Configuration Manual

Version 3.00
English

Configuration Manual for Kathrein RFID UHF Readers

KATHREIN

Contents

1 About This Guide

This document describes various configuration parameters and gives information how you can set the parameters of your Kathrein RFID reader to suit an application in an optimal way.

The target group of this manual is specialist personal who install, configure and put the reader into operation.

This document is valid for all Kathrein RFID readers.

Tip This document applies to all Kathrein RFID readers. Even if it's referred to in the text as RRU4, it is possible to control all other readers using the same commands.

Tip Keep these instructions for further reference, and if the device passes to another owner, pass them on to the new owner.

► For more information, visit our website www.kathrein-solutions.com.

⇨ The manuals are available for download at the internet product page.

2 Explanation of Symbols and Signal Words

2.1 Symbols

!	Risk of material damage or malfunction

2.2 Signal Words

Tip	This signal word indicates useful tips and recommendations.

2.3 Other Symbols

Symbol	Meaning
►	operating instruction
1, 2, 3...n	operating instructions in a fixed order
⇨	result of an operating instruction
✓	condition for the execution of an operating instruction
•	list/list entry
MaxErrors	commands, file names, configuration parameters
Listen Before Talk	proper names or titles of other documents/standards, cross references within the text; parameters in the equations
www.kathrein-solutions.com	hyperlinks

3 Kathrein RFID Reader Systems

The Kathrein UHF RFID reader system RRU4 is characterised by great flexibility in regard to RFID applications. One reason for it is the wide variety of reading devices compatible to each other which allows to select a reader from the Kathrein product portfolio ideally suited for the respective application. Another reason for this flexibility is the wide range of parameters for configuring the reader firmware.

4 Configuration Parameters

A configuration parameter of the RRU4 reader system consists of a 32-bit long identification number (ID) and a data part which is 8 to 32 bits depending on the parameter. The data part is referred to below as the parameter value or just the value. The ID allows the various parameters to be read or set in the reader system.

Each ID – and, therefore, each configuration parameter – stands for a special functionality within the reader system.

4.1 Structure of the configuration IDs

The ID of a configuration parameter is not randomly selected, it contains more detailed information about the respective configuration parameter. The ID of a configuration parameter contains the following information:

- the configuration group to which the parameter belongs,
- a consecutive number to differentiate parameters within a group,
- the data type (byte, word etc.) of the value,
- the number of data bytes the value consists of,
- whether the value of the parameter is signed (and whether negative values are possible),
- the unit of the value.

For a simplified procedure, the configuration parameters are addressed by means of their plain text names. The plain text name begins with *cfgid* followed by the name of the configuration group. The function name of the parameter, i.e. the part clarifying the function/use of the configuration parameter, comes next, for example:

Configuration parameter *cfgidTagCommIntelligentWrite*

cfgid	initial code
TagComm	name of the configuration group
IntelligentWrite	function name of the parameter

For more information about the ID structure or the naming of configuration parameters, see the *konfigids.h* file in the source files for the programming environment of the RRU4 reader system.

For programmers:

This file contains macros in the programming language C, which gives you the possibility to address the configuration parameters by their plain text names in your programming environment. The plain text name is then translated into the respective configuration ID at compile time.

4.2 Parameter Sets

The configuration of an RFID reader of the RRU4 reader system is organised in parameter sets. Each reader has eight parameter sets.

Apart from one exception (*cfgidGlobalDefaultParamset*), all the configuration parameters listed below are represented in every parameter set. The use of parameter sets allows an RFID reader to switch from one configuration to another by using only one command. The parameter set currently selected is called the *active parameter set*. Reading and writing configuration parameters using the protocol commands *GetParameterById* and *SetParameterById* is always performed on the active parameter set.

A changed active parameter set is saved into the reader's EEPROM using *SaveActiveParamset*, and thus is available when the reader restarts.

The *SetActiveParamset* command is used to switch betwee parameter sets.

5 Configuration Parameters of the RRU4 Reader System

5.1 *Global* Configuration Group

5.1.1 *DefaultParameterSet*

Characteristics

available from firmware	v 1.30.00
available up to firmware	—
data type	byte (8-bit)
unit	—
value range	0 – 7

Description

This parameter is the only one in its configuration group. In contrast to all the other parameters, this parameter set is "independent", i.e. it is not held in any parameter set, it exists on its own. The parameter indicates which parameter set should be loaded and activated after the reader start-up.

5.2 *RFInterface* Configuration Group (High-Frequency Interface)

5.2.1 *RFPortPower1...8*

Characteristics

available from firmware	v 1.30.00
available up to firmware	—
data type	byte (8-bit)
unit	¼ dBm (erp)
value range	0; 68–136

Description

This parameter allows the reader transmission power to be set for the respective antenna port, namely the power which the antenna should radiate. The data is given in *dBm (erp)*. So that the power radiated by the antenna corresponds to the value of this parameter, the parameters for the attenuation of the antenna cable and the antenna gain must be set correctly.

The setting of the transmission power to a value greater than 0 dBm (erp) is required to be able to carry out an inventory using this antenna port.

Tip The transmission power is always set in *dBm (erp)*. If the desired transmission power is stated in *dBm (eirp)*, it is necessary to convert it to *dBm (erp)*:
dBm (erp) = *dBm (eirp)* – 2.15

5.2.2 *TimeToPowerOff*

Characteristics

available from firmware	v 1.30.00
available up to firmware	V 2.99.99
data type	word (16-bit)
unit	seconds
value range	0 – 65535

Description

This parameter indicates the time during which the transmission carrier must remain switched on after the completion of an inventory or a tag operation in general.

A certain time must elapse after the receipt of an inventory command before the reader can start the inventory. The reader requires this time for LBT (*Listen Before Talk*) and an antenna test, among other things. Using this parameter, it is possible to reduce this time: if an inventory has been completed by the reader, and the next inventory command has been received within the time configured by this parameter, the reader can dispense with the LBT and the antenna test and start the inventory more quickly.

Tip Due to the time during which the transmission carrier is switched on but there is no tag operation pending, the overall power consumption of the reader increases.

5.2.3 *ModulationType*

Characteristics

available from firmware	V 1.30.00
available up to firmware	V 2.99.99
data type	byte (8-bit)
unit	—
value range	0; 1

Description

This parameter determines the modulation type used for the tag communication by the reader. There are two modulation types available:

0	Double Side Band (DSB)
1	Phase Reversal Amplitude Shift Keying (PR-ASK)

Tip For readers manufactured for the European Union (EU), Phase Reversal Amplitude Shift Keying is used irrespective of the setting of this parameter.

5.2.4 *ActivateSelfJammerCancellation*

Characteristics

available from firmware	V 1.30.00
available up to firmware	—
data type	bool (8-bit)
unit	—
value range	0; 255

Description

Some Generation 3 readers are equipped with a self-jammer cancellation hardware. It is used to increase the sensitivity of the reader by suppressing the reader's own reflective transmission signal (reader's own interference signal) in an environment with increased reflection, e.g. metallic superstructural parts in industrial environments. If this parameter is active, the self-jammer cancellation hardware is set to the optimal receiver sensitivity immediately before each inventory. This process is time-consuming and slows down the tag detection.

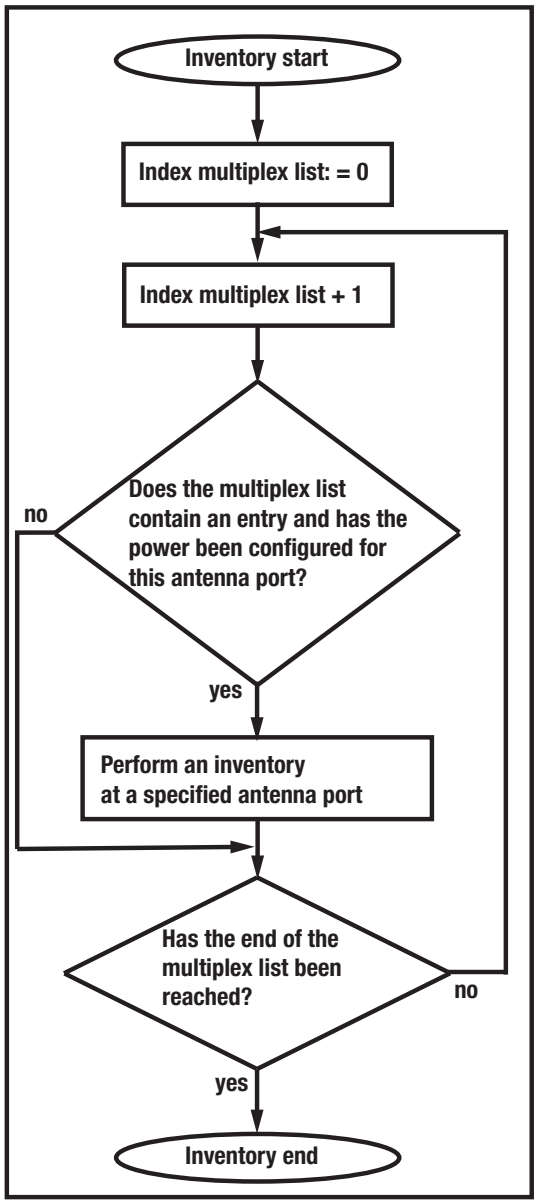
5.2.5 *MultiplexingAntennaport1...8*

Characteristics

available from firmware	V 1.30.00
available up to firmware	—
data type	byte (8-bit)
unit	—
value range	0; 1–8

Description

These eight parameters form the antenna multiplex list of the reader. Either an antenna port number (1 to 8) or a zero can be entered in each of the eight list slots. If a zero is entered, the list slot is deactivated and the reader goes to the next list slot. This is shown in the following diagram:



5.2.6 *MultiplexingExposureTime1...8*

Characteristics

available from firmware	V 1.30.00
available up to firmware	—
data type	word (16-bit)
unit	milliseconds
value range	0 – 65535

Description

The values of these configuration parameters are of interest only to reader commands that start with *ASync...* . Each parameter stands for an exposure time which specifies how long the reader maintains exposure for inventories in the respective position – and, therefore, the antenna – in the multiplex list. In contrast to synchronous commands, when using asynchronous commands, the reader does not proceed to the next entry in the multiplex list immediately after performing an inventory. Instead, it waits until the exposure time given by these parameters for the respective multiplex entry has expired. An inventory in progress is not interrupted at the expiry of the exposure time, but is continued to completion.

5.2.7 *CableLoss1...8*

Characteristics

available from firmware	V 1.30.00
available up to firmware	—
data type	byte (8-bit)
unit	¼ dB
value range	0 – 255

Description

These parameters contain the cable attenuation of the antenna cable between the reader and the antenna for the respective antenna port of the reader. The reader can set the transmission power correctly only if the attenuation values for the antenna cable have been entered correctly.

5.2.8 *AntennaGain1...8*

Characteristics

available from firmware	V 1.30.00
available up to firmware	—
data type	byte (8-bit); signed
unit	¼ dB
value range	–125 – 127

Description

These parameters allows the antennas gain for the antennas connected to the reader to be communicated to the reader. The reader calculates from the transmission power setting (antenna radiated power), the antenna gain and the cable attenuation the port power at the RF output:

$Port\ power_{dBm} = radiated\ power_{dBm(erp)} - antenna\ gain_{dBic} + cable\ attenuation_{dB} + 5.15$

Use the following formula to convert an antenna gain expressed in dBi to dBic units:

$Antenna\ gain_{dBic} = antenna\ gain_{dBi} + 3$

> **!** Near-field antennas have a negative gain, because they are not designed for electromagnetic coupling with the tag but for magnetic coupling.
>
> To configure near-field antennas correctly,:
>
> ► Enter 5.25 dBic (a parameter value of 21) for the antenna gain and the the maximum input power stated in the antenna data sheet for the antenna radiated power (*RFPower1...8*).

5.2.9 *RSSIThreshhold1...8*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 255

Description

When the reader is performing an inventory, the field strength of the response from the tag that is addressed is measured at the same time. This is a so-called RSSI value. These parameters allow the threshold value for the RSSI value to be set for each antenna port. Tags with an RSSI value less than the threshold setting are then no longer detected by the reader.

5.2.10 *MultiPowerTagAccess1...8*

Characteristics

available from firmware	V 1.30.00
available up to firmware	V 2.99.99
data type	bool (8-bit)
unit	–
value range	0; 255

Description

The stronger the reader transmission signal that strikes the tag, the more difficult it is for the tag to modulate the reader transmission signal by means of the backscatter. Therefore, the strength of the tag response decreases as the reader transmission power increases. Due to this phenomenon, under certain circumstances it may happen that the reader can no longer read a tag which is located immediately in front of the antenna but can easily detect it at a lower transmission power.

If *MultiPowerTagAccess* is activated for an antenna port, after an inventory with high transmission power has been carried out, the reader reduces the transmission power by half and searches for “overlooked” tags.

5.2.11 *MaxAllowerdAntennaOutputPower1...8*

Characteristics

available from firmware	V 1.30.00
available up to firmware	V 2.99.99
data type	byte (8-bit)
unit	¼ dBm (erp)
value range	0 – 255

Description

This parameter allows the radiated power of the antenna at an antenna port to be limited to a specified value.

5.2.12 *EnableRSSIThresholdAtSpecificCmds*

Characteristics

available from firmware	V 1.46.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0;255

Description

The RSSI threshold value set by the *RSSIThreshold1…8* parameter equally applies to non-specific (*…GetEPCs*, *…Any*) and specific (*…Specific*) tag reader commands. These configuration parameters can, however, switch the effect on specific tag reader commands on and off.

The following scenario can be set: *SyncGetEPCs* commands the reader to scan cyclically for tags in the antenna field. The configuration parameter *RSSIThreshold1…8* means that tags with less than a specified RSSI value are not reported. A tag is close to the RSSI threshold, and when the threshold is reached, the reader reports it to the higher level. This triggers a specific command for the reported tag. If *EnableRSSIThresholdAtSpecificCmds* is activated, it can happen that the specific command comes to nothing, since the RSSI value of the tag is fluctuating around the threshold value. In such a scenario, it is necessary to deactivate *EnableRSSIThresholdAtSpecificCmds*.

5.2.13 *FlashWriteAdditionalPower*

Characteristics

available from firmware	V 2.00.00
available up to firmware	–
data type	byte (8-bit)
unit	¼ dB
value range	0 – 48

Description

It takes more power to write to a tag than to read data from a tag. Therefore, for a given transmission power, the tag must be located closer to the antenna for writing than for reading. In order to overcome this distance differential, this parameter can be used to specify whether and by how much the reader transmission power needs to be increased for write commands compared to read commands.

5.2.14 *FlashReadAdditionalPower*

Characteristics

available from firmware	V 2.13.00
available up to firmware	–
data type	byte (8-bit)
unit	¼ dB
value range	0 – 48

Description

Some tags require more energy for reading the user memory bank than for the inventory. Therefore, for a given transmission power, it is necessary to place such a tag closer to the antenna for reading the user memory than for the inventory to detect the EPC. In order to overcome this distance differential, this parameter can be used to specify whether and by how much the reader transmission power needs to be increased for reading the user memory bank instead of running an inventory.

5.3 Tag Communication (*TagComm*) Configuration Group

5.3.1 *UsePilottone*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0;255

Description

This parameter allows the pilot tone tag to be switched on and off. Tags according to *EPCGlobal Class 1 Gen 2* are able to transmit a so-called pilot tone ahead of the user data. The purpose of the pilot tone is the synchronisation of the reader to the response of the tag. Without a pilot tone it is more difficult for the reader to synchronise itself to the tag response.
In order to ensure reliable tag detection, it is necessary to activate this parameter.

5.3.2 *InitialQ*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 15

Description

The value *Q* in the inventory process specifies how many tags are located in the reader antenna field and must be detected. The number x of tags is calculated by means of the following formula:

$x = 2^Q$

The value Q is communicated to the tags by the reader, whereupon each of the tags selects a random *Communications slot* from x for its response. In order to perform an inventory as quickly and efficiently as possible, as many of the x communications slots should be occupied by tags as possible. It is important to avoid any multiple occupation of communications slots which would lead to collisions. If the reader detects that the value chosen for Q is too large (hardly any communications slots are occupied) or too small (collisions occur), it will be adjusted automatically and loaded to the tags. Due to the fact that this adjustment takes time, the reader with this configuration parameter should be informed of the approximate number of tags to expect in the antenna field. This allows the number of communications slots to be set to an appropriate value right from the start of the inventory process.

5.3.3 *Session*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 3

Description

Tags according to the *EPCGlobal Class 1 Gen 2* standard support four different sessions. During each session, a tag can be given an inventoried flag to indicate whether or not it has already been detected by the reader during an inventory process. Inventoried flags have different properties for the individual sessions, which allows recognition of their persistence times. Therefore, the time indicates how long a tag remembers whether it has been detected by the reader or not.

	Tag has energy	**Tag has no energy**
Session 0	unlimited persistence	no persistence
Session 1	persistence greater than 500 milliseconds but less than 5 seconds	persistence greater than 500 milliseconds but less than 5 seconds
Session 2	unlimited persistence	persistence greater than 2 seconds
Session 3	unlimited persistence	persistence greater than 2 seconds

This configuration parameter instructs the reader which session it should work with.

5.3.4 *MaxErrors*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 255

Description

The *MaxErrors* configuration parameter indicates how often a command is issued by the reader to the tag if the response expected by the reader from the tag is missing.

5.3.5 *CommunicationProfile*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 255

Tip Up to firmware V 2.04.00, this parameter has been called *DefaultProfile*. The configuration ID has not been changed.

Description

This configuration parameter sets the communication profile between the reader and the tag. A communication profile consists of:

- the data transmission rate (reader to tag communication)
- the data reception rate (tag to reader communication)
- the coding of the data from tag to reader

There are various data transmission rates, data reception rates and codings available. Since not every combination of these three properties is possible, selected combinations are available as communication profiles. A list of the viable communication profiles can be downloaded from the reader by executing the command *GetProfileList*. Whethe the reader operates in the *Dense Reader Mode,* depends on the selected communication profile.

5.3.6 *CommunicationStandard*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 255

Tip Up to firmware V 2.04.00, this parameter has been called *DefaultProfile*. The configuration ID has not been changed.

Description

Different countries have different regulations regarding the permissible transmission power and transmission channels that can be used for communication with RFID tags. This configuration parameter informs the reader which regulations to comply with for radio communication with RFID tags.

► For more details on the supported country profiles that are supported, see the *rrui4api.h* file in the source files for the
programming environment of the RRU4 reader system.

5.3.7 *IntelligentWrite*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0; 255

Description

Depending on the type, a tag requires 10 to 20 milliseconds to write 16-bit data (one word). If, for instance, it is necessary to write a 96-bit EPC, then the time which a tag requires for saving the data is 120 milliseconds in the worst case. Only a fifth to a tenth of this time is required to read the data from a tag. In practice, it often happens that the data is which is already on the tag is written to a tag. Despite this, the tag requires the full stated time to complete the write command.

It is necessary to activate this configuration parameter in order to accelerate the write event and to avoid writing data which is already present on the tag. This way, the reader first reads the relevant data area on the tag and then writes only the parts which are necessary to change.

Tip If a memory area on a tag is protected by a lock against overwriting, and if identical content is scheduled to be written to the tag with *IntelligentWrite* activated, no error message is generated by the reader. No write command is issued to the tag in the process of reading the existing data, comparing it with the data to be written and establishing by the reader that no changed data need be written to the tag. With no write command issued, the reader is not able to detect the lock in the memory area.

5.3.8 *VerifyWrite*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0; 255

Description

After a write operation, a tag sends the result to the reader, which can be either an error code or a success message. The memory cells of a tag cannot be written infinitely, since they are subject to ageing. Depending on the tag, it has a working life of 1,000 to 1,000,000 write cycles. At the end of a tag's working life it may happen that having completed a write operation, a tag sends out a success message to the reader but has not in fact stored the data correctly in the tag memory. If *VerifyWrite* is activated, the reader issues a read command after receiving the success message. This reads the data in the tag memory and reports any mismatches to the higher level as *Verify Fail*.

! Even with *VerifyWrite* activated, there is no guarantee that the data are stored correctly in the tag memory. Aged tags may “forget” the content of their memory, be it minutes or hours after the write operation!

5.3.9 *QueryTarget*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0; 255

Description

Tags according to the *EPCGlobal Class 1 Gen 2* standard support four different sessions. During each session, a tag can be given an inventoried flag to indicate whether or not it has already been detected by the reader during an inventory process. The status of the inventoried flag can be either *A* or *B*. When the tag is detected in the inventory, the status of the flags switches either from A to B or from B to A. The status of the flag can also be influenced by *Select commands*.

The configuration parameter *QueryTarget* determines which tags should participate in the inventory. If the configuration parameter has the value zero, only the tags for which the inventoried flag is set to A take part in the inventory. In the other case, only the tags for which the inventoried flag is set to B participate in the inventory. This way, filter tasks are performed together with the *Select filters*.

► For more information, see the *EPCglobal Class 1 Generation 2 UHF RFID" (E)* specification (V1.2.0, Section 6.3.2.2, page 43f).

5.3.10 *QuerySel*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 3

Description

This configuration parameter specifies the content of the field *Sel* in the Gen2 command *Query*. This field instructs the tag whether the content of the *Selected flag* is or is not relevant for participation in the inventory. This way, filter tasks are performed together with the *Select filters*.

5.3.11 *ForcePowerOffAfterEPCWrite*

Characteristics

available from firmware	V 1.40.00
available up to firmware	V2.99.99
data type	byte (8-bit)
unit	milliseconds
value range	0 – 255

Description

During the inventory process, a tag transmits its EPC and a checksum to the reader. This checksum is formed when the tag is powered up from the memory area of the EPC. If a write command changes the EPC and a new inventory is started without any intervening of the power up – i.e. without switching off the antenna field, the tag cannot participate in the inventory, because the checksum it communicates no longer matches the EPC it transmits.

This configuration parameter specifies whether and for how long after a write operation to the memory bank of the EPC the carrier should be switched off so as to "repower" the tag.

► For more information, see the *EPCglobal Class 1 Generation 2 UHF RFID" (E)* specification (V1.2.0, Section 6.3.2.1.2.1, page 38).

5.3.12 *TransmitGetEPCsPreSelect*

Characteristics

available from firmware	V 1.41.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0; 255

Description

The content of this configuration parameter affects only the protocol commands *SyncGetEPCs*, *SyncBulkGetEPCs*, *ASyncGetRawEPCs* and *ASyncGetEPCs*. All other protocol commands act as if *TransmitGetEPCsPreSelect* were zero. Depending on the value of this configuration parameter, an inventory runs as follows:

***TransmitGetEPCsPreSelect* is zero:**

1. The first antenna is selected from the multiplex list.
2. A select to reset all tags within the reception range of the selected antenna is executed.
3. An inventory is executed by the selected antenna until no further tags are found.
4. As long as there are further antennas in the multiplex list, the next antenna is selected and the process resumes at point 2.
5. The protocol command is completed and the result is transferred to the higher level.

***TransmitGetEPCsPreSelect* is not equal to zero:**

1. The first antenna is selected from the multiplex list.
2. A select to reset all tags within the reception range of the selected antenna is executed.
3. As long as there are further antennas in the multiplex list, the next antenna is selected and the process resumes at point 2.
4. The first antenna is selected from the multiplex list.

5. An inventory is executed by the selected antenna until no further tags are found.
6. As long as there arefurther antennas in the multiplex list, the next antenna is selected and the process resumes at point 5.
7. The protocol command is completed and the result is transferred to the higher level.

If several antennas look at a population of tags and it is not important which antenna detects a tag, the time for a complete detection of the tag population can be reduced by activation of this configuration parameter. Tags which have already been detected by one antenna are no longer detected by the following antennas in the multiplex list.

5.3.13 *TransmitSelectIfNoFilterIsOn*

Characteristics

available from firmware	V 1.45.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0; 255

Description

At the start of an inventory the reader sets all tags within antenna range to a defined initial status using a defined “select filter” or a “select” command. The subsequent inventory detects all tags that are located in this defined initial status. If no select filters were defined, this configuration parameter can be used to specify whether or not a select command should be sent to perform a global reset of all tags within the antenna range before the inventory.

5.3.14 *NumberOfEPCWords*

Characteristics

available from firmware	V 2.00.00
available up to firmware	V 2.99.99
data type	byte (8-bit)
unit	–
value range	0–31; 255

Description

From firmware version V 2.00.00, RRU4 RFID readers of the Kathrein reader system can read tags with an EPC length of 0 to 31 words (0 to 496-bit EPCs). This parameter allows deactivation of the automatic detection of the EPC length, thus forcing the reader to work with a fixed length.

5.3.15 *UseBlockWrite*

Characteristics

available from firmware	V 2.00.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0; 255

Description

If this configuration parameter is activated, the reader uses the *BlockWrite* command for writing data to a tag. This means that more than 16 bits (one word) can be written to a tag with just a single command and thus save write time.

Tip Note that not all tags support the *BlockWrite* command.

► For more information, see also the *EPCglobal Class 1 Generation 2 UHF RFID (E)* specification (V1.2.0, Section 6.3.2.11.3.7, page 74).

5.3.16 *DisableReceivingNXPReadProtectedTags*

Characteristics

available from firmware	V 2.01.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0; 255

Description

If a tag from the company NXP were protected by *ReadProtect*, it would no longer communicate its EPC or a valid checksum during an inventory. The data content of the EPC and the checksum is zero. To allow such tags to be detected, the reader allows tags for which the EPC and checksum are zero to pass. Since such tags are no longer secured with a valid checksum, it can occasionally happen that the reader detects such a tag where none exists. In order to prevent this, it is possible to suppress the reception of *ReadProtected* tags by activating this configuration parameter.

5.4 @KRAI Configuration Group

5.4.1 *AntennaPropertyAntennaport1...8*

Characteristics

available from firmware	V 2.40.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 255

Description

These parameters contain different settings for the ©KRAI antennas based on the connected antenna type.

Bit	WiRa 70°KRAI	WiRa 30° CSB KRAI
	Polarisation of the antenna beam	Direction of the antenna beam
0	right-handed circular (RHCP)	directed straight (C)
1	left-handed circular (LHCP)	directed left (L)
2	horizontal (HP)	directed right (R)
3	vertical (VP)	no function
4	no function	no function
5	no function	no function
6	no function	no function
7	no function	no function

If no bit has been set, a default setting will be used based on the selected antenna. If more than one bit is selected, the tag communication will take place step by step in the specified order.

5.4.2 *JumpercableCableLossAntennaport1...8*

Characteristics

available from firmware	V 2.40.00
available up to firmware	–
data type	byte (8-bit)
unit	¼ dB
value range	0 – 255

Description

This parameter sets the cable loss of the used jumper cable for cascadable ©KRAI antennas (e.g. SMSH antennas) for the corresponding reader antenna port. The reader is only able to correctly set the transmission power if the values for the cable loss have been properly set.

5.4.3 *LED1...8OutputFunctionAntennaport1...8*

Characteristics

available from firmware	V 2.40.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 255

Description

This parameter sets the functionality of a @KRAI antenna LED.

Value	Function
0	LED is off
1	LED is on
2	shows that the high frequency has been switched on
3	shows an antenna error
4	indicates that a tag has been detected
5	shows a successful tag operation
6	it is possible to set the LED status by means of the communication protocol

5.4.4 *LED1...8TimeToSwitchOffAntennaport1...8*

Characteristics

available from firmware	V 2.40.00
available up to firmware	–
data type	word (16-bit)
unit	milliseconds
value range	0 – 65535

Description

If the LED functionality of a ©KRAI antenna (see the previous parameter) has been set to *tag has been detected* or *tag operation was successful*, this parameter shows after what time the reader will switch off the LED.

5.5 *ObservedList* Configuration Group

5.5.1 *GlimpsedTimeoutCount*

Characteristics

available from firmware	V 1.30.00
available up to firmware	V 2.99.99
data type	byte (8-bit)
unit	–
value range	0 – 255

Description

This configuration parameter applies only to asynchronous protocol commands (*ASync...*). For the duration of an asynchronous command, the reader compiles a list of all the tags found within the antenna range. If a tag is present in the antenna range for multiple inventories, a “coming” message is generated for the tag and sent to the higher level. If a tag is no longer detected during multiple inventories, a “going” message is generated and sent.

This configuration parameter shows after how many inventories the tag is deleted from the internal administration list after the “going” message has been generated for a tag which has no longer been detected. This parameter should not be changed. It has no influence over the generation of a “coming” or “going” message.

Kathrein reserves the right to remove this parameter from firmware versions at a future point in time.

5.5.2 *ObservedThresholdCount*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 255

Description

This configuration parameter applies only to asynchronous protocol commands (*ASync...*). For the duration of an asynchronous command, the reader compiles a list of all the tags found within the antenna range. If a tag is present in the antenna range for multiple inventories, a “coming” message is generated for that tag and is sent to the higher level. If a tag is no longer detected during multiple inventories, a “going” message is generated and sent.

This configuration parameter specifies the number of inventories in which the tag is detected, which then triggers the generation of a “coming” message sent to the higher level.

5.5.3 *ObservedTimeoutCount*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 255

Description

This configuration parameter applies only to asynchronous protocol commands (*ASync...*). For the duration of an asynchronous command, the reader compiles a list of all the tags found within the antenna range. If a tag is present in the antenna range for multiple inventories, a “coming” message is generated for that tag and is sent to the higher level. If a tag is no longer detected during multiple inventories, a “going” message is generated and sent.

This configuration parameter specifies the number of inventories in which the tag is no longer detected, which then triggers the generation of a “going” message sent to the higher level.

5.6 Host Communication (*HostComm*) Configuration Group

5.6.1 *ExtendedResultFlag*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 63

Description

This configuration parameter specifies which additional information on a tag should be sent when tag data are sent to the higher level. Every bit of the lower four bits that is set to “1” in this configuration parameter triggers the transmission of certain additional information:

Bit	Information transmitted
0	antenna information (the antenna which detected the tag)
1	RSSI value (field strength information of the tag response)
2	time stamp (the time at which the tag was detected)
3	protocol control word of the tag (PC, [XPC_W1, [XPC_W2]]; see also the *EPCglobal Class 1 Generation 2 UHF RFID* specification V1.2.0, Section 6.3.2.1.2, p. 38)
4	frequency and tag phase
5	RSSI value in dBm

5.6.2 *AntennaIndependentOperation*

Characteristics

available from firmware	V 1.30.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0; 255

Description

This configuration parameter differentiates between antenna-dependent (configuration parameter deactivated) and antenna-independent (configuration parameter activated) operation of the reader. This configuration parameter is relevant to all asynchronous protocol commands (*ASync...*) and to the *SyncBulkGetEPCs* command. In the case of the specified protocol commands the reader compares a tag which it has detected during an inventory with the tags saved in an internal list.

During antenna-dependent operation, the antenna information is used in addition to the EPC. This means that a tag which is detected by several antennas also generates several data sets in the reader. Each data set contains the same EPC but a different antenna port number. During antenna-independent operation the antenna information is irrelevant. A tag which is detected by several antennas only generates a single data set in the reader.

5.6.3 *ASyncAdditionalRSSIDataDeliveryDelta*

Characteristics

available from firmware	V 2.00.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 255

Description

This configuration parameter influences the behavior of all asynchronous protocol commands (*ASync...*) with the exception of *ASyncGetRawEPCs*.

For asynchronous commands, when a tag is within the antenna range, a “coming” message is generated for that tag and sent to the higher level. When a tag leaves the antenna field, a "going" message is generated. In various application scenarios it is interesting to know how the field strength (RSSI value) of a tag behaves in the period between the "coming" and "going" message. This way it is possible to make a conclusion about the behavior of a tag in the antenna field.

This configuration parameter shows how much the RSSI value of a tag must change for a *TagDataChanged* message to be generated and transmitted to the higher level. If the value is 255, no *TagDataChanged* messages are generated.

In order for the RSSI value to be included into the *TagDataChanged* message, it is necessary to set the *ExtendedResultFlag* parameter correspondingly.

5.6.4 *UseMillisecondsAsTimestamp*

Characteristics

available from firmware	V 2.00.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0; 255

Description

After an inventory, it is possible to send a time stamp with the time when the tag was detected to the higher level as part of the tag information (see *ExtendedResultFlag*). This configuration parameter specifies whether the time stamp is the UTC time in seconds since the 01.01.1970 0:00, or the milliseconds since the reader started. If this configuration parameter is activated, the milliseconds since the start of the reader will be sent as the time stamp.

5.6.5 *ASyncHeartbeatInterval*

Characteristics

available from firmware	V 2.55.00
available up to firmware	–
data type	word (16-bit)
unit	milliseconds
value range	0 – 65535

Description

The interval shows the time in milliseconds after which a heartbeat is sent to the synchronous *ResultHandler* for asynchronous commands. A value of zero turns off the heartbit.

5.7 ETSI Condiguration Group

5.7.1 *PortChannelListGlobalValue1...16*

Characteristics

available from firmware	V 1.30.00
available up to firmware	V 2.99.99
data type	byte (8-bit)
unit	–
value range	0 – 15

Description

These configuration parameters are only relevant if *ETSI_EN302208* or *ETSI_EN302208_LBT* has been selected as the communications standard.

These configuration parameters serve for the administration of the radio channels approved for Europe; taken together they constitute the ETSI channel list. This channel list contains a maximum of 16 entries. Each entry can contain an ETSI channel number in the range from 1 to 15. A value of zero means the end of the channel list. All entries of configuration parameters with a higher index are then ignored. If the configuration parameter *ChannelSwitchingMode* is set accordingly, the reader selects a channel at random for communication with the tags from this channel list.

5.7.2 *PortChannelListPort1...8Value1...16*

Characteristics

available from firmware	V 1.30.00
available up to firmware	V 2.99.99
data type	byte (8-bit)
unit	–
value range	0 – 15

Description

This parameter is only active if only relevant if *ETSI_EN302208* or *ETSI_EN302208_LBT* has been selected as the communications standard.

These configuration parameters are used to manage the allowed transmission channels in Europe and together constitute a unique ETSI channel list for each antenna port. Each channel list includes up to 16 entries. Each entry can have a channel number from 1 to 15. A value of zero means the end of a channel list. All entries of configuration parameters with a higher index will be ignored. If the configuration parameter *ChannelSwitchingMode* is set accordingly, the reader selects a channel at random for communication with the tags from this channel list.

5.7.3 *ChannelSwitchingMode*

Characteristics

available from firmware	V 1.30.00
available up to firmware	V 2.99.99
data type	byte (8-bit)
unit	–
value range	0 – 1

Description

These configuration parameters are only relevant if *ETSI_EN302208* or *ETSI_EN302208_LBT* has been selected as the communication standard.

This configuration parameter specifies whether the reader performs the channel selection in “mode 0” or in “mode 1”:

ETSI Communication Standard	Mode 0	Mode 1
ETSI_EN302208	no LBT; uses the global channel list for every port and randomly selects a channel	no LBT; uses the channel list associated with the port and , with random selection of the channel
ETSI_EN302208_LBT	LBT on the first parameterised antenna; uses the global channel list for every port and randomly selects the channel sequence; no new LBT – and hence no channel change – when changing port	LBT at each change on this port; uses the channel list associated with the port and randomly selects the channel

5.7.4 *PowerCheckOverAllAllowedChannels*

Characteristics

available from firmware	V 1.30.00
available up to firmware	V 2.99.99
data type	bool (8-bit)
unit	–
value range	0; 255

Description

These configuration parameters are only relevant if *ETSI_EN302208* or *ETSI_EN302208_LBT* has been selected as the communications standard.

Depending on the communications standard, different maximum transmission powers are allowed per channel:

For EN 302208, these are:

Channel	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Maximum permitted transmission power	0 W	0 W	0 W	2 W	0 W	0 W	2 W	0 W	0 W	2 W	0 W	0 W	2 W	0 W	0 W

For EN 302208_LBT, these are:

Channel	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Maximum permitted transmission power	0,1 W	0,1 W	0,1 W	2 W	2 W	2 W	2 W	2 W	2 W	2 W	2 W	2 W	2 W	0,5 W	0,5 W

If this parameter is activated, the following happens:

1. The used transmission power is limited to the lowest maximum power for the selected channels. For example, if *EN302208_LBT* is selected, and channels 3 and 4 are entered in the channel list, and 2 Watt has been set as the transmission power, the reader transmits only at 0.1 Watt, since channel 3 has a maximum power setting of only 0.1 Watt within these channels.
2. If point 1 yields a maximum power setting of 0 Watt (if, for instance, *EN 302208* was selected and a channel other than channels 4, 7, 10 or 13 was entered in the channel list), the reader generates a “power check error” for the respective antenna port.

5.7.5 *ActiveChannels*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	word (16-bit)
unit	–
value range	0 – 65535

Description

From Version V 3.00.00, this parameter replaces *PortChannelListGlobalValue1...16* and *PortChannelListPort1...8Value1...16*.

Each set bit means an activated ETSI radio channel. The standard value for the four high-power channels is 0x1248 (4680).

5.8 Communication Standard (CommStandard)Configuration Group

The following configuration parameters contain the setting options for the *Special* communications standard. By means of this communications standard it is possible to enter country profiles for countries for which there has not been an entry implemented in the reader yet. The main requirement is that the communication standard to be set fits into the schematic channel grid with specified exposure and pause times and random channel selection. A further requirement is that the values of the configuration parameter, taken together, ensure 100% coverage of the time. This means that the reader is able to determine a valid channel from the values set in the parameters at any time. To ensure a 100% time coverage, one of the following conditions must be satisfied:

(FirstChannel = *LastChannel*) AND (*MinChannelWaitTime* = 0)

oder

(MaxChannelTime – 5 ms) * (*LastChannel* – *FirstChannel* + 1) ≥ *MinChannelWaitTime*

Due to the fact that the hardware of the RFID reader cannot display every frequency, when using the *Special* communications standard it is necessary to carry out a spectrum analysis to check whether it is possible to set the frequency of each channel correctly.

5.8.1 *CenterFreqCH0*

Characteristics

available from firmware	V 1.32.00
available up to firmware	–
data type	DWord (32-bit)
unit	kHz
value range	0 – 1048575

Description

This configuration parameter specifies the mid-frequency of channel 0 for the *Special* communications standard.

5.8.2 *ChannelWidth*

Characteristics

available from firmware	V 1.32.00
available up to firmware	–
data type	Word (16-bit)
unit	kHz
value range	0 – 65535

Description

This configuration parameter specifies the width of each radio channel for the *Special* communications standard.

5.8.3 *MaxChannelTime*

Characteristics

available from firmware	V 1.32.00
available up to firmware	–
data type	word (16-bit)
unit	milliseconds
value range	0; 10 – 65535

Description

This configuration parameter for the *Special* communications standard specifies how long the reader may occupy a selected channel until it has to change to the next channel.

5.8.4 *MinChannelWaitTime*

Characteristics

available from firmware	V 1.32.00
available up to firmware	–
data type	word (16-bit)
unit	milliseconds
value range	0; 10 – 65535

Description

This configuration parameter for the *Special* communications standard specifies how long the reader must wait before returning to a channel after its maximum exposure time (*MaxChannelTime*) has elapsed.

5.8.5 *FirstChannel*

Characteristics

available from firmware	V 1.32.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 255

Description

This configuration parameter for the *Special* communications standard specifies the first channel to be used for this communications standard. The frequency of the channel is determined by the following formula:

f = CenterFreqCH0 + FirstChannel + ChannelWidth

5.8.6 *LastChannel*

Characteristics

available from firmware	V 1.32.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 255

Description

This configuration parameter for the *Special* communications standard specifies the last channel to be used for this communications standard. The frequency of the channel is determined by the following formula:

f = CenterFreqCH0 + LastChannel + ChannelWidth

5.8.7 *UseLBT*

Characteristics

available from firmware	V 2.52.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0; 255

Description

This configuration parameter for the *Special* communication standard specifies whether LBT (*Listen Before Talk*) should be used.

5.8.8 *LBTThreshold*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	word (16-bit); signed
unit	¼ dBm
value range	–32768 – 32767

Description

This configuration parameter for the *Special* communication standard specifies the LBT threshold. The requirement for an active LBT is that the *UseLBT* parameter is activated.

5.9 LED Configuration Group

5.9.1 *ColourLED1...12*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	Dword (32-bit)
unit	¼ dBm
value range	0 – 16777215

Description

The RGB colour value of the corresponding LED is saved in the lower 24 bits of this configuration value:

Bits 0 to 7	8-bit blue portion
Bits 8 to 15	8-bit green portion
Bits 16 to 23	8-bit red portion

5.9.2 *FunctionLED1...12*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 36

Description

This parameter specifies the functionality of a reader LED:

Value	Function
0	LED is off
1	LED is on
2	LED flashes with ca. 1 Herz
3	LED flashes with ca. 2 Herz
4	LED flashes with ca. 4 Herz
5	LED flashes with ca. 8 Herz
6	LED shows that high frequency is on
7	LED shows an antenna error
8	LED shows that a tag has been detected
9	LED shows a successful tag operation
10	it is possible to set the LED status by means of the communication protocol
11–31	not used
32	LED shows whether a @KRAI antenna is connected
33	LED shows the Wi-Fi status
34	LED shows the GSM status
35	LED shows the Bluetooth status
36	LED shows the Ethernet link status

5.9.3 *FunctionFirstAntennaPortLED1...12* and *FunctionLastAntennaPortLED1...12*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0 – 8

Description

This parameter specifies which antenna port the set LED function corresponds to. This parameter is relevant for LED functions 6 to 9; see Chapter *FunctionLED1...12, p. 40*.

5.9.4 *FunctionTimeToSwitchOffLED1...12*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	word (16-bit)
unit	milliseconds
value range	0 – 65535

Description

This parameter specifies after what time the LED should turn off after an event occured. This parameter is relevant for LED functions 8 and 9; see Chapter *FunctionLED1...12, p. 40*.

5.9.5 *Brightness*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	byte (16-bit)
unit	percent
value range	0 – 100

Description

This parameter sets the brightness of the Generation 3 reader LEDs. The value 0 has a special function. If the value is set to 0, the LED brightness is set according to the surrounding light.

5.10 GPIO Configuration Group

5.10.1 *InvertInput1...8*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0; 255

Description

If this parameter has been activated, the logic of the input signal is inverted. 0 becomes 1 and vice versa.

5.10.2 *DebounceTimeInput1...8*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	word (16-bit)
unit	milliseconds
value range	0 – 65535

Description

This parameter specifies the debounce time in milliseconds. A level change that is shorter than the time configured here will not be taken into account.

5.10.3 *InvertOutput1...8*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	bool (8-bit)
unit	–
value range	0; 255

Description

If this parameter has been activated, the logic of the output signal is inverted. 0 becomes 1 and vice versa.

5.10.4 *FunctionOutput1...8*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0–10

Description

This parameter specifies the functionality of an output:

Value	Function
0	output is off
1	output is on
2	output sends a square-wave signal with a frequency of ca. 1 Herz
3	output sends a square-wave signal with a frequency of ca. 2 Herz
4	output sends a square-wave signal with a frequency of ca. 4 Herz
5	output sends a square-wave signal with a frequency of ca. 8 Herz
6	output shows that high frequency is on
7	output shows an antenna error
8	output shows that a tag has been detected
9	output shows a successful tag operation
10	it is possible to set the output status by means of the communication protocol

5.10.5 *FunctionFirstAntennaPortOutput1...8* and *FunctionLastAntennaPortOutput1...8*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	byte (8-bit)
unit	–
value range	0–8

Description

This parameter specifies which antenna port the set output function corresponds to. This parameter is relevant for output functions 6 to 9; see Chapter *FunctionOutput1...8, p. 43.*

5.10.6 *FunctionTimeToSwitchOffOutput1...8*

Characteristics

available from firmware	V 3.00.00
available up to firmware	–
data type	word (16-bit)
unit	milliseconds
value range	0–65535

Description

This parameter specifies after what time the output should turn off after an event occured. This parameter is relevant for output functions 8 and 9; see Chapter *FunctionOutput1...8, p. 43.*

6 Contact Information

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