

# RFID

## SMART RFID MODULE

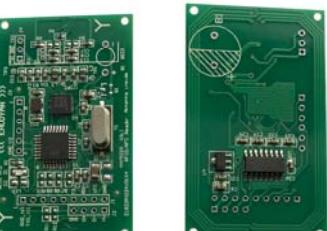


# EHUOYAN

**YHY522R    RFID module**  
RFID/NFC Reader/Writer Module

**User manual**

Version 1.0  
Dec, 2018



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## 1. Introduction

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This document describes the functionality of the contactless reader/writer YHY522R . It includes the functional and electrical specifications.

## 2. General description

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The YHY522R is a highly integrated reader/writer for contactless communication at 13.56MHz. The YHY522R reader supports ISO14443A/MIFARE® mode.

The YHY522R has built-in transceiver antenna to communicate with ISO/IEC 14443A/ MIFARE® cards without additional circuitry. The module provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO/IEC 14443A/ MIFARE® compatible cards and transponders. The digital part handles the complete ISO/IEC 14443A framing and error detection(Parity & CRC).

In the master mode, YHY522R will seek the card or data itself and output to host automatically.

In the slave mode, the module just needs only one command to finish one action, such as read or write data from card's block. The user does not need input three steps : request, anticollision and selection. The module will do this function for you automatically. What you need is just sending one command to the module. Then it will send back what you want. Anything is just so simple and so easy. Also, if there is any card goes into the rf field, the red led on the module will light and the IRQ pin will change from "1" to "0" to indicate the event.

Host interface : Serial RS232

## 3. Features

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- ▲ Can detect UID clone card
- ▲ Small size and built-in antenna on board
- ▲ Auto scan for presence of tags and upload data
- ▲ NFC NDEF text commands
- ▲ Encrypted EEPROM to store up to 40 groups of keys
- ▲ Contactless operating frequency 13.56 MHz
- ▲ Supports ISO14443A ,Mifare® Classic1K,Mifare® UltraLight, NTAG213
- ▲ RS232 Interface, baud rate up to 230400bps,default 19200bps
- ▲ Typical Operating Distance: 0 ~5cm
- ▲ Operating Voltage : DC 5.0V
- ▲ 1 LED indicator,

▲ Size: 58mm × 35mm × 7mm

▲ Weight:12g

## 4. Application information

YHY522R can be used on vending machine, secure access, parking, payment, ticketing, leisure, membership, time & attendance, biometrics, IT-access, Identify, loyalty, Counter, data storage and fast data collection systems.

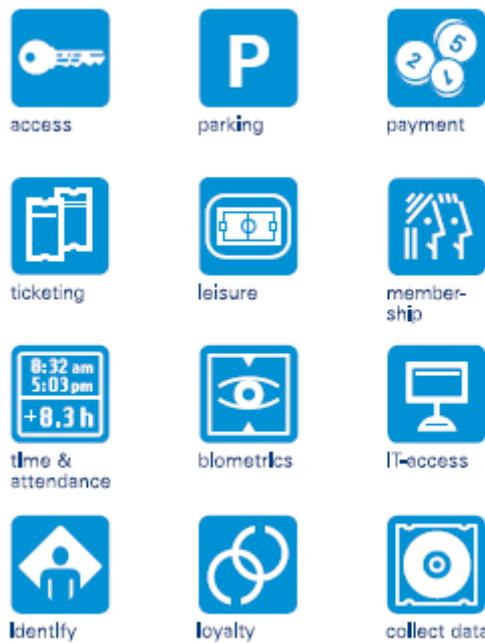


Figure 1. YHY522R Applications

## 5. Quick reference data

Table 1: Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CC</sub>	Supply voltage	GND=0V	2.7	5.0	7.0	V
I <sub>HPD</sub>	Hard Power-down Current		-	-	100	uA
I <sub>ASD</sub>	Antenna Soft-down	V <sub>CC</sub> =5.0V		15	20	mA
I <sub>VCC</sub>	Supply Current	V <sub>CC</sub> =5.0V		53	75	mA
D <sub>RW</sub>	Read/Write card Distance	V <sub>CC</sub> =5.0V	0		60	mm
T <sub>amb</sub>	Operating ambient temperature		-25		+85	°C

## 6. Ordering Information

Table 2: Ordering Information

Type Number	Package	
	Name	Description
YHY522R	YPHDR9-5	

## 7. Block diagram

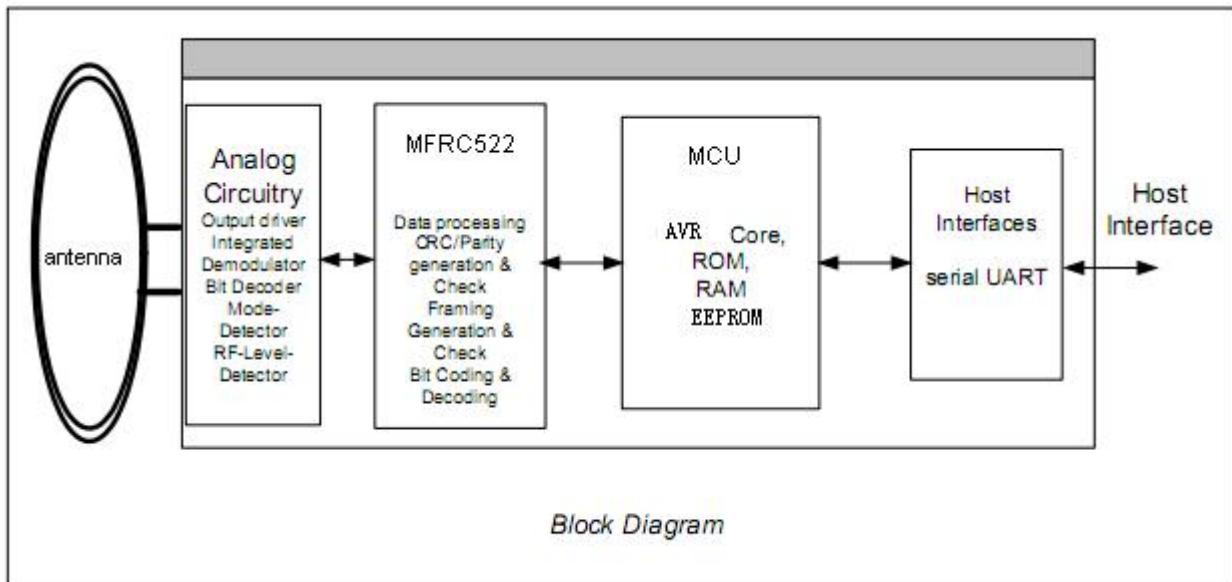


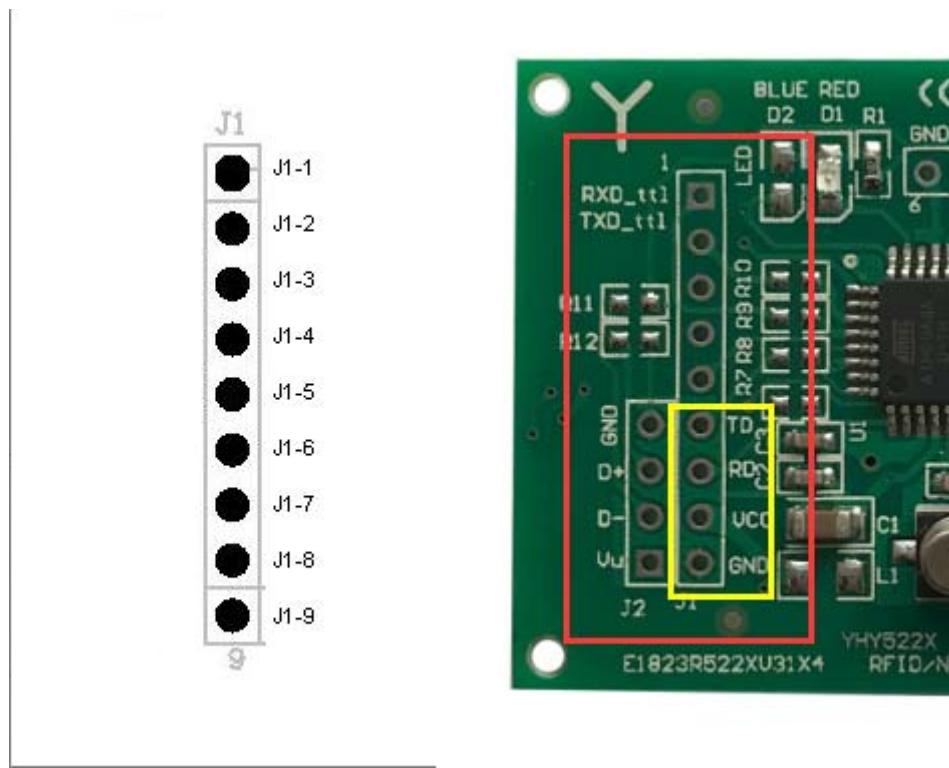
Figure 2. Simplified YHY522R Block diagram

The Analog circuitry and MFRC522 handle the modulation and demodulation RFID signal.

The MCU handles the protocol requirements for the communication schemes including the RF base protocols as well as the protocols for host communication.

## 8. Pinning information

### 8.1 Pinning



*Figure 3 – Pinning configuration*

## 8.2 Pin description

*Table 3: J1 Pin description*

Pin	Symbol	Type	Description
J1-1			
J1-2			
J1-3			
J1-4			
J1-5	RST	I	Reset, active-low, floating for power-on reset by default
J1-6	TXD	O	RS232 Transmitter
J1-7	RXD	I	RS232 Receiver
J1-8	V <sub>CC</sub>	PWR	Power supply
J1-9	GND	PWR	Power supply Ground

## 9. Functional description

YHY522R supports the Reader/Writer mode for ISO/IEC 14443A/MIFARE card.

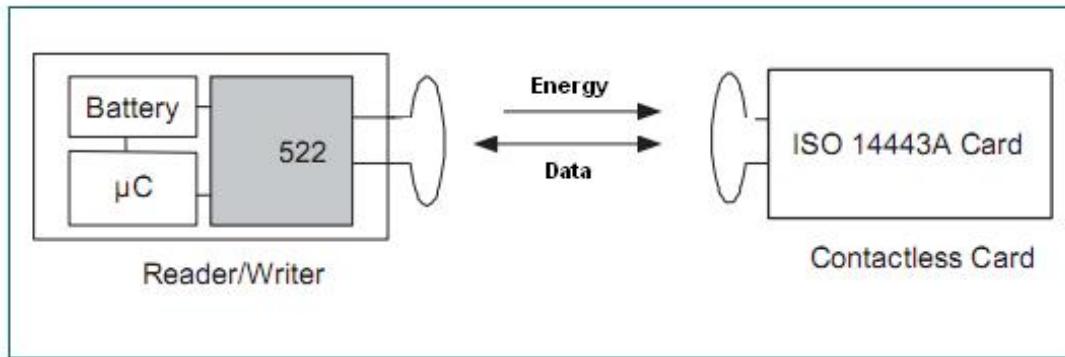


Figure 4 – YHY522R Reader/Writer mode

## 10. Digital interface

### 10.1 RS232 Interface

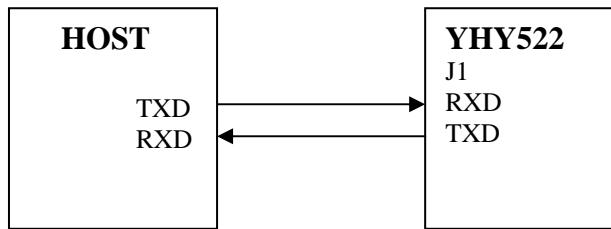


Figure 5 – YHY522R RS232 interface to host

### 10.3 Selection of the transfer speeds

The default transfer speed is 19.2 kbit/s.

To change the transfer speed, the host controller has to write a value for the new transfer speed by the **CONFIG** command, after reset the module, the new speed will active.

Table 5: Selectable transfer speeds

Transfer Speed [kbit/s]	Configure Code
2.4	1
4.8	2
9.6	3
14.4	4
19.2	5
38.4	6
57.6	7
115.2	8
230.4	9

### 10.4 Transfer Protocol

The original setting for the host and YHY522R communicates at **19200bps, N, 8, 1.**

In the slave mode, the host first sends the command and the module executes the operation and replies with a response to the command. The host can analyze the reply to check if the operation was successful or if any error occurred during the operation.

#### 10.4.1 Host to YHY522R Transfer Protocol

*Table 5. UART frame send by host*

Header	Length	Command	Data	CSUM
2 Byte	1 Byte	1 Byte	N Bytes	1 Byte

- 1. Header:** This header has 2 bytes that indicates the beginning of a frame. These 2 bytes should be always 0xAA 0xBB.
- 2. Length:** This byte is used to indicate the length of the payload data. This includes the Length, Command and the Data bytes.
- 3. Command:** This byte is used to instruct the module on what operation to perform.
- 4. Data:** These are parameters for the module to execute the command. For example, for a Read command, the data will be the block number to be read and the authenticated key. For a Write command, this will be the block number and the authenticated key and 16 bytes data to write into the block. For other command, it maybe empty.
- 5. CSUM:** This is the checksum byte. This byte is used on the host as well as the module to check the validity of the packet and to trap any data corruption. This is calculated by **XOR** all the bytes in the packet except the Header and the CSUM byte.

$$\text{CSUM} = \text{Length} \oplus \text{Command} \oplus \text{Data}[0] \oplus \text{Data}[1] \dots \oplus \text{Data}[n-1]$$

**Note:** If there is one byte “0xAA” in the packet data from Length to CSUM, please insert one byte “0x00” after “0xAA”, but the Length need not change.

Code example:

```
//-----
if (cSendBuffer[i] == 0xAA)
{
    TI = 0;
    SBUF = 0;
    while (!TI);
}
//-----
```

#### 10.4.2 YHY522R to Host Transfer Protocol

*Table 6. UART frame send by YHY522R*

Header	Length	Status	Data	CSUM
2 Byte	1 Byte	1 Byte	N Bytes	1 Byte

- 1. Header:** This header has 2 bytes that indicates the beginning of a frame. These 2 bytes should be always 0xAA 0xBB.
- 2. Length:** This byte is used to indicate the length of the payload data. This includes the Length, Command and the Data bytes
- 3. Status:** This is the status for which the response is being sent back. If ok then the module return the command which host has sent, if failure it return the ones-complement code. For example, the command is 0x19, then the ones-complement code is 0xe6.
- 4. Data:** This contains the result data if an operation was successful. It may be empty.
- 5. CSUM:** This is the checksum byte. This byte is used on the host as well as the module to check the validity of the packet and to trap any data corruption. This is calculated by **XOR** all the bytes in the packet except the Header and CSUM byte.

$$\text{CSUM} = \text{Length} \oplus \text{Command} \oplus \text{Response}[0] \oplus \text{Response}[1] \oplus \dots \oplus \text{Response}[n-1]$$

AA BB 06 20 3D 98 62 01 E0

0x20: Auto scan UID.

3D 98 62 01: UID

## 12. Power Reduction mode

---

### 12.1 Hard Power-down

A Hard Power-down is enabled with sending command **0x03** to the YHY522R . This turns off all internal current sinks as well as the oscillator. All digital input buffers are separated from the input pads and clamped internally. The output pins are frozen at a certain value.

### 12.2 Transmitter Soft Power-down

The Transmitter Soft Power-down mode is entered immediately after send command **0x11** to the YHY522R . The module will switch off the antenna power, but the mcu is still working.

## 13. Reset

---

The YHY522R is reset when a low level is present on the RST pin for longer than the minimum pulse length. During Reset, all I/O pins are set to their initial states, and the program starts execution from the Reset Vector.

*Table 7: Reset Characteristics*

Symbol	Parameter	Condition	Min	Typ	Max	Units
$V_{POT}$	Power-on Reset Threshold Voltage (rising) <sup>(1)</sup>			1.4	2.3	V
	Power-on Reset Threshold Voltage (falling)			1.3	2.3	V
$V_{RST}$	RESET Pin Threshold Voltage		0.2		0.9	V <sub>CC</sub>
$t_{RST}$	Minimum pulse width on RESET Pin				1.5	μs

Notes: The Power-on Reset will not work unless the supply voltage has been below  $V_{POT}$  (falling).

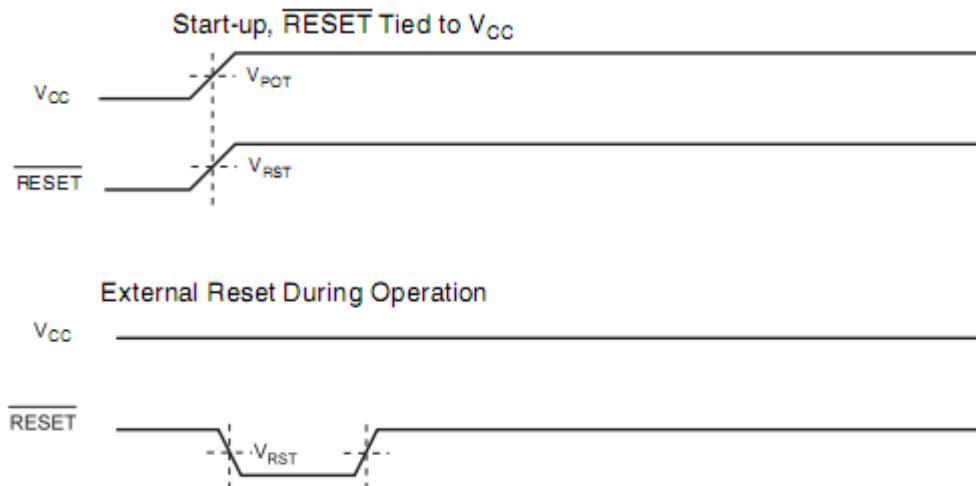


Figure 7–Reset timing

## 14. YHY522R Command Set

### 14.1 Commands overview

The commands for the YHY522R include system commands and RFID commands.

The system commands are used for controlling the module settings and saving parameters to the EEPROM.

The RFID commands are used for operating the RFID card, such as read or write block data.

Table 8: Command list

Code	Command	Description
<b>SYSTEM COMMANDS</b>		
0x03	MSleep	Module Sleep(Hard Power Down)
0x04	MConfigure	Configure parameters to the module
0x05	Download_Keys	Download auth keys to the module
0x11	Antenna_Control	Control Antenna on or off
0x13	Sense_Mode	Set Auto Sense Mode
<b>RFID COMMANDS</b>		
0x06	Change_Card_Keys	Change the Card's Key
0x12	Card_Sleep	Card Sleep(Halt)
0x19	Card_Type	Read Card Type
0x20	Card_ID	Read Card UID
<b>S50 commands</b>		
0x0c	Detect_Clone	Detect a clone card
0x21	Block_Read	Read Data From Card Block, 16 bytes
0x22	Block_Write	Write Data Into Card Block, 16 bytes
0x23	Value_Init	Initialize block data to Value format, 4 bytes
0x24	Value_Read	Read Value, 4 bytes
0x25	Value_Inc	Increase Value, 4 bytes, Low Byte First
0x26	Value_Dec	Decrease Value, 4 bytes, Low Byte First
0x27	Value_Backup	Backup Value to Another Block
0x2a	Sector_Read	Read One Sector
0x2b	Sector_Write	Write One Sector
<b>NTAG213 commands</b>		
0x28	Pages_Read_UL	Read out 4 pages of the UL data,
0x29	Page_Write_UL	Write in 4 bytes data into 1 page to the UL chip
0x40	Ntag_Read_Text	Read NFC text from NTAG chip
0x41	Ntag_Write_Text	Write NFC text into NTAG chip

## 14. 2 Commands and Response

After power on or reset YHY522R , the RED led will flash one time, It means that YHY522R is ready.

If a Mifare® tag detected by the module, pin IRQ will change from “1” to “0” and the red led on board will light till the tag moves out of rf field.

The RED led will flash during data stream exchanging between host and YHY522R .

### 14. 2. 1 Detect\_Clone

This command will detect the UID clone card, if it is a clone card, it will

reply success, else reply failure.

Table 9. Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x02	0x0c		BCC

Table 10. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x0C		0x0E
Failure	0xAA 0xBB	0x02	0XF3		0Xf1

Table 11 Example

Send	<b>AA BB 02 0C 0E</b>		
Description	AA BB Head 02 Length 0C COMMAND 0E BCC=02 ⊕ 0C		
Receive(Success)	<b>AA BB 02 0C 0E</b>		
Description	AA BB Head 02 Length 0C Status 0E BCC		
Receive(Failure)	<b>AA BB 02 F3 FE</b>		
Description	AA BB Head 02 Length F3 Error F1 BCC		

#### 14.2.2 MSleep

After executing this Command the YHY522R will power down, waking up the module it needs to give the **RST** pin a low-level pulse or Re-power on the module.

Table 12. Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x02	0x03		0x01

Table 13. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x03		0x01
Failure	0xAA 0xBB	0x02	0xFC		0xFE

Table 14. Example

Send	<b>AA BB 02 03 01</b>		
Description	AA BB Head 02 Length 03 COMMAND 01 BCC=02 ⊕ 03		

Receive(Success)	<b>AA BB 02 03 01</b>				
Description	AA BB 02 03 01	Head Length Status BCC			
Receive(Failure)	<b>AA BB 02 FC FE</b>				
Description	AA BB 02 FC FE	Head Length Error BCC			

### 14. 2. 3 MConfigure

This command will configure parameters to the YHY522R . After Reset YHY522R the configuration will active.

Table 15. Command--:Host →YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x12	0x04	Configure data: 16 bytes	BCC

Configure data: 16 bytes.

Table 16. Configure data

D[0]	D[1]	D[2..7]	D[8]	D[9]	D[10]	D[11]	D[12]	D[13]	D[14]	D[15]
Auto code	Key Type	Key String	Block R	RFU	RFU	Start Sector	End Sector	Auth Mode	RFU	Baud Code

D[0]:Auto code -----

0—Auto function off ,the YHY522R will not auto seek card and the IRQ pin is not active.

1—Auto seek card, if there are cards in the RF field, the RED led will light and IRQ pin will output low level.

2—Same 1, and it will read the card id and upload to host, and then halt the card.

3—Same 1, and it will read the selected block and upload to host, and then halt the card.

7-- Same 1, and it will read the start and end sector and upload to host, and then halt the card.

8-- Same 1, and it will read the NTAG213 NDEF text and upload to host, and then halt the card.

D[1]:Key Type -----

0x00 ---Key A

0x01 ---Key B

D[2..7]:Key string -----

Key(6 Bytes) to authenticate the mifare card

D[8]:Block R -----

Define one block of the card to be read.

D[9]: RFU-default 0x00

D[10]:RFU-default 0x00

D[11]:Start sector to be scan

D[12]:End sector to be scan

D[13]:Auth mode -----

Define the auth mode----

0—Auth directly from host, default mode

1—The YHY522R will use the downloaded keys for authentication card

D[14]:RFU -----

Reserved For future Used. Default **0x60**.

D[15]:Baud code -----

See table 5 for the baud rate code.

*Table 17. Response--: YHY522R →Host*

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x04		0x06
Failure	0xAA 0xBB	0x02	0xFB		0xF9

*Table 18. Example 1 ---Auto read card id, Auto code=0x02*

Send	AA BB 12 04 <b>02</b> 00 FF FF FF FF FF FF 00 00 00 00 00 00 00 <b>08</b> 1C				
Description	AA BB 12 04 COMMAND 02 Any data 08 Baud code---115200bps 1C BCC	Head Length Status Auto code—auto read id Any data Baud code---115200bps BCC			
Receive(Success)	AA BB 02 04 <b>06</b>	AA BB 02 04 06	Head Length Status BCC		
Description					
Receive(Failure)	AA BB 02 FB <b>F9</b>	AA BB 02 FC FE	Head Length Error BCC		
Description					

If success then reset the YHY522R to active this function. The reader will read the card id itself when there is a card into the RF field and then output the id to host, at the same time the buzzer would beep one time if it is connecting to a buzzer.

**Example 2 ---Auto read card block, Auto code=0x03**

*Configure command--: Host → YHY522R*

**AA BB 12 04 03 00 FF FF FF FF FF FF 00 05 06 03 04 01 60 08 78**

Description:

**03**: Auto code

**00 FF FF FF FF FF FF**: Auth key A and key string

**00**: Read block 0

**01**: Auth mode 1

**08**: Baud code, 115200bps

If success then reset the YHY522R to active this function. The reader will read the card block itself when there is a card into the RF field and then output the block data to host, at the same time the buzzer would beep one time if it is connecting to a buzzer. Below is the output string example.

*YHY522R → Host----*

AA BB 12 **51 5E C0 E0 7A 04 88 04 00 47 51 35 56 61 10 28 08 EB**

Description:

**51**: Status code

**5E C0 E0 7A 04 88 04 00 47 51 35 56 61 10 28 08**: Data in the block 0

**Example 3 ---Auto Read NTAG213 NFC NDEF text dada, Auto code=0x08**

*Configure command--: Host → YHY522R*

AA BB 12 04 **08 00 FF FF FF FF FF FF 00 00 00 00 00 00 00 05 1B**

Description:

**08**: Auto code

**05**: Baud code, 19200bps

If success then reset the YHY522R to active this function. The reader will read the NFC tag when there is a tag into the RF field and then output the status to host. Below is the output string.

**AA BB 1E 40 31 53 69 6E 67 6C 65 4C 69 6E 65 31 32 33 34 35 36 37 38 39 FE 04 A7 B3 02 09 40 80 6F**

Description:

**40**: Status code

**31 53 69 6E 67 6C 65 4C 69 6E 65 31 32 33 34 35 36 37 38 39**: Ascii code of the "1SingleLine123456789"

**FE**: End of this text

**04 A7 B3 02 09 40 80**: UID of this tag

Auto scan commands:

AA BB 12 04 **01 00 FF FF FF FF FF 00 00 00 00 00 00 00 05 12**// Auto mode 1, baud 19200

AA BB 12 04 **02 00 FF FF FF FF FF 00 00 00 00 00 00 00 05 11**// Auto mode 2, scan UID

AA BB 12 04 02 00 FF FF FF FF FF 00 00 00 00 00 00 00 00 03 17 // Scan UID, baud 9600  
 AA BB 12 04 03 00 FF FF FF FF FF 00 00 00 00 00 00 00 05 10//Auto mode 3, scan block  
 AA BB 12 04 07 00 FF FF FF FF FF 00 00 00 01 02 00 00 05 17// Auto mode 7, scan sector1-2

#### 14. 2. 4 Download\_Keys

This command can load up to 40 groups keys to the YHY522R's EEPROM, all the data stored in the EEPROM is encrypted. When **auth mode** is 1, the reader will use the EEPROM's key to auth the card. After reset this keys will active.

Table 19. Command--: Host →YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x09	0x05	7 bytes Sector: 1 byte Keys: 6 bytes	BCC

Sector: 0—0x27 (mifare 4 k card has 40 sectors)

Keys: KeyA or KeyB, default FF FF FF FF FF FF.

Table 20. Response--: YHY522R →Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x05		0x07
Failure	0xAA 0xBB	0x02	0xFA		0xF8

Table 21. Example

Send	<b>AA BB 09 05 01 FF FF FF FF FF FF OD</b>	
Description	AA BB 09 05 01 FF FF FF FF FF FF OD	Head Length COMMAND Sector 01 Key BCC
Receive(Success)	<b>AA BB 02 03 01</b>	
Description	AA BB 02 05 07	Head Length Status BCC
Receive(Failure)	<b>AA BB 02 FC FE</b>	
Description	AA BB 02 FA F8	Head Length Error BCC

#### 14. 2. 7 Antenna\_Control

This command set the antenna power on or off .

Table 28. Command--:Host →YHY522R

Send	Header	Length	Command	Data	XOR Checksum

	0xAA 0xBB	0x03	0x11	Switch:1Byte	BCC
--	-----------	------	------	--------------	-----

Switch----

0x00: antenna soft power-down

0x03: antenna soft power-on

Table 29. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x11		0x13
Failure	0xAA 0xBB	0x02	0xEE		0xEC

Table 30. Example

Send	AA BB 03 11 00 12	
Description	AA BB 03 11 00 12	Head Length COMMAND antenna soft power-down BCC
Receive(Success)	AA BB 02 11 13	
Description	AA BB 02 11 13	Head Length Status BCC
Receive(Failure)	AA BB 02 EE EC	
Description	AA BB 02 EE EC	Head Length Error BCC

#### 14.2.8 Sense\_Mode

This command can change the auto sense mode any time during the YHY522R working, it needs no reset operation.

Table 31. Command--: Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x03	0x13	Auto code:1Byte	BCC

Auto code -----

0—Auto function off ,the YHY522R will not auto seek card and the IRQ pin is not active.

1—Auto seek card, if there are cards the RED led will light and IRQ pin output low level.

2—Same 1, and it will read the card id and upload to host, and then halt the card.

3—Same 1, and it will read the selected block and upload to host, and then halt the card.

Table 32. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x13		0x11
Failure	0xAA 0xBB	0x02	0xEE		0xEE

Table 33. Example

Send	<b>AA BB 03 13 00 10</b>					
Description	AA BB 03 13 00 10					
Receive(Success)	<b>AA BB 02 13 11</b>					
Description	AA BB 02 13 11					
Receive(Failure)	<b>AA BB 02 EC EE</b>					
Description	AA BB 02 EC EE					

#### 14. 2. 13 Change\_Card\_Keys

This command will change the card's authentication keys. The card needs to be put on the field when performing this action.

Table 45. Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x1A	0x06	Key Info: 24 bytes	BCC

Key Info: Key type + Sector number + Old Key + New Key + Key A + Access bits + Key B

Key type: 1 byte, 0x00—Key A, 0x01—Key B.

Sector number: 1 byte, 0x00..0x27 (0..39)

Old Key: 6 bytes, default “FFFFFFFFFFFF” (\*)

Key A: 6 bytes new key

Access bits: 4 bytes---‘ FF 07 80 69’

Key B: 6 bytes ----default ‘FF FF FF FF FF FF’

(\*)Note: If auth mode is “1”, then this key is not active, it can be any 6 data bytes.

Table 46. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x06		0x04
Failure	0xAA 0xBB	0x02	0xF9		0xFB

Table 47. Example

Send	<b>AA BB 1A 06 00 08 FF FF FF FF FF FF 00 11 22 33 44 55 FF 07 80 69 FF FF FF FF FF FF 14 (*)</b>													
Description	AA BB 1A 06 00													

	08 <u>FF FF FF FF FF FF</u> 00..55 <u>FF 07 80 69</u> <u>FF FF FF FF FF FF</u> 30	Sector 08 Old Key New key Access bytes Key B BCC
Receive(Success)	<b>AA BB 02 06 04</b>	
Description	AA BB 02 06 04	Head Length Status BCC
Receive(Failure)	<b>AA BB 02 F9 FB</b>	
Description	AA BB 02 F9 FB	Head Length Error BCC

#### 14. 2. 15 Card\_Sleep

This command sets the Card into sleeping. After successfully operation the card will be halt. Reactivate the card need to remove the card from antenna area and put the card into antenna area again. Or reset the YHY522R to repower the card.

Table 51. Command--:Host →YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x02	0x12		0x10

Table 52. Response--: YHY522R →Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x12		0x10
Failure	0xAA 0xBB	0x02	0x ED		0xEF

Table 53. Example

Send	<b>AA BB 02 12 10</b>	
Description	AA BB 02 12 10	Head Length COMMAND BCC
Receive(Success)	<b>AA BB 02 12 10</b>	
Description	AA BB 02 12 10	Head Length Status BCC
Receive(Failure)	<b>AA BB 02 ED EF</b>	
Description	AA BB 02 ED EF	Head Length Error BCC

### 14. 2. 16 Card\_Type

This command reads card type.

*Table 54. Command--:Host → YHY522R*

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x02	0x19		0x1B

*Table 55. Response--: YHY522R → Host*

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x04	0x19	Card type: 2Bytes	BCC
Failure	0xAA 0xBB	0x02	0x E6		0xE4

Card type:

0x0400---Mifare 1k card(s50)

0x0200---Mifare 4k card(s70)

0x4400---UL(NTAG2XX)

*Table 56. Example*

Send	<b>AA BB 02 19 1B</b>		
Description	AA BB 02 19 1B		Head Length COMMAND BCC
Receive(Success)	<b>AA BB 04 19 04 00 19</b>		
Description	AA BB 04 19 04 00 19		Head Length Status Card TYPE 04 00: S50 Card; 02 00: S70 Card BCC
Receive(Failure)	<b>AA BB 02 E6 E4</b>		
Description	AA BB 02 E6 E4		Head Length Error BCC

### 14. 2. 17 Card\_ID

This command read the mifare card UID.

*Table 57. Command--:Host → YHY522R*

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x02	0x20		0x22

*Table 58. Response--: YHY522R → Host*

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x06	0x20	Card ID: 4Bytes	BCC
Failure	0xAA 0xBB	0x02	0x DF		0xDD

Table 59. Example

Send	<b>AA BB 02 20 22</b>	
Description	AA BB 02 20 22	Head Length COMMAND BCC
Receive(Success)	<b>AA BB 06 20 92 BF 72 59 20</b>	
Description	AA BB 06 20 <u>92 BF 72 59</u> 20	Head Length Status Card ID BCC
Receive(Failure)	<b>AA BB 02 DF DD</b>	
Description	AA BB 02 DF DD	Head Length Error BCC

#### 14. 2. 18 Block\_Read

This command reads data from the appointed block. One block has 16 bytes.

Table 60. Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x0A	0x21	Block Info: 8 bytes	BCC

Block Info: Key type +Block number + Key

Key type: 1 byte, 0x00—Key A, 0x01—Key B.

Block number: 1 byte, 0x00..0xff (0..255) (\*)

Key: 6 bytes, default “FFFFFFFFFFFF”

(\*)Note: If auth mode is “1”, then this key is not active, it can be any 6 data bytes.

Table 61. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x12	0x21	Block data: 16Bytes	BCC
Failure	0xAA 0xBB	0x02	0x DE		0xDC

Table 62. Example

Send	<b>AA BB 0A 21 00 08 FF FF FF FF FF FF 23</b>	
Description	AA BB 0A 21 00 08 <u>FF FF FF FF FF FF</u> 23	Head Length COMMAND Authenticate with Key A Read Block 08(Sector 02, 1 <sup>st</sup> block ) Keys BCC

Receive(Success)	<b>AA BB 12 21 00 11 22 33 44 55 66 77 88 99 AA 00 BB CC DD EE</b> <b>FF 23 (*)</b>
Description	AA BB Head 12 Length 21 Status <u>00..FF</u> 16 Bytes Data of Block 08 <u>23</u> BCC
Receive(Failure)	<b>AA BB 02 DE DC</b>
Description	AA BB Head 02 Length DE Error <u>DC</u> BCC

\*If receive one block data include 'AA', then the '00' will be added behind 'AA', but the length does not add 1.

#### 14. 2. 19 Block\_Write

This command writes 16 bytes data to the appointed card's block.

Table 63. Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x1A	0x22	Block Info: 24 bytes	BCC

Block Info: Key type +Block number + Key + BData

Key type: 1 byte, 0x00—Key A, 0x01—Key B.

Block number: 1 byte, 0x01..0xff (1..255)

Key: 6 bytes, default “FFFFFFFFFFFF” (\*)

BData: 16 bytes data to be write into card

(\*)Note: If auth mode is "1", then this key is not active, it can be any 6 data bytes.

Table 64. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x22		0x20
Failure	0xAA 0xBB	0x02	0xDD		0xDF

Table 65. Example

Send	<b>AA BB 1A 22 00 08 FF FF FF FF FF FF 00 11 22 33 44 55 66 77</b> <b>88 99 AA 00 BB CC DD EE FF 30 (*)</b>
Description	AA BB Head 1A Length 22 COMMAND 00 Key type A 08 Write Block 08(Sector 02, 1 <sup>st</sup> block ) <u>FF FF FF FF FF FF</u> <u>00..FF</u> Authenticate with Key A <u>30</u> 16 bytes data BCC
Receive(Success)	<b>AA BB 02 22 20</b>

Description	AA BB 02 22 20	Head Length Status BCC
Receive(Failure)	<b>AA BB 02 DD DF</b>	
Description	AA BB 02 DD DF	Head Length Error BCC

\*If write one block data include 'AA', then the '00' will be added behind 'AA', but the length does not add 1.

#### 14. 2. 20 Value\_Init

This command initializes block as value format. It needs to perform this command before any block to be use as value format.

Below is the description of value block.

##### DATA BLOCKS

All sectors contain 3 blocks of 16 bytes for storing data (Sector 0 contains only two data blocks and the read-only manufacturer block).

The data blocks can be configured by the access bits as

- read/write blocks for e.g. contactless access control or
- value blocks for e.g. electronic purse applications, where additional commands like increment and decrement for direct control of the stored value are provided.

An authentication command has to be carried out before any memory operation in order to allow further commands.

##### Value Blocks

The value blocks allow to perform electronic purse functions (valid commands: *read*, *write*, *increment*,

*decrement*, *restore*, *transfer*).

The value blocks have a fixed data format which permits error detection and correction and a backup management.

A value block can only be generated through a *write* operation in the value block format:

- Value: Signifies a signed 4-byte value. The lowest significant byte of a value is stored in the lowest address byte. Negative values are stored in standard 2's complement format. For reasons of data integrity and security, a value is stored three times, twice non-inverted and once inverted.
- Adr: Signifies a 1-byte address, which can be used to save the storage address of a block, when implementing a powerful backup management. The address byte is stored four times, twice inverted and non-inverted. During *increment*, *decrement*, *restore* and *transfer* operations the address remains unchanged. It can only be altered via a *write* command.

Byte Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Description	Value			Value			Value			Adr		Adr		Adr		

Table 66. Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x0E	0x23	Value Info: 12 bytes	BCC

Value Info: Key type +Block number + Key + Value

Key type: 1 byte, 0x00—Key A, 0x01—Key B.

Block number: 1 byte, 0x01..0xfe (1..254)

Key: 6 bytes, default “FFFFFFFFFFFF” (\*)

Value: 4 bytes value to be write into card, low byte first

(\*)Note: If auth mode is “1”, then this key is not active, it can be any 6 data bytes.

Table 67. Response--: YHY522R →Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x23		0x21
Failure	0xAA 0xBB	0x02	0xDC		0xDE

Table 68. Example

Send	AA BB 0E 23 00 09 FF FF FF FF FF FF 01 00 00 00 25
Description	AA BB Head 0E Length 23 COMMAND 00 Key type A 09 Init Block 09(Sector 02,2nd block ) <u>FF FF FF FF FF FF</u> <u>01 00 00 00</u> <u>25</u> BCC
Receive(Success)	AA BB 02 23 21
Description	AA BB Head 02 Length 23 Status 21 BCC
Receive(Failure)	AA BB 02 DC DE
Description	AA BB Head 02 Length DC Error DE BCC

#### 14. 2. 21 Value\_Read

This command reads value from the appointed block.

Table 69. Command--:Host →YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x0A	0x21	Value Info: 8 bytes	BCC

Value Info: Key type +Block number + Key

Key type: 1 byte, 0x00—Key A, 0x01—Key B.

Block number: 1 byte, 0x01..0xfe (1..254) (\*)

Key: 6 bytes, default “FFFFFFFFFFFF”

(\*)Note: If auth mode is “1”, then this key is not active, it can be any 6 data bytes.

Table 70. Response--: YHY522R →Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x06	0x24	Value: 4Bytes	BCC

Failure	0xAA 0xBB	0x02	0x DB		0xD9
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Table 39. Example

Send	<b>AA BB 0A 24 00 09 FF FF FF FF FF FF 27</b>	
Description	AA BB Head 0A Length 24 COMMAND 00 Authenticate with Key A 09 Read Block 09(Sector 02,2nd block ) <u>FF FF FF FF FF FF</u> <u>27</u> Keys BCC	
Receive(Success)	<b>AA BB 06 24 01 00 00 00 23</b>	
Description	AA BB Head 06 Length 24 Status <u>01 00 00 00</u> <u>23</u> 4 Bytes value BCC	
Receive(Failure)	<b>AA BB 02 DB D9</b>	
Description	AA BB Head 02 Length DB Error <u>D9</u> BCC	

#### 14. 2. 22 Value\_Inc

This command perform value increment.

Table 71. Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x0E	0x25	Value Info: 12 bytes	BCC

Value Info: Key type +Block number + Key + Value

Key type: 1 byte, 0x00—Key A, 0x01—Key B

Block number: 1 byte, 0x01..0xfe (1..254)

Key: 6 bytes, default “FFFFFFFFFFFF” (\*)

Value: 4 bytes value to increment, low byte first

(\*)Note: If auth mode is “1”, then this key is not active, it can be any 6 data bytes.

Table 72. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x25		0x27
Failure	0xAA 0xBB	0x02	0xDA		0xD8

Table 73. Example

Send	<b>AA BB 0E 25 00 09 FF FF FF FF FF FF 01 00 00 00 23</b>	
Description	AA BB Head 0E Length <u>25</u> COMMAND	

	00 09 <u>FF FF FF FF FF FF</u> <u>01 00 00 00</u> <b>23</b>	Key type A Block 09(Sector 02,2nd block ) Authenticate with Key A 4 bytes value BCC
Receive(Success)	<b>AA BB 02 25 27</b>	
Description	AA BB 02 25 27	Head Length Status BCC
Receive(Failure)	<b>AA BB 02 DA D8</b>	
Description	AA BB 02 DA D8	Head Length Error BCC

#### 14. 2. 23 Value\_Dec

This command perform value decrement.

Table 74. Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x0E	0x26	Value Info: 12 bytes	BCC

Value Info: Key type +Block number + Key + Value

Key type: 1 byte, 0x00—Key A, 0x01—Key B

Block number: 1 byte, 0x01..0xfe (1..254)

Key: 6 bytes, default “FFFFFFFFFFFF” (\*)

Value: 4 bytes value to decrement, low byte first

(\*)Note: If auth mode is “1”, then this key is not active, it can be any 6 data bytes.

Table 75. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x26		0x24
Failure	0xAA 0xBB	0x02	0xD9		0xDB

Table 76. Example

Send	<b>AA BB 0E 26 00 09 FF FF FF FF FF FF 01 00 00 00 20</b>
Description	AA BB 0E 23 00 09 <u>FF FF FF FF FF FF</u> <u>01 00 00 00</u> <b>20</b> Head Length COMMAND Key type A Block 09(Sector 02,2nd block ) Authenticate with Key A 4 bytes value BCC
Receive(Success)	<b>AA BB 02 26 24</b>

Description	AA BB 02 26 24	Head Length Status BCC
Receive(Failure)	<b>AA BB 02 D9 DB</b>	
Description	AA BB 02 D9 DB	Head Length Error BCC

#### 14. 2. 24 Value\_Backup

This command will backup one block value to another block in the same Sector.

Table 77. Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x0B	0x27	Backup Info: 9 bytes	BCC

Backup Info: Key type + Key + Source block + Target block

Key type: 1 byte, 0x00—Key A, 0x01—Key B

Key: 6 bytes, default “FFFFFFFFFFFF” (\*)

Source block: 1 byte

Target block: 1 byte

(\*)Note: If auth mode is “1”, then this key is not active, it can be any 6 data bytes.

Table 78. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x27		0x25
Failure	0xAA 0xBB	0x02	0xD8		0xDA

Table 79. Example

Send	<b>AA BB 0B 27 00 FF FF FF FF FF FF 09 0A 2F</b>				
Description	AA BB 0B 27 00 <u>FF FF FF FF FF FF</u> <u>09</u> <u>0A</u> <u>2F</u>				
Receive(Success)	<b>AA BB 02 27 25</b>				
Description	AA BB 02 27 25				
Receive(Failure)	<b>AA BB 02 D9 DB</b>				
Description	AA BB 02				

	<b>D8</b> <b>DA</b>	<i>Error</i> <i>BCC</i>
--	------------------------	----------------------------

## 14.2.25 Sector\_Read

This command reads data from the appointed sector. One sector has 3 blocks(48 bytes, sector 0 to 31) . This command would not read the tailor block.

*Table 80. Command--:Host → YHY522R*

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x0A	0x2A	Sector Info: 8 bytes	BCC

Sector Info: Key type + Sector number + Key

Key type: 1 byte, 0x00—Key A, 0x01—Key B.

Sector number: 1 byte, 0x00..0x1F (0..31) (\*)

Key: 6 bytes, default “FFFFFFFFFFFF”

(\*)Note: If auth mode is "1", then this key is not active, it can be any 6 data bytes.

*Table 81. Response--: YHY522R → Host*

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	Len	0x2A	Sector data: 49 Bytes	BCC
Failure	0xAA 0xBB	0x02	0xD5		0xD7

Len:-----

0x33 (51)—if sector is 0-31

Sector data: Sector number(1 byte) + Blocks data(48 Bytes)

*Table 82. Example*

	D7	BCC
--	----	-----

#### 14. 2. 26 Sector Write

This command writes 48/240 bytes data to the appointed sector.  
One sector has 3 blocks(48 bytes, sector 0 to 31) .This command can not write the tailor block and sector 0, sector 0 include block 0 which is read only.

Table 83. Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	Len	0x2B	Write Info: 48 bytes	BCC

Len:-----

0x3A (58)—if sector is 0-31

Write Info: Key type +Sector number + Key + SData

Key type: 1 byte, 0x00—Key A, 0x01—Key B.

Sector number: 1 byte, 0x01..0x1F (1..31)

Key: 6 bytes, default “FFFFFFFFFFFF” (\*)

SData: 48 Bytes data to be write into card

(\*)Note: If auth mode is “1”, then this key is not active, it can be any 6 data bytes.

Table 84. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x2B		0x29
Failure	0xAA 0xBB	0x02	0xD4		0xD6

Table 85. Example

Send	AA BB 3A 2B 00 01 FF FF FF FF FF FF 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 22 22 22 22 11 22 22 22 22 11 22 22 22 22 11 22 22 22 22 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 10	
Description	AA BB 3A 2B 00 01 FF FF FF FF FF FF 11 ..33 10	Head Length COMMAND Key type A Write Sector 01 Authenticate with Key A 48 bytes data BCC
Receive(Success)	AA BB 02 22 20	
Description	AA BB 02 2B 29	Head Length Status BCC
Receive(Failure)	AA BB 02 DD DF	
Description	AA BB	Head

	<b>02</b>	Length
	<b>D4</b>	Error
	<b>D6</b>	BCC

-----UL commands-----

#### 14. 2. 27 Pages\_Read\_UL

This command reads 4 continuous pages data from the appointed start page.

Table 86. Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x03	0x28	Start page	BCC

Table 87. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x12	0x28	4 pages data: 16Bytes	BCC
Failure	0xAA 0xBB	0x02	0xD7		0xD5

Table 88. Example

Send	<b>AA BB 03 28 03 28</b>				
Description	AA BB Head 03 Length 28 COMMAND 03 Start page 28 BCC				
Receive(Success)	<b>AA BB 12 28 00 11 22 33 44 55 66 77 88 99 AA 00 BB CC DD EE</b> <u><b>FF 3A (*)</b></u>				
Description	AA BB Head 12 Length 28 Status <u>00...FF</u> 16 Bytes Data 3A BCC				
Receive(Failure)	<b>AA BB 02 D7 D5</b>				
Description	AA BB Head 02 Length D7 Error D5 BCC				

\*If receive one block data include 'AA', then the '00' will be added behind 'AA', but the length does not add 1.

#### 14. 2. 28 Page\_Write\_UL

This command write 4 bytes data into one page of the UL chip.

Table 89 Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum

	0xAA 0xBB	0x07	0x29	Page Info: 5 bytes	BCC
--	-----------	------	------	-----------------------	-----

Page Info: 1byte(page address)+4 bytes data

Table 90. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x29		0x2B
Failure	0xAA 0xBB	0x02	0xD6		0xD4

Table 91. Example

Send	<b>AA BB 07 29 08 01 00 00 00 27</b>				
Description		AA BB 07 29 08 <u>01 00 00 00</u> 27	Head Length COMMAND Page 08 4 bytes BCC		
Receive(Success)	<b>AA BB 02 29 2B</b>				
Description		AA BB 02 29 2B	Head Length Status BCC		
Receive(Failure)	<b>AA BB 02 D6 D4</b>				
Description		AA BB 02 D6 D4	Head Length Error BCC		

#### 14. 2. 29 Ntag\_Read\_Text

This command will read the NTAG213 NDEF text data. Send command "aabb03130010" to switch off the auto scan, then send "AA BB 02 20 22" to get the UID of the tag, at last you can send this command to read the NDEF data.

Table 92. Command--: Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	0x02	0x40	-	0x42

Table 93. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	Len	0x40	Text	BCC
Failure	0xAA 0xBB	0x02	0xBF	-	0xBD

Table 94. Example

Send	<b>AA BB 02 40 42</b>				
Description		AA BB	Head		

	<b>02</b>	<i>Length</i>
	<b>40</b>	<i>COMMAND</i>
	<b>42</b>	<i>BCC</i>
Receive(Success)	<b>AA BB 0C 40 30 31 32 33 34 35 36 37 38 39 4D</b>	
Description	<b>AA BB</b>	<i>Head</i>
	<b>0C</b>	<i>Length</i>
	<b>40</b>	<i>Status</i>
	<b>30..39</b>	<i>"0-9" ascii代码</i>
	<b>4D</b>	<i>BCC</i>
Receive(Failure)	<b>AA BB 02 BF BD</b>	
Description	<b>AA BB</b>	<i>Head</i>
	<b>02</b>	<i>Length</i>
	<b>BF</b>	<i>Error</i>
	<b>BD</b>	<i>BCC</i>

#### 14. 2. 30 Ntag\_Write\_Text

This command can write the NDEF text data into the NTAG213 chip.

Table 95 Command--:Host → YHY522R

Send	Header	Length	Command	Data	XOR Checksum
	0xAA 0xBB	Len1	0x41	Data	BCC

#### Data=Lock+Len2+Text

Lock: 00-rewrite, 01-Lock(read only)

Len2: length of the text, up to 58 bytes;

Text: NFC NDEF ascii code.

Table 96. Response--: YHY522R → Host

Receive	Head	Length	Status	Data	XOR Checksum
Success	0xAA 0xBB	0x02	0x41		BCC
Failure	0xAA 0xBB	0x02	0xBE		0xBC

Table 97. Example

Send	<b>AA BB 0E 41 00 0a 30 31 32 33 34 35 36 37 38 39 44</b>	
Description	<b>AA BB</b>	<i>Head</i>
	<b>0E</b>	<i>Length</i>
	<b>41</b>	<i>COMMAND</i>
	<b>00</b>	<i>Unlock</i>
	<b>0a</b>	<i>Text length</i>
	<b>30..39</b>	<i>"0..9"</i>
	<b>44</b>	<i>BCC</i>
Receive(Success)	<b>AA BB 02 41 43</b>	
Description	<b>AA BB</b>	<i>Head</i>
	<b>02</b>	<i>Length</i>
	<b>41</b>	<i>Status</i>
	<b>43</b>	<i>BCC</i>

Receive(Failure)	AA BB 02 BE BC				
Description	AA BB 02 BE BC	Head Length Error BCC			

---

## 15. Electrical Characteristics

### 15.1 Operating Condition

Table 86: Operating Condition Range

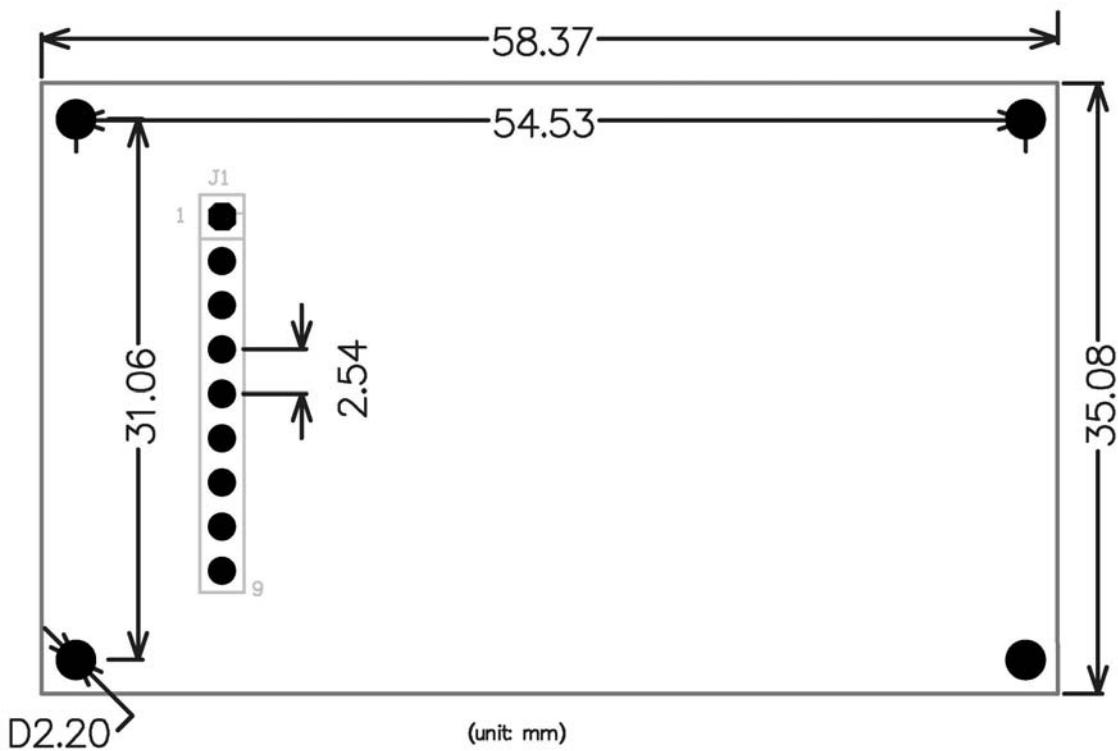
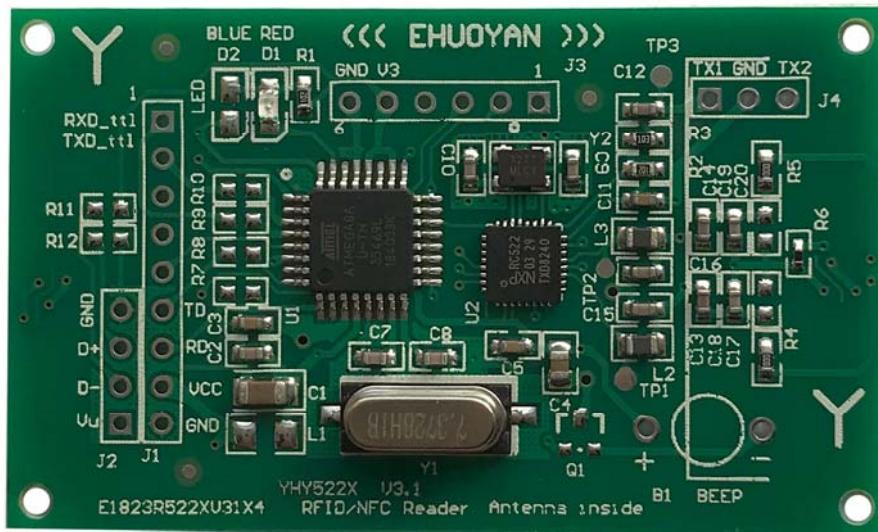
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Tamb	Ambient Temperature	-	-25	+25	+85	°C
V <sub>CC</sub>	DC Supply Voltages	GND = 0V	2.7	5.0	7.0	V
RD	Reading Distance	V <sub>CC</sub> = 5.0V	0	50	60	mm
WD	Writing Distance	V <sub>CC</sub> = 5.0V	0	40	50	mm

### 15.2 Current Consumption

Table 87: Current Consumption

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
I <sub>VCC</sub>	Supply Current V <sub>CC</sub> =2.7V-3.6V	Continuous read or write		43	65	mA
		Antenna Soft Power Down		25	30	mA
		Module Hard Power Down		-	100	µA

## 16. Package outline



*Figure 8– YHY522R Top view*



Figure 9– YHY522R Side View

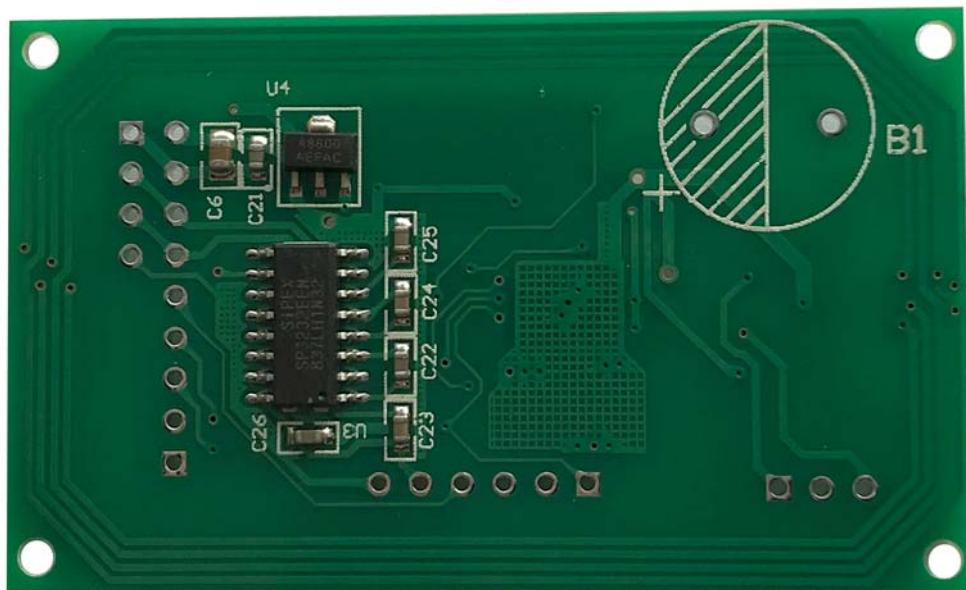


Figure 10– YHY522R Back side View

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## 17. Contact information

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To obtain information about EHUYOAN sales and technical information, please reference the following information.

### **Contact Information:**

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