

# UHF RFID Reader Plus

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## Protocol Application Example

Version 1.3

2015/1/29

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## 1.0. RFID Command Overview

| Command*   | Return Message**  | Description                     |
|--|---|---------------------------------|
| <b>V</b>   | Vxxyy,<message><br>xx: major version number<br>yy: minor version number<br><message>: other info.   | display reader firmware version |
| <b>S</b>   | S01234567<br>01234567 is reader ID  | display reader ID               |
| <b>Q</b>   | Q<none or EPC><br><none or EPC><br>none: no tag in RF field<br>EPC: PC+EPC+CRC16  | display tag EPC ID              |
| R<bank>,<address>,<length><br><bank> memory bank<br>0: reserved<br>1: EPC<br>2: TID<br>3: USER<br><address> start address<br>0 ~ 3FFF<br><length> read word length<br>1 ~ 20 | R<none or read data> or<br><error code><br><none or read data><br>none: no tag in RF field<br><Error code><br>0: other error<br>3: memory overrun<br>4: memory locked<br>B: Insufficient power<br>F: Non-specific error | read tag memory data            |

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|   |   |                          |
|---|---|--------------------------|
| <b>W</b> <bank>,<address>,<length>,<data><br><bank> memory bank<br>0: reserved<br>1: EPC<br>2: TID<br>3: USER<br><address> start address<br>0 ~ 3FFF<br><length> write words length<br>1 ~ 20 | <b>W</b> <none or <OK>> or <error code><br><none or <OK>><br>none: no tag in RF field<br><OK>: written ok<br><error code><br>0: other error<br>3: memory overrun<br>4: memory locked<br>B: Insufficient power<br>F: Non-specific error<br>Z00~Z1F: words write<br>3Z00~3Z1F: error code and words write | write data to tag memory |
| <b>K</b> <password>,<recom><br><password> kill password<br>00000000~FFFFFFFF<br><recom> recommissioning<br>0~7  | <b>K</b> <none or <OK>> or <error code><br><none or <OK>><br>none: no tag in RF field<br><OK>: kill ok<br><error code><br>0: other error<br>3: memory overrun<br>4: memory locked<br>B: Insufficient power<br>F: Non-specific error   | kill tag                 |

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|  |  |  |
|--|--|--|
| <b>L</b> <mask>,<action><br><mask> lock mask<br>000~3FF<br><action> lock action<br>000~3FF | <b>L</b> <none or <OK>> or<br><error code><br><none or <OK>><br>none: no tag in RF field<br><OK>: lock ok<br><error code><br>0: other error<br>3: memory overrun<br>4: memory locked<br>B: Insufficient power<br>F: Non-specific error | lock memory  |
| <b>P</b> <password><br><password> access password<br>00000000~FFFFFFFF                     | <b>P</b>   | set access password for R<br>W L command, one time<br>use  |
| <b>U</b>   | <b>U</b> <none or EPC><br><none or EPC><br>none: no tag in RF field<br>EPC: PC+EPC+CRC16   | Multi-TAG read EPC   |
| <b>G1</b><br><b>G0</b><br><b>G2</b>  | <b>G1</b><br><b>G0</b><br><b>G2</b>  | Start command logging<br>End command logging<br>Run logging commands<br>For external TACT<br>switch function |

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|  |  |   |
|--|--|---|
| <b>T&lt;bank&gt;,&lt;bit address&gt;,&lt;bit length&gt;,&lt;bit data&gt;</b><br><bank> memory bank<br>0: reserved<br>1: EPC<br>2: TID<br>3: USER<br><bit address> start bit address<br>0~3FFF<br><bit length> select bit length<br>1~60<br><bit data> select bit mask data | <b>T</b>   | Select matching tag, one time use                     |
| <b>N0,00</b><br><br><b>N1, &lt;value&gt;</b><br><value> 00~14  | <b>N&lt;value&gt;</b><br><br><b>&lt;NULL&gt;</b> | read RFID power level<br><br>set RFID power(-2~18dBm) |
| <b>N4,00</b><br><br><b>N5, &lt;value&gt;</b><br><value> 01~05<br>01: US 902~928<br>02: TW 922~928<br>03: CN 920~925<br>04: CN2 840~845<br>05: EU 865~868   | <b>N&lt;value&gt;</b><br><br><b>&lt;NULL&gt;</b> | read Regulation<br><br>set Regulation                 |

\*command is start with <LF> stop with <CR>

\*Return Message is start with <LF> stop with <CR><LF>

## 2.0. Command overview

V S N command is for Reader information and parameter command. User can run in any time after reader power up.

Q R W K L U T command is for TAG operation. In multi-TAG application, user can/must combination command for a TAG operation.

In single TAG operation environment, user can do P Q R W K L command.

In multi-TAG operation environment, only U command support multi-TAG Read EPC. Otherwise, user can or must combination T P U R W K L command for a single particular TAG operation.

## 2.1. V: display reader firmware version

After sending V command, reader return firmware message and hardware information.

**Host:** <LF>V<CR>

**Reader:** <LF>VC1C6,9B9F5244,B0,2<CR><LF>

Note:

|                 |                    |
|-----------------|--------------------|
| <b>C1C6</b>     | firmware version   |
| <b>9B9F5244</b> | reader ID          |
| <b>B0</b>       | hardware version   |
| <b>2</b>        | RF band regulation |

## 2.2. S: display reader ID

After sending S command, reader returns reader ID.

**Host:** <LF>S<CR>

**Reader:** <LF>S9B9F5244<CR><LF>

Note:

|                 |           |
|-----------------|-----------|
| <b>9B9F5244</b> | reader ID |
|-----------------|-----------|

## 2.3. Q: display tag EPC ID

Q command reading EPC ID and only support single TAG in RF field. If there are no TAG or multi TAG in RF field, reader only return Q data.

**Host:** <LF>Q<CR>

**Reader:** <LF>Q<CR><LF>

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If single TAG in RF field, after sending Q command, reader returns EPC ID, The EPC ID include PC word, EPC and CRC16.

**Host:** <LF>Q<CR>

**Reader:** <LF>Q34006666777788889999AAAABBBB71FE<CR><LF>

Note:

|                          |         |
|--------------------------|---------|
| 3400                     | PC word |
| 6666777788889999AAAABBBB | EPC     |
| 71FE                     | CRC16   |

## 2.4. R: read tag memory data

R command read TAG memory data and only support single TAG in RF field. R command can read TAG memory data; include Reserved, EPC, TID and User bank. R command can read address start form 0 to 16383(3FFFh) and support read 32 words in single command.

If there are no TAG or multi TAG in RF field, reader only return R data.

**Host:** <LF> R0,0,4<CR>

**Reader:** <LF>R<CR><LF>

Read Reserved bank kill and access password. If kill and access bank not read/ write locked.

**Host:** <LF>R0,0,4<CR>

**Reader:** <LF>R111111122222222<CR><LF>

Note:

|          |                 |
|----------|-----------------|
| 11111111 | kill password   |
| 22222222 | access password |

Read EPC bank start word address from 2 and 6 word length.

**Host:** <LF>R1,2,6<CR>

**Reader:** <LF>R6666777788889999AAAABBBB<CR><LF>

Read TID bank start word address from 0 and 4 word length.

**Host:** <LF>R2,0,4<CR>

**Reader:** <LF>RE20034120136F800<CR><LF>

Read USER bank start word address from 0 and 32 word length.

**Host:** <LF>R3,0,20<CR>

**Reader:** <LF>R0000111122223333444455556666777788889999AAAAB BBB  
CCDDDDDEEEEEFFFF00001111222233334444555566667  
77788889999AAAABBBBCCDDDDDEEEEEFFFF<CR><LF>



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If the read command and TAG not match, reader may return data error message. In this case, kill and access password is read/write locked, after sending R command, reader return error code, memory locked.

**Host:** <LF> R0,0,4<CR>

**Reader:** <LF>4<CR><LF>

Note: error code is based on TAG return message.

|   |                    |
|---|--------------------|
| 0 | other error        |
| 3 | memory overrun     |
| 4 | memory locked      |
| B | Insufficient power |
| F | Non-specific error |

## 2.5. W: write data to tag memory

W command write TAG memory data and only support single TAG in RF field. W command can write TAG memory data, include Reserved, EPC and User bank. W command can write address start from 0 to 16383(3FFFh) and support write 32 words in single command.

Write User bank, address start at 0, word length is 8.

**Host:** <LF>W3,0,8,00001111222233334444555566667777<CR>

**Reader:** <LF>W<OK><CR><LF>

In this case, writing TAG get error message. First, read the TAG User Bank data is **00001111222233334444555566667777h**, then write zero data to replace it, but reader return **Z04** message, it means some data write fail, Z04 means the write word index 00~04 may be write success. We read the bank again, the data is **00000000000000000000555566667777h**. In this situation, move the TAG close to ANTENNA and write again can fix it.

**Host:** <LF>R3,0,8<CR>

**Reader:** <LF>R00001111222233334444555566667777<CR><LF>

**Host:** <LF>W3,0,8,00000000000000000000000000000000<CR>

**Reader:** <LF>Z04<CR><LF>

**Host:** <LF>R3,0,8<CR>

**Reader:** R00000000000000000000555566667777<CR><LF>

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### 2.6. K: kill tag

If TAG Kill pwd is not zero, K command can kill the TAG. If the TAG is killed, the TAG shall not respond to any command.

**Host:** <LF>K12341234,0<CR>

**Reader:** <LF>K<OK><CR><LF>

### 2.7. L: lock memory

Lock command is used to:

- Lock individual passwords (Kill pwd & Access pwd) – preventing or allowing subsequent reads and writes of that password
- Lock individual memory banks(EPC, TID, USER) – preventing or allowing subsequent writes to that memory bank
- Permalock – make the lock status permanently unchangeable for a password or memory bank mask field bits

|    |    | Kill pwd       |                | Access pwd     |                | EPC memory     |                | TID memory     |                | User memory    |                |
|----|----|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 11 | 10 | 9              | 8              | 7              | 6              | 5              | 4              | 3              | 2              | 1              | 0              |
| 0  | 0  | skip/<br>write | skip/<br>write | skip/<br>write | skip/<br>write | skip/<br>write | skip/<br>write | skip/<br>write | skip/<br>write | skip/<br>write | skip/<br>write |

bit = 0: Ignore the associated Action field and retain the current lock setting.

bit = 1: Implement the associated Action field and overwrite the current lock setting.

action field bits

|    |    | Kill pwd          |               | Access pwd        |               | EPC memory   |               | TID memory   |               | User memory  |               |
|----|----|-------------------|---------------|-------------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|
| 11 | 10 | 9                 | 8             | 7                 | 6             | 5            | 4             | 3            | 2             | 1            | 0             |
| 0  | 0  | pwd<br>read/write | perma<br>lock | pwd<br>read/write | perma<br>lock | pwd<br>write | perma<br>lock | pwd<br>write | perma<br>lock | pwd<br>write | perma<br>lock |

bit = 0: Deassert lock for the associated memory location.

bit = 1: Assert lock or permalock for the associated memory location.

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### Action-field functionality

| pwd-write | permalock | Description   |
|-----------|-----------|---|
| 0         | 0         | Associated memory bank is writeable                                     |
| 0         | 1         | Associated memory bank is permanently writeable and may never be locked |
| 1         | 0         | Associated memory bank is writeable if ACCESS password is correct       |
| 1         | 1         | Associated memory bank is not writeable                                 |

| pwd-read/write | permalock | Description  |
|----------------|-----------|--|
| 0              | 0         | Associated password location is readable and writeable                               |
| 0              | 1         | Associated password location is readable and writeable and may never be locked       |
| 1              | 0         | Associated password location is readable and writeable if ACCESS password is correct |
| 1              | 1         | Associated password location is not readable and writeable                           |

In memory lock operation, need ACCESS pwd to protect writable or readable/writable, we need P command to set ACCESS operation, please refer to P command.

Below Example is protect the Kill password not readable/writable. If TAG's Kill pwd and ACCESS pwd is zero. First, we write the KILL pwd 01230123h and ACCESS pwd CDEF CDEFh, then do lock operation to protect

1. Write reserved bank, KILL pwd: 01230123h, ACCESS pwd: CDEF CDEFh

**Host:** <LF>W0,0,4,01230123CDEF CDEF<CR>

**Reader:** <LF>W<OK><CR><LF>

2. Set ACCESS password, next command do ACCESS operation

**Host:** <LF>PCDEF CDEF<CR>

**Reader:** <LF>P<CR><LF>

3. Use L command to set Kill pwd readable/writable protect

**Host:** <LF>L200,200<CR>

**Reader:** <LF>L<OK><CR><LF>

4. Read reserved bank, kill pwd memory read/write locked, reader return lock message

**Host:** <LF>R0,0,2<CR>

**Reader:** <LF>4<CR><LF>

5. Set access pwd: CDEF CDEFh, next command do ACCESS operation

**Host:** <LF>PCDEF CDEF<CR>

**Reader:** <LF>P<CR><LF>

**Reader: <LF>R01230123<CR><LF>**

## 2.8. P: set ACCESS password for ACCESS operation

P command support R W L command. Use the P command by following R W L command every time. P command can use with T command do select operation. In multi-TAG application, user can use T to select a TAG, then P assign ACCESS password to do R W L operation. After R W L command, T and P will clear, there are one time use command. Please reference T command for operation.

If USER memory bank is writable locked. We know ACCESS pwd is CDEFCDEFh, use P command and W command to write data.

**Host: <LF>PCDEFCDEF<CR>**

**Reader: <LF>P<CR><LF>**

**Host: <LF>W3,0,8,00001111222233334444555566667777<CR>**

**Reader: <LF>W<OK><CR><LF>**

## 2.9. U: Multi-TAG read EPC

U command support multi-TAG reading EPC in RF field, after sending U command, reader return EPC like Q command, but reader return message is end by single U data.

Bellow example is read 5 TAG EPC in RF field. There are 3 TAG's EPC length is 6word and 2 TAG's EPC length is 31 word.

**Host:** <LF>U<CR>

**Reader:**

<LF>U30003005FB63AC1F3841EC880467F29E<CR><LF>

<LF>U340027BC7A2CE826ADB871EA00AE6F36<CR><LF>

```
<LF>UFC000101AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
```

[illegible]

**0000000000000067E3<CR><LF>**

<LF>U3000300833B2DDD901400000000039BB<CR><LF>

**<LF>UF800000100020003000400050006000700080009000A000B000C000D000E000F00**

10001100120013001400150016001700180019001A001B001C001D001E001FFA1F<

**CR><LF>**

$$\langle \mathbf{LF} \rangle \mathbf{U} \langle \mathbf{CR} \rangle \langle \mathbf{LF} \rangle$$

## 2.10. G: logging command operation

G command is a special command, it can logging command set in the reader's non-volatile memory. G command is start at G1, end at G0, G2 is running the memorized command set. Clean the memorized command is start at G1 and followed by G0.

The example setting a command set to display EPC and read TID memory.

|                         |                            |
|-------------------------|----------------------------|
| Host: <LF>G1<CR><LF>    | start logging              |
| Host: <LF>Q<CR>         | display EPC                |
| Reader: <LF>QF8<CR><LF> | remain 248 charter can log |
| Host: <LF>R2,0,4<CR>    | Read TID memory            |
| Reader: <LF>RF1<CR><LF> | remain 241 charter can log |
| Host: <LF>G0<CR>        | end logging                |

After sending G2 command, reader do a memorized command, return message bellow.

Host: <LF>G2<CR>  
Reader:  
    <LF>G2<CR><LF>  
    <LF>Q30006666777788889999AAAABBBB8C5B<CR><LF>  
    <LF>RE20034120136F800<CR><LF>

## 2.11. T: Select matching tag

In multi-TAG application or critical issue application, T command can select particular TAG to do Q R W K L P U commands. After Q R W K L U command, T and P will clear, there are one time use. If you want to select same or another TAG, you must do T command again.

Two TAG in RF field, read the EPC.

Host: <LF>U<CR>  
Reader:  
    <LF>U30006666777788889999AAAABBBB8C5B<CR><LF>  
    <LF>U30009908040B00000000000052D02021<CR><LF>  
    <LF>U<CR><LF>

Select a TAG's EPC data start at bit address 32(20h), bit length is 64(40h), mask data is 6666777788889999h, and read the TAG's EPC bank start at word address 6, word length is 2.

Host: <LF>T1,20,40,6666777788889999<CR>  
Reader: <LF>T<CR><LF>  
Host: R1,6,2<CR>  
Reader: <LF>RAAAABBBB<CR><LF>

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If the TAG's EPC data is 30009908040B00000000000052D02021h and kill password is read/write lock, we want to read kill password. The procedure is select the TAG, set ACCESS password(ABCDABCDh), read kill password(ABABABABh).

**Host: <LF>T1,20,60, 9908040B00000000000052D0<CR>**

**Reader: <LF>T<CR><LF>**

**Host: <LF>PCDEFCDEF<CR>**

**Reader: <LF>P<CR><LF>**

**Host: R0,0,2<CR>**

**Reader: <LF>RABABABAB<CR><LF>**

### 2.12. N0/N1: Read/Set RF power level

N command can setting the Reader RF output power. In application, user can reduce output power to do short range operation.

**Host: <LF>N0,00<CR>** read RF power level

**Reader: <LF>N14<CR><LF>** RF power is 18dBm

**Host: <LF>N1,02<CR>** set RF power level to 0dBm,

Note:

Setting RF power, reader no return message and will re-startup.

### 2.13. N4/N5: Read/Set RF Regulation

N command can setting the Reader RF regulation.

**Host: <LF>N4,00<CR>** read regulation

**Reader: <LF>N02<CR><LF>** regulation is 02: TW 922~928MHz

**Host: <LF>N5,03<CR>** set regulation to CN: 920~925MHz

Note:

Setting regulation , reader no return message and will re-startup.