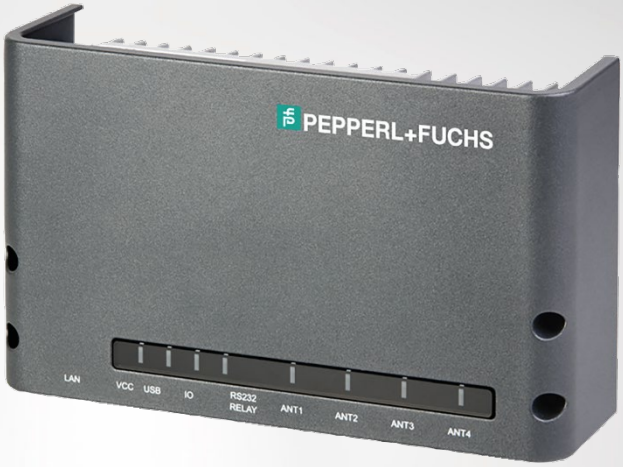
IUR-F800-V1D-4A-FR*

Parameters, Protocols, Data Transmission

Firmware Version 02.06.00



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1. Safety Instructions / Warning

The device may only be used for the intended purpose designed by the manufacturer.

The operation manual should be conveniently kept available at all times for each user.

Unauthorized changes and the use of spare parts and additional devices which have not been sold or recommended by the manufacturer may cause fire, electric shocks or injuries. Such unauthorized measures shall exclude any liability by the manufacturer.

The liability-prescriptions of the manufacturer in the issue valid at the time of purchase are valid for the device. The manufacturer shall not be held legally responsible for inaccuracies, errors, or omissions in the manual or automatically set parameters for a device or for an incorrect application of a device.

Repairs may only be executed by the manufacturer.

Installation, operation, and maintenance procedures should only be carried out by qualified personnel.

Use of the device and its installation must be in accordance with national legal requirements and local electrical codes.

When working on devices the valid safety regulations must be observed.

Special advice for carriers of cardiac pacemakers:
Although this device doesn't exceed the valid limits for electromagnetic fields you should keep a minimum distance of 25 cm between the device and your cardiac pacemaker and not stay in an immediate proximity of the device respective the antenna for some time.

2. Introduction

2.1 Abbreviations

ADR	Address
ASK	Amplitude Shift Keying
CB	Config Block
CFG	Configuration Parameter Block
CRC	Cyclic Redundancy Check
DB	Data Block
DIP	Dual Inline Plastic
DRM	Dense Reader Mode
FIFO	First in First out
frq	Frequency
FSK	Frequency Shift Keying
h	Hour
Hz	Hertz
ID	Identification
IDD	Identifier Data
IN	Input
LEN	Length
LOC	Location
LSB	Least Significant Byte
min	Minutes
ms	Milliseconds
MSB	Most Significant Byte
N	Number
OUT	Output
R/W	Read / Write Access
RD	Read
REL	Relay
RF	Radio Frequency
RSSI	Received Signal Strength Indicator
RTC	Real Time Clock
TAB	Table
TR	transponder
TS	Timeslot
UID	Unique Identifier (read only Serial Number)
WO	Write Only Access
WR	Write

2.2 Function

The IUR-F800-V1D-4A-FR* is a UHF Long Range Reader and has the following key features:

- Low Noise Transmitter Architecture
- High sensitivity receiver increases the tag detection range so that transponders can be read over the entire power up, field strength area.
- Reader protection against various fault conditions as e.g. antenna shortcut, antenna mismatching and electrostatic discharge.
- Tough, solid aluminum die case housing for rough environments.
- Quick installation due to easy access to the interfaces and antenna ports.
- Indication of read events via 4 separate reading point LEDs.
- Various I/O's suit industrial needs

The base set of commands and features are compatible with the commands used throughout the product line. The configuration possibilities of the IUR-F800-V1D-4A-FR* make it easy to adapt the reader to a wide range of applications by software and hardware configurations.

The reader has three hardware interface ports: Ethernet, RS232 and USB. Furthermore, the reader has digital I/O's for direct control of various trigger possibilities as well as various outputs for sensor applications and for a direct control of several indicators. In access control applications the digital outputs of the reader can be configured as Data/Clock (Wiegand/MagStripe) interface.

3. Data Transmission (Reader and Host)

Six different ways of data transmission between readers and host (terminal, PC) are possible. The Host Commands, Buffered Read Mode, Scan Mode and Notification Mode are used for the data exchange between transponder and host, whereas the Configuration Commands and the reader Control Commands serves for adapting the reader parameters to the individual range of applications. The following chart shows which method of data transmission is supported by which interface:

Interface

	RS232	Data Clock	USB	LAN
Configuration Command	X	-	X	X
Reader Control Commands	X	-	X	X
Host Commands	X	-	X	X
Buffered Read Mode	X	-	X	X
Scan Mode	X	X	X	-
Notification Mode	-	-	-	X

Table 1.

3.1 Configuration Commands and Control Commands

This method of data transmission is used for reader configuration and the diagnosis via the different Hardware Interfaces of the reader.

The reader-configuration parameters will be stored in the reader memory. To store the current configuration during a power down of the reader the reader-Configuration has to be stored in the EEPROM. After power up the reader reads the configuration out of the EEPROM.

The reader control is immediately processed and the response from the reader contains status or data information of the control command.

<table>
<tr><th>Host (Terminal / PC / ....)</th><th></th><th colspan="2">Reader</th></tr>
<tr><td rowspan="2">parameter- / control command</td><td rowspan="2">→</td><td colspan="2">parameter received and stored / control command processed</td></tr>
<tr><td>yes</td><td>no</td></tr>
<tr><td></td><td>←</td><td>status / data</td><td>error status</td></tr>
<tr><td></td><td>←</td><td colspan="2"></td></tr>
</table>

Table 2.

3.2 Host Commands

The Host Commands provide the exchange of data between a host and transponders via the reader as long as the transponder remains in the detection range of the reader.

Note

During the writing of data to a transponder, it must be ensured that the transponder is located within the detection range of the reader for the duration of the entire process. If the transponder is removed from detection range of the reader during a writing process, this will cause a loss of data.

Addressed mode:

Before reading or writing data in addressed mode, the UID of the transponder has to be known. This is executed by sending the protocol [0x01] Inventory.

If a transponder is located within the detection range of the reader at that time, it answers with its UID. For all following read- / write orders the transponder must be addressed with its correct UID. The following chart will show the necessary steps for the communication with a transponder in addressed mode:

Host (Terminal / PC / ....)		Reader	
Inventory to get the UID	→	transponder in antenna field?	
		Yes	No
	←	status / number of transponders / UID	status = no transponder
	←		
read data from transponder with UID	→	transponder with correct UID in antenna field?	
		Yes	No
	←	status / transponder read data	status = no transponder in reader field
	←		
write data to transponder with UID	→	transponder with correct UID in antenna field?	
		Yes	No
	←	OK status	status = no transponder in reader field
	←		

Table 3.

3.3 Buffered Read Mode

The Buffered Read Mode is a high level operating mode to detect transponders which are within the detection range of the reader. This operation mode processes all transponder read data and filter operations to make the user interface transparent to transponder data and to minimize data transfers between reader and host. There are only three commands used to control Buffered Read Mode.

In this operating mode the reader automatically selects transponders which are within the detection range of the reader and reads their requested data. The read transponder data is stored in a ‘FIFO’ organized data buffer. Up to 960 can be stored into the buffer. In case of power down the buffer will be initialized and all datasets get lost.

The sampled transponder data can be read with the 0x22] Read Buffer command. This command always reads the first available data sets from the data buffer. However data already read have to be deleted with the

[0x32] Clear Data Buffer command before the next data sets in the data buffer can be reached with the read command.

If the Buffered Read Mode is enabled in the CFG1: Interface and Mode configuration block, the reader immediately starts sampling transponder data after power up. The Buffered Read Mode can be reinitialized with the [0x33] Initialize Buffer command.

If turned to Buffered Read Mode the reader answers every valid message with data- or status-protocol. The answer includes the control byte which has been received by the reader.

Host (Terminal / PC / ....)		Reader	
read data	→	transponder data in data buffer?	
		Yes	No
	←	status / data protocol	status = no valid data
	←		
clear data	→	transponder data read?	
		Yes	No
	←	OK status	status = no valid data
	←		

Table 4.

Note

Only read operations are available with the Buffered Read Mode.

3.4 Notification Mode

The Notification Mode is an extended option of the Buffered Read Mode: queued transponder data and optionally Input / Status events are notified automatically and asynchronously to a host with the Protocols for Buffered Read Mode and Notification Mode response protocol. The destination address and the notification conditions can be set in CFG49: Notification Channel configuration block. In general, the notification channel can be used simultaneously with the host interface.

In difference to the Buffered Read Mode procedure, a notification is normally not acknowledged by the host. Thus, the deletion of the transferred data with the [0x32] Clear Data Buffer command is not necessary. As an option, the acknowledgement can be enabled to synchronize the notifications with the host to prevent notification overflow in the host application.

The notification message format depends on trigger settings in CFG10: Trigger and settings for the read mode in CFG11: Read Mode – Read Data and CFG12: Read Mode – Filter as well as settings for the notification trigger in CFG49: Notification Channel The following table lists the message formats:

Notification Trigger: continuous or time-triggered		
	Input/Status Event	Data Event
Read Trigger disabled	Input/Status and Data Events are notified together in one or multiple messages. The message format depends on settings in TR-DATA of CFG11.	
Read Trigger enabled	Notification separately and immediately, if in: ▪ CFG11: IN flag in TR-DATA2 is set and ▪ CFG12: flag is set for input and/or status to be observed	Notification shortly after notification of input/status event. The message format depends on settings in TR-DATA of CFG11.

Table 5.

Note

One notification can contain more than one input/status event, if multiple events occur at the same time.

Notification Trigger: host-triggered		
	Input/Status Event	Data Event
Independent of Read Trigger	Input/Status and Data Events are notified together in one message. The notification is activated by command [0x34] Force Notify Trigger. The message format depends on settings in TR-DATA of CFG11.	

Table 6.

An additional option of the Notification Mode is the Keepalive message, which can be sent periodically to the host. The Keepalive message transports valuable information about the reader hardware and antenna tuning status. Keepalive messages are always never acknowledged by the host. The Keepalive message should not be mistaken with the keepalive option of a LAN connection initiated by a host.

3.5 Scan Mode

In this operation mode the reader autonomously sends out data to the host as soon as a transponder is within the detection range and valid data could be read.

In Scan Mode the contents of the message block (IDD, data block) can be

adapted to each user-application. Scan mode is available via the asynchronous Interface.

The reader starts the output of the protocol block as soon as all required data have been read correctly from the transponder. If the reader is not able to read all data of a protocol block completely and without error, it does not send data. For example, if the address of the data block is invalid, the IDD of the transponder will not be sent out.

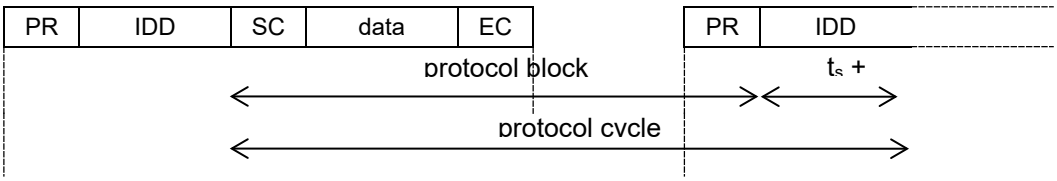
Scan-Mode via asynchronous interface:

The data will be sent out depending on their configuration according to the following scheme, the sequence of which cannot be changed.

Depending to the configuration and the number of transponders in the detection range of the reader the transmitted protocols have a different format.

Example 1:

One transponder in detection range and UID and data block should be read:



Example 2:

3 transponder in detection range only UID should be read:

PR	IDD1	EC	IDD2	EC	IDD3	EC

Example 3:

3 transponder in detection range only data block should be read:

PR	data1	EC	data2	EC	data3	EC

Example 4:

2 transponder in detection range UID and data block should be read:

PR	IDD1	SC	data1	EC	IDD2	SC	data2	EC

PR:	Com-Prefix (optional)	ts:	SCAN-LOCK-TIME
IDD:	Identifier Data (fix)	tr:	time to the next new transponder reading

data: data blocks (free programmable)

SC Separation character (optional)

EC End character (optional)

Note

If configuration protocols shall be sent to the reader while the Scan Mode is active, no transponder should be within the detection range of the reader during this time. Only read operations are available with the Scan Mode.

4. Interface

The IUR-F800-V1D-4A-FR* has 3 interface ports. The protocol frame of these ports can be different. On the asynchronous serial interface the whole protocol frame is described in Serial Data Format and Protocol Frame. The TCP/IP protocol frame is described below.

4.1 Characteristics of TCP/IP protocol

If the reader uses the LAN interface the data is packaged in TCP/IP protocol frames. This means the whole data format and protocol frame which is described Serial Data Format and Protocol Frame is packaged as the data of TCP/IP protocol frames.

If you use the TCP/IP protocol, please be aware that the data packaged in the TCP/IP frame is transferred with Protocol frame: Advanced Protocol-Length as describe below.

The LAN socket on the reader side uses the keepalive option for detecting interrupted connections. The default parameters for keepalive are initialized as listed in the table:

Parameter	Value	Note
idle time	5 seconds	The reader sends every 5 seconds a keepalive probe which has to be acknowledged by the client
repeat count	2 seconds	If a keepalive probe is not acknowledged, the reader repeats the probe only two times with an interval of 5 seconds.
interval	5 second	

Table 7.

If the 15 second time span is expired and no keepalive probe response is obtained from the client the connection is closed and the client application must enable a new connection. The keepalive parameters can be modified in the configuration pages for LAN. This keepalive option should not be mistake with the Keepalive message for notification mode.

4.2 Serial Data Format and Protocol Frames

The IUR-F800-V1D-4A-FR* can be configured by different interfaces and data may be written on transponders or read from transponders. The communication between reader and connected host (terminal, PC, etc.) is executed by means of fixed protocols. The used protocol is intended for data bus use and is equipped with a bus address.

During data transfer via the asynchronous interface the reader supplies the required data or a status byte. The reply contains the transmitted control byte.

There is no reply from the reader if there is a protocol frame failure.

Protocol frame: Advanced Protocol-Length

Reader <- Host

1	2	3	4	5	(6...n-2)	n-1	n
STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	CONTROL - BYTE	(DATA)	LSB CRC16	MSB CRC16

Table 8.

Host -> Reader

1	2	3	4	5	6	(7...n-2)	n-1	n
STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	CONTROL - BYTE	STATUS	(DATA)	LSB CRC16	MSB CRC16

Table 9.

Note

The reader supports the advanced protocol frame only.

STX

If the responded protocol of the reader starts with the STX sign (0x02) the protocol includes more than 255 Byte. Then the protocol length is defined by the 2 Byte Parameter ALENGTH.

ALENGTH (n = 8...65535)

Number of protocol bytes including STX, ALENGTH and CRC16

COM-ADR

0..254 address of device in bus mode

Note

The reader can be addressed via COM-ADR 255 at any time.

CONTROL-BYTE

Defines the command which the reader should operate.

STATUS

Includes the status message or protocol data from or to the reader.

DATA

Is an optional data field with variable length. The number of DATA bytes depends on the command. The data will be sent always as MSB first if the reader is in the Host Command Mode.

CRC16

Cyclic redundancy check of the protocol bytes from 1 to n-2, as specified by CCITT-CRC16

Polynomial: $x^{16} + x^{12} + x^5 + 1$ (0x8408)

Start Value: 0xFFFF

Direction: Backward

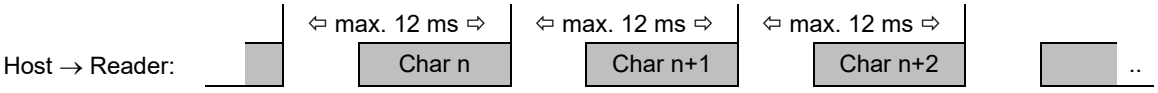
Data Format

Start bits: 1
Data bits: 8
Stop bits: 1
Parity: even (default), odd, none

Timing conditions:

Data timeout:

Within one protocol, the characters have to follow each other in intervals of maximum 12 ms.



4.3 CRC16 Calculation Algorithm

Polynomial: $x^{16} + x^{12} + x^5 + 1$ ==> CRC_POLYNOM = 0x8408;

Start Value: 0xFFFF ==> CRC_PRESET = 0xFFFF;

C-Example:

```
unsigned int crc = CRC_PRESET;


for (i = 0; i < cnt; i++)      /* cnt = number of protocol bytes without CRC */
{
   crc ^= DATA[i];
   for (j = 0; j < 8; j++)
   {
            if (crc & 0x0001)
                     crc = (crc >> 1) ^ CRC_POLYNOM;
            else
                     crc = (crc >> 1);
   }
}
```

5. Configuration Parameters

The configuration memory of the reader is organized in configuration blocks of 16 byte each. These are divided into 14 byte configuration parameters and a 2 byte CRC16 checksum. Each of these configuration blocks takes a number (CFG 0...CFG n).

Structure of a configuration block in Reader configuration memory and Reader EEPROM (CFG):

Byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Contents	PARAMETER														CRC16	

Table 10.

The parameters are stored in two different configuration memory locations:

- Reader RAM
- Backup EEPROM (used for storing parameter over power down)

Multiple configuration memory locations can be addressed by the value of the parameter CFG-ADR.

CFG-ADR:

CFGn: memory-address of the required configuration block

LOC: specifies the location of the configuration block (RAM / EEPROM)

MODE: specifies one or all configuration blocks

Bit	7	6	5	4	3	2	1	0
Function	LOC	MODE	CFGn: address of configuration block					

Table 11.

The EEPROM configuration blocks are protected by a 16 bit CRC-checksum. The examination of these checksums is executed after each reset of the reader. If a checksum error is found, the reader goes into an error status "EE-Init-Mode" and sets the configuration block which is faulty to the default-values.

While the EE-Init-Mode is active, the LED blinks alternately red and green and the reader answers external commands with the status "0x10 EEPROM Failure". The "EE-Init-Mode" can be exited now by a new reset (cold start or [0x64] System Reset command). If after this the checksums of all data records are correct, the reader shifts to the configured operation mode.

Note

Malfunctions may occur if parameters are configured outside their described range or if unspecified parameters have been changed!

A downgrade of the firmware will result in a complete reset of the EEPROM. All parameters will be reset to factory default.

Structure of configuration parameter description.

Byte	0	1	2	.....n
contents	RAM-eff.	EEPROM-eff.	00 res	.....

Table 12.

not marked

Changing of this parameter becomes immediately effective after writing / saving this configuration block to RAM

gray marked

Changing of this parameter only becomes effective after writing / saving this configuration block to EEPROM and a reset of the RF Controller with [0x64] System Reset in mode 0x00.

marked with “00“

these bits or bytes are reserved for future extensions or for internal testing and manufacturing-functions. These bits or bytes and also any not described bits and bytes must not be changed, as this may cause faulty operation of the reader.

5.1 CFG0: Passwords

The parameters of the CFG0 configuration block contain the identification codes to personalize the reader for a user to prevent outside access to some features of the reader. For security reasons data from this configuration block cannot be read from the host, they are “write-only”.

Also the command [0x83] Reset Configuration isn’t available for this configuration block.

Byte	0	1	2	3	4	5	6
Contents	READER-ID				0x00	0x00	0x00
Default	0x00000000						

Byte	7	8	9	10	11	12	13
Contents	0x00	CFG_ACCESS				0x00	0x00
Default	0x00000000						

Table 13.

READER-ID: (AccessProtection.Password)

Defines the password with which the host logs into the reader for a read / write access to the configuration parameter blocks.

CFG_ACCESS: (AccessProtection.Lock_CFGX)

Defines the Configuration blocks which are accessible only if the user has had a successful login to the reader.

Byte	8								9							
Bit	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
CFG No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Byte	10								11							
Bit	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
CFG_NO.	16	17	18	19	20	21	22-29	30-39	40-49	50-59	60-62	63	-	-	-	-

Table 14.

CFG_NO

The Bit in CFG_NO defines if the access to the configuration block is free or if the use should login to the reader to get access to the configuration block.

b0 ==> Access if free

b1==> Access need a login

Note

A READER-ID = 0x00000000 disables the password function.

If the reader ID is not set 0x00000000 the configuration page CFG0 is automatically read protected.

A read with the command [0x80] Read Configuration will always get ‘0x00000000’.

To change the READER-ID you must write to the CFG0 immediately after the Login to the reader with the command [0xA0] reader-Login.

A changed password becomes valid after a System Reset [0x64] System Reset.

The commands [0x81] Write Configuration and [0x83] Reset Configuration don’t change the CFG0 register if all configuration blocks are used. Also access protected Con-figuration Pages will not be influenced by these Commands.

The command [0xA0] reader-Login is used to enable configuration data access.

It is possible to disable the READER-ID with an activation code, if the READER-ID is unknown.

The activation code must be ordered by your supplier or Pepperl+Fuchs SE.

Config Protection

By means of Config Protection, the access to the configuration parameters stored within the reader is protected by a 32-bit password, the "READER-ID". This means that only after a "Login" with a valid READER-ID the configuration parameters in the EEPROM of the reader can be read and changed in the EEPROM of the reader.

5.2 CFG1: Interface and Mode

The parameters of the configuration block CFG1 contain the data communication settings.

Byte	0	1	2	3	4	5	6
Contents	COM-ADR	0x00	BAUD[1]	TRANS-FORM[3]	0x00	0x00	TR-RESPONSE -TIME
Default	0x00 *0x00*		0x08 *38400 Baud*	0x01 *e,8,1*			0x01

Byte	7	8	9	10	11	12	13
Contents	TR-RESPONSE -TIME	0x00	0x00	0x00	SCAN-INTERFACE	INTERFACE	READER - MODE
Default	0x2C *1,5 sec.*				0x02	0x95	0x00

Table 15.

COM-ADR: (HostInterface.Serial.BusAddress)

Bus address of the reader (0 .. 254) for communication via the asynchronous interface.

Note

Do not configure address 255!

Via the COM-ADR 255 in the send protocol, the reader is able to be addressed at any time. It answers then with the configured address.

[1] A reasonableness check is performed by writing this parameter to the reader. If an error occurs the reader answers with STATUS = 0x11.

BAUD: (HostInterface.Serial.Baudrate)

By means of this byte the baud rate of the asynchronous interface can be defined.

0x05: 4800 baud

0x06: 9600 baud

0x07: 19200 baud

0x08: 38400 baud

0x09: 57600 baud

0x0A: 115200 baud

Note

Changing of BAUD only becomes effective after writing / saving configuration block CFG1 to EEPROM and a reset of the reader.

The reader sets the baud rate to 38400 baud, if the user sets an invalid baudrate.

TRANS-FORM:

By means of this byte, several parameters for the data transmission format of the asynchronous interface can be defined.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	S	D	P	

Table 16.

P: (HostInterface.Serial.Parity)

Kind of Parity

b00: no Parity

b01: even Parity

b10: odd Parity

b11: - do not use –

D: (HostInterface.Serial.Databits)

Number of Data Bits

b0: 8 Data Bits

b1: - do not use –

S: (HostInterface.Serial.Stopbits)

Number of Stop Bits

b0: 1 Stop Bit

b1: - do not use –

Note

Changing of TRANS-FORM only becomes effective after writing / saving configuration block CFG1 to EEPROM and reset of the reader.

Always 8 Data Bits and 1 Stop Bits should be used.

TR-RESPONSE-TIME: (AirInterface.TimeLimit)

By means of this parameter the maximum duration for the transponder command can be defined.

The TR-RESPONSE-TIME starts after the reader has received a new command. At the latest after the TR-RESPONSE-TIME elapsed the reader will send an answer protocol. In this case, the current commands between reader and transponder are aborted. If this time is too short the Interface Status “0x83 RF Communication Error“ will appear.

	max. response duration
TR-RESPONSE-TIME	0...65535 * 5 ms

Table 17.

Note

TR-RESPONSE-TIME has no effect with the protocols for reader Configuration and the protocols for reader Control.

The TR-RESPONSE Time must be less than “Block Timeout” in the Host Interface settings.

SCAN-INTERFACE: (OperatingMode.ScanMode.Interface)

Selection of the communication port for Scan-Mode

Bit	7	6	5	4	3	2	1	0
Function	-	-	DC-Format			IF-NO		

Table 18.

IF-NO: Interface Number

b000: RS232

b001: - do not use –

b010: USB

b011: Data clock

b1xx: - do not use –

DC-FORMAT:

By means of this parameter the kind of data transmission via data-/clock interface could by selected:

b000: Wiegand emulation Wiegand Emulation
data format: binary 1:1, according written to transponder.

b010: magnetic stripe Magnetic Strip Emulation
data format: according ISO 7811-2, track 2+3 (5 Bit)

b011: magnetic stripe Magnetic Strip Emulation
data format: according ISO 7811-2, track 1 (7 Bit)

b100: Wiegand emulation Wiegand Emulation
data format: Wiegand formatted protocol frame with start and stop sign.

b101: magnetic stripe Magnetic Strip Emulation
data format: according ISO 7811-2, track 2+3 (5 Bit)
additional a prefix of 16 leading zero clocks before the start character and
additional a trailer of 16 attached zero clocks following to the LRC character.

b110: Wiegand emulation Wiegand Emulation
data format: Wiegand formatted protocol frame

INTERFACES: (HostInterface.Interfaces)

Flags for enabling the communication ports

Bit	7	6		5	4	3	2	1	0
Function	Discovery	-		-	USB	-	LAN	RS4xx	RS232

Table 19.

RS232:

b0: disable

b1: enable

LAN:

b0: disable

b1: enable

USB:

b0: disable

b1: enable

Discovery:

b0: disable

b1: enable

READER-MODE: (OperatingMode.Mode)

By means of this byte, the reader mode can be defined.

Bit	7	6	5	4	3	2	1	0
Function	BRM-E	NTF-E	0	0	0	0	0	SCAN-E

Table 20.

SCAN-E:

By setting of this bit the Scan-Mode can be enabled

b0: Host Mode Protocols for Host Commands

b1: Scan Mode

BRM-E:

By setting of this bit the Buffered Read Mode can be enabled

b0: Host Mode or Scan Mode

b1: BRM-Mode

NTF-E:

By setting of this bit the Notification Mode can be enabled

b0: Off

b1: On (only together with BRM-Mode)

The following table lists the bit combinations for the reader modes:

		Bit							
		7	6	5	4	3	2	1	0
Reader Mode	Host-Mode	0	0	0	0	0	0	0	0
	Scan Mode	0	0	0	0	0	0	0	**1**
	Buffered Read Mode	**1**	0	0	0	0	0	0	0
	Notification Mode	**1**	**1**	0	0	0	0	0	0

Table 21.

5.2.1 Magnetic Strip Emulation

Data Format:

The following table shows data coding depending on DC-FORMAT

For cutting the length of data output the parameters D_LGT and D_START

CFG11: Read Mode – Read Data are used. D_LGT and D_START are the number of Bits to be read and the Start Bit.

DC-FORMAT	b010 b101 according ISO 7811-2 (5 bit)	b011 according ISO 7811-2 (7 bit)
raw data	P / MSB.....LSB	P / MSB.....LSB
0x0	b 1 / 0 0 0 0	b 0 / 0 1 0 0 0 0
0x1	b 0 / 0 0 0 1	b 1 / 0 1 0 0 0 1
0x2	b 0 / 0 0 1 0	b 1 / 0 1 0 0 1 0
0x3	b 1 / 0 0 1 1	b 0 / 0 1 0 0 1 1
0x4	b 0 / 0 1 0 0	b 1 / 0 1 0 1 0 0
0x5	b 1 / 0 1 0 1	b 0 / 0 1 0 1 0 1
0x6	b 1 / 0 1 1 0	b 0 / 0 1 0 1 1 0
0x7	b 0 / 0 1 1 1	b 1 / 0 1 0 1 1 1
0x8	b 0 / 1 0 0 0	b1 / 0 1 1 0 0 0
0x9	b 1 / 1 0 0 1	b 0 / 0 1 1 0 0 1
0xA	b 1 / 1 0 1 0	b 1 / 1 0 0 0 0 1
0xB	b 0 / 1 0 1 1	b 1 / 1 0 0 0 1 0
0xC	b 1 / 1 1 0 0	b 0 / 1 0 0 0 1 1
0xD	b 0 / 1 1 0 1	b 1 / 1 0 0 1 0 0
0xE	b 0 / 1 1 1 0	b 0 / 1 0 0 1 0 1
0xF	b 1 / 1 1 1 1	b 0 / 1 0 0 1 1 0
Start „%“	b 0 / 1 0 1 1	b 1 / 0 0 0 1 0 1
Stop „?“	b 1 / 1 1 1 1	b 0 / 0 1 1 1 1 1

Table 22.

Example: Output of raw data 0x19BF

Sign DC-FORMAT	prefix (16*0)	Start %	0x1	0x9	0xB	0xF	Stop ?	LRC	trailer (16*0)
b010	-	1101/0	1000/0	1001/1	1101/0	1111/1	1111/1	0001/0	-
b101	000...000	1101/0	1000/0	1001/1	1101/0	1111/1	1111/1	0001/0	000...000
b011	-	101000/1	100010/1	100110/0	010001/1	011001/0	111110/0	011010/0	-

Time →

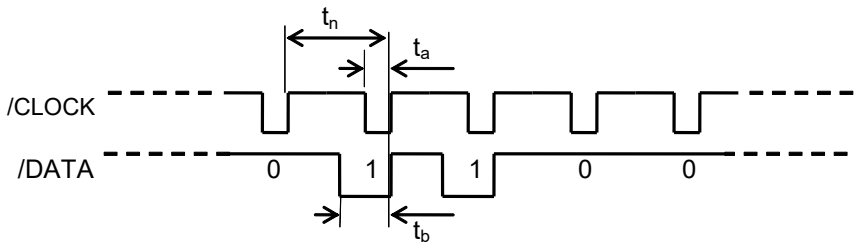
Table 23.

LRC:

XOR operation on Start-, Data and Stop-sign

Timing:

The following diagram represents the signal response of the 2 data lines of the data-/clock-interface in magnetic strip emulation.



t_n = 0,5 ms
$t_{a(n)} \approx t_n / 3$
$t_{b(n)} \approx t_n / 2$

5.2.2 Wiegand Emulation

Data Format:

The following description represents the data coding depending on DC-FORMAT

DC-FORMAT = b000 ==> binary 1:1

In this configuration the output data format is equal to the data coding on the transponder. The reader doesn't add a protocol frame e.g. parity Bits or start or stop signs across the data stream.

DC-FORMAT = b100 ==> Wiegand formatted protocol frame with start and stop sign

In this configuration the reader build the protocol frame with one even parity bit at the beginning and one odd parity bit at the end and one start and one stop sign:

4 Bit	1 Bit	n Bit	1 Bit	4 Bit
START	EVEN	DATA	ODD	STOP

Table 24.

START: b1011

EVEN: Even parity bit calculated across the first half DATA bits.

DATA: Data bits as read from the transponder and defined in scan-mode settings.

ODD: Odd parity bit calculated across the last half DATA bits.

STOP: b1111

DC-FORMAT = b110 ==> Wiegand formatted protocol frame

In this configuration the reader build the protocol frame with one even parity bit at the beginning and one odd parity bit at the end.

1 Bit	n Bit	1 Bit
EVEN	DATA	ODD

Table 25.

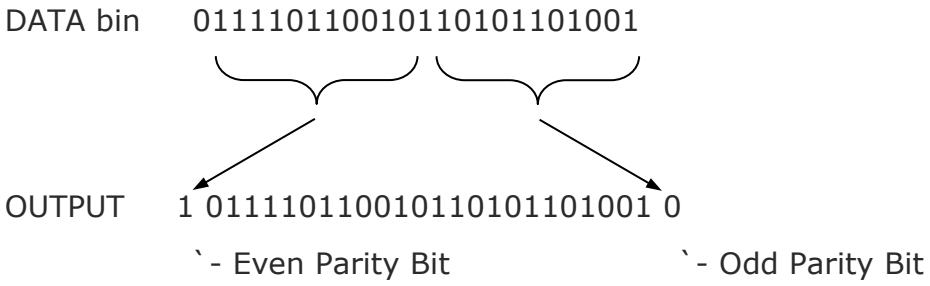
EVEN: Even parity bit calculated across the first half DATA bits.

DATA: Data bits as read from the transponder and defined in scan-mode settings.

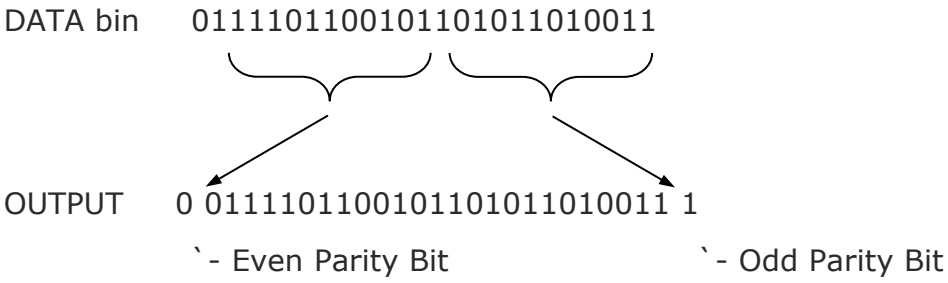
ODD: Odd parity bit calculated across the last half DATA bits.

Example of parity calculation

Example 1: 24 DATA bits

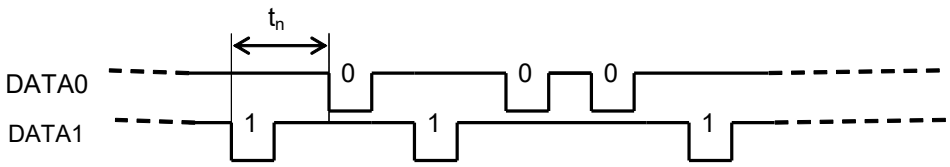


Example 1: 25 DATA bits



Timing

The following diagram represents the signal response of the 2 data lines of the data-/clock-interface in Wiegand emulation.



t_n = 0,5 ms

5.3 CFG2: Inputs / Outputs

The parameters of configuration block CFG2 contain the digital-input and -output settings.

Byte	0	1	2	3	4	5	6
Contents	IDLE-MODE		ACTIVE-STATE		IN-ACTIVE	0x00	REL1-TIME MSB
Default	0xAAAB		0x0000		0x00		0x00

Byte	7	8	9	10	11	12	13
Contents	REL1-TIME LSB	OUT1-TIME		REL2-TIME		0x00	OUT2-Time
Default	0x00	0x0000		0x0000			0x00

Table 26.

IDLE-MODE: (DigitalIO.Output.NoX.IdleMode) x=1,2

(DigitalIO.Relay.NoX.IdleMode)

Defines the status of the signal emitters (OUT1,2 and REL1,2) during the idle mode.

Bit	15	14	13	12	11	10	9	8
Function	REL1 mode		OUT2 mode		OUT1 mode		REL2 mode	

7	6	5	4	3	2	1	0
1	0	1	0	1	0	1	0

Mode	Function	
b01	ON	Signal emitter on
b10	OFF	Signal emitter off
b11	FLASH	signal emitter alternating on with 1Hz

Table 27.

ACTIVE-STATE: (DigitalIO.Output.NoX.ActiveState) x=1,2

(DigitalIO.Relay.No1.ActiveState)

Allocates a flashing-frequency to each output when a transponder was read.

Bit	15	14	13	12	11	10	9	8
Function	REL1 frq		OUT2 frq		OUT1 frq		REL2 frq	

7	6	5	4	3	2	1	0
1	0	1	0	1	0	1	0

Table 28.

Bit combination	flashing frequency
b11	1 Hz
b10	2 Hz
b01	4 Hz
b00	No Flash (0 Hz)

Table 29.

IN-ACTIVE: (DigitalIO.Input.NoX.Mode)x=1,2

Determines if the input is active with a closed or open contact:

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	0	IN2	IN1

Table 30.

b0: closed contact activates input

b1: open contact activates input

OUT1-TIME and REL1/2-TIME (DigitalIO.Output.No1.SettlingTime)

(DigitalIO.Relay.NoX.SettlingTime) x=1,2

Defines the holding time of the digital output OUT1 / REL1 / REL2. If the reader receives a valid transponder response the antenna assigned to the output by CFG9: Input / Output II (Assignment – output to antenna read event) is activated for the value in OUT1 / RELx-TIME.

If OUT1 / RELx -TIME is zero the function is disabled.

If OUT1 / RELx is high in idle mode, OUT1 / RELx will low for OUT1 / RELx -TIME.

If the flash mode is enabled, the output goes low.

Range: 0x0000 ... 0xFFFF (* 100ms) = 0s ... 6553,5s.

OUT2-TIME: (DigitalIO.Output.No2.SettlingTime)

Defines the holding time of the digital output OUT2. If the reader receives a valid transponder response the antenna assigned to the output by CFG9: Input / Output II (Assignment – output to antenna read event) is activated for the value in OUT2-TIME.

If OUT2 -TIME is zero the function is disabled.

If OUT2 is high in idle mode, OUT2 will low for OUT2-TIME.

If the flash mode is enabled, the output goes low.

Range: 0x00 ... 0xFF (* 100ms) = 0s ... 25,6s.

Note

Automated reader Modes (reading of serial number and data):If the serial number was read OK and the data not, no data set will be transferred, but the assigned RELx and / or the OUTx will be active.

5.4 CFG3: RF-Interface

The parameters of the CFG3 configuration block contain global transponder drivers and reader settings.

Byte	0	1	2	3	4	5	6
Contents	TAG-DRV[2]		RF-POWER-ANT1	REG	0x00	DC-POWER	0x00
Default	0x0010		0x19	0x06 0x04	0x00	0x00	0x00

Byte	7	8	9	10	11	12	13
Contents	0x00	FREQ_US		0x00	NR_PREFERRED_CHN	PREFERRED_CHN	
Default	0x00	0x0000		0x00	0x00	0x0000	

Table 31.

TAG-DRV: (transponder.Driver.UHF.Drivers)

Defines the transponder types that are operated by the reader.

Byte	0								1							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Driver	0	0	0	0	0	0	0	0	0	0	0	**E**	0	0	0	0

Table 32.

b0: Driver for the transponder type is inactive

b1: Driver for the transponder type is active

E: (transponder.Driver.UHF.EPC_Class1Gen2) EPC class 1 Gen 2

In principle, only those transponder drivers should be active that are used in the actual application. Thus, the reaction time of the reader for transponder read- / write-operations is reduced and the danger of a parasitic transponder access is minimized.

[2] A reasonableness check is performed by writing this parameter to the reader. If an error occurs the reader answers with STATUS = [0x11].

RF-POWER-ANT1[3]: (AirInterface.Antenna.UHF.No1.OutputPower)

Defines the RF output power for antenna 1.

Bit	7	6	5	4	3	2	1	0
Function	0	0	LEVEL					

Table 33.

LEVEL

Level of the RF output power

LEVEL	RF-POWER [Watt]	RF-POWER [dBm]
0x10	0,1	20,0
0x11	0,2	23,0
0x12	0,3	24,8
0x13	0,4	26,0
0x14	0,5	27,0
0x15	0,6	27,8
0x16	0,7	28,5
0x17	0,8	29,0
0x18	0,9	29,5
0x19	1,0	30,0
0x1A	1,1	30,4
0x1B	1,2	30,8
0x1C	1,3	31,1
0x1D	1,4	31,5
0x1E	1,5	31,8
0x1F	1,6	32,0
0x20	1,7	32,3
0x21	1,8	32,6
0x22	1,9	32,8
0x23	2,0	33,0

Table 34.

Note

If region = Morocco, the maximal output power is 0,5W.

If region = Japan, the maximal output power is 1W.

The output power for Antenna 2-4 can be configured in CFG20: RF-Parameter.

[3] A plausibility check is performed by writing this parameter to the reader. If an error occurs the reader answers with STATUS = [0x11].

REG: (AirInterface.Region.UHF.Regulation)

Note

Value is locked and cannot be changed subsequently.

Defines the region specific behavior according to the RF regulations. For FR1 read-/write devices readers following regions are applicable:

REG	Name	Countries	Number of Channels	Frequency Band
0X06	Europe	Armenia	4	865 MHz – 868 MHz
		Austria		
		Azerbaijan		
		Belarus		
		Belgium		
		Bosnia Herzegovina		
		Bulgaria		
		Croatia		
		Cyprus		
		Czech Republic		
		Denmark		
		Estonia		
		Finland		
		France		
		Germany		
		Greece		
		Hungary		
		Iceland		
		Ireland		
		Italy		
		Latvia		
		Lithuania		
		Luxembourg		
		Macedonia		
		Malta		
		Moldova		
		Netherlands		
		Norway		
		Poland		

		Portugal		
		Romania		
		Serbia		
		Slovak Republic		
		Slovenia		
		Spain		
		Sweden		
		Switzerland		
		Turkey		
		United Kingdom		
0x16	Asia / Oceania	Hong Kong	4	865 MHz – 868 MHz
		Iran		
		Jordan		
		Oman		
		Pakistan		
		Saudi Arabia		
		United Arab Emirates		
		New Zealand		
0x26	Russia	Russia	3	866 MHz – 868 MHz (866,3 MHz; 866,9 MHz; 867,5 MHz)
0x36	Africa	Nigeria	4	865 MHz – 868 MHz
		South Africa		
		Tunisia		
0x46	India	India	3	865 MHz – 867 MHz
0x56	Morocco	Morocco	1	867,7 MHz or 867,9 MHz
0xFE (EU)	Unknown	All other countries	-	manually
0xFF (FCC)	Unknown	All other countries	-	manually

Table 35.

Note

The Region settings are locked upon delivery and cannot be changed.

For FR2 read-/write devices following regions are applicable:

REG	Name	Countries	Number of Channels	Frequency Band
0x04	America	Argentina	50	902 MHz – 928 MHz
		Canada		
		Chile		
		Costa Rica		
		Dominican Republic		
		Mexico		
		Panama		
		Puerto Rico		
		USA		
		Uruguay		
0x14	China	China	16	920,5 MHz – 924,5 MHz
0x24	Australia / New Zealand	Australia	9	921,5 MHz – 926 MHz
		New Zealand		
0x34	Brazil	Brazil	10 + 25	902 MHz – 907,5 MHz 915 MHz – 928 MHz
		Colombia		
		Peru		
0x44	Israel	Israel	3	915 MHz – 916,8 MHz
0x54	Japan	Japan	4	916,7 MHz – 920,9 MHz
0x64	Malaysia	Malaysia	8	919 MHz -923 MHz
0xFF	Unknown	All other countries	-	manually

Table 36.

Note

The Region settings are locked upon delivery and cannot be changed.

FREQ_US:

Defines the reader specific frequency channel usage.

Byte	8								9							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	0	0	upper channel						0	0	lower channel					

Table 37.

upper/lower channel:

(AirInterface.Region.UHF.FCC.Channel.UpperChannel)

(AirInterface.Region.UHF.FCC.Channel.LowerChannel)

Frequency which is used by the FCC reader as upper and lower limit.

upper/lower channel	Frequency
1	902,75 MHz
2	903,25 MHz
3	903,75 MHz
...	…
50	927,25 MHz

Table 38.

Note

These settings are only applicable for FCC readers.
These settings are only applicable if Region [0xFF] Unknown FCC is selected.

NR_PREFERRED_CHN:

(AirInterface.Region.UHF.EU.Channel.EN302208_4_ChannelPlan.

PreferredChannels.NoOfChannels)

Number of channels (1- 4) used by the European reader.

Note

These settings are only applicable for EU readers.
These settings are only applicable if Region [0xFE] Unknown EU is selected.

PREFERRED_CHN:

(AirInterface.Region.UHF.EU.Channel.EN302208_4_ChannelPlan.

PreferredChannels.ChannelNoX) x=1-4

Defines the preferred channels used by the European reader.

Byte	12								13							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	1. Pref Chn				2. Pref Chn				3. Pref Chn				4. Pref Chn			

Table 39.

Preferred Channel	Bin / (Hex)	EU-Frequency
1	0100 / (4)	865,7 MHz
2	0111 / (7)	866,3 MHz
3	1010 / (A)	866,9 MHz
4	1101 / (D)	867,5 MHz

Table 40.

Note

These settings are only applicable for EU readers.

These settings are only applicable if Region [0xFE] Unknown EU is selected.

5.5 CFG4: Transponder Parameters

The parameters of the CFG4 configuration block contain general transponder settings.

Byte	0	1	2	3	4	5	6
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	TAG_ AUTHENT	WR-OPTION	IDDIB	TID-Length
Default					0x01	0x00	0x00

Table 41.

TAG_AUTHENT:

(transponder.UHF.EPC_Class1Gen2.Miscellaneous.TagAuthent)

Defines if an automatic Tag-authentication is performed. Only if the authentication was successfully, the data exchange between reader and transponder can be successful executed.

Bit	7	6	5	4	3	2	1	0
Contents	-	-	-	-	-	AUTHENT-TYPE		

Table 42.

AUTHENT-TYPE:

b000: Tag-authentication disabled

b001: Use Access Password to read hidden data

b010: TAM1 Authentication with Key 0
Tag-authentication for AES encrypted tags according ISO 29167-10 (e.g. UCODE DNA)

b011: TAM2 Authentication with Key 1
Tag-authentication and Data-decryption for AES encrypted tags according ISO 29167-10 (e.g. UCODE DNA)

b101: TAM1 Authentication with Key 1
Tag-authentication for AES encrypted tags according ISO 29167-10 (e.g. UCODE DNA)

b110: TAM2 Authentication with Key 0
Tag-authentication and Data-decryption for AES encrypted tags according ISO 29167-10 (e.g. UCODE DNA City)

Note

Only one authentication mode is possible.

To store the Access-Password in the reader [0xAD] Write reader Authentication Key.

To store the Key0,1 in the reader [0xA3] Write AES reader Keys.

Some tags (e.g. NXP UCODE DNA City) contains only one AES Key (Key0) for authentication. For further information please check the documentation of the transponder chip manufacturer.

If the authentication was not successfully status 0x08 (Authent Error) will set in ISO-Host Mode.

In Buffered Read Mode, Notification Mode and Scan Mode it is only possible to read non encrypted data blocks from the tag if authentication is done by the reader.

In Buffered Read Mode, Notification Mode and Scan Mode it is not possible to read additional data blocks from the tag if authentication is done by the host. The Tags Serial Number is transmitted in the regular way. The Challenge (80 bits random number generated by the reader) and the encrypted tag response are transmitted as data.

WR-OPTION:

(transponder.UHF.EPC_Class1Gen2.Miscellaneous.WriteOption)

Defines the number of Blocks to be written by one write command. By default information issued by the Write Multiple Blocks command are written in blocks.

Bit	7	6	5	4	3		2	1	0
Function		Number of Blocks							

Table 43.

0x01 – 1 Block (default)

0x02 – 2 Blocks

….

Note

The number of Blocks to be written at once is depending on the used transponder chip. Please check the number of supported blocks in the datasheet.

If a Write Multiple Blocks command with the configured settings failed the reader will automatic retry the write command with Number of Blocks set to 1.

IDDIB (Identifier Data Interpretation Byte):

(transponder.Miscellaneous.IdentifierInterpretationMode)

Defines in which way the reader interprets and displays the Identifier Data read during inventory process by using the inventory command or in Buffered reader Mode.

0x00: Automatic Mode (EPC only)

0x02: EPC and TID (EPC+TID)

Note

If IDDIB is 0x02 then only the TID must be used to address commands (e.g. read, write...) to the tag.

TID-Length: (transponder.Miscellaneous.TID-Length)

Defines the length of the TID to be expected when IDDIB is EPC and TID.

0x00: automatic Mode

0x20: 32 Bits

0x40: 64 Bits

0x60: 96 Bits

Note

If TID-Length is 0x00 the reader will automatically add the complete content of the TID memory bank.

5.6 CFG5: Anticollision

The parameters of the CFG5 configuration block contain anti-collision and session settings.

Byte	0	1	2	3	4	5	6
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	SESSION	ONT	0x00	0x00
Default				0x02	0x04		

Table 44.

ONT:

Defines which transponder will be sent to the host.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	ACOLL	0	0

Table 45.

ACOLL: (transponder.Anticollision.Enable)

This bit activates Anticollision Mode. In Anticollision Mode the reader automatically sets transponder specific communication parameters.

b0: disabled
In this case the reader doesn't processes any anticollision procedure for transponders inside the antenna field.

b1: enabled (default)
In this case the reader processes the anticollision procedure for transponders inside of the antenna field.

Note

If ACOLL is disabled (b0) the reader forces a Query (with Q=1), ACK, Req_RN sequence and set the Tag in the OPEN/SECURED state.

SESSION: (transponder.UHF.EPC_Class1Gen2.Anticollision.Session)

Defines which Session flag (A/B) behavior of the EPC Gen 2 transponders will be used by the reader in an Inventory round process.

The combination of the tags manufactured persistence time selected by session 0,1,2, or 3, the readers persistence reset time defined in CFG16: Persistence Reset and the tags presence inside the antenna RF-field determine how long it remains quiet or answers.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	0	SESSION	

Table 46.

b00: Session 0
A tag automatically resets quickly, only if it gets out of the active RF field or the RF field was turned Off

Or according to the reader Persistence Reset Time as defined in CFG16: Persistence Reset. (Whatever comes first)

b01: Session 1
A tag resets automatically in the time frame between 500 ms and 5 s no matter if it stays inside or outside the RF-field

OR according to the reader Persistence Reset Time as defined in

(Whatever comes first) CFG16: Persistence Reset

b10: Session 2
A tag automatically resets delayed, only if it gets out of the active RF field or the RF field was turned Off for more than 2 seconds

OR according to the reader Persistence Reset Time as defined in

(Whatever comes first) CFG16: Persistence Reset

b11: Session 3
Same as Session 2, just an additional independent flag to use

Note

The above-mentioned timings of tag persistence (quickly, 500ms to 5sec, delay 2sec) are transponder specific parameters and cannot be changed by any of the reader settings. This tag persistence is maintained by the transponder manufacturer during production.

An exact tag persistence timing therefore cannot be set by the user, but an approximation according to the selected Session 0,1,2, or 3 combined with the reader configuration settings of CFG16 Persistence Reset and presence inside the antenna RF-field.

If the defined reader CFG16 Persistence Reset time is shorter than the manufacturer tag persistence time, it will determine almost precise how long the tag remains quiet.

Information according to the GS1 EPCglobal Gen2 specifications can be found at www.gs1.org

5.7 CFG6 - CFG8: Reserved

The configuration blocks CFG6 to CFG8 are reserved for future use.

Byte	0	1	2	3	4	5	6
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Table 47.

5.8 CFG9: Input / Output II (Assignment – output to antenna read event)

The configuration block CFG9 contains the parameter for the Input / Output II.

Byte	0	1	2	3	4	5	6
Contents	Output1_AE	Output2_AE	0x00	WIEGAND-DELAY	TPI		TPW
Default	0x00	0x00		0x00	0x0000		0x00

Byte	7	8	9	10	11	12	13
Contents	Relay1_AE	Relay2_AE	0x00	0x00	0x00	0x00	0x00
Default	0x00	0x00					

Table 48.

Output1_AE: Output1 assignment to antenna read event

(DigitalIO.Output.No1.ReadEventActivation.AntennaNo)

defines which antenna activates the Ouptut1 if a transponder has been detected.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	ANT4	ANT3	ANT2	ANT1

Table 49.

Output2_AE: Output2 assignment to antenna read event

(DigitalIO.Output.No2.ReadEventActivation.AntennaNo)

defines which antenna activates the Ouptut2 if a transponder has been detected.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	ANT4	ANT3	ANT2	ANT1

Table 50.

Relay1_AE: Relay1 assignment to antenna read event

(DigitalIO.Relay.No1.ReadEventActivation.AntennaNo)

defines which antenna activates the Relay1 if a transponder has been detected.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	ANT4	ANT3	ANT2	ANT1

Table 51.

Relay2_AE: Relay2 assignment to antenna read event

(DigitalIO.Relay.No2.ReadEventActivation.AntennaNo)

defines which antenna activates the Relay2 if a transponder has been detected.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	ANT4	ANT3	ANT2	ANT1

Table 52.

WIEGAND-DELAY

(DigitalIO.Wiegand-Delay)

Delay before transmission on Wiegand interface is started in ms.

0x01 = 1 ms

0x02 = 2 ms

…

0xFF = 255 ms

TPW

(DigitalIO.TPW)

TPW is the pulse width of a data0 or a data1 signal.

TPW_{min} = 120 µs

TPW_{max} = 510 µs

Byte 6	Value
0x00	Default (200µs)
0x3C (60*2)	120 µs
0x3D (61*2)	122 µs
…	
0xFF (255*2)	510 µs

Table 53.

Note

A value of less than 120 µs should not be used

TPI

(DigitalIO.TPI)

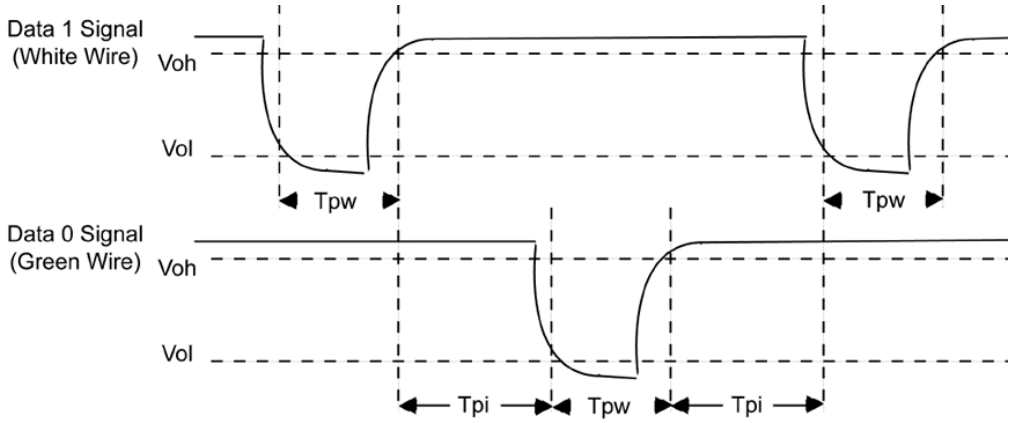
TPI is the interval between two following pulses.

TPI_{min} = 2 µs

TPI_{max} = 65535 µs

Byte 4-5	Value
0x0000	Default (250µs)
0x0002	2 µs
…	
0x0100	256 µs
…	
0xFFFF	65535 µs

Table 54.



5.9 CFG10: Trigger

The configuration block contains parameters for the trigger configuration.

Byte	0	1	2	3	4	5	6
Contents	TRIGGER-MODE	TRIGGER-USE	TRIGGER_1-HOLD-TIME		TRIGGER_2-HOLD-TIME		0x00
Default	0x00	0x00	0x0005 *500ms*		0x0005 500ms		

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	0x00	0x00	0x00	ACTION
Default							0x00

Table 55.

TRIGGER-MODE

defines the mode of the scanner.

Bit	7	6	5	4	3	2	1	0
Function	Trigger	0	Condition	0	0	0	0	Unlimited Valid Time

Table 56.

Trigger:

(OperatingMode.BufferedReadMode.Trigger.Enable)

(OperatingMode.NotificationMode.Trigger.Enable)

(OperatingMode.ScanMode.Trigger.Enable)

b0: Trigger disabled:
The reader RF Power is on and the reader scans all the time in BRM Mode.

b1: Trigger enabled:
The reader start the RF Power and the scan, if the trigger is activated by the external switch.

Note

If Trigger is enabled and not activated by the external switch, the RF-field will be switched off.

Condition:

(OperatingMode.BufferedReadMode.Trigger.Condition)

(OperatingMode.NotificationMode.Trigger.Condition)

(OperatingMode.ScanMode.Trigger.Condition)

b0: Level Triggered:
RF Field will be switched on with the rising edge. Trigger Hold Time starts to run with the falling edge

b1: Edge Triggered:
RF Field will be switched on with the rising edge. Trigger Hold Time starts to run with the rising edge.

Unlimited Valid Time:

(OperatingMode.BufferedReadMode.Trigger.Enable_UnlimittransponderValidTime)

(OperatingMode.NotificationMode.Trigger.Enable_UnlimittransponderValidTime)

(OperatingMode.ScanMode.Trigger.Enable_UnlimittransponderValidTime)

b0: Valid Time is limited to one Trigger Period:
The Valid Time (s. CFG12) is restarted with each Trigger Period and thus not longer than one Trigger Period.

b1: Unlimited Valid Time:
The Valid Time (s. CFG12) is applicable for more than one Trigger Period.

TRIGGER-USE:

Defines whether Input 1 or Input 2 is used as a start trigger.

TRIGGER-USE

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	TU 2		TU 1	

Table 57.

TU-x:

(OperatingMode.BufferedReadMode.Trigger.Source.Input.NoX.TriggerUse)

(OperatingMode.NotificationMode.Trigger.Source.Input.NoX.TriggerUse)

(OperatingMode.ScanMode.Trigger.Source.Input.NoX.TriggerUse)

X is the input which is used as a trigger (X=1-2)

b00: trigger not used

b01: trigger start the reader operation

TRIGGER_X-HOLD-TIME: x=1,2

(OperatingMode.BufferedReadMode.Trigger.Source.Input.NoX.HoldTime)

(OperatingMode.NotificationMode.Trigger.Source.Input.NoX.HoldTime)

(OperatingMode.ScanMode.Trigger.Source.Input.NoX.HoldTime)

(1 ... 65535 * 100 ms = 100 ms ... 6553,5 sec)

The TRIGGER-HOLD-TIME defines the period in which the reader performs inventory commands and holds the RF Power active.

Note

The time the RF field stays on is depending on the combination of the Trigger Condition and the Hold Time

ACTION:

defines actions in trigger mode.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	NO_READ_ SIGNALIZATION			RF-OFF_AFTER_READ

Table 58.

RF-OFF_AFTER_READ:

(OperatingMode.BufferedReadMode.Trigger.Enable_RF-OffAfterRead)

(OperatingMode.NotificationMode.Trigger. Enable_RF-OffAfterRead)

(OperatingMode.ScanMode.Trigger. Enable_RF-OffAfterRead)

Defines if the RF-Field is switched off after a read event

b0: disabled

b1: enabled

NO_READ_SIGNALIZATION:

(OperatingMode.BufferedReadMode.Trigger.NoReadSignalization)

(OperatingMode.NotificationMode.Trigger.NoReadSignalization)

(OperatingMode.ScanMode.Trigger.NoReadSignalization)

Defines whether a signal emitter (OUT1,2 or REL1,2) is activated if no transponder was detected.

b000: no signal emitter will be activated

b001: OUT1 will be activated

b010: OUT2 will be activated

b100: REL1 will be activated

b101: REL2 will be activated

Note

Only one output can be configured for no read signalization.

5.10 CFG11: Read Mode – Read Data

The parameters of the configuration block CFG11 contain Buffered Read Mode and Scan Mode settings. To enable Buffered Read Mode the BRM bit in the READER-MODE register of the configuration block CFG1: Interface and Mode must be set. It is useful to enable “Anticollision Select Mode” in CFG5: Anticollision, if there is a large or unknown number of transponders in the antenna field. The Buffered Read Mode can be used with the Antenna Multiplex Mode. The parameters for this function have to be configured in CFG15: Antenna Multiplexing I

Byte	0	1	2	3	4	5	6
Contents	TR-DATA1[4]	TR-DATA2	TR-DATA3	BANK	DB-ADR6		0x00
Default	0x31	0x00	0x02	0x01	0x0000		

Byte	7	8	9	10	11	12	13
Contents	0x00	DB-N[5]		0x00	D-START	D-LGT	
Default		0x0001			0x00	0x0004	

Table 59.

TR-DATA1:

Selects the data that will be stored and transferred.

Bit	7	6	5	4	3	2	1	0
Function	Extension	DATE	TIME	ANT	Byte Order DB	-	DB	UID

Table 60.

[4] A reasonableness check is performed by writing this parameter to the reader. If an error occurs the reader answers with STATUS = [0x11].
[5] A plausibility check is performed by writing this parameter to the reader. If an error occurs the reader answers with STATUS = [0x11].

IDD:

(OperatingMode.BufferedReadMode.DataSelector.UID)

(OperatingMode.NotificationMode.DataSelector.UID)

(OperatingMode.ScanMode.DataSelector.UID)

b0: no Identifier Data (EPC or EPC+TID) will be stored and transferred

b1: Identifier Data (EPC or EPC+TID) as defined in CFG4: transponder Parameters will be stored and transferred

DB:

(OperatingMode.BufferedReadMode.DataSelector.Data)

(OperatingMode.NotificationMode.DataSelector.Data)

(OperatingMode.ScanMode.DataSelector.Data)

b0: no data block will be stored and transferred

b1: data block will be stored and transferred

Byte Order DB:

(OperatingMode.BufferedReadMode.DataSource.ByteOrderOfData)

(OperatingMode.NotificationMode.DataSource.ByteOrderOfData)

(OperatingMode.ScanMode.DataSource.ByteOrderOfData)

b0: MSB first

b1: LSB first

ANT:

(OperatingMode.BufferedReadMode.DataSelector.AntennaNo)

(OperatingMode.NotificationMode.DataSelector.AntennaNo)

(OperatingMode.ScanMode.DataSelector.AntennaNo)

b0: no antenna number will be stored and transferred

b1: the number of the antenna (1-4) where the transponder has been detected, will be stored and transferred

Note

If Number of Antenna is enabled (ANT = b1) Antenna Extended in TR-DATA2 must be disabled (ANT_Ext = b0).

TIME:

(OperatingMode.BufferedReadMode.DataSelector.Time)

(OperatingMode.NotificationMode.DataSelector.Time)

(OperatingMode.ScanMode.DataSelector.Time)

b0: no time stamp will be stored and transferred

b1: time stamp provided by the internal system timer will be stored and transferred

DATE:

(OperatingMode.BufferedReadMode.DataSelector.Date)

(OperatingMode.NotificationMode.DataSelector.Date)

(OperatingMode.ScanMode.DataSelector.Date)

b0: no date stamp will be stored and transferred

b1: date stamp provided by the internal system timer is stored and transferred

Note

The internal system timer is not a real time clock (RTC) and the accuracy cannot be guaranteed.

Extension:

b0: extension flag disabled, additional data defined in TR-DATA2 will not be requested

b1: extension flag is enabled, additional data defined in TR-DATA2 will be requested

TR-DATA2:

Selects the additional data that will be stored and transferred.

Bit	7	6	5	4	3	2	1	0
Function	-	-		ANT_Ext	TAG_STATISTIC	-	MAC	IN

Table 61.

IN:

(OperatingMode.BufferedReadMode.DataSelector.InputEvents)

(OperatingMode.NotificationMode.DataSelector.InputEvents)

(OperatingMode.ScanMode.DataSelector.InputEvents)

b0: no Input states will be stored and transferred

b1: Input states from IN1 and IN2 will be stored and transferred

MAC:

b0: no MAC-Address will be stored and transferred

b1: MAC-Address of the reader will be stored and transferred

TAG_STATISTIC:

b0: no tag statistic will be stored and transferred

b1: tag statistic data as defined in 0x22] Read Buffer will be stored and transferred

ANT_Ext: Antenna Extended

(OperatingMode.BufferedReadMode.DataSelector.RSSI)

(OperatingMode.NotificationMode.DataSelector.RSSI)

b0: no values for RSSI and phase angle will be stored and tranferred

b1: values for RSSI and phase angle will be stored and transferred for all antennas on which a transponder was read

Note

If Antenna Extended is enabled (ANT_Ext = b1) Number of Antenna in TR-DATA1 must be disabled (ANT = b0).
Antenna Extended is only available for Buffered Read Mode and Notification Mode.
TAG_STATISTIC must be selected together with ANT-Bit = 1 in TR-DATA1 and STORE-Bit = 0 in TR-DATA3.

TR-DATA3:

Selects the data that will be stored and transferred.

Bit	7	6	5	4	3	2	1	0
Function	-	ACTION_ON_EPC	-	-	READ_COMPLETE_BANK	-	ANT-STORE	COM Prefix

Table 62.

COM Prefix: (Scan Mode only)

(OperatingMode.ScanMode.DataFormat.BusAddressPrefix)

b0: no COM Prefix is transferred

b1: the COM-ADR will be transferred in front of each data set

ANT-STORE:

OperatingMode.BufferedReadMode.DataSelector.Mode.Enable_AntennaPool)

(OperatingMode.NotificationMode.DataSelector.Mode.Enable_AntennaPool)

(OperatingMode.ScanMode.DataSelector.Mode.Enable_AntennaPool)

If this bit is set, the reader stores only one data set also if a tag has been detected of more than one antenna. If this bit is not set, the reader stores a data set for each antenna.

Examples:

ANT-STORE = 1, Tag was detected by antenna 1 and 4
one data set, antenna number = 0x09

Antenna	8	7	6	5	4	3	2	1
Bit	7	6	5	4	3	2	1	0
detected	0	0	0	0	**1**	0	0	**1**

Table 63.

Note

If ANT-STORE = 1 and a Tag was detected by antenna 1 and the data set was transmitted to the host, the reader doesn't store new data sets for this transponder if read on another antenna, while the valid time has not expired.

READ_COMPLETE_BANK:

(OperatingMode.BufferedReadMode.DataSelector.Mode.Read_Complete_Bank)

(OperatingMode.NotificationMode.DataSelector.Mode.Read_Complete_Bank)

(OperatingMode.ScanMode.DataSelector.Mode.Read_Complete_Bank)

If this bit is set the reader will read out all memory blocks from the selected Memory BANK starting from DB-ADR. If DB-ADR is “0” the complete memory bank is read.

b00: Reader reads out the memory blocks according to the settings in DB-ADR, DB-N, D-Start and D-LGT.

b01: Reader reads out all blocks of the selected memory bank starting at

DB-ADR

Note

This functionality has following limitations with respect to the individual memory banks:

EPC Memory: max. 512 Bit

User Memory: max. 16 kBit

TID Memory: max. 512 Bit

Reserved Memory: max. 64 Bit

The Read Complete Bank functionality is not available, if Tag Authentication by Host with TAM2 is enabled.

ACTION_ON_EPC:

(OperatingMode.BufferedReadMode.DataSelector.Mode.Action_on_EPC)

(OperatingMode.NotificationMode.DataSelector.Mode.Action_on_EPC)

If this bit is set the reader will check if an action on EPC has to be executed. For further information refer to the application Note N40610-0e-ID-B.

b00: action on EPC disabled.

b01: action on EPC enabled

BANK:

Memory bank of the transponder which will be accessed by the reader

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	BANK_NR		

Table 64.

BANK_NR:

(OperatingMode.BufferedReadMode.DataSource.BankNo)

(OperatingMode.NotificationMode.DataSource.BankNo)

(OperatingMode.ScanMode.DataSource.BankNo)

In case of Class 1 Gen 2 transponder BANK_NR is defined as follows:

b000: reserved

b001: EPC memory bank

b010: TID memory bank

b011: User memory bank

b101: EPC memory bank with Tag Authentication by Host

b110: TID memory bank with Tag Authentication by Host

b111: User memory bank with Tag Authentication by Host

Note

EPC Gen 2 memory banks can only be read in open state.

If Data for Tag Authentication and Decryption by Host is enabled the transmitted data is according to the settings of parameter Tag-Authent in CFG4 . If only an authentication shall be executed DB-N shall be set to zero.

If Data for Tag Authentication and Decryption by Host is enabled and Authentication with TAM2 is selected in CFG4 the Blocksize for DB-ADR and DB-N is 64 Bits. Otherwise the Blocksize is 16 Bits.

If Data for Tag Authentication and Decryption by Host is enabled and Authentication with TAM2 is selected in CFG4 maximum 2 Datablocks (128 Bit) can be read from the transponder.

If Data for Tag Authentication and Decryption by Host is enabled the settings for D-START and D-LGT are ignored by the reader.

If Data for Tag Authentication and Decryption by Host is enabled and data blocks shall be read from the tag data is transmitted in the following format:

- Customer defined data
- Challenge (80 bits random number generated by the reader)
- encrypted tag response

DB-ADR1:

(OperatingMode.BufferedReadMode.DataSource.FirstDataBlock)

(OperatingMode.NotificationMode.DataSource.FirstDataBlock)

(OperatingMode.ScanMode.DataSource.FirstDataBlock)

Address of first data block. Range: 0x00...0xFF.

DB-N[6]:

(OperatingMode.BufferedReadMode.DataSource.NoOfDataBlocks)

(OperatingMode.NotificationMode.DataSource.NoOfDataBlocks)

Number of data blocks. Range: 0x01...0x20. The data block size in the Buffered Read Mode is always 2 bytes.

[6] A plausibility check is performed by writing this parameter to the reader. If an error occurs the reader answers with STATUS = [0x11].

D-START:

(OperatingMode.ScanMode.DataSource.FirstByte)

This parameter defines the first byte in the raw data (defined by DB-ADR and D-LGT), which will be transferred in Scan-Mode. To transfer the whole data block D-START must be set to 0.

Note

The size of one data block depends on the type of transponder.

D-LGT:

(OperatingMode.ScanMode.DataSource.NoOfBytes)

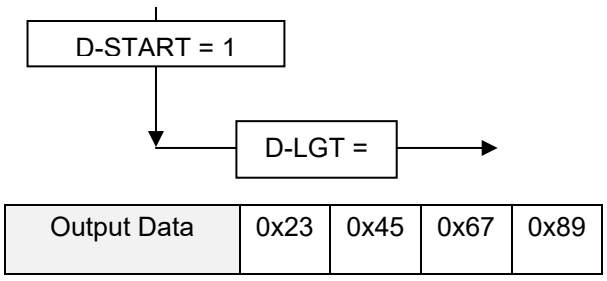
D-LGT defines the length of raw data which are transmitted in the Scan-Mode.

Number of data bytes to be transferred, starting with the D-START.

Example:

data block

Byte	0	1	2	3	4	5	6	7
Data	0x01	0x23	0x45	0x67	0x89	0xAB	0xCD	0xEF



Output Data	0x23	0x45	0x67	0x89

Note

If Wiegand / DataClock is selected as Scan Mode Interface D-LGT indicates the number of Bits to be transmitted.

Example for reading of datablocks if Tag Authentication and Decryption by Host is disabled (Blocksize 16 Bits):

1) Reading first 128 Bits of User Memory:

   Bank = 0x03

   DB-ADR = 0x00

   DB-N = 0x08

   >>> Reads User Memory Bit 0x00 to Bit 0x7F

2) Reading 64 Bits of User Memory starting from Bit 64:

   Bank = 0x03

   DB-ADR = 0x04

   DB-N = 0x04

   >>> Reads User Memory Bit 0x40 to Bit 0x7F

Example for reading of datablocks if Tag Authentication and Decryption by Host is enabled (Blocksize 64 Bits, Authentication with TAM2):

1) Reading first 128 Bits of User Memory:

   Bank = 0x07

   DB-ADR = 0x00

   DB-N = 0x02

   >>> Reads User Memory Bit 0x00 to Bit 0x7F

2) Reading 64 Bits of User Memory starting from Bit 64:

   Bank = 0x07

   DB-ADR = 0x01

   DB-N = 0x01

   >>> Reads User Memory Bit 0x40 to Bit 0x7F

DB in field data blocks of Read Buffer Command 0x22] Read Buffer

No. of Bytes	10	16	8
Example Data	FD5D8048F48DD09AAD22	3C6410EF3498A29D6C0F30F4F17A56E5	ABCDEFAB12345678
Description	80 Bits Challenge (Random Number)	128 Bits Ciphertext (encrypted Challenge)	User Memory Data Bit 0x40 to 0x7F

Table 65.

5.11 CFG12: Read Mode – Filter

Byte	0	1	2	3	4	5	6
Contents	VALID-TIME[1]		TR-ID				IN-EV-FLT
Default	0x0037 5,5sec.		0x01	0x00	0x00	0x01	0x00

Byte	7	8	9	10	11	12	13
Contents	ST-EV-FLT	VALID-TIME-MODE	0x00	0x00	0x00	0x00	0x00
Default	0x00	0x00					

Table 66.

VALID-TIME:

only for Buffered Read Mode, Notification Mode and Scan Mode

(OperatingMode.BufferedReadMode.Filter.transponderValidTime)

(OperatingMode.NotificationMode.Filter.transponderValidTime)

(OperatingMode.ScanMode.Filter.transponderValidTime)

(0...65534 x 100 ms = 0 ms ... 6553,4 sec)

The period of time during which a transponder will not be reported a 2nd time.

The value 65535 [0xFFFF] indicates that a transponder will never be reported a 2nd time.

TR-ID:

- only for Buffered Read Mode and Notification Mode

TR-ID sets the parameters for transponder identification.

If several transponders have the same content in the addressed data block, only one dataset will be generated.

Byte	2	3	4	5
Function	TR-ID-SOURCE	TR-ID-DB-ADR		TR-ID-DB-N

Table 67.

TR-ID-SOURCE:

(OperatingMode.Miscellaneous.transponderIdentification.Source)

Sets the data source for transponder identification.

b0: data block

b1: Serial Number

TR-ID-DB-ADR:

(OperatingMode.Miscellaneous.transponderIdentification.DataBlockNo)

Sets the address of the data block for transponder identification. If ID-SOURCE selects the Serial Number as data source, the ID-DB-ADR will be ignored.

TR-ID-DB-N:

(OperatingMode.Miscellaneous.transponderIdentification.NoOfDataBlocks)

Sets the number of data blocks to be read for transponder identification. If ID-SOURCE selects the Serial Number as data source, the ID-DBN will be ignored.

Note

Changing of VALID-TIME only becomes effective after writing / saving configuration block CFG12 to EEPROM.
The address TR-ID-DB-ADR must be in the range of the selected data blocks:
DB-ADR[7] ≤ TR-ID-DB-ADR ≤ DB-ADR[1] + DB-N[1] – 1.

IN-EV-FLT:

(OperatingMode.BufferedReadMode.Filter.Enable_InputXEvent) x=1,2

(OperatingMode.NotificationMode.Filter.Enable_InputXEvent) x=1,2

Input Event Filter

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	-	-	Input2	Input1

Table 68.

Input1,2:

b0: input event will not be notified

b1: input event will be notified

[7] DB-ADR, DB-N of CFG11

ST-EV-FLT: Status Event Filter

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	-	-	TIMEOUT	BRM

Table 69.

TIMEOUT:

(OperatingMode.BufferedReadMode.Filter.Enable_TimeoutEvent)

(OperatingMode.NotificationMode.Filter.Enable_TimeoutEvent)

b0: timeout event while active BRM or Notification mode will not be notified

b1: timeout event while active BRM or Notification mode will be notified

BRM:

(OperatingMode.BufferedReadMode.Filter.Enable_TriggerEvent)

(OperatingMode.NotificationMode.Filter.Enable_TriggerEvent)

b0: change of BRM or Notification mode status will not be notified

b1: change of BRM or Notification mode status will be notified

VALID-TIME_MODE:

- only for Buffered Read Mode, Notification Mode and Scan Mode

(OperatingMode.BufferedReadMode.Filter.transponderValidTimeMode)

(OperatingMode.NotificationMode.Filter.transponderValidTimeMode)

(OperatingMode.ScanMode.Filter.transponderValidTimeMode)

0x00: Standard Mode
If the transponder is read for the first time, it will be reported immediately and again only after the VALID-TIME time has elapsed.

0x01: Tag Statistic Mode
The transponder will be reported for the first time after the VALID-TIME has been elapsed. During the VALID-TIME the reader collects statistic data of tag communication (see 0x22] Read Buffer).

Note

Input Event Filters and Status Event Filters are only available for Buffered Read Mode and Notification Mode.

5.12 CFG13 Scan Mode

The configuration block CFG13 contains the Scan Mode settings.

Byte	0	1	2	3	4	5	6
Contents	DB-USE	SEP-CHAR	SEP-USER	END-CHAR	END-USR1	END-USR2	END-USR3
Default	0x02	0x20	0x2C	0x01	0x0D	0x00	0x00

Byte	7	8	9	10	11	12	13
Contents	0x00	HEADER-USR1	HEADER - USR2	HEADER - USR3	HEADER - USR4	0x00	LEN-USR
Default		0x00	0x00	0x00	0x00		0x00

Table 70.

DB-USE:

Defines the data format of the data and the value of the data.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	DB-FORMAT			

Table 71.

DB-FORMAT:

(OperatingMode.ScanMode.DataFormat.Format)

b0000: unformatted hex-data
In this case the data are transferred as they were read by the reader

b0010: ASCII formatted hex-data
In this case the raw data from the transponder were converted to ASCII-Code before transfer. For this purpose, the data bytes first are separated into their Nibbles and then changed into ASCII signs according the following table.

raw data (hex / binary)		ASCII data (ASCII / hex)		raw data (hex / binary)		ASCII data (ASCII / hex)	
0x0	b0000	'0'	0x30	0x8	b1000	'8'	0x38
0x1	b0001	'1'	0x31	0x9	b1001	'9'	0x39
0x2	b0010	'2'	0x32	0xA	b1010	'A'	0x41
0x3	b0011	'3'	0x33	0xB	b1011	'B'	0x42
0x4	b0100	'4'	0x34	0xC	b1100	'C'	0x43
0x5	b0101	'5'	0x35	0xD	b1101	'D'	0x44
0x6	b0110	'6'	0x36	0xE	b1110	'E'	0x45
0x7	b0111	'7'	0x37	0xF	b1111	'F'	0x46

Table 72.

SEP-CHAR:

(OperatingMode.ScanMode.DataFormat.SeparationChar)

Selects the separation character between two data types for the send data.

Bit	7	6	5	4	3	2	1	0
Function	USER	‘ ‘	‘,‘	‘;’	TAB	CR	LF	CR+LF

Table 73.

ASCII	Hex
CR+LF	0x0D and 0x0A
LF	0x0A
CR	0x0D
TAB	0x09
‘;’	0x3B
‘,’	0x2C
‘ ‘	0x20
USER	user defined in SEP-USR
none	0x00

Table 74.

Note

Only one option can be selected.

SEP-USR:

(OperatingMode.ScanMode.DataFormat.UserSeparationChar)

User defined separation character.

END-CHAR:

(OperatingMode.ScanMode.DataFormat.EndChar)

Selects the end character between two data types for the send data.

Bit	7	6	5	4	3	2	1	0
Function	USER	‘ ‘	‘,‘	‘;’	TAB	CR	LF	CR+LF

Table 75.

ASCII	Hex
CR+LF	0x0D and 0x0A
LF	0x0A
CR	0x0D
TAB	0x09
‘;’	0x3B
‘,’	0x2C
‘ ‘	0x20

USER	user defined in END-USR1…3
None	0x00

Table 76.

Note

Only one option can be selected.

END-USR1...3:

(OperatingMode.ScanMode.DataFormat.UserEndCharX)

User defined end character.

HEADER-USR1...4:

(OperatingMode.ScanMode.DataFormat.UserHeaderCharX)

User defined Header character.

LEN-USR:

Defines the length of the HEADER character and END character.

Bit	7	6	5	4	3	2	1	0
Function	HEADER-LEN				END-LEN			

Table 77.

END-LEN:

(OperatingMode.ScanMode.DataFormat.NoOfUserEndChars)

b0000: END-USR1

b0001: END-USR1

b0010: END-USR1 +2

b0011: END-USR1 + 2 + 3

HEADER-LEN:

(OperatingMode.ScanMode.DataFormat.NoOfUserHeaderChars)

b0000: no HEADER byte

b0001: HEADER-USR1

b0010: HEADER-USR1 +2

b0011: HEADER-USR1 + 2 + 3

b0100: HEADER-USR1 + 2 + 3 + 4

Example of scan data:

COM-ADR	Separation Character	Header				UID	Separation Character	Data-Blocks	END Character		
COM-ADR	SEP-CHAR	USR 1	USR 2	USR 3	USR 4	UID	SEP-CHAR	DB	USR 1	USR 2	USR 3

Table 78.

5.13 CFG14: Reserved

The configuration block CFG14 is reserved for future use.

Byte	0	1	2	3	4	5	6
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Table 79.

5.14 CFG15: Antenna Multiplexing I

The parameters in CFG15 are used to configure for multiplexing of antennas in Buffered Read Mode, Notification Mode and Scan Mode.

Byte	0	1	2…9	10	11	12	13
Contents	MUX-MODE	ANT_OUT	0x00	ANT_OUT_EXT_1	ANT_OUT_EXT_2	ANT_OUT_EXT_3	ANT_OUT_EXT_4
Default	0x00	0x00					

Table 80.

MUX-MODE:

Activates or deactivates multiplexing and determines when the next output is selected.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	0	0	Multiplexing

Table 81.

Multiplexing

Multiplexing: (AirInterface.Multiplexer.Enable)

b0: disable

b1: enable

ANT_OUT:

Specifies the antenna outputs used in BRM Mode, Notification Mode and Scan Mode.

Bit	7	6	5	4	3	2	1	0
Function	0	ANT_OUT_INT				0	0	0
		ANT4	ANT3	ANT2	ANT1			

Table 82.

ANT_OUT_INT:

(AirInterface.Multiplexer.UHF.Internal.SelectedAntennas)

Defines the antennas which are used for the internal multiplexing

b0: Antenna disabled

b1: Antenna enabled

Example: Reader shall read on antenna 2 and 4

ANT_OUT_INT = b1010

5.15 CFG16: Persistence Reset

The parameters in CFG16 are used to configure the reader reset timing of the persistence flags of UHF transponders. The timing for reset of the persistence flags is used by all reader Modes.

Byte	0	1	2	3	4	5	6
Contents	PERSISTANCE-MODE	0x00	PER-RESET-TIME-ANT_1		PER-RESET -TIME-ANT_2		PER-RESET -TIME-ANT_3
Default	0x00	0x00	0x0050 80 x 5ms = 400ms		0x0050 80 x 5ms = 400ms		0x00

Byte	7	8	9	10	11	12	13
Contents	PER-RESET –TIME-ANT_3	PER-RESET –TIME-ANT_4		0x00	0x00	0x00	0x00
Default	0x50	0x0050 80 x 5ms = 400ms		0x00	0x00	0x00	0x00

Table 83.

PERSISTENCE-MODE:

The Parameter below defines if all antenna ports of the reader act as one reading point respectively one signal source or if each antenna act as a single reading point respectively each antenna act as one independent signal source.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	0	0	PER_ANT_MODE

Table 84.

PER_ANT_MODE:

(transponder.PersistenceReset.Mode)

b0: all antenna ports act as one reading point.
Only PER_RESET_TIME_ANT_1 is used as timer for the whole reading area

b1: each antenna port acts as a reading point.
Each antenna uses its own timer

PER-RESET-TIME-ANT_x:

(transponder.PersistenceReset.Antenna.NoX.PersistenceResetTime) X=1-4

The timer value specifies a time which determines the reset of the transponder persistence flags by the reader. The timer PER-RESET-TIME-ANT_x starts after the reader gets a response at the related antenna port/ports. After this time has expired the reader send a persistence reset command to the transponders at the related antenna port/ports.

Timer ticks = 5ms

Maximum timer value = 5ms x 65534 [0xFFFE] = 5,46125 min.

The value 65535 [0xFFFF] indicates that no persistence reset is performed by the reader.

Note

For ISO-Host Mode PER_ANT_MODE is always 1. Each antenna port acts as a reading point.

5.16 CFG17 - CFG19: Reserved

Byte	0	1	2	3	4	5	6
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Table 85.

5.17 CFG20: RF-Parameter

The parameters of the CFG20 configuration block contain the antenna gain setting.

Byte	0	1	2	3	4	5	6
Contents	RSSI-Filter ANT 1	RSSI-Filter ANT 2	RSSI-Filter ANT 3	RSSI-Filter ANT 4	0x00	0x00	0x00
Default	0x00	0x00	0x00	0x00			

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	RF-POWER-ANT2	RF-POWER-ANT3	RF-POWER-ANT4	0x00
Default				0x19	0x19	0x19	

Table 86.

RSSI-Filter:

AirInterface.Antenna.UHF.RSSI-Filter-ANTx (x=1..4)

Defines the RSSI Filter Level

Bit:	7	6	5	4	3	2	1	0
Function	Filter Level							

Table 87.

Filter-Level

Level of the RSSI-Filter

Filter-Level	Level
0x00	No Filtering
0x01	-1 dBm
0x02	-2 dBm
0x03	-3 dBm
0x04	-4 dBm
0x05	-5 dBm
0x06	-6 dBm
0x07	-7 dBm
0x08	-8 dBm
0x09	-9 dBm
0x0A	-10 dBm
0x0B	-11 dBm
0x0C	-12 dBm
0x0D	-13 dBm
0x0E	-14 dBm
0x0F	-15 dBm
0x10	-16 dBm
…	- … dBm
0xFF	-255 dBm

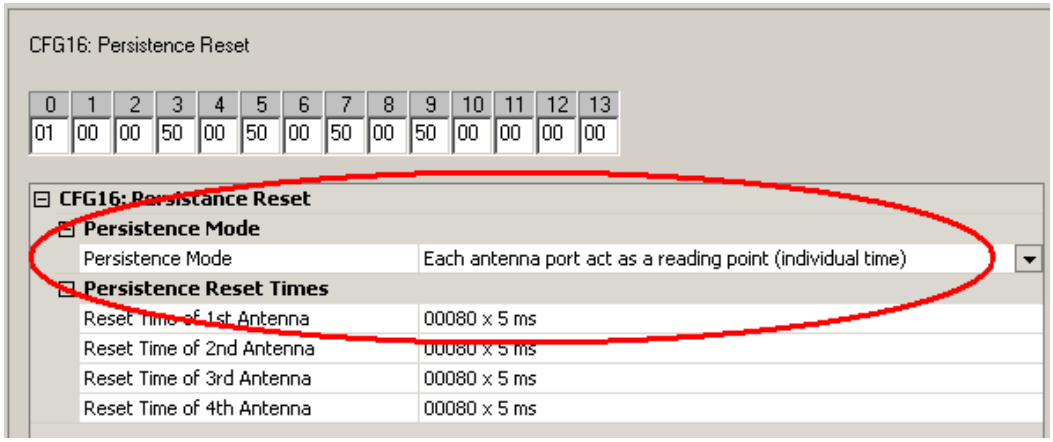
Table 88.

Note

Only transponders will be displayed whose received signal strength is above the defined Filter Level.

Typically a transponder on the surface of the antenna is responding with a signal strength below -15 dBm.

It is recommended to configure the Persistance Reset Mode in CFG16 to the value “Each antenna port act as a reading point (individual time). In that way it can be ensured that a transponder which e.g. was first detected on antenna 1 below the RSSI filter level will be displayed when it is read by another antenna above the defined threshold.



Further details about the RSSI filtering can be found in the separate application note N11101-xe-ID-B.pdf.

RF-POWER-ANTx[8]:

(AirInterface.Antenna.UHF.No2.OutputPower)

(AirInterface.Antenna.UHF.No3.OutputPower)

(AirInterface.Antenna.UHF.No4.OutputPower)

Defines the RF output power for antenna 2, 3 and 4.

Bit	7	6	5	4	3	2	1	0
Function	0	0	LEVEL					

Table 89.

LEVEL

Level of the RF output power

LEVEL	RF-POWER [Watt]	RF-POWER [dBm]
0x10	0,1	20,0
0x11	0,2	23,0
0x12	0,3	24,8
0x13	0,4	26,0
0x14	0,5	27,0
0x15	0,6	27,8
0x16	0,7	28,5
0x17	0,8	29,0
0x18	0,9	29,5
0x19	1,0	30,0
0x1A	1,1	30,4
0x1B	1,2	30,8
0x1C	1,3	31,1
0x1D	1,4	31,5

[8] A plausibility check is performed by writing this parameter to the reader. If an error occurs the reader answers with STATUS = [0x11].

0x1E	1,5	31,8
0x1F	1,6	32,0
0x20	1,7	32,3
0x21	1,8	32,6
0x22	1,9	32,8
0x23	2,0	33,0

Table 90.

Note

If region = Morocco, the maximal output power is 0,5W.

If region = Japan, the maximal output power is 1W.

The output power for Antenna 1 can be configured in CFG3.

5.18 CFG22 - CFG27: Selection masks for EPC Gen 2

The configuration block CFG22 - CFG27 holds 3 selection masks for selection of EPC Gen 2 transponders. The table below showed which configuration block holds which mask. The reader starts to select Tags with mask 1 and sends further selection commands with mask 2 and 3, if these masks are enabled.

Mask number	Config. Block
1	CFG 22/23
2	CFG 24/25
3	CFG26/27

Table 91.

Each selection mask has a format as shown below.

CFG (even)

Byte	0	1	2	3	4	5	6
Contents	S_MASK_LGT	S_MODE	S_START_ POINTER		S_MASK_MSB		
Default	0x00	0x01	0x0010		0x30	0x00	0x00

Byte	7	8	9	10	11	12	13
Contents	S_MASK						
Default	0x00	0x00	0x00	0x00	0x00	0x00	0x00

Table 92.

CFG (odd)

Byte	0	1	2	3	4	5	6
Contents	S_MASK						
Default	0x00	0x00	0x00	0x00	0x00	0x00	0x00

Byte	7	8	9	10	11	12	13
Contents	S_MASK						
Default	0x00	0x00	0x00	0x00	0x00	0x00	0x00

Table 93.

S_MASK_LGT:

(transponder.UHF.EPC_Class1Gen2.SelectionMask.MaskLength)

Defines the length of the mask in Bit

If S_MASK_LGT is 0 the selection mask is disabled

S_MODE:

Bit	7	6	5	4	3	2	1	0
Function	S_T	0	0	0	S_LOGIC	S_NOT	S_BANK	

Table 94.

S_BANK:

(transponder.UHF.EPC_Class1Gen2.SelectionMask.BankNo)

Defines whether mask applies to EPC, TID, User memory

b00: reserved

b01: EPC memory bank

b10: TID memory bank

b11: User memory bank

S_NOT:

(transponder.UHF.EPC_Class1Gen2.SelectionMask.Negation)

Enable negated selection.

b0: no negation

b1: negation

S_LOGIC:

(transponder.UHF.EPC_Class1Gen2.SelectionMask.Logic)

Defines the logic function of the masks.

b0: OR operation

b1: AND operation

Note

S_LOGIC is only available for the second and third selection mask in CFG 24 and CFG26.

S_START_POINTER:

(transponder.UHF.EPC_Class1Gen2.SelectionMask.FirstBit)

Defines the memory bit address on which the bit String of the Mask is compared to the memory of the Tag.

Note

If a selection mask is set to the EPC memory bank start address should be 0x10 or higher. The first 16 bits are CRC16.

S_MASK:

(transponder.UHF.EPC_Class1Gen2.SelectionMask.Mask)

Bit contains the bit string that the tag compares against the memory location.

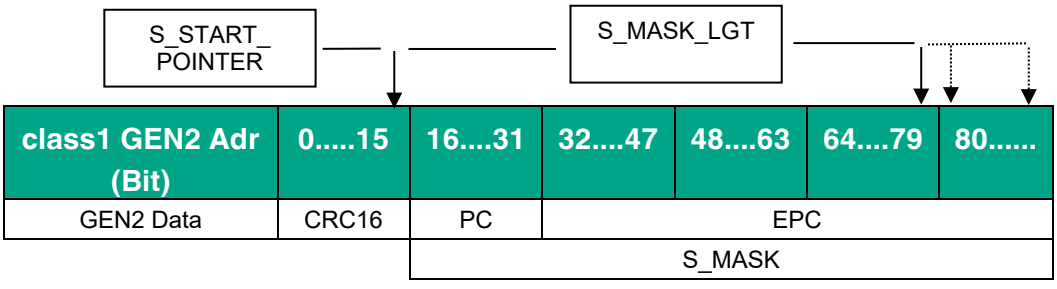
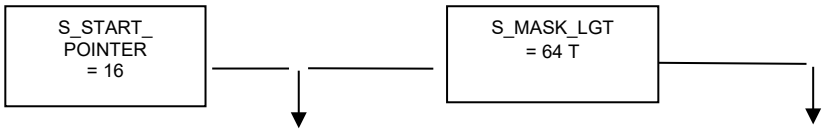


Table 95.

Example 1:



class1 GEN2 Adr (Bit)	0.....15	16....31	32....47	48....63	64....79	80.....		Transponder Response
EPC 1	CRC16	0x3000	0xA02A	0x0510	0x15A0	0x1234 ..	→	YES
EPC 2	CRC16	0x3000	0xA02A	0x0510	0x15A0	0x6789 ..	→	YES
EPC 3	CRC16	0x3000	0xA02A	0x0510	0x15A1	0x6789 ..	→	NO
S_MASK_1	not checked	0x3000	0xA02A	0x0510	0x15A0	not checked		

Table 96.

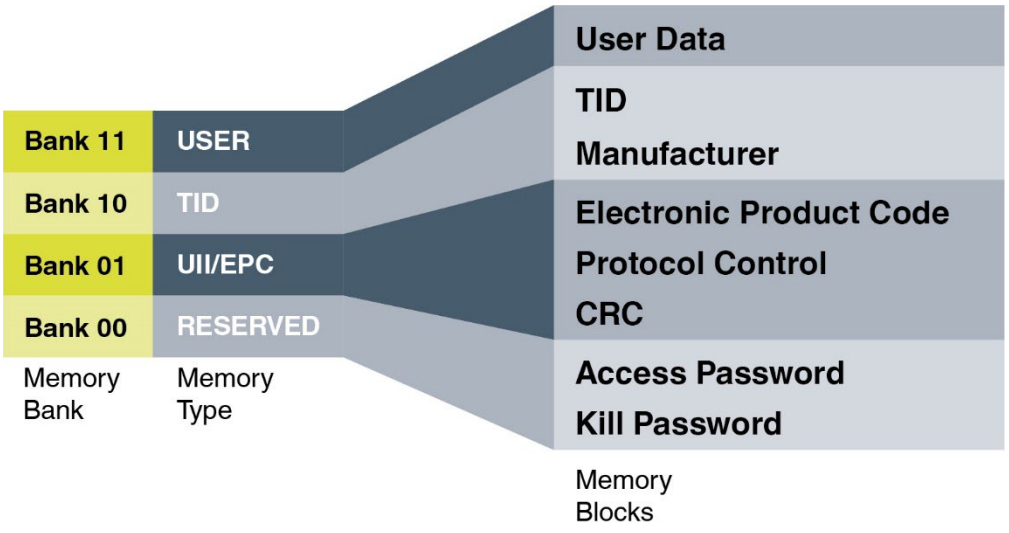
Example 2:

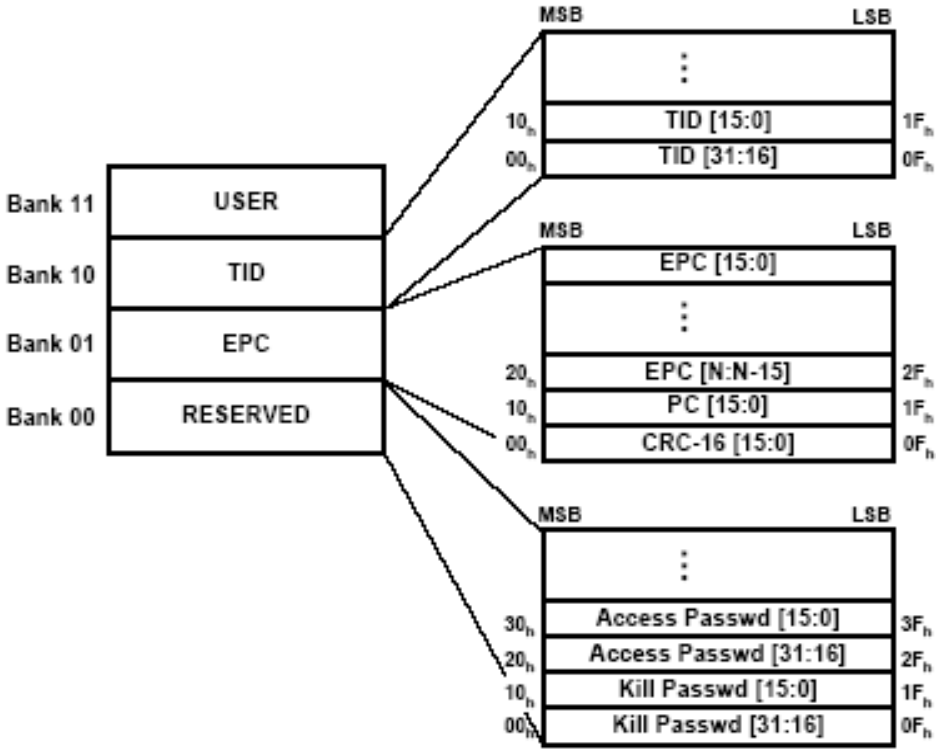
class1 GEN2 Adr (Bit)	0.....15	16....31	32....47	48....63	64....79	80.....		Transponder Response
EPC 1	CRC16	0x3000	0xA02A	0x0510	0x15A0	0x1234 ..	→	YES
EPC 2	CRC16	0x3000	0xA02B	0x0510	0x15A0	0x6789 ..	→	YES
EPC 3	CRC16	0x3000	0xA02A	0x0510	0x15A1	0x6789 ..	→	NO
S_MASK_1 S_START_POINTER = 16 S_MASK_LGT = 32	not checked	0x3000	0xA02A	not checked	not checked	not checked		
OR NOT S_MASK_2 S_START_POINTER = 16 S_MASK_LGT = 32	not checked	0x3000	0xA02B	not checked	not checked	not checked		
AND S_MASK_3 S_START_POINTER = 48 S_MASK_LGT = 32	not checked	not checked	not checked	0x0510	0x15A0	not checked		

Table 97.

The compare starts always with mask1, mask2 and finishes with mask3. An AND-operation has no priority over an OR-operation.

EPC class GEN2 Memory specification:





5.19 CFG28 - CFG32: Reserved

The configuration pages CFG28 - CFG32 are reserved for future use.

Byte	0	1	2	3	4	5	6
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Table 98.

5.20 CFG33 .. 34: LAN-Hostname

The configuration blocks CFG33 .. 34 hold the LAN-Hostname.

CFG 33:

Byte	0	1	2	3	4	5	6
Contents	LENGTH	LAN-HOSTNAME					
Default	0x00	0x000000000000					

Byte	7	8	9	10	11	12	13
Contents	LAN-HOSTNAME						
Default	0x00000000000000						

Table 99.

CFG 34:

Byte	0	1	2	3	4	5	6
Contents	LAN-HOSTNAME						
Default	0x000000000000						

Byte	7	8	9	10	11	12	13
Contents	LAN-HOSTNAME						
Default	0x00000000000000						

Table 100.

LENGTH:

(HostInterface.LAN.Hostname.Length)

Defines the length of the LAN-Hostname

0x00: disabled

0x01: 1 Byte

0x02: 2 Bytes

…

0x1B: 27 Bytes

Note

The LAN-Hostname can have a maximum length of 27 Bytes.

LAN-HOSTNAME:

(HostInterface.LAN.Hostname.Name)

Defines the LAN-Hostname

5.21 CFG35 - CFG39: Reserved

The configuration pages CFG35 - CFG39 are reserved for future use.

Byte	0	1	2	3	4	5	6
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Table 101.

5.22 CFG40: LAN Settings, Part 1

Configuration of the IP address and port number.

Byte	0	1	2	3	4	5	6
Contents	IP_ADDRESS_LAN				-	-	-
Default	0xC0	0xA8	0x0A	0x0A	0x00	0x00	0x00
	192	*168*	*10*	*10*			

Byte	7	8	9	10	11	12	13
Contents	-	IP_PORT_NUMBER_LAN		-	-	-	-
Default	0x00	0x27	0x11	0x00	0x00	0x00	0x00
			10001				

Table 102.

IP_ADDRESS_LAN:

(HostInterface.LAN.IPv4.IPAddress)

Defines the IP address for wired LAN connection. Changing of this parameter only becomes effective after writing / saving this configuration block to EEPROM and a [0x64] System Reset.

IP_PORT_NUMBER:_LAN

(HostInterface.LAN.PortNumber)

Defines the port number for wired LAN connection. Changing of this parameter only becomes effective after writing / saving this configuration block to EEPROM and a [0x64] System Reset.

5.23 CFG41: LAN Settings, Part 2

Configuration of the Subnet Mask and other LAN options.

Byte	0	1	2	3	4	5	6
Contents	SUBNET-MASK-LAN				LAN-OPTIONS	KEEP-CNT	GW-ADDRES-LAN
Default	0xFF *255*	0xFF *255*	0x00 *0*	0x00 *0*	0x01	0x02	0x00

Byte	7	8	9	10	11	12	13
Contents	GW-ADDRES-LAN			0x00	0x00	KEEP-INTERVAL	
Default	0x00	0x00	0x00			0x00	0x05

Table 103.

SUBNET_MASK_LAN:

(HostInterface.LAN.IPv4.SubnetMask)

Defines the subnet mask for wired TCP/IP connection. Changing of this parameter only becomes effective after writing / saving this configuration block to EEPROM and a [0x64] System Reset of the RFC

GW_ADDRESS_LAN:

(HostInterface.LAN.IPv4.GatewayAddress)

Defines the gateway address for TCP/IP connection. Changing of this parameter only becomes effective after writing / saving this configuration block to EEPROM and a [0x64] System Reset of the RFC

LAN-OPTIONS:

Bit:	7	6	5	4	3	2	1	0
Function:	DHCP	SPEED	DUPLEX	HOST-NAME	AUTO-NEGOTIATION	0	0	KEEP-ALIVE

Table 104.

KEEP-ALIVE:

(HostInterface.LAN.Keepalive.Enable)

b0: Keep-Alive option disabled

b1: Keep-Alive option enabled

AUTONEGOTIATION:

(HostInterface.LAN.Autonegotiation.Disable)

b0: Autonegotiation enabled

b1: Autonegotiation disabled

HOSTNAME:

(HostInterface.LAN.Hostname.Enable)

b0: Hostname option disabled

b1: Hostname option enabled

DUPLEX:

(HostInterface.LAN.Autonegotiation.Duplex)

b0: Half Duplex

b1: Full Duplex

SPEED:

(HostInterface.LAN.Autonegotiation.Speed)

b0: 10 Mbit

b1: 100 Mbit

DHCP:

(HostInterface.LAN.IPv4.Enable_DHCP)

b0: DHCP client disable

b1: DHCP client enabled

KEEP-CNT:

(HostInterface.LAN.Keepalive.RetransmissionCount)

Specifies the maximum number of retransmissions. This is the number of times that the reader re-transmits a keepalive packet to the host to check for connectivity. The valid range is 1..255.

KEEP-INTERVAL:

(HostInterface.LAN.Keepalive.IntervalTime)

Set the Keepalive Interval. This is the polling frequency used to determine if a

keepalive exchange is needed. This interval is used when the connection failed. The valid range is 1..255 sec.

Note

The command has no effect on this setting

Changing of this parameter only becomes effective after writing / saving this configuration block to EEPROM and a [0x64] System Reset of the RFC.

5.24 CFG47: Summer Winter Time

The parameters of the CFG47 configuration block contain setting for summer winter time overchange.

Byte	0	1	2	3	4	5	6
Contents	0x00	Reserved	0x00	0x00	0x00	0x00	0x00
Default		0x00					

Byte	7	8	9	10	11	12	13
Contents		WDAY	SMONTH	SDAY_BGN	SDAY_END	SHOUR	MIN_STEP
Default	0x00	0x11	0xA3	0x19	0x19	0x22	0x3C
		0x11	*March /*	*25.*	*25.*	*2 am /*	*+ 60 min*
		Sunday	*October*			*2 am*	

Table 105.

WDAY:

Together with SDAY_x defines the day of the week or date when the respective change should occur.

Bit:	7	6	5	4	3	2	1	0
Function:	WDAY_END (0..7)				WDAY_BGN (0..7)			

Table 106.

WDAY_BGN

0 ==> Changeover date is defined by SMONTH_BGN and SDAY_BGN.

1..7 ==> Changeover occurs on a defined day of the week (1: Sunday, 2: Monday, ...7: Saturday) in the month SMONTH_BGN. SDAY_BGN defines the time period.

WDAY_END

0 ==> Changeover date is defined by SMONTH_END and SDAY_END.

1..7 ==> Changeover occurs on a defined day of the week (1: Sunday, 2: Monday, ...7: Saturday) in the month SMONTH_END. SDAY_END defines the time period.

SMONTH:

Defines the starting month for daylight saving time

Bit:	7	6	5	4	3	2	1	0
Function:	SMONTH_END (0..7)				SMONTH_BGN (0..7)			

Table 107.

SMONTH_BGN

1..12 ==> Defines the starting month for daylight saving time

0 ==> Change disabled

SMONTH_END

1..12 ==> Defines the ending month for daylight saving time

0 ==> Change disabled

SDAY_BGN / SDAY_END (1...31):

Defines the type of changeover depending on WDAY_BGN and WDAY_END (WDAY_x).

WDAY_x > 0 (weekday changeover):

Changeover occurs on the weekday defined by WDAY which lies between the days SDAY_x and SDAY_x + 6.

Example:

To have the changeover occur on the last Sunday of a month having 31 days, set WDAY = 1 (Sunday) and SDAY_x = 25 (31 - 6). The changeover then takes place on the Sunday which occurs between the 25th and 31st of the month defined by SMONTH_x.

To have the changeover occur for example on the 1st Friday of a month, set WDAY = 6 and SDAY_x = 1.

WDAY_x = 0 (Date changeover)

Changeover occurs on the date defined by SMONTH_x and SDAY_x.

SHOUR:

Defines the time of day in full hours between midnight (0) and 15:00 (15) when the changeover should occur .

Bit:	7	6	5	4	3	2	1	0
Function:	SHOUR_END				SHOUR_BGN			

Table 108.

SHOUR_BGN:

Time in full hours of normal time when daylight saving time begins.

SHOUR_END:

Time in full hours of normal time when daylight saving time ends.

SHOUR_END = T_{SDST} - MIN_STEP

T_{SDST}: Time in daylight saving time when daylight saving time ends.

MIN_STEP: see below

MIN_STEP:

Defines the difference by which the clock time deviates from winter to summer time.

Bit:	7	6	5	4	3	2	1	0
Function:	SIGN	MIN_INC						

Table 109.

SIGN:

Specifies the sign for the minute increments

1 ==> "-"

0 ==> "+"

MIN_INC (0...127):

Defines the number of minutes by which the clock time deviates in DST mode from standard time.

Note

SHOUR_END and SHOUR_BGN refer to standard time (winter time). If the end of daylight saving time needs to be 3:00 for example and the clock has to be set back by –1 hour, SHOUR_END should be defined as = 2:00. To have the changeover occur on Saturday at 23:59, the changeover time must be configured for Sunday at 00:00.

5.25 CFG49: Notification Channel

Settings for Notification mode.

Byte	0	1	2	3	4	5	6
Contents	MODE	0x00	0x00	0x00	KEEP-ALIVE	KEEP-ALIVE-TIME	
Default	0x00				0x00	0x00	0x02
	continuously				*Off*	*0s*	

Byte	7	8	9	10	11	12	13
Contents	DEST-IP-ADDRESS				DEST-IP-PORT		HOLD-Time
Default	0x00	0x00	0x00	0x00	0x00	0x00	0x05

Table 110.

MODE:

Defines the basic settings for the notification channel.

Bit:	7	6	5	4	3	2	1	0
Function	ACK	0	0	0	0	0	0	0

Table 111.

ACK: Acknowledge Notification

(OperatingMode.NotificationMode.Transmission.Enable_Acknowledge)

b0: Notification must not be acknowledged

b1: Notification must be acknowledged with protocol [0x32] Clear Data Buffer

KEEP-ALIVE:

Mode for keep alive notification.

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	0	0	EN

Table 112.

EN:

(OperatingMode.NotificationMode.Transmission.KeepAlive.Enable)

b0: disabled

b1: enabled

KEEP-ALIVE-TIME:

(OperatingMode.NotificationMode.Transmission.KeepAlive.IntervalTime)

Defines the cycle time for keep alive notification.

	max. time period
KEEP-ALIVE-TIME	0...65535 * 1s

Table 113.

DEST-IP-ADDRESS:

(OperatingMode.NotificationMode.Transmission.Destination.IPv4.IPAddress)

Defines the destination IP address.

DEST-IP-PORT-NUMBER:

(OperatingMode.NotificationMode.Transmission.Destination.PortNumber)

Defines the destination port number.

HOLD-Time:

(OperatingMode.NotificationMode.Transmission.Destination.ConnectionHoldTime)

Defines the connection hold time.

5.26 CFG63: Customer Parameter

The configuration block CFG63 is used for customer parameter.

Byte	0	1	2	3	4	5	6
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Default							

Table 114.

6. Protocols for Reader Configuration

Via the protocols for reader configuration, the reader can be adapted to individual conditions of application within wide limits.

6.1 [0x85] Set System Timer

The Set System Timer command sets the internal system timer of the CPU. The actual internal system time is stored in each data set after a transponder select, read or write command.

Host -> Reader

1	2	3	4	5	6-9	10,11
STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x85]	TIMER	CRC16

Table 115.

Host <- Reader

1	2	3	4	5	6	7,8
STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x85]	STATUS	CRC16

Table 116.

TIMER:

Byte	6	7	8,9
TIME	h	min	ms
	0...23	0...59	0...59999

Table 117.

6.2 [0x86] Get System Timer

The Get System Timer command reads the internal system timer of the CPU.

Host -> Reader

1	2	3	4	5	6, 7
STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x86]	CRC16

Table 118.

Host <- Reader

1	2	3	4	5	6	7-10	11, 12
STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x86]	STATUS	TIMER	CRC16

Table 119.

TIMER:

Byte	7	8	9, 10
TIME	h	min	ms
	0...23	0...59	0...59999

Table 120.

6.3 [0x87] Set System Time and Date

The Set System Time and Date command sets the internal system timer and the date.

Host -> Reader

Byte	1	2	3	4	5	6 .. 10	11 .. 13	14 .. 15
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x87]	DATE	TIMER	CRC16

Table 121.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x87]	STATUS	CRC16

Table 122.

DATE:

Byte	6	7
TIME	century	year
	0...99	***0...99***

8	9	10
month	day	time zone
1...12	***1...31***	***0...23***

Table 123.

TIMER:

Byte	7	8	9, 10
TIME	h	min	ms
	0...23	0...59	0...59999

Table 124.

Note

After setting the system time and date a [0x33] Initialize Buffer s necessary if the Buffered Read Mode or Notification Mode is used.

6.4 [0x88] Get System Time and Date

The Get System Time and Date command reads the internal system timer and the date

Host -> Reader

Byte	1	2	3	4	5	6 .. 7
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x88]	CRC16

Table 125.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 11
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x88]	STATUS	DATE

Table 126.

DATE:

Byte	6	7
TIME	century	year
	0...99	***0...99***

8	9	10
month	day	time zone
1...12	***1...31***	***0...23***

Table 127.

TIMER:

Byte	7	8	9, 10
TIME	h	min	ms
	0...23	0...59	0...59999

Table 128.

6.5 [0x80] Read Configuration

By using the Read Configuration the actual configuration of the reader can be detected. In order to do this, the configuration is read in blocks of 14 bytes each and addressed by CFGn in the byte CFG-ADR.

Host -> Reader

Byte	1	2	3	4	5	6	7-8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x80]	CFG-ADR	CRC16

Table 129.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 20	19-20
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x80]	STATUS	CFG-REC	CRC16

Table 130.

CFG-ADR:

Bit	7	6	5	4	3	2	1	0
Function	LOC	0	CFGn: Address of Configuration Block					

Table 131.

CFGn: memory-address of the required configuration block

LOC: specifies the location of the configuration block

b0: RAM

b1: EEPROM

CFG-REC:

14 bytes configuration block read from address CFGn in CFG-ADR.

Note

A read configuration from EEPROM with reserved configuration blocks will cause an 0x15 error code.

6.6 [0x81] Write Configuration

The configuration of the reader can be changed by means of the Write Configuration command. In order to do this, the configuration memory is written to with 14 bytes long blocks and addressed by CFGn in the byte CFG-ADR. The description of parameters can be taken from Chapter Configuration Parameters

Host -> Reader

Byte	1	2	3	4	5	6	7...20	19-20
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x81]	CFG-ADR	CFG-REC	CRC16

Table 132.

Host <- Reader

Byte	1	2	3	4	5	6	7-8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x81]	STATUS	CRC16

Table 133.

CFG-ADR:

Bit	7	6	5	4	3	2	1	0
Function	LOC	0	CFGn: Address of Configuration Block					

Table 134.

CFGn: memory-address of the required configuration block

LOC: specifies the location of the configuration block

b0: RAM

b1: RAM and EEPROM

CFG-REC:

14 bytes configuration block stored in the configuration memory of the reader at address CFGn.

Note

A write configuration to EEPROM with reserved configuration blocks will cause an 0x16 error code.

6.7 [0x83] Reset Configuration

Using the command Set Default Configuration each configuration block can be reset to the manufacturer's setting.

Host -> Reader

Byte	1	2	3	4	5	6	7...8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x83]	CFG-ADR	CRC16

Table 135.

Host <- Reader

Byte	1	2	3	4	5	6	7...8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x83]	STATUS	CRC16

Table 136.

CFG-ADR:

Bit	7	6	5	4	3	2	1	0
Function	LOC	MODE	CFGn: Address of Configuration Block					

Table 137.

CFGn: memory-address of the required configuration block

MODE: specifies one or all configuration blocks

- b0: configuration block specified by CFGn
- b1: all configuration blocks

LOC: specifies the location of the configuration block

- b0: RAM
- b1: RAM and EEPROM

Note

A set default configuration command with reserved configuration blocks will cause an error code.

7. Protocols for Reader Control

7.1 [0x52] Baud Rate Detection

This protocol serves to determine the actual baud rate of the reader's asynchronous interface.

Host -> Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x52]	0x00	CRC16

Table 138.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x52]	0x00	CRC16

Table 139.

Note

The return protocol will only be sent if the inquiry is executed with the baud rate and actual parity of the reader.

7.2 [0x63] RF Controller Reset

This protocol allows you to reset the RF Controller.

Host -> Reader

Byte	1	2	3	4	5	6 .. 7
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x63]	CRC16

Table 140.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x63]	STATUS	CRC16

Table 141.

Note

The RF-field will be switched off after a “RF Controller Reset”

Commands issued after a [0x63] command must be delayed with at least 300 ms, otherwise the reader will not respond.

The communication interface will not be reset.

7.3 [0x64] System Reset

This protocol allows you to reset the RF Controller.

Host -> Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x64]	Mode	CRC16

Table 142.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x64]	Mode	CRC16

Table 143.

MODE:

Defines Controller which will be reset.

MODE	Controller
0	RF Controller

Table 144.

Note

The communication interface will be reset.

7.4 [0x66] Get Reader Info

This protocol allows you to determine the currently installed Firmware version, its type and the types of the transponders which are supported by the Firmware as well as some other hard- and firmware options of the reader. Also the Device-ID can be determined.

Host -> Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x66]	MODE	CRC16

Table 145.

MODE:

Via the Parameter MODE different information can be requested from the reader.

0x00: RF-Controller Firmware

0x10: Hardware Information

0x15: RF-Stack Information

0x16: IDT-Stack Information

0x40: CFG-Information for read

0x41: CFG-Information for write

0x50: LAN-Information: MAC

0x51: LAN-Information: IP-Address

0x52: LAN-Information: Netmask

0x53: LAN-Information: Gateway-Address

0x60: I/O Capabilities

0x80: Device-ID (Information is required for Firmware upgrades)

0xFF: All (reads all available information at once)

Depending on the MODE Parameter the reader response has a different structure including different information:

MODE = 0x00 (RFC Controller Firmware)

Host <- Reader

Byte	1	2	3	4	5	6	7...8	9
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x66]	STATUS	SW-REV	D-REV

Table 146.

10	11	12 .. 13	14 .. 15	16 .. 17
HW-TYPE	SW-TYPE	TR-TYPE	RX-BUF	TX-BUF

Table 147.

18 .. 19	20	21	22 .. 23
Reserved	RDR-REV	RDR-ASSEMBLY	CRC16

Table 148.

SW-REV:

Revision status of the Firmware. Depending on the Mode and reader type different controllers are meant.

D-REV:

Revision status of the development Firmware. D-REV is set to ‘0’ in customized Firmware revisions.

HW-TYPE:

Displays information about the Hardware Version

SW-TYPE:

Type of RFC reader Firmware

0x5B: IUR-F800-V1D-4A* (91)

TR-TYPE:

Displays the transponders supported by the RFC software.

RX-BUF:

RX-BUF is the maximum receive buffer size of the reader. If a protocol from the host exceeds the RX-BUF size the reader responds with 0x81 PROTOCOL LENGTH ERROR.

TX-BUF:

TX-BUF is the maximum transmit buffer size of the reader. The Host has to take in to account that a response protocol of the reader can have this length.

RDR-REV:

Revision of the reader.

RDR-REV	Comment
0	Any firmware version can be loaded
2	Requires firmware version ≥ 02.04.00

Table 149.

RDR-ASSEMBLY:

Assembly of the reader (IUR-F800-V1D-4A*=0x00).

Mode = 0x10 (Hardware Information)

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 8	9 .. 10
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x66]	STATUS	HW-INFO	D_HW

Table 150.

11 ..12	13	14	15	16	17	18 .. 19
A_HW	FREQUENCY	PORT_TYPE	Reserved	Reserved	Reserved	CRC16

Table 151.

HW-INFO:

internal use

D-HW:

internal use

A-HW:

internal use

FREQUENCY:

Flags for supported frequencies

Bit	7	6	5	4	3	2	1	0
Function	HF	UHF	-	-	-	LOCK	FCC	EU

Table 152.

EU: b0: EU frequencies not supported

b1: EU frequencies supported

FCC: b0: FCC frequencies not supported

b1: FCC frequencies supported

LOCK: b0: Region is not locked

b1: Region is locked

UHF: b0: UHF not supported

b1: UHF supported

HF: b0: HF not supported

b1: HF supported

PORT_TYPE:

Flags for supported communication ports

Bit	7	6	5	4	3	2	1	0
Function	DISC	-	BT	USB	WLAN	LAN	RS4xx	RS232

Table 153.

RS232: b0: not supported

b1: supported

RS4xx: b0: not supported

b1: supported

LAN: b0: not supported

b1: supported

WLAN: b0: not supported

b1: supported

USB: b0: not supported

b1: supported

BT: b0: not supported

b1: supported

DISC: b0: Discovery not supported

b1: Discovery supported

Mode = 0x40 .. 0x41 (Configuration Information for read and write)

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 8	9 .. n-2	n-1 .. n
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x66]	STATUS	NR_OF_ PAGES	PERMISSION	CRC16

Table 154.

NR_OF_PAGES:

Defines the number of read / written configuration pages

PERMISSION:

Byte	7							
Bit	7	6	5	4	3	2	1	0
CFG_NO	0	1	2	3	4	5	6	7

Table 155.

Byte	8							
Bit	7	6	5	4	3	2	1	0
CFG_NO	8	9	10	11	12	13	14	15

Table 156.

Byte	9							
Bit	7	6	5	4	3	2	1	0
CFG_NO	16	17	18	19	20	21	22	23

Table 157.

.
.
.

Byte	n-2							
Bit	7	6	5	4	3	2	1	0
CFG_NO	X	X	X	X	X	X	X	X

Table 158.

Mode = 0x50 - 0x53 (LAN LConfiguration)

In case of setting Ethernet parameters per DHCP, these parameters can be requested with the following format.

Host <- Reader

Byte	1	2	3	4	5	6	7	8 .. n-2	n-1 .. n
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x66]	STATUS	FLAGS	DATA	CRC16

Table 159.

FLAGS: indicates additional settings

Byte	5							
Bit	7	6	5	4	3	2	1	0
	0	0	DHCP v4	0	Disabled v4	0	Supported v4	0

Table 160.

Supported v4:

b0: not supported

b1: supported

Disabled v4:

b0: LAN channel is enabled

b1: LAN channel is disabled

DHCP v4:

b0: disabled

b1: enabled

DATA (Mode 0x50.-.0x53):

MODE		DATA
0x50 (LAN-MAC)	FLAGS	6 Byte MAC
0x51 (LAN-IP-Address)	FLAGS	IPv4: 4 Byte IP-Address
0x52 (LAN-Netmask)	FLAGS	IPv4: 4 Byte Netmask
0x53 (LAN-Gateway)	FLAGS	IPv4: 4 Byte Gateway

Table 161.

Mode = 0x60 (I/O-Capabilities)

Host <- Reader

Byte	1	2	3	4	5	6	7	8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x66]	STATUS	NR_OF_ INPUTS	NR_OF_ OUTPUTS

Table 162.

9	10 .. 11
NR_OF_ RELAYS	CRC16

Table 163.

NR_OF_INPUTS:

Indicates the number of available Inputs

NR_OF_OUTPUTS:

Indicates the number of available Outputs

NR_OF_RELAYS:

Indicates the number of available Relays

Mode = 0x80 (Device Information)

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 10	11..14
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x66]	STATUS	DEV_ID	Custom_L

Table 164.

15 .. 16	17 .. 18	19 .. 20	21 .. 22	23 .. 24
FW_L	TR_DRV_L	FNC_L	-	CRC16

Table 165.

DEV_ID:

Individual device identifier of the reader.

CUSTOM_L

Indicates which customer Firmware is licensed on the reader.

FW_L:

Indicates which Firmware version is licensed on the reader.

TR_DRV_L:

Indicates which transponder drivers are licensed on the reader.

FNC_L:

Indicates which optional functions are licensed on the reader.

Mode = 0xFF (All Info Records)

Return of all Info records in one Response.

Host <- Reader

Byte	1	2	3	4	5	6	7
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x66]	STATUS	DATASETS

Table 166.

8	9..38	n-1, n
MODE	DATA	CRC16
Repeated DATASETS times		

Table 167.

MODE

Mode byte

DATA (Mode 0xFF):

Data record according to the definition in the previous sections.

The data record is always 30 byte long and information begins always with byte 0. Unused bytes must be filled with 0x00.

7.5 [0x69] RF Reset

The RF-field of the reader antenna can be switched off for about t_{rf} = 15 ms by the command RF Reset.

Host -> Reader

Byte	1	2	3	4	5	6 .. 7
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x69]	CRC16

Table 168.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x69]	STATUS	CRC16

Table 169.

Note

The response of this command will be sent after the RF Reset was completed.

7.6 [0x6A] RF Output ON/OFF

The command RF ON/OFF switches the RF field of the reader antenna ON and OFF.

If the reader works in Auto Read Mode the RF communication can be interrupted by transmitting RF OFF and continued with RF ON. After RF OFF, the reader accepts every Host command and the RF communication is handled on the last selected antenna. For selecting a specific antenna without continuing the Auto Read Mode, the option flag HM must be set.

Host -> Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x6A]	RF_OUTPUT	CRC16

Table 170.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x6A]	STATUS	CRC16

Table 171.

RF-OUTPUT:

Set one of four antenna output.

Bit	7	6	5	4	3	2	1	0
Function	HM	0	0	0	0	Antenna Output		

Table 172.

Antenna Output

Set one RF output active or RF Power off

Antenna Output	Description
b000	RF OFF
b001	RF Power on antenna output 1
b010	RF Power on antenna output 2
b011	RF Power on antenna output 3
b100	RF Power on antenna output 4

Table 173.

HM Maintain Host Mode (applicable only for Auto Read Mode)

b0: Auto Read Mode is continued, if Antenna Output is greater than zero

b1: Host Mode is maintained and Antenna Output is selected, if greater than zero

Note

In the case of sending RF output ON/OFF with antenna output = b000 the reader sends a command to reset the persistence flags of the transponder. This command is sent on the antenna port which was active before the RF output ON/OFF command is sent to the reader.

Switching of antenna is also possible in BRM- or Scan-Mode, if multiplexer is disabled.

7.7 [0x6E] Reader Diagnostic

The command Reader Diagnostic displays several hardware diagnostics on the reader.

Host -> Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x6E]	MODE	CRC16

Table 174.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. n-2	n-1 .. n
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x6E]	STATUS	DATA	CRC16

Table 175.

MODE:

Reader Diagnostic Modes

0x01: Listing of detail information for STATUS = 0x84 (RF-Warning)

0x04: Listing of detail information for STATUS = 0x10 (EEPROM-Failure)

0x05: Listing of detail information for Flags A (control, |Z|>, |Z|<) (Mux channel impedance status)

0x20: Listing of detail information for STATUS = 0x18 (Wrong firmware)

0xFF: All

DATA:

Response for Reader Diagnostic Modes

MODE = 0x01:

Byte	5	6
Contents	FLAGS A	FLAGS B

Table 176.

FLAGS A:

Bit	7	6	5	4	3	2	1	0
Function	TEMP_ ALARM	-	TEMP_ WARN	RF Power CONTROL	-	-	NOISE	-

Table 177.

FLAGS B:

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	|Z| </> Ant4	|Z| </> Ant3	|Z| </> Ant2	|Z| </> Ant1

Table 178.

Error Conditions (Flag A and B):

Error	Set condition	Clear condition Trouble shouting	RF Power	LED 5
NOISE	The noise in the receiver channel is very high	Select other preferred channel(s) or add more preferred channels (max. four) in CFG3.	ON	ON
RF Power CONTROL	RF-Power out of control range	configured Power to high check cable	ON	ON
TEMP_WARN	temp ≥ warning level ≥100°C	temp < warning level	ON	ON
TEMP_ALARM	temp ≥ alarm level ≥105°C	cpu reset	OFF	ON
|Z| <>	absolute impedance value << or >> 50 Ohm	check cable check antenna matching	ON	ON

Table 179.

MODE = 0x04:

Byte	5-6
Contents	INT_ERROR

Table 180.

INT_ERROR

Bit	15	14	13	12	11	10	9	8
Function	-	-	-	-	-	USB-IMAX	DC-OUT	IO-EXPANDER

Table 181.

Bit	7	6	5	4	3	2	1	0
Function	ADC	RTC	-	-	RF-Decoder	-	-	EE DEV1

Table 182.

EE_DEV1:

Error during the communication with EEPROM Dev 1

RF-Decoder:

Error during the communication with RF-Decoder

DC-OUT:

Error DC-OUT

USB-IMAX:

Error during the communication with USB

RTC:

Error during the communication with RTC

ADC:

Error during the communication with ADC

IO-EXPANDER:

Error during the communication with IO-Expander

MODE = 0x05:

Detail information of Flags A if ID ISC.ANT.UMUX is used

Byte	7	8	9	10	11
Contents	Control UMUX1	reserved	reserved	Control UMUX2	reserved

Table 183.

11	12	13	14	15
reserved	Control UMUX3	reserved	reserved	Control UMUX4

16	17
reserved	reserved

Table 184.

Control:

Indicates the status of the connected multiplexer antennas

Bit	8	7	6	5	4	3	2	1
Function	Chn8	Chn7	Chn6	Chn5	Chn4	Chn3	Chn2	Chn1

Table 185.

b0: IZI = 50 Ohm

b1: IZI < > 50 Ohm

MODE = 0x20:

ASCII-String with a description of the error.

MODE = 0xFF: READ ALL

Executes all Modes described above an combines their results in one protocol.

Host <- Reader

Byte	1	2	3	4	5	6	7
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x6E]	STATUS	DATASETS

Table 186.

8	9..38	n-1, n
MODE	DATA	CRC16
Repeated DATASETS times		

Table 187.

MODE

Mode byte

DATA (Mode 0xFF):

Data record according to the definition in the previous sections.

The data record is always 30 byte long and information begins always with byte 0. Unused bytes must be filled with 0x00.

7.8 [0x72] Set Output

The command Set Output serves temporary limited or unlimited activation of the outputs of the reader.

Each output takes the state defined by the byte OUTx-mode for the period of time (OUT-TIME) included in the protocol. The flashing frequency is defined by the byte OUTx-frq. Via this protocol the outputs can be switched on or off for the indicated period of time. If the reader receives a command Set Output, all times that have been active until then are being overwritten by the new times included in the protocol if they are ? 0.

Host -> Reader

Byte	1	2	3	4	5	6	7
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x72]	Mode	OUT-N

Table 188.

8	9	10 .. 11	n-1...n
OUT-NR	OUT-S	OUT-TIME	CRC16
Repeated OUT-N times			

Table 189.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x71]	STATUS	CRC16

Table 190.

Mode:

0x01 (reserved)

OUT-N:

Defines the number of output records.

OUT-NR:

Defines the Typ and the number of the output

Bit	7	6	5	4	3	2	1	0
Function	OUT-Typ			0	OUT-Number			

Table 191.

OUT-typ:

b000: Digital Outputs

b100: Relays

any other Bit configuration is reserved.

OUT-S:

OUT-S (Output State) defines the status of the output during the time defined in OUT-TIME and provides the possibility to allocate its own flashing-frequency to each output.

Bit	7	6	5	4	3	2	1	0	
Function	0	0	0	0	OUTx-frq		OUTx-mode		

Table 192.

OUTx-mode:

b01: ON output for OUT-TIME = active

b10: OFF output for OUT-TIME = inactive

b11: FLASH output for OUT-TIME = with OSF alternating

OUTx-frq:

b11: 1 Hz

b10: 2 Hz

b01: 4 Hz

b00: 8 Hz

OUT-TIME

By the values defined by “OUT-TIME”, the outputs can be activated temporary limited or unlimited.
An exception is the time value 0 and 65535 (0xFFFF) (see following table).

0x0001	1 x 100ms	--> 100ms
...	...	
0xFFFE	65534 x 100ms	--> 1:49:13 h
0xFFFF	continuously active	

Note

In order to reset a continuously active time, OUT-TIME = 1 has to be sent to the reader, which effects a change to the idle status after 100 ms.

The continuous activation is being set back after a reset or a power failure

7.8.1 Set Output Examples

Example No. 1:

OUT1 is alternating with 4 Hz for 500 ms.

REL1 is not activated for 200 ms.

OUT-N	OUT-NR	OUT-S	OUT-TIME
0x0002	*0x01*	*0x07*	*0x0005*
	OUT-NR	**OUT-S**	**OUT-TIME**
	0x81	*0x02*	*0x0002*

Table 193.

7.9 [0x74] Get Input

With this protocol the actual status of the digital inputs IN1...IN2 can be determined at any time.

Host -> Reader

Byte	1	2	3	4	5	6 .. 7
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x74]	CRC16

Table 194.

Host <- Reader

Byte	1	2	3	4	5	6	7	8 .. 9
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x74]	STATUS	INPUTS	CRC16

Table 195.

INPUTS:

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	-	-	IN2	IN1

Table 196.

b0: digital input = inactive

b1: digital input = active

Note

If the trigger is enabled in Buffered Read Mode the input IN1/2 isn't available for common use.

7.10 [0x8D] Lock Region

This command locks the region in CFG3, after using the command it is no longer possible to change the region.

Host -> Reader:

Byte	1	2	3	4	5	6 .. 7
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x8D]	CRC16

Table 197.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x8D]	STATUS	CRC16

Table 198.

Note

The Region settings are locked upon delivery and cannot be changed.

7.11 [0xA0] Reader-Login

The Reader-Login must be executed after every power up or [0x63] RF Controller Reset command, if an access to the configuration parameters is desired.

Host -> Reader:

Byte	1	2	3	4	5	6 .. 9	10 .. 11
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0xA0]	READER-ID	CRC16

Table 199.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0xA0]	STATUS	CRC16

Table 200.

READER-ID:

The READER-ID is a password which protects the configuration parameters from any read and write access.

The READER-ID can be changed in the configuration block CFG0: Passwords.

Note

A Reader-Login with wrong READER-ID causes a "Logout".
A "Logout" can be affected via the command [0x63] RF Controller Reset.

7.12 [0xA3] Write AES Reader Keys

The keys which are required by the reader in order to authenticate itself to an AES encrypted transponder (e.g. UCODE DNA) will be stored in the reader by this command. Only if the keys of the reader and the transponder correspond, the data exchange between reader and transponder can be successful executed.

REQUEST-DATA

1	1	1	1	KEY-LEN
MODE	READER-KEY-IDX	AUTH-MODE	KEY-LEN	KEY

Table 201.

MODE:

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	0	0	LOC

Table 202.

LOC:

Specifies the location where the KEY should be stored in the reader

b0: RAM
The KEY will be stored only temporary in the RAM of the reader. After the supply power was interrupted the keys has to be loaded once again into the RAM. This option is recommended, if the reader is used on a

public place, if anybody can to take the reader away easily.

b1: EEPROM
The KEY will be stored in the EEPROM and in the RAM of the reader. The key can be used also after the supply power was interrupted. This option can be used, if the reader is used on a secured place.

Note

The keys in the :EEPROM are not strong protected against hacking its content.

READER-KEY-IDX (0...1):

Address where the key is stored in the reader.

AUTH-MODE:

This parameter defines the authentication mode which will be performed by the reader with this key.

AUTH-MODE	authentication method	KEY-LEN
5	AES	16 Byte

Table 203.

KEY-LEN :

This parameter defines the length of the following key (fix 16 bytes).

KEY:

Key which has to be used for authentication.

7.13 [0xAD] Write Reader Authentication Key

The key which is required by the reader in order to authenticate with the access password to a transponder will be stored in the reader by this command. Only if the key of the reader and of the transponder correspond, the data exchange between reader and transponder can be successful executed.

REQUEST-DATA

1	1	1	KEY-LEN
MODE	KEY-TYPE	KEY-LEN	KEY

Table 204.

MODE:

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	0	0	LOC

Table 205.

LOC:

Specifies the location where the KEY should be stored in the reader

b0: RAM
The KEY will be stored only temporary in the RAM of the reader. After the supply power was interrupted the keys has to be loaded once again into the RAM. This option is recommended, if the reader is used on a public place, if anybody can to take the reader away easily.

b1: EEPROM
The KEY will be stored in the EEPROM and in the RAM of the reader. The key can be used also after the supply power was interrupted. This option can be used, if the reader is used on a secured place.

Note

The keys in the :EEPROM are not strong protected against hacking its content.

KEY-TYPE:

This parameter defines the Key Type to be written.

0x03 – EPC Class1 Gen2 Access Password for transponder Authentication

CFG4: transponder Parameters

KEY-LEN :

This parameter defines the length of the following key (fix 4 bytes).

KEY:

Key which has to be used for authentication.

8. Protocols for Host Commands

The Host commands can be used to access the transponders.

	Transponder Types EPC Class 1 Gen 2
[0xB0] Host commands	X
[0x01] Inventory	X
[0x23] Read Multiple Blocks	X
[0x24] Write Multiple Blocks	X
[0xB3] Host commands for EPC transponders	X
[0x0A] Select	X
[0x22] Lock	X
[0x25] BlockPermalock	X
[0x26] Read Permalock Status	X
[0x30] Untraceable	X
[0x31] Authenticate	X

Table 206.

8.1 [0xB0] Host commands

This command set sends RF commands to the transponder.

Host -> Reader

Byte	1	2	3	4	5	6 .. n-2	n-1 .. n
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0xB0]	REQUEST-DATA	CRC16

Table 207.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. n-2	n-1 .. n
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0xB0]	STATUS	RESPONSE-DATA	CRC16

Table 208.

REQUEST-DATA:

Command specific request

RESPONSE-DATA:

Command specific response

Note

Data is only transferred if STATUS = 0x00, 0x83, 0x94, 0x95.

These commands aren't available if Scan-Mode, Buffered Read Mode or Notification Mode is active.

8.2 [0x01] Inventory

This command reads the IDD (Identifier Data) of all transponders inside the antenna field. IDD can be UID or EPC.

REQUEST-DATA

Byte	6	7	(8)
Contents	0x01	MODE	ANT_SEL

Table 209.

RESPONSE-DATA if ANT = 0

Byte	7	8	9	10	11 .. n
Contents	DATA-SETS	TR-TYPE	IDDIB	IDD_LEN	IDD
		Repeated DATA-SETS times			

Table 210.

RESPONSE-DATA if ANT = 1

Byte	7	8	9	10	11	12 .. n	n+1
Contents	DATA-SETS	FLAGS	TR-TYPE	IDDIB	IDD_LEN	IDD	ANT_CNT
		Repeated DATA-SETS times					

Table 211.

n+2	n+3	n+4	n+5...n+6	n+7...n+8
ANT_NR	ANT_STATUS	RSSI	PHASE_ANGLE	reserved
Repeated ANT_CNT times				
Repeated DATA-SETS times				

Table 212.

RESPONSE-DATA (STATUS = 0x95)

Byte	7
Contents	EPC Class1 Gen2 ERROR

Table 213.

MODE:

Bit	7	6	5	4	3	2	1	0
Function	MORE		0	ANT	0	0	0	0

Table 214.

MORE:

b0: new Inventory requested

b1: more data requested (IF Status 0x94 appears-> more data sets are available)

ANT:

b0: Request without antenna number

b1: Request with antenna number (ANT_SEL)

ANT-SEL:

Is a bit field and defines the corresponding bits of antenna where the reader starts an Inventory. ANT-SEL will be only transmitted if Bit "ANT" is set in Mode-Byte.

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	ANT4	ANT3	ANT2	ANT1

Table 215.

ANT1...4

b0: no reading on this antenna output

b1: reading on this antenna output

DATA-SETS:

Number of transponder data sets to be transferred in this reader response.

FLAGS:

Is a bit field and defines which data will be send.

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	ANT	-	-	-	IDD

Table 216.

IDD:

b0: no IDD will be send

b1: IDD will be send

ANT:

b0: no antenna information will be send

b1: antenna information (ANT_CNT, ANT_NR, ANT_STATUS, RSSI, PHASE_ANGLE) will be send

TR-TYPE:

Transponder type ANNEX A: Codes of transponder Types

IDDIB:

(Identifier Data Interpretation Byte)

Defines the type of Data transmit beginning at Byte 10. Possible Inventory Data Type ANNEX B: Codes of Identifier Data Interpretation Byte (IDDIB)

IDD-LEN:

Identifier Data Length defines the length of the IDD in Byte.

IDD:

Identifier Data of the transponder

ANT_CNT:

Number of antennas where transponder was read

ANT_NR:

Number of the antenna (1...255)

ANT_STATUS:

The ANT_STATUS can be 0x00 (OK) or
0x83 (RF communication error)) ANNEX C: Index of Status Bytes

RSSI:

Received Signal Strength Identification in dBm

PHASE_ANGLE:

RF phase angle of a transponder. The corresponding angle can be calculated as: PHASE_ANGLE * 360° / 4096

Note

This command supports all transponders.

If the STATUS byte of the protocol frame has the value 0x94 more IDD can be read out of the reader with MORE = b1.

8.3 [0x23] Read Multiple Blocks

This command reads one or more data blocks. The supported Host commands depend on the different UHF transponder types.

REQUEST-DATA

Byte	6	7	1 Byte	UID_LNG Bytes	1Byte	1 Byte	A_PW_LGT Bytes	1 or 2 Bytes (def. by EXT_ADR)	1 Byte
Contents	0x23	MODE	UID_LNG	UID	BANK	A_PW_LGT	A_PW	DB-ADR	DB-N

Table 217.

RESPONSE-DATA

Byte	7	8	9	10 .. n
Contents	DB-N	DB-SIZE	SEC-STATUS	DB
			Repeated DB-N times	

Table 218.

RESPONSE-DATA (STATUS = 0x95)

Byte	7
Contents	EPC Class1 Gen2 ERROR

Table 219.

MODE:

Bit	7	6	5	4	3	2	1	0
Function	0	READ_COMPLETE_BANK	EXT_ADR	UID_LF	0	ADR		

Table 220.

ADR:

b000: non-addressed

b001: addressed

UID_LF:

If this bit is set the parameter UID_LNG must inserted into the protocol.

b0: The protocol UID_LNG doesn't include the UID_LNG byte and the UID field has a fixed length of 12 byte, from byte 6 to byte 17.

b1: The protocol includes the parameter UID_LNG. The UID has a variable length as defined in UID_LNG.

EXT_ADR:

If this bit is set the command includes extended address fields.

b0: transponder memory addressing is done by the 1 byte DB-ADR Field.

b1: transponder memory addressing is done by BANK and 2 byte DB-ADR Field

READ_COMPLETE_BANK:

If this bit is set the reader will automatically read out all blocks of the selected memory bank starting from DB-ADR. If DB-ADR is “0” the complete content of the memory bank will be read.

b0: Reader reads out the memory blocks according to the settings for DB-ADR and DB-N

b1: Reader reads out all blocks of the selected memory bank starting from DB-ADR

Note

The read complete bank functionality is limited for memory banks with a maximum size of 128 blocks.

UID_LNG:

Is a optional parameter and depends on the setting of UID_LF (see MODE). UID_LNG defines the length of the following UID field.

UID:

Read-only serial number of the transponder. The UID is required only in the addressed mode.

BANK:

Memory bank of the transponder which will be accessed by the reader

Bit	7	6	5	4	3	2	1	0
Function	A_FLAG	0	0	0	0	0	BANK_NR	

Table 221.

BANK_NR:

In case of Class 1 Gen 2 transponder BANK_NR is defined as follows:#

b00: reserved

b01: EPC memory bank

b10: TID memory bank

b11: User memory bank

A_FLAG:

Indicates whether the reader tries to read a Gen 2 tag in Secured State. If A_FLAG is set the protocol contains the access password.

A_FLAG:

b0: no access password in protocol

b1: access password and access password length in protocol. Reader executes access command

A_PW_LNG:

Length of Access Password.

A_PW:

Access password which is used to access to the secured state of the Tag.

DB-ADR:

First block number to be read. Depending on EXT_ADR. First block can be any

value between 0 and 255 or 0 and 65535.

DB-N:

Number of data blocks to be read from the transponder, starting at DB-ADR.

The maximum number of DB-N, depends on DB-Size and the interface transmit buffer size TX-BUF. The maximum number of DB-N is:

(TX-BUF - 10) / (DB-Size + 1) e.g. Block size 2 (DB-N = (512 – 10) / (2 + 1) = 167).

Note

Without using the read complete bank functionality, maximum 167 datablocks can be read with a single read multiple blocks command!

DB-SIZE:

Number of bytes of one data block. This value depends on the specification of the transponder

SEC-STATUS:

Block security status of following data block.

DB:

Requested data block. The block size is defined by DB-SIZE.

8.4 [0x24] Write Multiple Blocks

This command writes one or more data blocks.

REQUEST-DATA

Byte	6	7	1 Byte	UID_LNG Bytes	1Byte
Contents	0x24	MODE	UID_LNG	UID	BANK

1 Byte	A_PW_LGT Bytes	1 or 2 Bytes (def. by EXT_ADR)	1 Byte	1 Byte	DB-N times DB-SIZE Bytes
A_PW_LGT	A_PW	DB-ADR	DB-N	DB-SIZE	DB
					Repeated DB-N times

Table 222.

RESPONSE-DATA (STATUS = 0x03)

Byte	7	(8)
Contents	DB-ADR-E	(DB-ADR-E)

Table 223.

RESPONSE-DATA (STATUS = 0x95)

Byte	7	8	(9)
Contents	EPC Class1 Gen2 ERROR	DB-ADR-E	(DB-ADR-E)

Table 224.

MODE:

Bit	7	6	5	4	3	2	1	0
Function	0	0	EXT_ADR	UID_LF	0	ADR		

Table 225.

ADR:

b000: non-addressed

b001: addressed

UID_LF:

If this bit is set the parameter UID_LNG must inserted into the protocol.

b0: The protocol UID_LNG doesn't include the UID_LNG byte and

the UID field has a fixed length of 12 byte, from byte 6 to byte 17.

b1: The protocol includes the parameter UID_LNG. The UID has a variable length as defined in UID_LNG.

EXT_ADR:

If this bit is set the command includes extended address fields.

b0: transponder memory addressing is done by the 1 byte DB-ADR Field.

b1: transponder memory addressing is done by BANK and 2 byte DB-ADR Field

UID_LNG:

Is a optional parameter and depends on the setting of UID_LF (see MODE). UID_LNG defines the length of the following UID field.

UID:

Read-only serial number of the transponder. The UID is required only in the addressed mode.

BANK:

Memory bank of the transponder which will be accessed by the reader

Bit	7	6	5	4	3	2	1	0
Function	A_FLAG	0	0	0	0	0	BANK_NR	

Table 226.

BANK_NR:

In case of Class 1 Gen 2 transponder BANK_NR is defined as follows:

b00: reserved

b01: EPC memory bank

b10: TID memory bank

b11: User memory bank

A_FLAG:

Indicates whether the reader tries to read a Gen 2 tag in Secured State. If A_FLAG is set, the protocol contains the access password.

b0: no access password in protocol

b1: access password and access password length in protocol. Reader execute access command

A_PW_LNG:

Length of Access Password.

A_PW:

Access password which is used to access to the secured state of the Tag.

DB-ADR:

First block number to be read. Depending on EXT_ADR First block can be any value between 0 and 255 or 0 and 65535.

DB-N:

Number of data blocks to be written to the transponder, starting at DB-ADR.

The maximum number of DB-N, depends on DB-Size and the interface receiver buffer size RX-BUF. The number of DB-N is also depending on the length of the UID.

DB-Nmax= 128

DB-SIZE:

Number of bytes of one data block.

DB:

Data of the data block to be written to the transponder. The required block size is defined by DB-SIZE. The number of the expected bytes are DB-N * DB-SIZE.

DB-ADR-E:

Block number were the error occurred.

Note

If an error occurred during a write command, the number of the block were the error occurred will be send to host.

DB-ADR-E will be 1 Byte if Extended Addressed Mode is disabled.

DB-ADR-E will be 2 Bytes if Extended Addressed Mode is enabled.

8.5 [0xB3] Host commands for EPC transponders

This command sends special commands to EPC transponder.

Host -> Reader

Byte	1	2	3	4	5	6 .. n-2	n-1 .. n
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0xB3]	REQUEST-DATA	CRC16

Table 227.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. n-2	n-1 .. n
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0xB3]	STATUS	RESPONSE-DATA	CRC16

Table 228.

REQUEST-DATA:

EPC specific request

RESPONSE-DATA:

EPC specific response

Note

Data is only transferred if STATUS = 0x00, 0x83, 0x94, 0x95.

8.6 [0x0A] Select

This command select a Tag subpopulation based on user defined criteria.

REQUEST-DATA

Byte	6	7	1 Byte	1 Byte
Contents	0x0A	MODE	TARGET	ACTION

1 Byte	4 Byte	1 Byte
MEM_BANK	POINTER	MASK_ LENGTH

(x Byte)	1 Byte
MASK	RESERVED

Table 229.

MODE:

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	0	0	0

Table 230.

TARGET:

Target indicates whether the Select modifies a Tag's SL flag or its inventoried flag.

Target	Flag
0x00	Inventoried (S0)
0x01	Inventoried (S1)
0x02	Inventoried (S2)
0x03	Inventoried (S3)
0x04	SL

Table 231.

ACTION:

Action defines the Tag behavior, in which matching and not-matching Tags assert or deassert SL or set their inventoried flag to A or B.

Action	Tag Matching	Tag Not-Matching
0x00	assert SL or inventoried → A	deassert SL or inventoried → B
0x01	assert SL or inventoried → A	do nothing
0x02	do nothing	deassert SL or inventoried → B
0x03	negate SL or (A→ B, B → A)	do nothing
0x04	deassert SL or inventoried→ B	assert SL or inventoried → A

0x05	deassert SL or inventoried→ B	do nothing
0x06	do nothing	assert SL or inventoried → A
0x07	do nothing	negate SL or (A → B, B → A)

Table 232.

MEM_BANK:

MemBank specifies how a Tag applies Mask

MEM_BANK	Memory
0x00	FileType
0x01	EPC
0x02	TID
0x03	File_0 (User)

Table 233.

POINTER:

Pointer specifies a starting bit address for the Mask comparison (0 - 65535)

MASK_LENGTH:

Length specifies the length of Mask in bits (0 – 255 bits)

MASK:

Mask is a bit string that a Tag compares to a memory location that begins at Pointer and ends Length bits later.

Maximum number of bytes for the mask: 32 byte

8.7 [0x18] Kill

This command writes one or more data blocks by using the kill command for C1G2. The transponder will never respond to any command afterwards.

REQUEST-DATA

Byte	6	7	1 Byte	EPC_LNG Bytes		
Contents	0x18	MODE	EPC_LNG	EPC		
			1 Byte	K_PW_LNG Bytes	(1 Byte)	
			K_PW_LNG	K_PW	(RECOM Bits)	

Table 234.

RESPONSE-DATA (STATUS = 0x95)

Byte	7
Contens	EPC Class1 Gen2 ERROR

Table 235.

MODE:

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	EPC_LF	RECOM	ADR		

Table 236.

ADR:

b000: non-addressed

b001: addressed

EPC_LF:

If this bit is set the parameter EPC_LNG must inserted into the protocol.

b1: The protocol includes the parameter EPC_LNG. The EPC has a variable length as defined in EPC_LNG.

RECOM:

b1: If this bit is set the Recommissioning Bits will be inserted into the protocol.

EPC_LNG:

Is a optional parameter and depends on the setting of EPC_LF (see MODE). EPC_LNG defines the length of the following EPC field.

EPC:

EPC of the transponder. The EPC is required only in the addressed mode.

K_PW_LNG:

Length of Kill Password

K-PW:

Kill Password

Note

For EPC Class 1:

- Kill password K_PW has to contain the kill code. A kill password “all zero” will have no effect on the transponder.
- Kill password length K_PW_LNG=4

RECOM Bits:

Recommissioning Bits according to EPC Global description.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	Asserted		
						3SB	2SB	LSB

Table 237.

8.8 [0x22] Lock

This command locks different memory portions of an EPC transponder.

REQUEST-DATA

Byte	6	7	1 Byte	EPC_LNG Bytes
Contents	0x22	MODE	EPC_LNG	EPC

1 Byte	1 Byte	LOCK_LNG Bytes	1 Byte	A_PW_LNT Bytes
EPC_TYPE	LOCK_LNG	LOCK_DATA	A_PW_LNG	A_PW

Table 238.

RESPONSE-DATA (STATUS = 0x95)

Byte	7
Contents	EPC Class1 Gen2 ERROR

Table 239.

MODE:

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	EPC_LF	0	ADR		

Table 240.

ADR:

b000: non-addressed

b001: addressed

EPC_LF:

If this bit is set the parameter EPC_LNG must inserted into the protocol.

b1: The protocol includes the parameter EPC_LNG. The EPC has a variable length as defined in EPC_LNG.

EPC_LNG:

Is a optional parameter and depends on the setting of EPC_LF (see MODE). EPC_LNG defines the length of the following EPC field.

EPC:

Read-only serial number of the transponder. The EPC is required only in the addressed mode.

EPC_Type:

Type of transponder according ANNEX

ANNEX A: Codes of transponder Types

LOCK_LNG:

Length of LOCK_DATA Field

LOCK_DATA:

Lock data which will be written to the Tag.

A_PW_LNG:

Length of Access Password.

A_PW:

Access password which is used to access to the secured state of the Tag.

Note

For EPC Class 1:

- Lock data length Lock_LNG=3

8.9 [0x25] BlockPermalock

This command permalocks one or more blocks of the user memory of an EPC transponder. The block size of the permalock section is vendor-defined.

REQUEST-DATA

Byte	6	7	1 Byte	EPC_LNG Bytes	1 Byte	1 Byte	A_PW_LNT Bytes	2 Byte	1 Byte	2x BLOCK_RANGE
Contents	0x25	MODE	EPC_LNG	EPC	BANK	A_PW_LNG	A_PW	BLOCK_PTR	BLOCK_RANGE	MASK

Table 241.

RESPONSE-DATA (STATUS = 0x95)

Byte	7
Contents	EPC Class1 Gen2 ERROR

Table 242.

MODE:

Bit	7	6	5	4	3	2	1	0
Function	0	0	1	1	0	ADR		

Table 243.

ADR:

b000: non-addressed

b001: addressed

EPC_LNG:

EPC_LNG defines the length of the following EPC field.

EPC:

Read-only serial number of the transponder. The EPC is required only in the addressed mode.

BANK:

Memory bank of the transponder which will be accessed by the reader

Bit	7	6	5	4	3	2	1	0
Function	A_FLAG	0	0	0	0	0	BANK_NR	

Table 244.

BANK_NR:

In case of Class 1 Gen 2 transponder BANK_NR is defined as follows:

b11: User memory bank

Note

The Block Permalock Command is only applicable for the User memory bank!

A_FLAG:

Indicates whether the reader tries to read a Gen 2 tag in Secured State. If A_FLAG is set the protocol contains the access password.

b0: no access password in protocol

b1: access password and access password length in protocol. Reader executes access command

BLOCK_PTR:

Specifies the starting address for mask, in units of 16 block sections.

BLOCK_RANGE:

Specifies the range of mask, starting at BLOCK_PTR and ending (16xBLOCK_RANGE)-1 block sections later.

MASK:

Defines which block sections a tag permalocks.

The tag interprets each bit as follows:

Mask bit = 0: Retain the current permalock setting

Mask bit = 1: Permalock the corresponding memory block section

The mask bits are ordered from lower-order section to higher (the leading mask bit refers to the first block section)

A_PW_LNG:

Length of Access Password.

A_PW:

Access password which is used to access to the secured state of the Tag.

Note

Only Tags in the secured state execute a BlockPermalock command.

Example:

Permalocks Block section 1-2

BLOCK_PTR = 0x0000

BLOCK_RANGE = 0x01

MASK = 0 1 1 0 0000 0000 0000 = 0x6000
| |--- block section 2
|--- block section1

8.10 [0x26] Read Permalock Status

This command reads the permalock status of the user memory of an EPC transponder.

REQUEST-DATA

Byte	6	7	1 Byte	EPC_LNG Bytes	1 Byte
Contents	0x26	MODE	EPC_LNG	EPC	BANK

1 Byte	A_PW_LNT Bytes	2 Byte	1 Byte	2x BLOCK_RANGE
A_PW_LNG	A_PW	BLOCK_PTR	BLOCK_RANGE	MASK

Table 245.

RESPONSE-DATA (STATUS = 0x95)

Byte	7
Contents	EPC Class1 Gen2 ERROR

Table 246.

RESPONSE-DATA (STATUS = 0x00)

Byte	2 x BlockRange
Contents	PERMALOCK_STATUS

Table 247.

MODE:

Bit	7	6	5	4	3	2	1	0
Function	0	0	1	1	0	ADR		

Table 248.

ADR:

b000: non-addressed

b001: addressed

EPC_LNG:

EPC_LNG defines the length of the following EPC field.

EPC:

Read-only serial number of the transponder. The EPC is required only in the addressed mode.

BANK:

Memory bank of the transponder which will be accessed by the reader

Bit	7	6	5	4	3	2	1	0
Function	A_FLAG	0	0	0	0	0	BANK_NR	

Table 249.

BANK_NR:

In case of Class 1 Gen 2 transponder BANK_NR is defined as follows:

b11: User memory bank

Note

The Read Permalock Command is only applicable for the User memory bank!

A_FLAG:

Indicates whether the reader tries to read a Gen 2 tag in Secured State. If

A_FLAG is set the protocol contains the access password.

b0: no access password in protocol

b1: access password and access password length in protocol. Reader executes access command

BLOCK_PTR:

Specifies the starting address for mask, in units of 16 block sections.

BLOCK_RANGE:

Specifies the range of mask, starting at BLOCK_PTR and ending (16xBLOCK_RANGE)-1 block sections later.

A_PW_LNG:

Length of Access Password.

A_PW:

Access password which is used to access to the secured state of the Tag.

PERMALOCK_STATUS:

Requested Permalock Status Bits for the selected range.

Note

Only Tags in the secured state execute a Read Permalock command.

Example:

Read block permalock section 0 to 2.
BLOCK_PTR = 0x0000
BLOCK_RANGE = 0x01
Response of permalock bits (PERMALOCK_STATUS):
s s s 0 0000 0000 0000
| | |--- section2
| |--- section 1
|--- section 0

8.11 [0x30] Untraceable

The Untraceable Command allows the transponder to hide the complete EPC, TID or User memory or rather parts of it. Additionally it is possible to reduce the read range of the transponder completely or temporarily.

The command can only be executed from the secured state and will be ignored if the Access Password is zero. All memory parts which are set untraceable are acting as they are non-existing in the open state.

REQUEST-DATA

Byte	6	7	1 Byte	EPC_LNG Bytes	1 Byte
Contents	0x30	MODE	EPC_LNG	EPC	BANK

1 Byte	A_PW_LNT Bytes	1 Byte	2 Byte	1 Byte
A_PW_LNG	A_PW	U_FLAG	HIDE	RANGE

Table 250.

RESPONSE-DATA (STATUS = 0x95)

7
ISO-ERROR

Table 251.

MODE:

Bit:	7	6	5	4	3	2	1	0
Function	0	0	EXT_ADR	EPC_LF	0	ADR		

Table 252.

ADR:

b000: non-addressed

b001: addressed

EPC_LF:

If this bit is set the parameter EPC_LNG must inserted into the protocol.

b1: The protocol includes the parameter EPC_LNG. The EPC has a variable length as defined in EPC_LNG.

EXT_ADR:

If this bit is set the command includes the bank field. This bit has to be set, because the Access-Password is always needed.

EPC_LNG:

Is an optional parameter and depends on the setting of EPC_LF (see MODE). EPC_LNG defines the length of the following EPC field.

EPC:

Read-only serial number of the transponder. The EPC is required only in the addressed mode.

BANK:

Memory bank of the transponder which will be accessed by the reader

Bit:	7	6	5	4	3	2	1	0
Function	A_FLAG	0	0	0	0	0	0	0
Function	0	0	EXT_ADR	EPC_LF	0	ADR		

Table 253.

A_FLAG:

Indicates whether the reader tries to read a Gen 2 tag in Secured State. If A_FLAG is set the protocol contains the access password.

b0: no access password in protocol

b1: access password and access password length in protocol. Reader execute access command

A_PW_LNG:

Length of Access Password.

A_PW:

Access password which is used to access to the secured state of the Tag.

U_FLAG:

reserved, should be 0.

HIDE:

Bit:	15	14	13	12	11	10	9	8
Function	0	0	HIDE_ EPC	NEW_EPC_LEN				

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	HIDE_TID		HIDE_ USER

Table 254.

HIDE_USER:

Specifies whether all parts or none of the USER Memory are hidden.

b0: view all

b1: hide all

HIDE_TID:

Specifies whether all parts, some or none of the TID Memory are hidden.

b00: view all

b01: hide some (for class identifier E2h – transponder hides TID Memory above 20h inclusive)

b10: hide all

b11: RFU

NEW_EPC_LEN:

Specifies the new EPC length after the executed Untraceable command. The rest of the EPC will be hidden.

HIDE_EPC:

Specifies which part of the EPC Memory will be hidden. The transponder hides the part of the EPC above or below the set EPC Length field.

b00: show memory above EPC

b01: hide memory above EPC

RANGE:

Specifies the operating range of a transponder.

b00: normal

b01: toggle temporarily

b10: reduced

b11: RFU

8.12 [0x31] Authenticate

This command performs tag, reader, or mutual authentication.

REQUEST-DATA

Byte	6	7	1 Byte	EPC_LNG Bytes	1 Byte
Contents	0x31	MODE	EPC_LNG	EPC	Bank

1 Byte	A_PW_LNT Bytes	1 Byte	1 Byte	1 Byte
A_PW_LNG	A_PW	AUTH_MODE	CSI	CRYPTO_TIME

2 Byte	n Bytes
MSG_LEN	MSG

Table 255.

RESPONSE-DATA (STATUS = 0x95)

7
ISO-ERROR

Table 256.

RESPONSE-DATA (STATUS = 0x00) for Key management in the Reader

7..8	9 .. (9+(DATA_LEN-1)/8)
DATA_LEN	DATA

Table 257.

RESPONSE-DATA (STATUS = 0x00) for Key management in the Host system

7..8	9 .. (9+(DATA_LEN-1)/8)
DATA_LEN	CRYPTOGRAPHIC RESPONSE

Table 258.

MODE:

Bit:	7	6	5	4	3	2	1	0
Function	0	0	EXT_ADR	EPC_LF	0	ADR		

Table 259.

ADR:

b000: non-addressed

b001: addressed

EPC_LF:

If this bit is set the parameter EPC_LNG must inserted into the protocol.

b1: The protocol includes the parameter EPC_LNG. The EPC has a variable length as defined in EPC_LNG.

EXT_ADR:

If this bit is set the command includes the bank field. This bit has to be set, because the Access-Password is always needed.

EPC_LNG:

Is a optional parameter and depends on the setting of EPC_LF (see MODE). EPC_LNG defines the length of the following EPC field.

EPC:

Read-only serial number of the transponder. The EPC is required only in the addressed mode.

BANK:

Memory bank of the transponder which will be accessed by the reader

Bit:	7	6	5	4	3	2	1	0
Function	A_FLAG	0	0	0	0	0	0	0

Table 260.

A_FLAG:

Indicates whether the reader tries to read a Gen 2 tag in Secured State. If A_FLAG is set the protocol contains the access password.

b0: no access password in protocol

b1: access password and access password length in protocol. Reader execute access command

A_PW_LNG:

Length of Access Password.

A_PW:

Access password which is used to access to the secured state of the Tag.

AUTH_MODE:

Defines the format of the request and the response

Bit:	7	6	5	4	3	2	1	0
Function	KEY-LOC	0	0	0	0	CRYPTO_FLAG	0	

Table 261.

KEY-LOC:

Defines the key store

b0: Keys are stored in the reader. Authentication of the transponder is done by the reader

b1: Keys are stored in the host system. Authentication of the transponder is done by the host system

CRYPTO_FLAG:

If CRYPTO FLAG is set the protocol contains the crypto exexcution time.

b0. no crypto execution time in protocol

b1. crypto execution time in protocol.

Note

If bit KEY-LOC is set to 1 the relevant keys are stored in the Host system. The host has to generate the challenge (80 bits random number) and has to transmitted the number to the reader. The readers response to the host system consists of the encrypted tag response. With knowledge of the relevant keys the host system encrypts the transmitted data and authenticates the transponder.

CSI:

Crypto Suite Identifier

CSI	Part	Crypto Suite
0x00	ISO/IEC 29167 - 10	AES128
0x01	ISO/IEC 29167 – 11	PRESENT 80
0x02	ISO/IEC 29167 – 12	ECC-DH
0x03	ISO/IEC 29167 - 13	GRAIN 128
0x04	ISO/IEC 29167 – 14	AES128-OFB

0x05	ISO/IEC 29167 – 15	XOR
0x06	ISO/IEC 29167 – 16	ECSDA-ECDH
0x07	ISO/IEC 29167 - 17	GPS
0x08	ISO/IEC 29167 – 18	Humming Bird 2
0x09	ISO/IEC 29167 - 19	RAMON

Table 262.

CRYPTO_TIME:

crypto execution time in ms

MSG_LEN:

Length of the message in bytes

MSG:

Message defined by the crypto suite specified by the CSI

8.12.1 Message TAM1

Send Interrogator challenge and request Tag authentication response.

Message TAM1 format

1	1	(10)
MSG_CMD	KEY_ID	(CHALLENGE)

Table 263

MSG_CMD:

Defines Authent Methode and Custom Data

Bit	7	6	5	4	3	2	1	0
Contents	AuthMethode		CustomData	TAM1_RFU				
Default	00		0	00000				

Table 264.

AuthMethod:

00b: specifies the use of TAM

CustomData:

0b: indicate that no custom data is requested (TAM1)

TAM1_RFU:

00000b: reserved

KEY_ID:

Defines which Key is used for TAM1

Bit	7	6	5	4	3	2	1	0
Contents	-	-	-	-	-	KEY-TYPE		

Table 265.

KEY-TYPE:

b000: Key 0 is used

b001: Key 1 is used

CHALLENGE:

80-bit random challenge that the Interrogator has generated for use in TAM1

Only necessary when authentication is done by the host system (KEY-LOC = 1).

DATA_LEN:

Number of bits

DATA:

Requested decrypted data

CRYPTOGRAPHIC RESPONSE:

Requested encrypted data

8.12.2 Message TAM2

Send Interrogator challenge and request Tag authentication response with custom data.

Message TAM2 format

1	1	(10)	3
MSG_CMD	KEY_ID	(CHALLENGE)	TAM2_ PARAMETER

Table 266.

MSG_CMD:

Defines Authent Methode, Custom Data and BlockSize

Bit	7	6	5	4	3	2	1	0
Contents	AuthMethode		CustomData	BlockSize	TAM2_RFU			
Default	00		1	0	0000			

Table 267.

AuthMethod:

00b: specifies the use of TAM

CustomData:

1b: specified that custom data requested (TAM2)

BlockSize:

Defines the size of custom data bock

0b: 64-bit block

1b: 16-bit block

TAM2_RFU:

0000b: reserved

KEY_ID:

Defines which Key is use for TAM2

Bit	7	6	5	4	3	2	1	0
Contents	-	-	-	-	-	KEY-TYPE		

Table 268.

KEY-TYPE:

b000: Key 0 is used

b001: Key 1 is used

CHALLENGE:

80-bit random challenge that the Interrogator has generated for use in TAM2

Only necessary when authentication is done by the host system (KEY-LOC = 1).

TAM2_PARAMETER:

Defines the parameter for TAM2

Bit:	23	22	21	20	19	18	17	16
Function:	PROFILE				OFFSET			

Bit:	15	14	13	12	11	10	9	8
Function:	OFFSET							

Bit:	7	6	5	4	3	2	1	0
Function:	BLOCK_COUNT				PROT_MODE			

Table 269.

PROFILE:

Defines the memory profile for the addition of custom data

0x00: EPC memory bank

0x01: TID memory bank

0x02: USER memory bank

OFFSET:

Defines the start address of the custom data block

BLOCK_COUNT:

Defines the size of the customer data as a number of 64-bit blocks (4 memory blocks). One memory block has 16 bits.

Size = (BLOCK_COUNT+1) * 64

PROT_MODE:

Defines the operation mode that shall be used to process the custom data.

PROT_MODE	Description
0x00	Plaintext
0x01	CBC
0x02	CMAC
0x03	CBC + CMAC

Table 270.

8.13 [0x32] Challenge

This command allows an interrogator to instruct multiple tags to simultaneously yet independently precompute and store a cryptographic value.

No response is send from tag on a challenge command.

REQUEST-DATA

Byte	6	7	1 Byte	EPC_LNG Bytes
Contents	0x32	MODE	EPC_LNG	EPC

1 Byte	1 Byte	1 Byte	2 Byte	n Bytes
AUTH_MODE	CSI	CRYPTO_ TIME	MSG_LEN	MSG

Table 271.

MODE:

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	ADR		

Table 272.

ADR:

b000: non-addressed

b001: addressed

Note

Only non addressed Mode is supported.

AUTH_MODE:

Defines the format of the request and the response

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	CRYPTO_ FLAG	0	0

Table 273.

CRYPTO_FLAG:

If CRYPTO FLAG is set the protocol contains the crypto exexcution time.

b0: no crypto execution time in protocol

b1: crypto execution time in protocol.

CSI:

Crypto Suite Identifier

CSI	Part	Crypto Suite
0x00	ISO/IEC 29167 - 10	AES128
0x01	ISO/IEC 29167 – 11	PRESENT 80
0x02	ISO/IEC 29167 – 12	ECC-DH
0x03	ISO/IEC 29167 - 13	GRAIN 128
0x04	ISO/IEC 29167 – 14	AES128-OFB
0x05	ISO/IEC 29167 – 15	XOR
0x06	ISO/IEC 29167 – 16	ECSDA-ECDH
0x07	ISO/IEC 29167 - 17	GPS
0x08	ISO/IEC 29167 – 18	Humming Bird 2
0x09	ISO/IEC 29167 - 19	RAMON

Table 274.

CRYPTO_TIME:

crypto execution time in ms

MSG_LEN:

Length of the message in bytes

MSG:

Message defined by the crypto suite specified by the CSI

8.13.1 Message TAM1

Interrogator sends a challenge.

Message TAM1 format

1	1	10
MSG_CMD	KEY_ID	CHALLENGE

Table 275

MSG_CMD:

Defines Authent Methode and Custom Data

Bit	7	6	5	4	3	2	1	0
Contents	AuthMethode		CustomData	TAM1_RFU				
Default	00		0	00000				

Table 276.

AuthMethod:

00b: specifies the use of TAM

CustomData:

0b: indicate that no custom data is requested (TAM1)

TAM1_RFU:

00000b: reserved

KEY_ID:

Defines which Key is used for TAM1

Bit	7	6	5	4	3	2	1	0
Contents	-	-	-	-	-	KEY-TYPE		

Table 277.

KEY-TYPE:

b000: Key 0 is used

b001: Key 1 is used

CHALLENGE:

80-bit random challenge that the Interrogator has generated for use in TAM1

8.13.2 Message TAM2

Interrogator sends a challenge.

Message TAM2 format

1	1	10	3
MSG_CMD	KEY_ID	CHALLENGE	TAM2_ PARAMETER

Table 278.

MSG_CMD:

Defines Authent Methode, Custom Data and BlockSize

Bit	7	6	5	4	3	2	1	0
Contents	AuthMethode		CustomData	BlockSize	TAM2_RFU			
Default	00		1	0	0000			

Table 279.

AuthMethod:

00b: specifies the use of TAM

CustomData:

1b: specified that custom data requested (TAM2)

BlockSize:

Defines the size of custom data bock

0b: 64-bit block

1b: 16-bit block

TAM2_RFU:

0000b: reserved

KEY_ID:

Defines which Key is use for TAM2

Bit	7	6	5	4	3	2	1	0
Contents	-	-	-	-	-	KEY-TYPE		

Table 280.

KEY-TYPE:

b000: Key 0 is used

b001: Key 1 is used

CHALLENGE:

80-bit random challenge that the Interrogator has generated for use in TAM2

TAM2_PARAMETER:

Defines the parameter for TAM2

Bit:	23	22	21	20	19	18	17	16
Function:	PROFILE				OFFSET			

Bit:	15	14	13	12	11	10	9	8
Function:	OFFSET							

Bit:	7	6	5	4	3	2	1	0
Function:	BLOCK_COUNT				PROT_MODE			

Table 281.

PROFILE:

Defines the memory profile for the addition of custom data

0x00: EPC memory bank

0x01: TID memory bank

0x02: USER memory bank

OFFSET:

Defines the start address of the custom data block

BLOCK_COUNT:

Defines the size of the customer data as a number of 64-bit blocks (4 memory blocks). One memory block has 16 bits.

Size = (BLOCK_COUNT+1) * 64

PROT_MODE:

Defines the operation mode that shall be used to process the custom data.

PROT_MODE	Description
0x00	Plaintext
0x01	CBC
0x02	CMAC
0x03	CBC + CMAC

Table 282.

8.14 [0x33] ReadBuffer

This command allows to read data stored in a tag response buffer.

REQUEST-DATA

Byte	6	7	1 Byte	EPC_LNG Bytes	1 Byte
Contents	0x33	MODE	EPC_LNG	EPC	Bank

1 Byte	A_PW_LNT Bytes	2 Byte	2 Byte
A_PW_LNG	A_PW	START_ADR	NB

Table 283.

RESPONSE-DATA (STATUS = 0x95)

7
ISO-ERROR

Table 284.

RESPONSE-DATA (STATUS = 0x00)

MODE:

Bit:	7	6	5	4	3	2	1	0
Function	0	0	EXT_ADR	EPC_LF	0	ADR		

Table 285.

ADR:

b000: non-addressed

b001: addressed

EPC_LF:

If this bit is set the parameter EPC_LNG must inserted into the protocol.

b1: The protocol includes the parameter EPC_LNG. The EPC has a variable length as defined in EPC_LNG.

EXT_ADR:

If this bit is set the command includes the bank field. This bit has to be set, because the Access-Password is always needed.

EPC_LNG:

Is a optional parameter and depends on the setting of EPC_LF (see MODE). EPC_LNG defines the length of the following EPC field.

EPC:

Read-only serial number of the transponder. The EPC is required only in the addressed mode.

BANK:

Memory bank of the transponder which will be accessed by the reader

Bit:	7	6	5	4	3	2	1	0
Function	A_FLAG	0	0	0	0	0	0	0

Table 286.

A_FLAG:

Indicates whether the reader tries to read a Gen 2 tag in Secured State. If A_FLAG is set the protocol contains the access password.

b0: no access password in protocol

b1: access password and access password length in protocol. Reader execute access command

A_PW_LNG:

Length of Access Password.

A_PW:

Access password which is used to access to the secured state of the Tag.

START_ADR:

Defines the starting address for the read buffer

NB:

Number of bits to read. If NB=0 the complete buffer will be read.

DATA_LEN:

Number of bytes

DATA:

Requested data

8.15 Supported Host commands for transponders

The command codes listed in the following table supports the various transponder commands and operations that are available for each transponder type.

8.15.1 EPC class 1 Gen 2

Memory organization:

Number of blocks	vendor specific
Block size	2 byte

Table 287.

Command Code	Function	Mode		Comment
		non-addressed	addressed	
0xB0 0x01	Inventory			
0xB0 0x23	Read Multiple Blocks	X	X	
0xB0 0x24	Write Multiple Blocks	X	X	
0xB3 0x18	Kill		X	
0xB3 0x22	Lock		X	
0xB3 0x25	Block Permalock		X	
0xB3 0x26	Read Permalock Status		X	
0xB3 0x30	Untraceable	X	X	
0xB3 0x31	Authenticate	X	X	
0xB3 0x32	Challenge	X		
0xB3 0x33	ReadBuffer	X	X	

Table 288.

Note

A separate Application Note is available, which describes the “0xB4” NXP Customer commands. Please contact Pepperl+Fuchs.de.

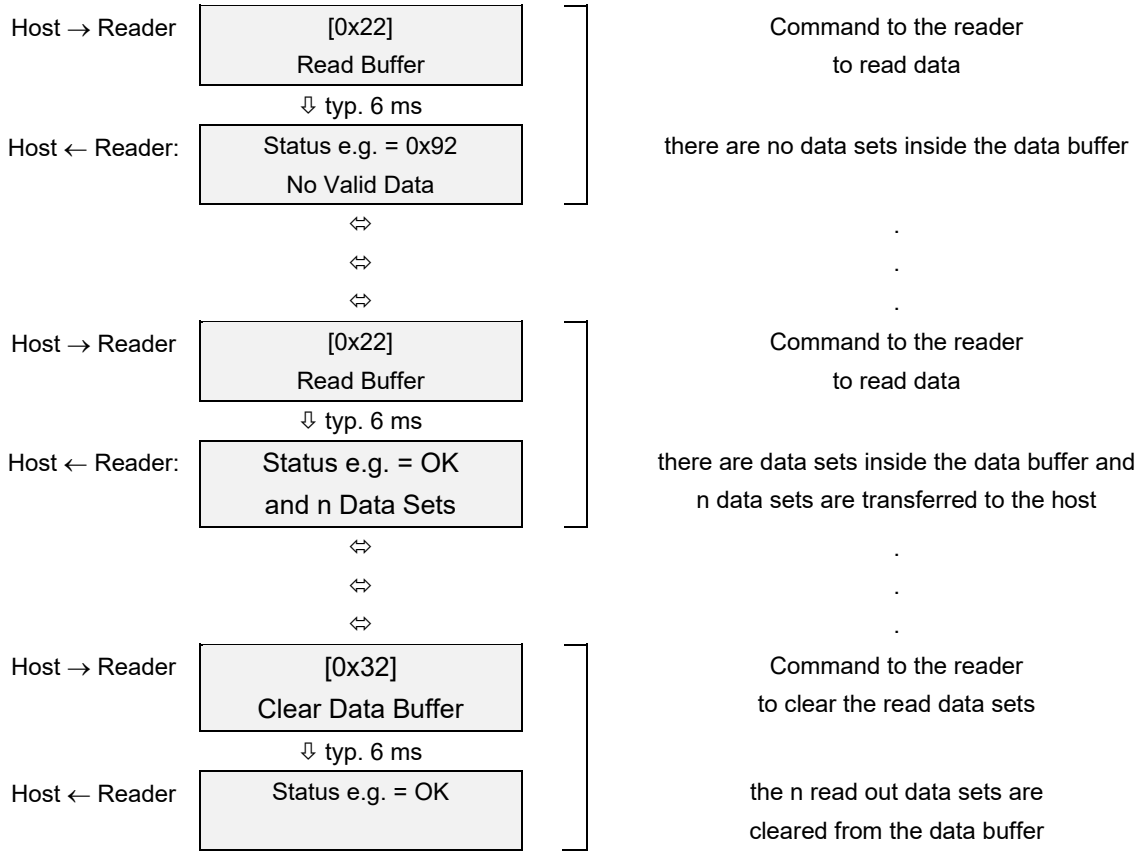
9. Protocols for Buffered Read Mode and Notification Mode

9.1 The Buffered Read Mode Procedure

By using the “BRM” the reader itself reads data from every transponder which is inside the antenna field. This mode must be enabled in the CFG1: Interface and Mode configuration block and configured in the CFG11: Read Mode – Read Data and CFG12: Read Mode – Filter configuration blocks.

The sampled transponder data sets are stored in a FIFO organized data buffer inside the reader. The buffered read mode runs offline from any host commands and it is immediately started after power up or a [0x63] RF Controller Reset command.

Only two commands are necessary to read out sampled transponder data sets. The figure below illustrates the Buffered Read Mode procedure:



⇩: Host waits for an answer from the reader

⇔: Host is able to do other jobs e.g. to communicate with other readers

Additional information about the capacity of the data buffer can be determined

with the [0x31] Read Data Buffer Info command.

9.2 The Notification Mode Procedure

By using Notification Mode together with the Buffered Read Mode the reader itself reads data from every transponder which is inside the antenna field and enables a connection to a host to send the queued data asynchronously. This mode must be enabled in the CFG1: Interface and Mode configuration block and configured in CFG49: Notification Channel configuration block. The settings for the Read Mode define the notification information sent to the host.

Only one command is necessary to send sampled transponder data sets. The figure below illustrates the Notification Mode procedure:

Reader → Host	[0x22] Read Buffer Response	Notification data from the reader to the Host After successful send process, the reader deletes transferred data sets from the internal table

Table 289.

The reader sends notifications as fast as possible, if the notification trigger is set to continuously or a very short cycle time in time-triggered mode is defined. To prevent a notification overflow in a host application the acknowledgement option can be set. In this case the notification must be acknowledged by the host with an response protocol to synchronize the notification process with the host application. The figure below illustrates this procedure:

Reader → Host	[0x22] Read Buffer Response	Notification data from the reader to the Host
	⇩ max. 5000ms	
Reader ← Host	[0x32] Clear Data Buffer	Command to the reader to delete the notified data sets from the internal table

Table 290.

The acknowledge [0x32] Clear Data Buffer must be in the space of 5 seconds. If no acknowledge is received the reader repeats the notification as it is configured.

Additional information about the capacity of the data buffer can be determined with the [0x31] Read Data Buffer Info command.

In Notification Mode the 0x22] Read Buffer command is not applicable.

As an additional option Keepalive messages can be sent periodically to a host. Keepalive notifications are always never acknowledged. The information sent by a Keepalive notification is identical with the command [0x6E] reader Diagnostic with mode = 0x01.

9.3 transponder Access in the Buffered Read Mode and Notification Mode

The Buffered Read Mode only reads data blocks from the transponders in the antenna field

The anticollision procedure can be configured in the CFG5: Anticollision configuration block.

After power up or a [0x63] RF Controller Reset command the buffered read mode starts with transponder reading.

9.4 [0x22] Read Buffer

The command Read Buffer reads a number of data sets from the data buffer.

Host -> Reader

Byte	1	2	3	4	5	6 .. 7	8 .. 9
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x22]	DATA-SETS	CRC16

Byte	1	2	3	4	5	6	7	(8)
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x22]	STATUS	TR-DATA1	TR-DATA2

8 .. 9 (9 .. 10)	10 .. n-2 (11 .. n-2)	n-1, n
DATA-SETS	DATA	CRC16

Table 291.

DATA-SETS:

Number of data sets to be transferred from the data buffer of the reader to the Host. If the data buffer does not contain the requested number of data sets, the reader responds with all available data sets and an error will occur.

TR-DATA1:

Indicates which data are transferred in the field DATA.

Bit	7	6	5	4	3	2	1	0
Function	Extension	DATE	TIMER	ANT	Byte Order DB	-	DB	IDD

Table 292.

IDD:

Identifier Data (EPC or EPC+TID)

DB:

Data block

Byte Order DB:

b0: MSB first

b1: LSB first

ANT:

Antenna number

TIME:

Time stamp from internal system timer

DATE:

Date stamp from internal system timer

Extension:

Extension flag, additional data indicated in TR-DATA2 will be transferred

TR-DATA2:

Indicates which additional data are transmitted in DATA.

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	ANT_Ext	TAG_STATISTIC	-	MAC	IN

Table 293.

IN:

Input states

MAC:

MAC address of the reader

TAG_STATISTIC:

Tag statistic data as defined in the data record structure

ANT-Ext: Antenna Extended

Values for RSSI and phase angle for all antennas on which a transponder was read

Note

- If the ANT bit in TR_DATA CFG11: Read Mode – Read Data is set in Buffer-Info-Mode:
  When a transponder is detected by multiple antennas, only one data set is stored. The Valid-Time is only set at the first detection. If a data set is transferred to the host and the same transponder is detected in another antenna but the Valid-Time has not yet elapsed, no other data set is stored.
- If the ANT bit in TR_DATA1 (CFG11) is not set in Buffer-Info-Mode and a transponder is detected by multiple antennas, the data set for each antenna is stored.

DATA:

Requested data records from the data buffer. Only selected data will be transferred to the host. See chapter CFG11: Read Mode – Read Data for details.

Each data record has the following structure:

Data Type		DATA				
Record Length	byte no.	1	2			
		MSB RecLen	LSB RecLen			
Identifier Data	byte no.	1	2	3	4…4+IDD-LEN	
		TR-TYP	IDDIB	IDD-LEN	IDD	
Data Blocks	byte no.	1	2	3	4…4+DB-N*DB-SIZE	
		DB-N		DB-SIZE	DB	
Time	byte no.	1...4				
		TIME				
Date	byte no.	1...5				
		DATE				
Antenna	byte no.	1	(2)	(4)	(5)	(6…9)
		ANT	TAG-CNT	RSSI-MAX	RSSI-AVG	reserved
Input	byte no.	1	1			
		IN	STATUS			
MAC	byte no.	6				
		MAC-ADR				
Antenna-Extended	byte no.	1	2	3	4…5	6...7
		ANT-CNT	ANTx	RSSIx	PHASE_ANGLE	reserved
			Repeated ANT-CNT times			

Table 294.

TR-TYP: (transponder Type)

transponder type ANNEX

ANNEX A: Codes of transponder Types

IDDIB: (Identifier Data Interpretation Byte)

Defines in which way the reader interprets and displays the Identifier Data

ANNEX B: Codes of Identifier Data Interpretation Byte (IDDIB)ANNEX B: Codes of Identifier Data Interpretation Byte (IDDIB)

IDD-LEN

Defines the length of the IDD in bytes

IDD: (Identifier Data)

EPC or EPC+TID; as defined in CFG4: transponder Parameters

DB-N

Number of data blocks

DB-SIZE

Defines block size

DB

Data Blocks

TIME

Byte	1	2	3,4
TIME	h	min	ms
	0...23	*0...59*	*0...59999*

Table 295.

DATE

Byte	1	2
TIME	century	year
	0...99	*0...99*

3	4	5
month	day	time zone
1...12	*1...31*	*0...23*

Table 296.

ANT: Antenna number

ANT is a bit field. If the tag is read on more than one antenna and the configuration option "all antenna ports act as one reading point" is set, the corresponding bits of each antenna were the transponder is read will be set in the bit field.

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	ANT4	ANT3	ANT2	ANT1

Table 297.

ANT1...4

b0: this antenna has not read transponder data

b1: this antenna has read transponder data

TAG-CNT: tag counter

Shows how often the tag was read on a certain antenna

RSSI_MAX:

Maximal RSSI value (in dBm; inverted)

RSSI_AVG:

Moving Average of RSSI value (in dBm; inverted)

RSSI_AVG(n) = (RSSI_AVG(n-1) x (TAG_CNT – 1) + RSSI) / TAG_CNT

IN: Input number

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	-	-	IN2	IN1

Table 298.

IN1/IN2

b0: Input inactive

b1: Input active

STATUS:

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	-	Tag Signalization	Timeout	BRM

Table 299.

BRM

b0: BRM -> OFF

b1: BRM -> ON

Timeout

b0: BRM interrupt due to Input state

b1: Timeout due to Trigger-Hold-Time timeout

Tag Signalization

b0: transponder data was read during Trigger-Hold-Time

b1: No transponder data was read during Trigger-Hold-Time

MAC-ADR

MAC address of the reader.

ANT-CNT: antenna counter

Shows the number on how many antennas a transponder was read.

ANTx: antenna number

The antenna number depends on the number of the output of the multiplexer and the connection of that multiplexer in the structure. The decimal places of the antenna number describe the active outputs of the multiplexers on all 3 levels to switch to the antenna.

ANT-CNT = (Level 2 Mux Channel) * 10 + (Level 1 Mux Channel) * 1

Example:

– Mux on output 2 Level 1

– Mux on output 4 Level 2

ANT-CNT = 4 * 10 + 2 * 1 = 42

RSSIx:

Receive signal strength identification (in dBm; inverted)

PHASE_ANGLE:

RF phase angle of a transponder. The corresponding angle can be calculated as:

PHASE_ANGLE * 360° / 4096

Note

This command reads the same data sets until they are cleared with the [0x32] Clear Data Buffer command.

This command is only available in the Buffered Read Mode.

Data are only transferred if STATUS = 0x00, 0x83, 0x84, 0x93, 0x94.

If STATUS = 0x83, 0x84, 0x85 the TR-DATA and DATA SETS will be always transferred. Every time if the trigger starts and stops a data set will be stored. All data will be set to 0x00, only the Input values “IN” and “STATUS” and “Date” and “Time” will be set.

If Bank is set to Data for Tag Authentication and Decryption by Host in CFG11: Read Mode – Read Data, DB contains the challenge (80 bits random number generated by the reader) and the encrypted tag response as data.

If a tag was several times detected during the VALID-TIME (in VALID-TIME_MODE Standard), TAG-CNT, RSSI_MAX and RSSI_AVG will be adapted, no other data set will be stored CFG12: Read Mode – Filter

TAG-CNT, RSSI_MAX and RSSI_AVG will be only transmitted if Bit “STATISTIC_DATA” is set in TR-DATA2.

9.5 [0x31] Read Data Buffer Info

The command Read Data Buffer Info reads the actual parameters of the data buffer.

Host -> Reader

Byte	1	2	3	4	5	6 .. 7
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x31]	CRC16

Table 300.

Host <- Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x31]	STATUS	TAB-SIZE

9 .. 10	11 .. 12	13 .. 14
TAB-START	TAB-LEN	CRC16

Table 301.

TAB-SIZE:

Maximum count of transponder data sets in the data buffer.

TAB-START:

Address of first Data Set in the data buffer.

TAB-LEN:

Number of transponder data sets reserved in the data buffer.

Note

Additional information about the data table status is transferred if STATUS = 0x00, 0x84, 0x85, 0x93.

9.6 [0x32] Clear Data Buffer

The command Clear Data Buffer clears the data sets from the data buffer which were transferred with the 0x22] Read Buffer command.

Host -> Reader

Byte	1	2	3	4	5	6 .. 7
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x32]	CRC16

Table 302.

Host -> Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x32]	STATUS	CRC16

Table 303.

9.7 [0x33] Initialize Buffer

The command Initialize Buffer clears the data buffer to an initial state. It does not matter if the data sets in the data buffer were read or not.

Host -> Reader

Byte	1	2	3	4	5	6 .. 7
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x33]	CRC16

Table 304.

Host -> Reader

Byte	1	2	3	4	5	6	7 .. 8
Contents	STX (0x02)	MSB ALENGTH	LSB ALENGTH	COM-ADR	[0x33]	STATUS	CRC16

Table 305.

10. Data Format for Scan Mode

By using Scan Mode the reader itself reads data from every transponder which is inside the antenna field and send the queued data asynchronously to a host. This mode must be enabled in the CFG1: Interface and Mode configuration block and configured in CFG13 Scan Mode configuration block. The settings for the Read Mode configured in CFG11: Read Mode – Read Data configuration block define the information sent to the host.

Following the requested data records are described. Only in CFG11: Read Mode – Read Data selected data will be transferred to the host. Each data record has the following structure:

Data Type		DATA	
Identifier Data	byte no.	1…	
		IDD	
Data Blocks	byte no.	1…	
		DB	
Time	byte no.	1...4	
		TIME	
Date	byte no.	1...5	
		DATE	
Antenna	byte no.	1	
		ANT	
Input	byte no.	1	1
		IN	STATUS

Table 306.

IDD: Identifier Data

EPC or EPC+TID; as defined in CFG4: transponder Parameters

DB

Data Blocks

TIME

Byte	1	2	3,4
TIME	h	min	ms
	0...23	*0...59*	*0...59999*

Table 307.

DATE

Byte	1	2	3	4	5
TIME	century	year	month	day	time zone
	0...99	*0...99*	*1...12*	*1...31*	*0...23*

Table 308.

ANT: Antenna number

ANT is a bit field. If the tag is read on more than one antenna and the configuration option "all antenna ports act as one reading point" is set, the corresponding bits of each antenna were the transponder is read will be set in the bit field.

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	ANT4	ANT3	ANT2	ANT1

Table 309.

ANT1...4

b0: this antenna has not read transponder data

b1: this antenna has read transponder data

IN: Input number

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	-	-	IN2	IN1

Table 310.

IN1/IN2

b0 : Input inactive

b1: Input active

STATUS:

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	-	Tag Signalization	Timeout	BRM

Table 311.

BRM

b0: BRM -> OFF

b1: BRM -> ON

Timeout

b0: BRM interrupt due to Input state

b1: Timeout due to Trigger-Hold-Time timeout

Tag Signalization

b0: transponder data was read during Trigger-Hold-Time

b1: No transponder data was read during Trigger-Hold-Time

Note

The different contents can be separated with a Separation Character defined in CFG13 Scan Mode.

11. ANNEX

11.1 ANNEX A: Codes of transponder Types

Value	Transponder type
0x84	EPC class 1 Gen 2 / ISO 18000-6-C

Table 312.

The Information will be send by performing the [0x01] Inventory command.

11.2 ANNEX B: Codes of Identifier Data Interpretation Byte (IDDIB)

Value	IDDIB
0x00	EPC
0x02	EPC + TID

Table 313.

The Information will be sent by performing the [0x01] Inventory command or using the Buffered Read Mode.

11.3 ANNEX C: Index of Status Bytes

General

Hex-value	Description
0x00	OK: ▪ Data / parameters have been read or stored without error ▪ Control command has been executed
0xF1	Hardware Warning: ▪ RFC works not properly ▪ RF Decoder or Hardware Filter works not properly

Table 314.

Transponder Status

Hex-value	Description
0x01	No transponder: ▪ No transponder is located within the detection field of the reader. ▪ The transponder in the detection field has been switched to mute . ▪ The communication between reader and transponder has been interfered and the reader is not able to read the transponder anymore.
0x02	Data False: ▪ CRC16 data error on received data.
0x03	Write-Error: Negative plausibility check of the written data: ▪ Too much distance between transponder and reader antenna. ▪ Attempt to write in a noisy area.
0x04	Address-Error: The required data are outside of the logical or physical transponder-address area: ▪ The address is beyond the max. address space of the transponder. ▪ The address is beyond the configured address space of the transponder. ▪ The reader is not able to handle the requested amount of data.
0x05	Wrong transponder-type: This command is not applicable at the transponder: ▪ A special command is not applicable to the transponder.
0x08	Authent Error: ▪ If access password is wrong

Table 315.

Parameter Status

Hex-value	Description
0x10	EEPROM-Failure: ▪ The EEPROM of the reader is not able to be written on. ▪ Before writing onto the EEPROM a faulty checksum of parameters has been detected.

0x11	Parameter-Range-Error: ▪ The value range of the parameters was exceeded.
0x13	Login-Request: ▪ Configuration access without having logged in to the reader before.
0x14	Login-Error: ▪ Login attempt with wrong password.
0x15	Read Protect: ▪ The configuration block is reserved for future use.
0x16	Write Protect: ▪ The configuration block is reserved for future use.
0x17	Firmware activation required: The firmware must be activated first using RFID Gate-Control demo program and the command “Set Firmware Upgrade”. The update code must be ordered by Pepperl+Fuchs. 1. Read the Device-ID using the command [0x66] Firmware version (Mode 0x80) 2. Send the Device-ID and the serial number of the reader to Pepperl+Fuchs 3. Write the upgrade code into the reader using the command [0x5F] Set Firmware Update
0x18	Wrong Firmware: ▪ Mismatch between RFC Firmware and Hardware

Table 316.

Interface Status

Hex-value	Description
0x80	Unknown Command: ▪ The reader does not support the selected function.
0x81	Length-Error: ▪ The selected function has the wrong number of parameters.
0x82	Command not available: ▪ A Host command was sent to the reader in the Buffered Read Mode. ▪ A Buffered Read Mode protocol was sent to the reader in the standard mode. ▪ The command with More bit does not correspond with the last command.

0x83	RF communication error: This error indicates that there is an error in communication between the transponder and the reader. Reason for this can be: ▪ Timeout for transponder communication. “transponder-Response-Time” in CFG1: Interface and Mode is too short. ▪ The collision handling algorithm was not continued until no collision is detected, reasons for the break.
0x84	RF-Warning: Detailed status information can be read with the command [0x6E] reader Diagnostic. ▪ The antenna configuration isn’t correct. Check the antenna cables and the antenna matching. ▪ The environment is too noisy. ▪ The RF power doesn’t have the configured value. ▪ All RF channel are occupied (EU reader only).

Table 317.

Buffer Status

Hex-value	Description
0x92	No valid Data: ▪ There is no valid data in the Buffered Read Mode. ▪ There is no transponder in the antenna field. ▪ The VALID-TIME has not elapsed for transponders in the antenna field.
0x93	Data Buffer Overflow: ▪ A data buffer overflow occurred.
0x94	More Data: ▪ There are more transponder data sets requested than the response protocol can transfer at once.
0x95	Tag Error: ▪ A Tag error code was sent from the transponder. The Tag error code is shown in the following byte.

Table 318.

11.4 ANNEX D: Transponder Error Codes

Response Error Code Definition

Hex-value	Description
0x01	Not supported: ▪ The tag does not support the specified parameters or feature.
0x02	Insufficient privileges: ▪ The interrogator did not authenticate itself with sufficient privileges for the tag to perform the operation.
0x03	Memory overrun: ▪ The specified memory location does not exist or the EPC length field is not supported by the tag.
0x04	Memory locked: ▪ The specified memory location is locked and/or permalocked and is either not writeable or not readable.
0x05	Crypto suite error: ▪ Catch-all for errors specified by the cryptographic suite.
0x06	Command not encapsulated: ▪ The interrogator did not encapsulate the command in an AuthComm or SecureComm as required.
0x07	Response Buffer overflow: ▪ The operation failed because the Response Buffer overflowed.
0x08	Security timeout: ▪ The command failed because the tag is in a security timeout.
0x0B	Insufficient power: ▪ The tag has insufficient power to perform the memory-write option.
0x0F	Non-specific error: ▪ The tag does not support error-specific codes.
0x00	Other error: ▪ “Catch-all” for errors not covered by other codes.
All other	▪ Reserved for future use.

Table 319.

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