



**OEM LF1S Devices**  
**LF RFID OEM Module**  
**Communication Protocol**  
**Tag Types: Read-only, Hitag 1, Hitag S, FDX-B, ID Card**

| Date       | Version | Description  |
|------------|---------|--|
| 2018-09-04 | 5.1     | Layout changed, updated to newer FW version that combined Hitag 1 with Hitag S, removed Hitag 2, added further tag types |
| 2020-12-17 | 5.1a    | Data tag information added, some command examples exchange with tested telegrams, examples added                         |
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# 1 Protocol Description

## 1.1 Default Baudrate

| Baudrate | Data Bits | Start Bits | Stopp Bits | Checksum |
|----------|-----------|------------|------------|----------|
| 9600 bps | 8         | 1          | 1          | None     |

## 1.2 Data Package Format

Data package format, command package is sent from Host to Reader, response package returned from Reader to Host

### CMD package format (Host to Reader)

|     |            |             |     |             |     |     |
|-----|------------|-------------|-----|-------------|-----|-----|
| STX | STATION ID | DATA LENGTH | CMD | DATA [0..N] | BCC | ETX |
|-----|------------|-------------|-----|-------------|-----|-----|

(BCC) = STATION ID  $\oplus$  DATALENGTH  $\oplus$  CMD  $\oplus$  DATA [0]  $\oplus$  ...  $\oplus$  DATA [n], where  $\oplus$  is the "EOR".

### Response package format (Reader to Host)

|     |            |             |        |            |     |     |
|-----|------------|-------------|--------|------------|-----|-----|
| STX | STATION ID | DATA LENGTH | STATUS | DATA[0..N] | BCC | ETX |
|-----|------------|-------------|--------|------------|-----|-----|

(BCC) = STATION ID  $\oplus$  DATA LENGTH  $\oplus$  STATUS  $\oplus$  DATA [0]  $\oplus$  ...  $\oplus$  DATA [n], where  $\oplus$  is the "EOR".

## 1.3 Byte Description in Data Package

| Field       | Length | Description   | Remark   |
|-------------|--------|---|--|
| STX         | 1      | 0xAA: 'start byte' – standard control byte, means the start of one data package.  | 0xAA = 0b1010.1010   |
| STATION ID  | 1      | Device address, necessary in multiple device communicating, when reader receive data package, it will judge the inner address if match up with itself preset, only response when match up | Address 0x00 is the special address only used under Single mode, reader will response any data package with 0 address(no address judge). |
| DATALLENGTH | 1      | Data byte length in data package, including CMD/STATUS and DATA field, but no BCC.<br>LENGTH= numbers of byte (CMD/STATUS + DATA[0..N])   |  |
| CMD         | 1      | Command byte: compose with one Cmd byte   | Only used in Send package  |
| STATUS      | 1      | Return status byte: status return from Reader to Host   | Only used in Return package  |
| DATA [0-N]  | 0–241  | This is a data flow related to Length and CMD byte. Some part of commands no need additional data   |  |
| BCC         | 1      | 8bits checksum byte, including all bytes XOR checksum besides STX, ETX  |  |
| ETX         | 1      | 0xBB: ' stop byte' – standard control byte, means end of data package   | 0xBB = 0b1011.1011   |

## 1.4 Command List

| CMD   | Name               | Description                                    |
|---|--------------------|--|
| <b>System Commands</b>                          |                    |  |
| 0x51  | Get_VersionNum     | To get device hardware version number          |
| 0x52  | BUZ_control        | Buzzer control                                 |
| 0x53  | LED_control        | LED control                                    |
| 0x54  | SET_ANT            | To open or close antenna                       |
| <b>Command for read-only Data Tags</b>          |                    |  |
| 0x57  | EM4100/4200_GetUID | Get UID from read-only tag                     |
| <b>Commands for Hitag-1 + Hitag S Data Tags</b> |                    |  |
| 0x58  | Hitag1/S_Request   | Request card                                   |
| 0x59  | Hitag1/S_Select    | Select card                                    |
| 0x5C  | Hitag1/S_Quiet     | Card quiet                                     |
| 0x5A  | Hitag1/S_ReadPage  | Read data per page                             |
| 0x5B  | Hitag1/S_WritePage | Write data per page                            |
| 0x60  | Hitag1/S_LockPage  | Lock page                                      |
| <b>Commands for further Data Tags</b>           |                    |  |
| 0x56  | Read FDX-B         | Read FDX_B Data Tag (ISO11784/85)              |
| 0x5D  | Format to FDX-B    | Format Hitag S Tag for operation as an FDX-B   |
| 0x5E  | Format to ID Card  | Format Hitag S Tag for operation as an ID Card |

### IMPORTANT NOTE

**Only Modules with Designation  
LF1S support Hitag 1 + Hitag S.**

## 2 Command Examples

### 2.1 General

This chapter is intended to provide an easy start with these RFID devices. It shows only a few commands that are explained in detail. For full reference to all commands, please consult the rest of this manual.

### 2.2 Communication Parameters

- 9600 Baud
- 8 data bits
- 1 start bit
- 1 stop bit
- no parity
- no flow control

### 2.3 Checksum Calculation

Checksum is calculated as XOR over these parts of a telegram:

- Device Address
- Payload Length Information
- Command Code (Payload)
- Parameters (Payload)

### 2.4 Command Examples

#### 2.4.1 Get Firmware Version Information

**Command from PC/PLC to RFID device:**

AA 00 01 51 50 BB

**The Bytes in Detail:**

|    |  |
|----|--|
| AA | = Start of Telegram                        |
| 00 | = Device Address, 0x00 = all devices react |
| 01 | = Payload Length                           |
| 51 | = Command Code (Counted as Payload)        |
| 50 | = Checksum                                 |
| BB | = End of Telegram                          |

**Reply from RFID device to PC/PLC:**

AA 00 07 00 48 69 74 61 67 53 07 BB

**The Bytes in Detail:**

|                   |  |
|-------------------|--|
| AA                | = Start of Telegram                                |
| 00                | = Device Address, 0x00 = all devices react         |
| 07                | = Payload Length                                   |
| 00                | = Status, 0x00 = OK (Payload)                      |
| 48 69 74 61 67 53 | = Firmware Version Information, "HitagS" (Payload) |
| 07                | = Checksum   |
| BB                | = End of Telegram                                  |

### 2.4.2 Read UID of Read-Only RFID Tag

**Command from PC/PLC to RFID device:**

AA 00 01 57 56 BB

**The Bytes in Detail:**

|    |                          |
|----|--------------------------|
| AA | = Start of Telegram      |
| 00 | = Device Address         |
| 01 | = Payload Length         |
| 57 | = Command Code (Payload) |
| 56 | = Checksum               |
| BB | = End of Telegram        |

**Reply from RFID device to PC/PLC:**

AA 00 06 00 01 10 2F BB AA 29 BB

**The Bytes in Detail:**

|                |                     |
|----------------|---------------------|
| AA             | = Start of Telegram |
| 00             | = Device Address    |
| 06             | = Payload Length    |
| 00             | = Status, 0x00 = OK |
| 01 10 2F BB AA | = UID, 5 Bytes      |
| 29             | = Checksum          |
| BB             | = End of Telegram   |

### 2.4.3 Read UID of Hitag1/S Tag

**Command from PC/PLC to RFID device:**

AA 00 01 58 59 BB

**The Bytes in Detail:**

|    |                          |
|----|--------------------------|
| AA | = Start of Telegram      |
| 00 | = Device Address         |
| 01 | = Payload Length         |
| 58 | = Command Code (Payload) |
| 59 | = Checksum               |
| BB | = End of Telegram        |

**Reply from RFID device to PC/PLC:**

AA 00 05 00 C5 0F 4A 8E 0B BB

**The Bytes in Detail:**

|             |                     |
|-------------|---------------------|
| AA          | = Start of Telegram |
| 00          | = Device Address    |
| 05          | = Payload Length    |
| 00          | = Status, 0x00 = OK |
| C5 0F 4A 8E | = UID, 4 Bytes      |
| 0B          | = Checksum          |
| BB          | = End of Telegram   |

#### 2.4.4 Select Hitag1/S

Before you can read/write data you need to select the tag first:

**Command from PC/PLC to RFID device:**

AA 00 05 59 C5 0F 4A 8E 52 BB

**The Bytes in Detail:**

|             |                          |
|-------------|--------------------------|
| AA          | = Start of Telegram      |
| 00          | = Device Address         |
| 05          | = Payload Length         |
| 59          | = Command Code (Payload) |
| C5 0F 4A 8E | = UID of tag to Select   |
| 52          | = Checksum               |
| BB          | = End of Telegram        |

**Reply from RFID device to PC/PLC:**

AA 00 05 00 CA 00 00 AA 65 BB

**The Bytes in Detail:**

|             |  |
|-------------|--|
| AA          | = Start of Telegram  |
| 00          | = Device Address   |
| 05          | = Payload Length   |
| 00          | = Status, 0x00 = OK  |
| CA 00 00 AA | = Configuration word, you can use this to identify the tag exactly |
| 65          | = Checksum   |
| BB          | = End of Telegram  |

#### 2.4.5 Read Data from Hitag1/S

**Command from PC/PLC to RFID device:**

AA 00 02 5A 00 58 BB

**The Bytes in Detail:**

|    |                             |
|----|-----------------------------|
| AA | = Start of Telegram         |
| 00 | = Device Address            |
| 02 | = Payload Length            |
| 5A | = Command Code              |
| 00 | = Page Address to Read From |
| 58 | = Checksum                  |
| BB | = End of Telegram           |

**Reply from RFID device to PC/PLC:**

AA 00 05 00 C5 0F 4A 8E 0B BB

**The Bytes in Detail:**

|             |  |
|-------------|--|
| AA          | = Start of Telegram                      |
| 00          | = Device Address                         |
| 05          | = Payload Length                         |
| 00          | = Status, 0x00 = OK                      |
| C5 0F 4A 8E | = Memory Content of Page 0, Page 0 = UID |



0B               = Checksum  
BB               = End of Telegram

## 3 System Commands

### 3.1 Get\_VersionNum (0x51)

#### Send Data

None

#### Reply with Success

STATUS: 0x00 – OK

DATA[0~5]: VersionNum

#### Reply in Case of Error

STATUS: 0x01 – FAIL

DATA: None

#### Example

Command from PC/PLC to RFID device: AA 00 01 51 50 BB

Reply from RFID device to PC/PLC: AA 00 07 00 48 69 74 61 67 53 07 BB

Note: 48 69 74 61 67 53 is the hardware version number

### 3.2 BUZ\_control (0x52)

#### Send Data

DATA[0]: Buzzer control time, unit as ms 0x00 ... 0xFF

#### Reply with Success

STATUS: 0x00 – OK

DATA: None

#### Reply in Case of Error

STATUS: 0x01 – FAIL

DATA: None

#### Example

Command from PC/PLC to RFID device: AA 00 02 52 64 34 BB (BUZ beeping 100 ms)

Reply from RFID device to PC/PLC: AA 00 01 00 01 BB (confirmation)

### 3.3 LED\_control (0x53)

#### Send Data

DATA[0]: LED number 0x00 = LED1

0x01 = LED2

DATA[1]: LED control time, unit as ms 0x00 ... 0xFF

#### Reply with Success

STATUS: 0x00 – OK

DATA: None

#### Reply in Case of Error

STATUS: 0x01 – FAIL

DATA:       None

#### Example

Command from PC/PLC to RFID device:   AA 00 03 53 00 64 34 BB (control LED1 lighting 100 ms)

Reply from RFID device to PC/PLC:       AA 00 01 00 01 BB

### 3.4 SET\_ANT (0x54)

#### Send Data

DATA[0]:     control flag               0x00 = close antenna  
  0x01 ... 0xFF = open antenna

#### Reply with Success

STATUS:      0x00 – OK

DATA:        None

#### Reply in Case of Error

STATUS:      0x01 – FAIL

DATA:        None

#### Example

Command from PC/PLC to RFID device:   AA 00 02 54 00 56 BB   Close antenna

Reply from RFID device to PC/PLC:       AA 00 01 00 01 BB

Note:                                    reader default is antenna opened after power up

## 4 Command for read-only Data Tag

### 4.1 EM4100/4200\_GetUID (0x57)

#### Send Data

None

#### Reply with Success

STATUS: 0x00 – OK

DATA[0~4]: 5byte card UID

#### Reply in Case of Error

STATUS: 0x01 – FAIL

DATA: None

#### Example

Command from PC/PLC to RFID device: AA 00 01 57 56 BB

Reply from RFID device to PC/PLC: AA 00 06 00 01 0F C3 4E 30 B5 BB, among them 01 0F C3 4E 30 is card UID

## 5 Hitag S Commands

### 5.1 Hitag1/S\_Request (0x58)

#### Send Data

None

#### Reply with Success

STATUS: 0x00 – OK

DATA[0~3]: 4 byte card UID

#### Reply in Case of Error

STATUS: 0x01 – FAIL

DATA: None

#### Example

Command from PC/PLC to RFID device: AA 00 01 58 59 BB

Reply from RFID device to PC/PLC: AA 00 05 00 C5 0F 4A 8E 0B BB, among them C5 0F 4A 8E is card UID

### 5.2 Hitag1/S\_Select (0x59)

#### Send Data

DATA[0~3]: card UID

#### Reply with Success

STATUS: 0x00 – OK

DATA[0~3]: HitagS configured package data, this is the memory contents of page 0x01 which is the configuration word

#### Reply in Case of Error

STATUS: 0x01 – FAIL

DATA: None

#### Example

Command from PC/PLC to RFID device: AA 00 05 59 31 1E 45 72 44 BB

Reply from RFID device to PC/PLC: AA 00 05 00 CA 00 00 AA 65 BB

Note: CA 00 00 AA is card configured package data

### 5.3 Hitag1/S\_Quiet (0x5C)

#### Send Data

None

#### Reply with Success

STATUS: 0x00 – OK

DATA: None

#### Reply in Case of Error

STATUS: 0x01 – FAIL

DATA: None

**Example**

Command from PC/PLC to RFID device: AA 00 01 5C 5D BB

Reply from RFID device to PC/PLC: AA 00 01 00 01 BB ,make card enter Quiet status

**5.4 Hitag1/S\_ReadPage (0x5A)****Send Data**

DATA[0]: page address

**Reply with Success**

STATUS: 0x00 – OK

DATA[0~3]: 4Byte card data

**Reply in Case of Error**

STATUS: 0x01 – FAIL

DATA: None

**Example**

Command from PC/PLC to RFID device: AA 00 02 5A 00 58 BB to read Page0

Reply from RFID device to PC/PLC: AA 00 02 5A 00 58 BB

**5.5 Hitag1/S\_WritePage (0x5B)****Send Data**

DATA[0]: Page address

DATA[1~4]: 4Byte data

**Reply with Success**

STATUS: 0x00 – OK

DATA: None

**Reply in Case of Error**

STATUS: 0x01 – FAIL

DATA: None

**Example**

Command from PC/PLC to RFID device: AA 00 06 5B 3F 00 01 02 03 62 BB

Write data of 00 01 02 03 into Page 3F of HitagS 2048 card

Reply from RFID device to PC/PLC: AA FF 01 00 FE BB

**5.6 Hitag1/S\_LockPage (0x60)****Send Data**

|          |                     |  |
|----------|---------------------|--|
| DATA[0]: | Lock page parameter | 0x01 = Lock page 1                             |
|          |                     | 0x02 = Lock page 2, page 3                     |
|          |                     | 0x03 = Lock page 4, page 5                     |
|          |                     | 0x04 = Lock page 6, page 7                     |
|          |                     | 0x05 = Lock page 8, page 9, page 10, page 11   |
|          |                     | 0x06 = Lock page 12, page 13, page 14, page 15 |
|          |                     | 0x07 = Lock pages 16 – 23                      |

0x08 = Lock pages 24 – 31

0x09 = Lock pages 32 – 47

0x0A = Lock pages 48 – 63

#### **Reply with Success**

STATUS: 0x00 – OK

DATA: None

#### **Reply in Case of Error**

STATUS: 0x01 – FAIL

DATA: None

#### **Example**

Command from PC/PLC to RFID device: AA 00 02 60 01 63 BB, Lock Page 1

Reply from RFID device to PC/PLC: AA FF 01 00 FE BB

## 6 Commands for FDX-B Data Tags

### 6.1 Read FDX-B tag/card (ISO11784/85) (0x56)

#### Send Data

None

#### Reply with Success

STATUS: 0x00 – OK

DATA[0~11]: 12 Bytes card data, including 5 bytes national code + 2 bytes country code +1 byte data mark +1 byte animal tag mark+ 3 bytes customized data

#### Reply in Case of Error

STATUS: 0x01 – FAIL

DATA: None

#### Example

Command from PC/PLC to RFID device: AA 00 01 56 57 BB

Reply from RFID device to PC/PLC: AA 00 0D 00 00 00 00 00 00 00 00 01 01 00 00 00 0D BB

### 6.2 Format Hitag S tag into FDX-B (0x5D)

#### Send Data

DATA[0]: lock flag(1 byte)

DATA[1-5]: national (5 byte)

DATA[6-7]: country code (2 bytes)

DATA[8-9]: animal flag(2 bytes)

DATA[10-12]: user data (3 bytes)

#### Reply with Success

STATUS: 0x00 – OK

DATA: none

#### Reply in Case of Error

STATUS: 0x01 – FAIL

DATA: None

#### Example

Command from PC/PLC to RFID device: AA 00 0E 5D 00 00 00 00 00 00 00 00 01 01 00 00 00 53 BB

Reply from RFID device to PC/PLC: AA 00 01 00 01 BB

### 6.3 Format Hitag S cards into ID card (0x5E)

#### Send Data

DATA[0] : lock flag(1 byte)

DATA[1-5]: EM4100 card Serial number (5 byte)

#### Reply with Success

STATUS: 0x00 – OK

DATA: none



**Reply in Case of Error**

STATUS: 0x01 – FAIL

DATA: None

**Example**

Command from PC/PLC to RFID device: AA 00 07 5E 00 10 00 00 00 01 48 BB

Reply from RFID device to PC/PLC: AA 00 01 00 01 BB

## 7 Data Tags, Memory Layout

### 7.1 EM4100 (64 bit), EM4102 (64 bit), EM4200 (128 bit)

These are read-only types, so you can only read the UID here.

### 7.2 Hitag S2048 (2 kbit, 256 Bytes, 64 Blöcke)

Memory blocks (pages) of 32 bit/4 Bytes.

| Block # | Hex-Address | Access     | Description   |
|---------|-------------|------------|---|
| 1       | 00          | Read-only  | UID   |
| 2       | 01          | Read/Write | Configuration word (Hitag S: CA0000AA)                          |
| 3       | 02          | No Access  | —   |
| 4       | 03          | Read/write | Configuration word, password protected, default PW: 0000 0000 h |
| 5       | 04          | Read/Write | Memory for user data  |
| ...     | ...         | ...        | Memory for user data  |
| 64      | 3F          | Read/Write | Memory for user data  |

### 7.3 Hitag S256 (256 bit, 32 Bytes, 8 Blöcke)

Memory blocks (pages) of 32 bit/4 Bytes.

| Block # | Hex-Address | Access     | Description  |
|---------|-------------|------------|--|
| 1       | 00          | Read-only  | UID  |
| 2       | 01          | Read/Write | Configuration word (Hitag S: CA0000A9)                           |
| 3       | 02          | No Access  | —  |
| 4       | 03          | Read/Write | Configuration word, password protected, standard PW: 0000 0000 h |
| 5       | 04          | Read/Write | Memory for user data   |
| 6       | 05          | Read/Write | Memory for user data   |
| 7       | 06          | Read/Write | Memory for user data   |
| 8       | 07          | Read/Write | Memory for user data   |

### 7.4 Hitag S64 (64 bit, 8 Bytes, 2 Blöcke)

Memory blocks (pages) of 32 bit/4 Bytes.

| Block # | Hex-Address | Access     | Description                            |
|---------|-------------|------------|--|
| 1       | 00          | Read-only  | UID                                    |
| 2       | 01          | Read/Write | Configuration word (Hitag S: CA0000A8) |

### 7.5 Hitag 1 (2 kbit, 256 Bytes)

Memory blocks (pages) of 32 bit/4 Bytes.

| Block # | Hex-Address | Access     | Description                            |
|---------|-------------|------------|--|
| 1       | 00          | Read-only  | UID                                    |
| 2       | 01          | Read/Write | Configuration word (Hitag 1: FF77AA00) |
| 3       | 02          | No Access  | —                                      |
| ...     | ...         | No Access  | —                                      |

|     |     |            |                      |
|-----|-----|------------|----------------------|
| 16  | 0F  | No Access  | —                    |
| 17  | 10  | Read/Write | Memory for user data |
| ... | ... | ...        | Memory for user data |
| 64  | 3F  | Read/Write | Memory for user data |

## 7.6 Hitag 2 (256 bit, 32 Bytes)

Memory blocks (pages) of 32 bit/4 Bytes.

| Block # | Hex Address | Access     | Description   |
|---------|-------------|------------|---|
| 1       | 00          | Read-only  | UID   |
| 2       | 01          | Read/Write | Password RWD, standard 4D494B52h                                |
| 3       | 02          | No Access  | —   |
| 4       | 03          | Read/Write | Configuration word, password-protected, standard PW 0000 0000 h |
| 5       | 04          | Read/Write | Memory for user data / 64 bit for Read-only-Emulation           |
| 6       | 05          | Read/Write | Memory for user data / 64 bit for Read-only-Emulation           |
| 7       | 06          | Read/Write | Memory for user data  |
| 8       | 07          | Read/Write | Memory for user data  |

## 7.7 EM4450/4550 (1 kbit)

Memory blocks (pages) of 32 bit/4 Bytes.

| Block # | Hex Address | Access     | Description                  |
|---------|-------------|------------|------------------------------|
| 1       | 00          | Read-only  | Password, standard 00000000h |
| 2       | 01          | Read-only  | Security word                |
| 3       | 02          | Read-only  | Control word                 |
| 4       | 03          | Read/Write | Memory for user data         |
| ...     | ...         | ...        | Memory for user data         |
| 31      | 1F          | Read/Write | Memory for user data         |
| 32      | 20          | Read-only  | Device Serial Number (UID)   |
| 33      | 21          | Read-only  | Device Identification        |