*Turn-off time*	sets the turn-off time for LED
③	*Get LED config*	shows the current LED configuration
④	*Set LED config*	sets the new LED configuration
⑤	*LED*	selects between LED 1–4
⑥	*Duration*	sets the duration of how long the LED is on; only if protocol access is selected in ①
⑦	*Set LED on*	switches the LED on for the duration in milliseconds selected in ⑥; if the duration is set to 65535 ms, the LED is permanently on
⑧	*Set LED off*	switches off the selected LED

14.10.3 Jumper Cable Attenuation
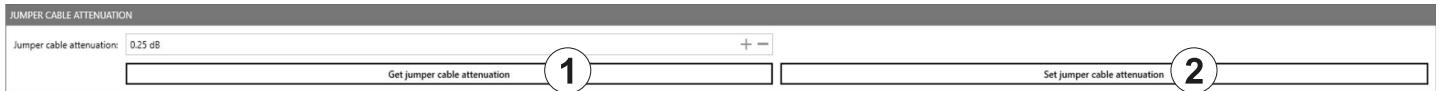
Fig. 74: @KRAI: jumper cable attenuation

①	*Get jumper cable attenuation*	reads the current jumper cable attenuation
②	*Set jumper cable attenuation*	sets the jumper cable attenuation

> ❗ For cascading smart shelf antennas, it is necessary to use cables with the same attenuation (cable length). Otherwise, the TX power of the antennas that is derived from the jumper cable attenuation is not calculated correctly.

14.10.4 Direction

Fig. 75: @KRAI: direction

①	*Left/Centre/ Right*	sets the direction of the antenna If there are several types of direction selected at the same time, the antenna configuration changes after every inventory.
②	*Get direction*	reads the antenna direction(s) currently set in the antenna
③	*Set direction*	sets the selected direction(s) in the antenna

14.11 AppManager

> **!** This chapter gives a short overview of the apps, the requirements to operate them and the installation instructions.
> ► For more information on how to operate an app, refer to the user guide for the corresponding app.

14.11.1 Currently Available Apps

AccessManager

Automated vehicle identification (AVI) is one of the key markets that Kathrein Solutions is focusing on. AVI includes free flow identification, plaza and parking applications. For parking applications, Kathrein provides a specially configured software for access control called *AccessManager*.

The RRU 4xxx and ARU 3xxx series readers have a built-in industrial controller with Linux operating system. The entire application can be installed and configured directly on the reader. The system can be operated as an isolated solution without a network connection or alternatively via remote access over the network for configuration purposes or for database adaptations.

The *AccessManager* application software allows user-guided input and configuration of the transponder data that is to be captured. No programming knowledge is required in this case.

Flexible and efficient detection (e.g. of vehicles) is assured on the basis of the four digital inputs provided in Kathrein RFID systems which can be used for activation. A start point can be defined for the application in this way, whereby a light barrier or inductive ground contact is queried in order to activate the reading process.

Skidata

The Skidata app is a software-based solution that provides simple and easy interface integration of Kathrein RFID readers with Ethernet in the latest generation of Skidata barrier systems. With the Skidata app, the reader will become an officially certified SKIDATA compatible product.

Low Level Reader Protocol

Kathrein RFID readers are available with an optional LLRP (Low Level Reader Protocol) stack installable as an LLRP app. All readers with an integrated embedded Linux OS can be controlled via LLRP 1.0.1 port 5084 for easier integration. To specify air interface commands between readers and clients, LLRP is a ratified standard protocol from EPCglobal.

Profinet IO

The Profinet IO app allows the integration of a reader into a Profinet IO environment; the reader acts as an IO device. To run the app, a valid licence key is needed. Licence keys (either a full licence or a time limited demo licence) are bound to the specific reader the app is running on. For obtaining a licence key, the hardware key provided by the app is needed.

TagBlower

The TagBlower app can read tags asynchronously and generate messages,when a tag is coming or going. The app provides a server on a configurable port, where TCP clients can connect to receive those messages. The message format can be specified by the user by setting a coming and/or going datagram. A datagram consists of normal text and keywords.

14.11.2   Installing an App

> ❗ This chapter describes installing an app shown on the example of *AccessManager*. You can install all other apps following the instructions described below.

✓ The *ReaderStart* software is installed.
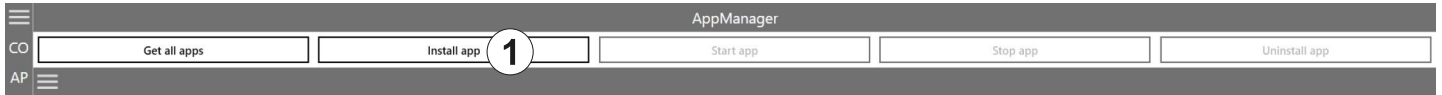
✓ The reader is connected to a PC.

Fig. 76:   AppManager: installing an app

1. Go to https://www.kathrein-solutions.com/products/software/interface-software/accessmanager.
2. Downoad the app.
3. If the downloaded app is in the zip format, extract a .tar file. Make sure not to extract the .tar file!
4. Start the *ReaderStart* software.
5. Go to the *AppManager* tab.
6. Click on *Install app* (①).
    ⇨ A pop-up window to select the file with the app opens.
7. Select the file with the app. Make sure it is the .tar file.
8. Click Open.
    ⇨ A pop-up message with the progress bar for the installation process appears for the duration of the installation .
    After the app has been successfully installed, the corresponding message is displayed in the status field and the app interface is shown in the *AppManager* tab:
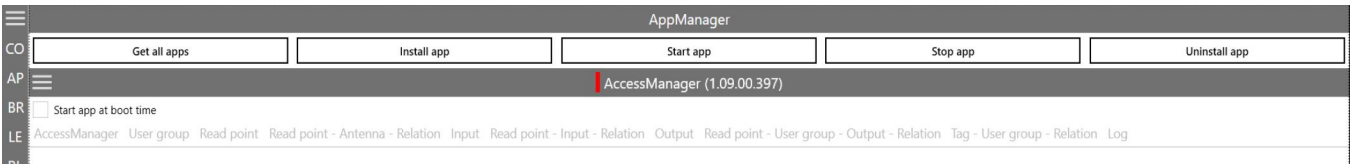
> **Tip**
> ► To see all the installed apps, click the menu symbol at (①).
>   ⇨ The installed apps are displayed:
>
>
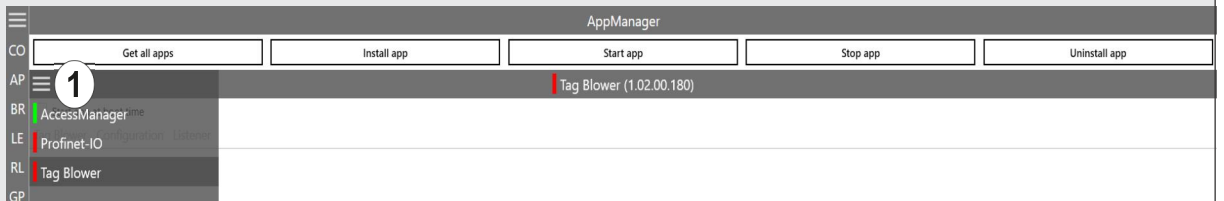
14.12   TagScan

To represent the relationship between the tag phase and the RSSI value, it is possible to plot both values by means of the TagScan.

✓   There is only one tag in the field or a tag has been selected.

►   Click *Start* to activate the TagScan.

⇨   The phase shifts are seen in the frequency switching. The RSSI value does not change because the transponder (tag) is not moved.
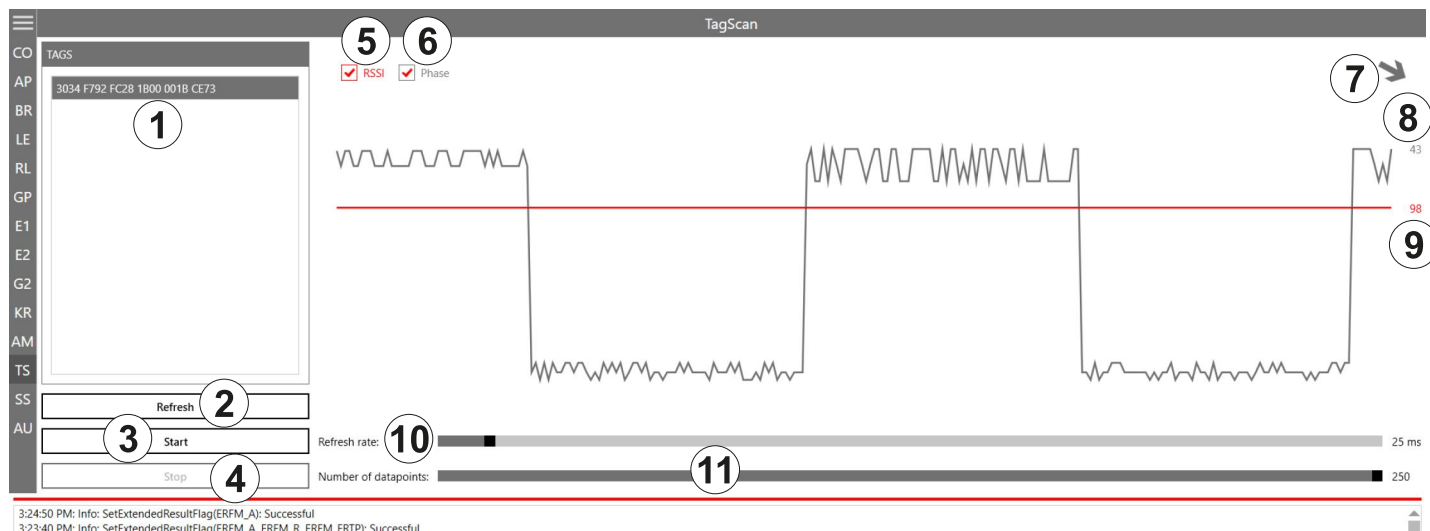

Fig. 77:   TagScan: phase shift (due to the channel change), transponder is not moved

①	*Tags*	shows the number of the tags present in the antenna field
②	*Refresh*	scans tags in the antenna field anew
③	*Start*	starts TagScan
④	*Stop*	stops TagScan
⑤	*RSSI*	activates/deactivates the presentation of the RSSI value in the graph
⑥	*Phase*	activates/deactivates the presentation of the phase in the graph
⑦		shows the phase in form of the rotating arrow
⑧		shows the current value of the phase
⑨		shows the current RSSI value
⑩	*Refresh rate*	sets the interval between the commands
⑪	*Number of data points*	sets the number of data points in the graph

> **Tip**   ►   To eliminate the phase shifts, select only one transmission frequency under *Expert settings 1*; see *Expert Settings 1, p. 93*.
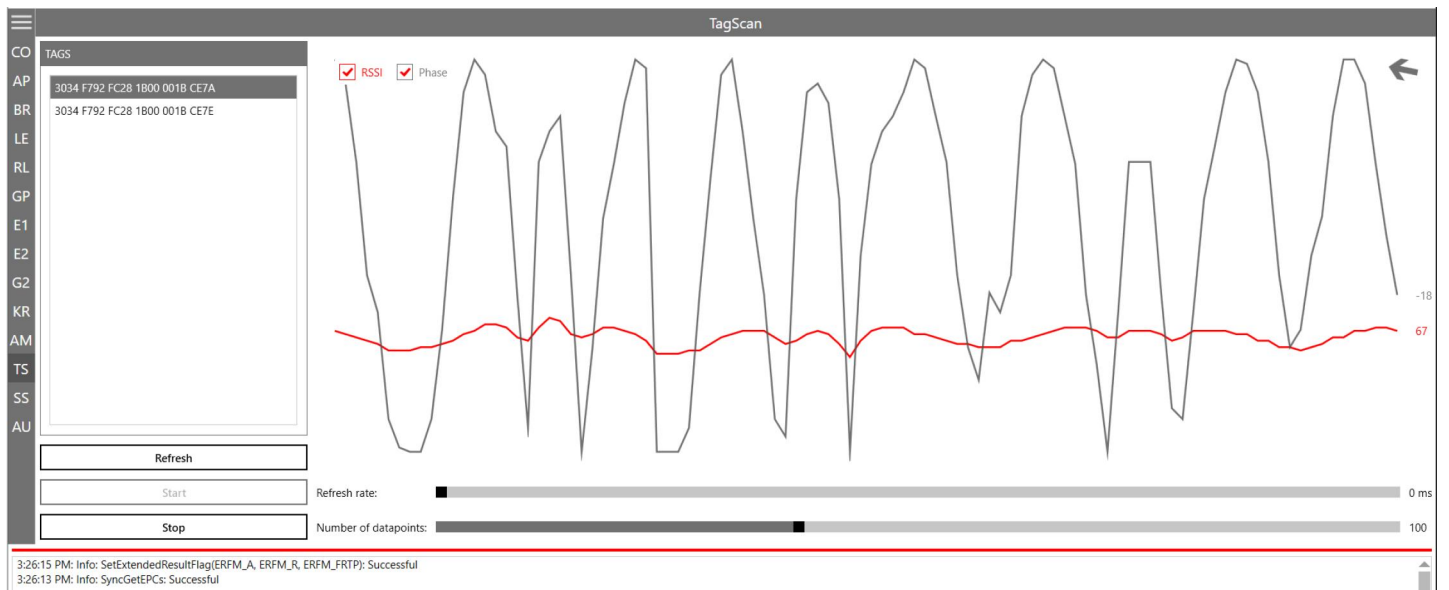
Fig. 78:   TagScan: phase shift, transponder is moved

Transponder movement is indicated by the amplitude of the phase. The RSSI value changes in small steps. The direction of the movement is indicated by means of the rotating pointer.

14.13   Spectral Scan

It may happen that the RFID transmission to or from the transponder is disturbed by frequency interfering. *SpectralScan* shows a qualitative frequency spectrum. Due to the fact that it is received by means of the connected RFID antenna, the frequency assignment on location is made visible.
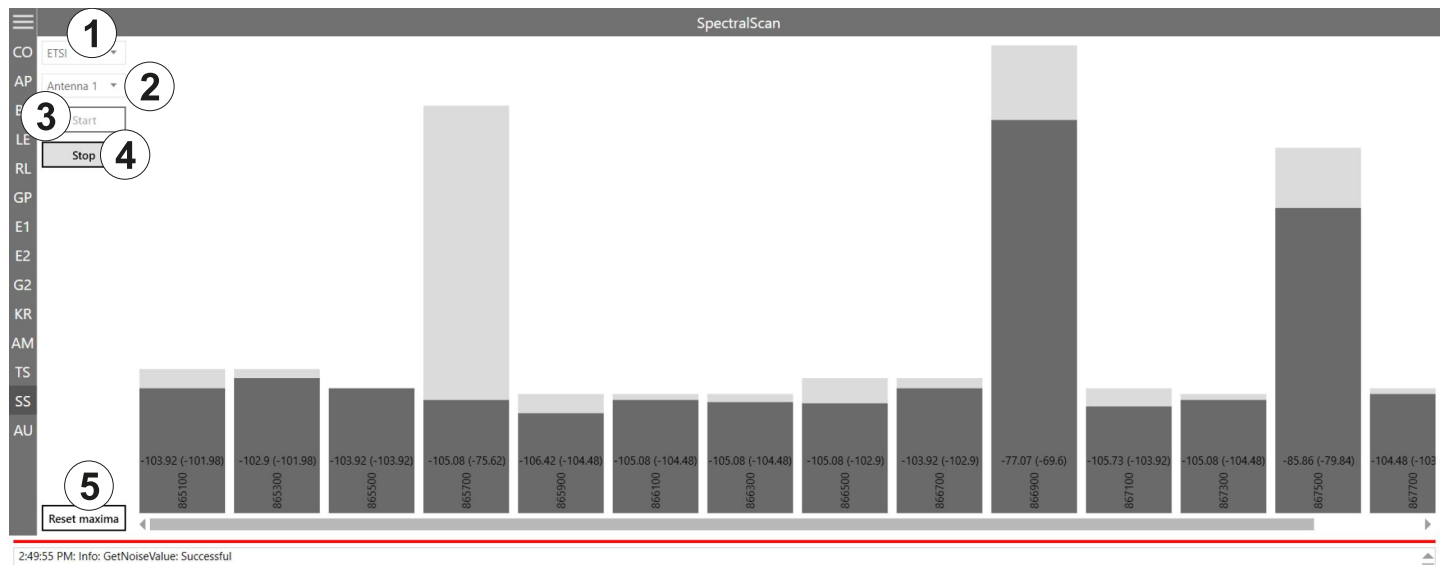

Fig. 79:   SpectralScan

①	*ETSI*	selects the frequency area
②	*Antenna 1–n*	selects an antenna from the drop-down menu
③	*Start*	starts SpectralScan
④	*Stop*	stops SpectralScan
⑤	*Reset maxima*	resets maxima

If there is more than one reader, spectral scan shows which channels might be occupied by other readers. In *Fig. 78, p. 112*, the channels 4, 10 and 13 are occupied by other readers. If the user is not satisfied with the reading results and the interferences keep occurring, it is possible to deactivate channels on which the interference occurs (4, 10 and 13) and only activate the channel that is free (7) to achieve better reading results, see ⑯ in *Fig. 56, p. 93*.

14.14 Authentication

Using this function, it is possible to authenticate a tag.

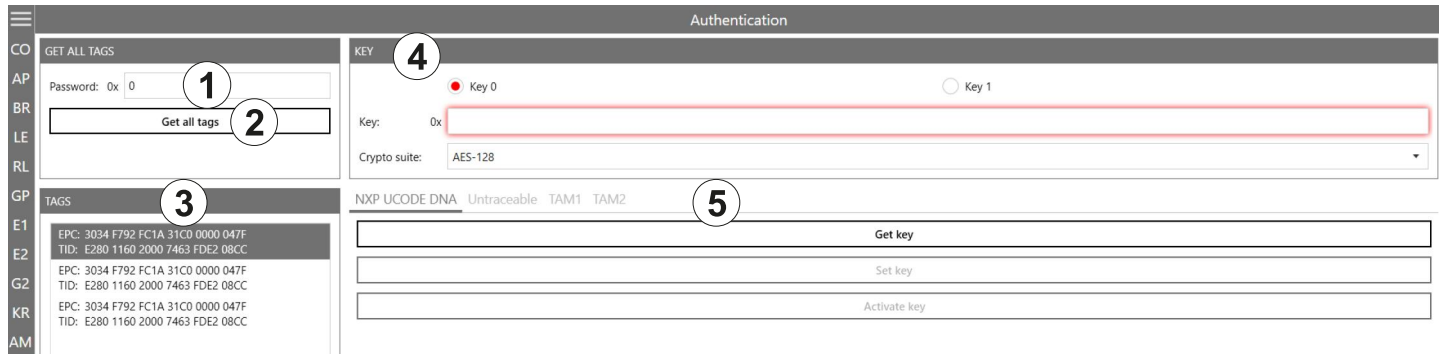The Authentication tab consists of 4 areas, *Get All Tags*, *Tags*, *Key* and functions that are described below.

Fig. 80:   Authentication

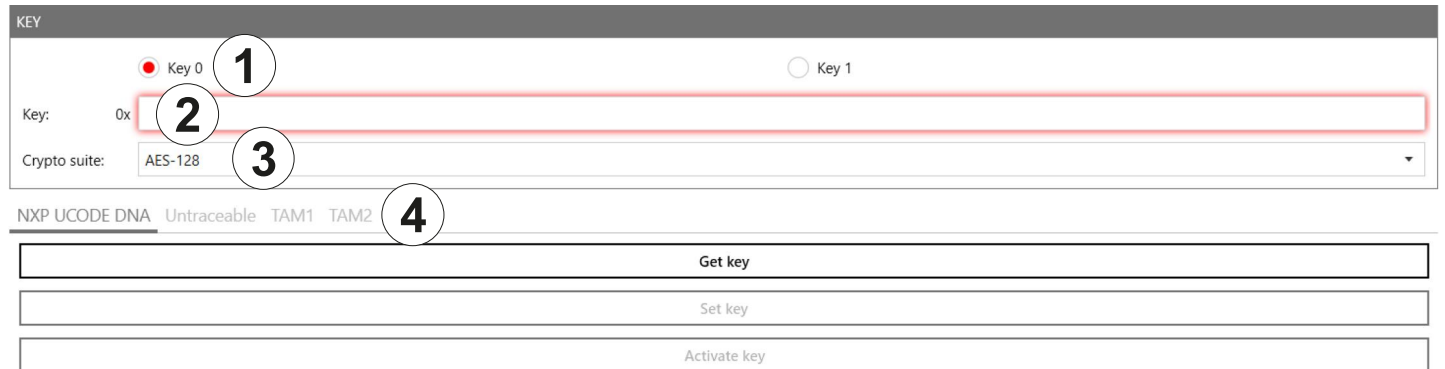| ①	*Password*	enters the access password; see *Password for Operation, p. 100*
②	*Get all tags*	reads all the tags in the antenna field
③	*Tags*	shows all the detected tags
④	*Key*	see *Key, p. 114*; necessary for *TAM1* and *TAM2*
⑤	*Functions*	see *Functions, p. 115*

14.14.1   Key

Fig. 81:   Authentication: Key

①	*Key 0/Key 1*	selects a key for the authentication (*Key 0* is only used for *TAM1*, *Key 1* is used for both *TAM1* and *TAM2*)
②	*Key*	enters the key selected in ①
③	*Crypto suite*	selects the crypto suite
④		see *Functions, p. 115*

14.14.2   Functions

NXP UCODE DNA

Fig. 82:   Authentication: NXP UCODE DNA

①	*Get key*	reads key 0 or key 1 currently set in the selected tag; only if the key has not been activated
②	*Set key*	sets key 0 or key 1 on the selected tag
③	*Activate key*	activates key 0 or key 1 on the selected tag

Untraceable

Fig. 83:   Authentication: untraceable

①	*U:*	asserts or deasserts U in XPC_W1; see *EPCglobal Gen2 Specification, p. 106*	
②	*EPC*	shows or hides memory above the visible EPC	
③	*New EPC length*	sets new EPC length in words	
④	*TID*	*Show*	shows the complete TID
		Truncated	shows the first two words in case of E2 and only one word in case of E1
		Hide	hides the complete TID
⑤	*User*	shows or hides the user memory bank	

		selects a range	
⑥	*Range*	*Normal*	the tag operates in the normal range
		Toggle temporarily	The tag temporarily toggles between normal and reduced operating range but reverts to its prior persisting operating range when the tag loses power
		Reduced	the tag operates in the reduced operating range
⑦	*Set Untraceable on selected tag*	sets settings 1–6 on the selected tag	

TAM1

TAM1 is used to check whether the selected tag is authentic.

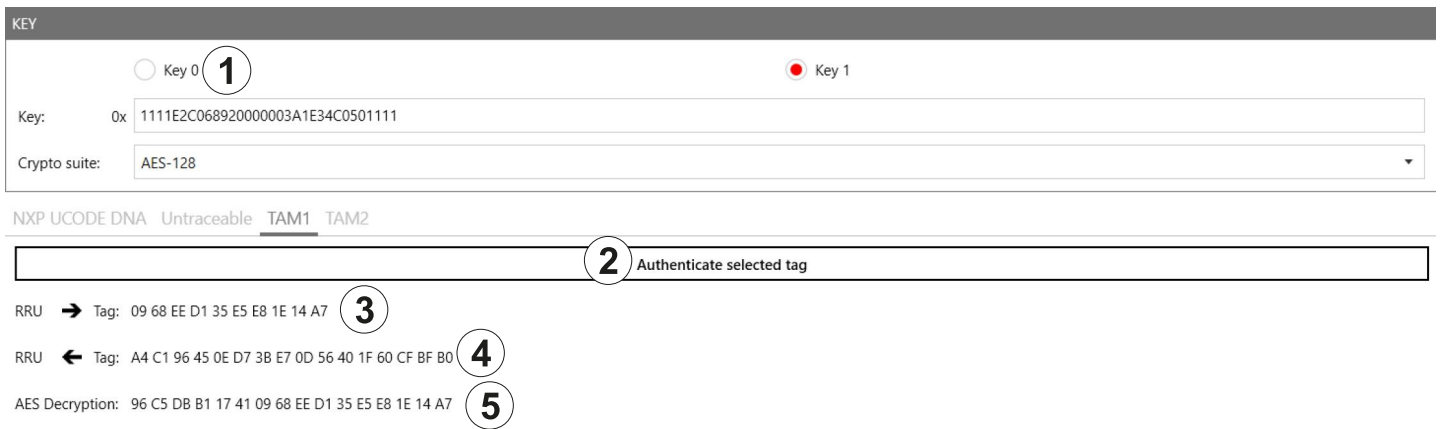✓ The tag has at least one activated key, *Key 0* or *Key 1*.

Fig. 84:   Authentication: key (TAM1)

	Key	see *Key, p. 114*
①	*Authenticate selected tag*	the reader sends the authenticate command to the selected tag; a pop-up message appears whether the authentication was successful or failed.
②	*RRU → Tag*	shows the random number sent to the tag by the reader
③	*RRU ← Tag*	shows the encrypted random number sent to the reader from the tag
④	*AES Decryption*	shows the data decrypted from ③ by means of the key entered at ② in *Authentication: Key, p. 114*; in the example above, this data contains the random number shown in ②

TAM2

TAM2 is used to read the data of the selected tag.

✓ *Key 1* has been activated.

Fig. 85:   Authentication: key (TAM2)

①	*Profile*	selects a profile the data of which is shown
②	*Offset*	sets the offset for ⑤
③	*Block count*	sets how many bits rare to be read
④	*Protection mode*	selects the protection mode for the TAM2 authentication operation
⑤	*Read data of selected tag*	reads the data of the selected tag provided the correct key 1 has been entered at *Key*
⑥	*Data*	shows data read in ⑤

15 Contact Information

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16   Waste Disposal

Electronic equipment is not domestic waste – in accordance with directive 2002/96/EC OF THE EUROPEAN PARLIAMENT AND THE COUNCIL dated 27th January 2003 concerning used electrical and electronic appliances, it must be disposed of properly. At the end of its service life, take this unit for disposal at a designated public collection point.

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