

RFID Reader Manual

(SST-US-URF01A)



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1. Overview of UHF RFID Reader

This product is RFID reader to transmit car information to a remote server for the purpose of electronic toll collection system with RF technology. The reader reads car information from TAG ID, which is embedded in TAG, and sends this information to the remote server. This reader can be used for 4 channels if it is connected to 4 antennas and can be used with parts of all antennas. The reader uses TCP/IP(Ethernet), RS-232 and RS-485 for transmitting TAG ID and receiving commands from and to the remote server. Between RS-232 and RS-485, one interface is selected for being used as communication interface and this is determined by dip switches in the MCU board. In addition, the reader has RS-422 interface to communicate with other devices, such as laser or camera, and has sync port to synchronize the operations of multi-readers. Relay interface can be used to control the switch of an outer device. The debug port is provided so that it can receive commands from user and display the status of reader. LED interface shows the status of reader and antennas. This product uses DC-24V.

2. Outer Image of Reader



(Figure 1) RFID Reader (SST-US-URFR01A)

3. Outer Image of Antenna



(Figure 2) Antenna (SST-US-URFA01A)

4. The method of power connection

Connect the power connector (Left of Figure3), located at the right-bottom side of a front panel, with SMPS(DC24V) power connector (Right of Figure3).



(1) Connection Power connector of Reader with connector of SMPS cable



(2) Power Cable

(Figure 3) Power Connection of RFID Reader

5. The method of Reader connection with Antenna



(1) Antenna connector of Reader



(2) Connector of Antenna

(그림4) Connection of RFID Reader with Antenna

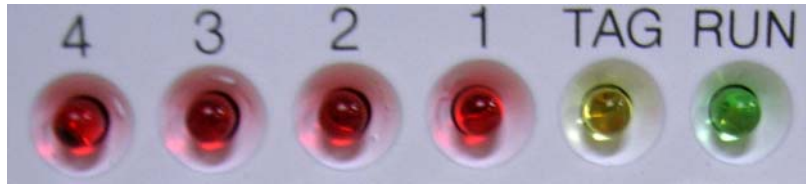
As in Figure 4 (1), Connect Rx, Tx TNC connector with Rx, Tx connector of Antenna with antenna cable. The reader has total 4 antenna connector ports and each port has Rx, Tx port separately. The Figure shows the first antenna is selected. Connect Rx connector of reader's antenna port to Rx connector in an antenna and connect Tx connector of reader's antenna port to Tx connector in an antenna. When all antennas are not selected, it is safe to connect dummy loads to unconnected antenna ports in a reader (Antenna selection is made in configuration menu of CPR503 program. Refer to Figure 29). If RF signal is output through unconnected antenna port, it would give a damage to a power amplifier in a reader.

6. Outer Interface of Reader



(1) LED Indicator

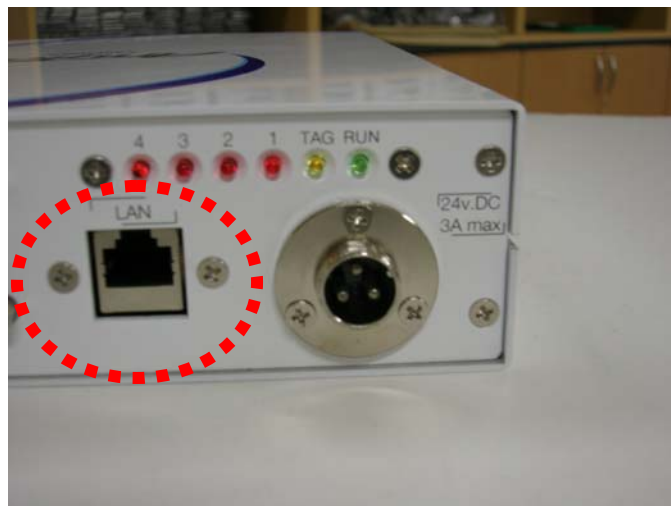
There are 6 leds in LED indicator interface. The RUN led lights as soon as power is inserted into reader and it blinks every 0.5 second after CPU is booted. TAG led is toggled on receiving Tag ID. (Tag led is operated only if buzzer option is selected as ON) The remaining 4 red-leds indicate the antenna being used. For example, if the first red-led lights, it tells that the 1st Antenna is being used.



(Figure 5) LED Indicators

(2) LAN

LAN is used for communicating with a remote server. It supports up to 100Mbps. By default, the IP address of a reader is set to 70.7.44.102.



(Figure 6) LAN Port

(3) SYNC

SYNC port is used to synchronize the readers in the case multi-readers occur the interference to each other.

SYNC port uses the same communication method as RS-422.

2	Synchro.Z	X34.3	Yellow
5	Syncro.GND	X34.2	Black
3	Synchro.Y	X34.1	White
6	Synchro.A	X34.5	White
7	Synchro.B	X34.4	Red

Table 1) DB9 pin map of SYNC port



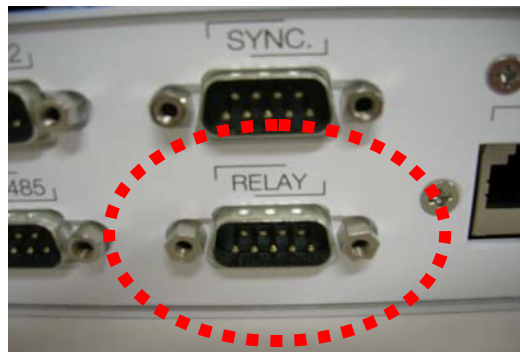
(Figure 6) SYNC port

(4) RELAY

Relay is used to control the outer device as a switch..

1	Opto.A	X36.4	Yellow
2	Opto.C	X36.3	White
4	Relay.1	X36.2	Red
5	Relay.2	X36.1	Black

Table 2) DB9 pin map of REALY port



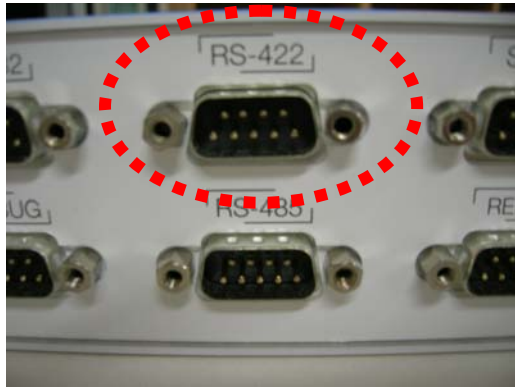
(Figure 7) RELAY port

(5) RS-422

RS-422 is used to communicate with outer devices. Currently the communication speed of RS-422 of the reader is fixed to 115200 bps.

2	RS422.Z	X33.3	Yellow
5	RS422.GND	X33.2	Black
3	RS422.Y	X33.1	White
6	RS422.A	X33.6	White
8	RS422.GND	X33.5	Red
7	RS422.B	X33.4	Black

Table 3) DB9 pin map of RS-422 Port



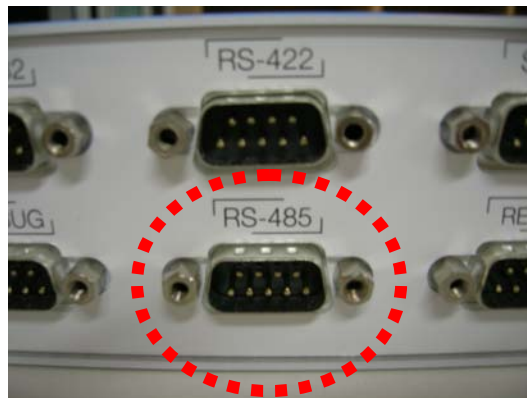
(Figure 8) RS-422 port

(6) RS-485

RS-485 is used to communicate with outer devices or a remote server. Currently the communication speed of RS-485 of a reader is fixed to 9600bps.

7	RS485.B	X32.6	Red
8	RS485.GND	X32.5	Black
6	RS485.A	X32.4	White

Table 4) DB9 pin map of 485 port



(Figure 9) RS-485 port

(7) RS-232

RS-232 is used to communicate with outer devices or a remote server. Currently the communication speed of RS-232 of a reader is fixed to 9600bps

3	RS232.TX	X32.8	White
2	RS232.RX	X32.7	Yellow
5	GND	X32.2	Black

Table 5) DB9 pin map of RS-232 port



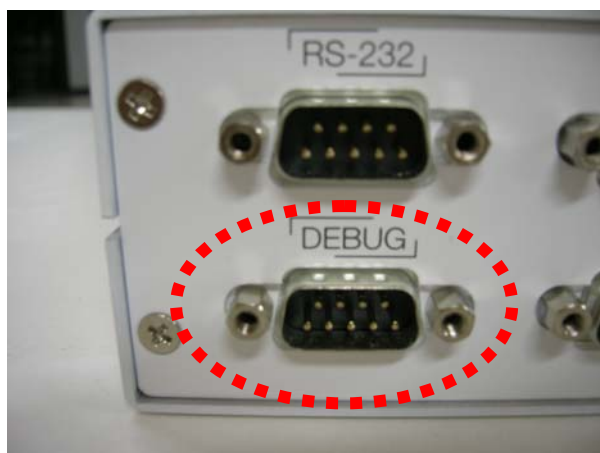
(Figure 10) RS-232 port

(8) DEBUG

DEBUG port is used when the user want to see the status of a reader or he want to input commands to a reader. It is a console of linux device. The command input method will be explained next chapter 9.

3	Debug.TX	X31.3	White
5	Debug.GND	X31.2	Black
2	Debug.RX	X31.1	Yellow

Table 6) DB9 pin map of debug port



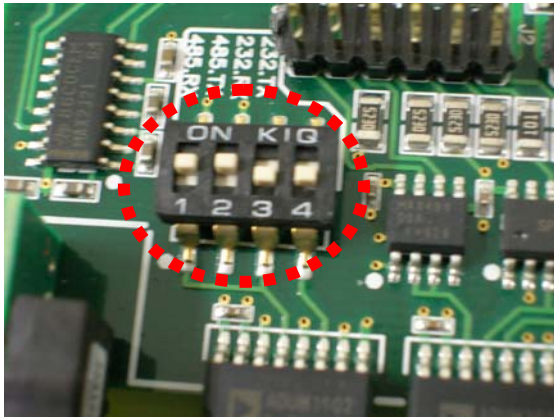
(Figure 11) DEBUG port

7. The setting of serial communication mode (DIP switch setting)

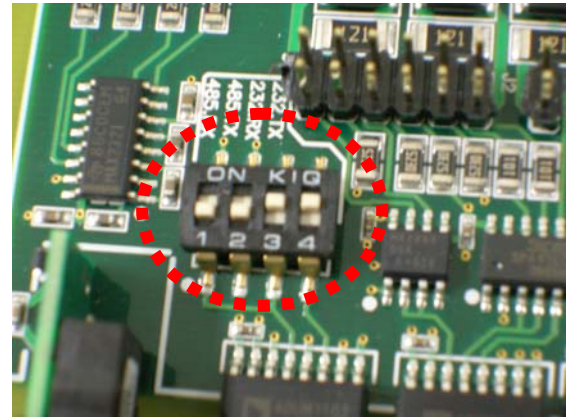
DIP switch is used to set the communication mode to RS-232 or RS-485. Only one mode between RS-232 and RS-485 is used. If number 1, 2 switches are ON, RS-232 mode is activated and if number 3,4 switches are ON, RS-485 mode is activated.

In addition, serial communication mode is selected though CPR-503 program as the

same mode as determined by DIP switches.



(1) RS-232 mode



(2) RS-485 mode

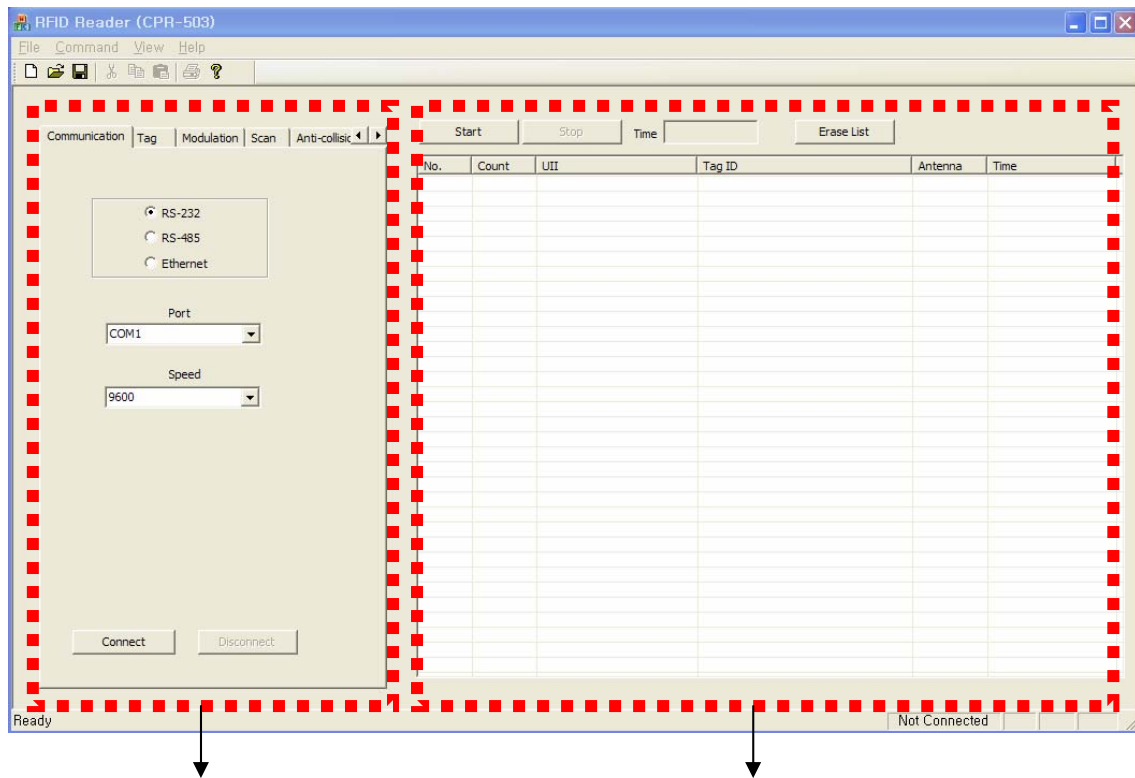
(Figure 12) DIP switch setting

8. RFID Configuration Program

RFID Reader (CPR-503) program can be used to measure the performance of a reader or set the configuration of a reader. It commits the functions through communication with a reader via serial/Ethernet. As major functions, this program can set parameters used in a reader and provide interfaces for read/write/lock functions to RFID tags.

In addition, it gives the interfaces for configuration of communication environment and displaying the information of tags which a reader recognizes.

(1) Configuration of program



Tabs for setting parameters

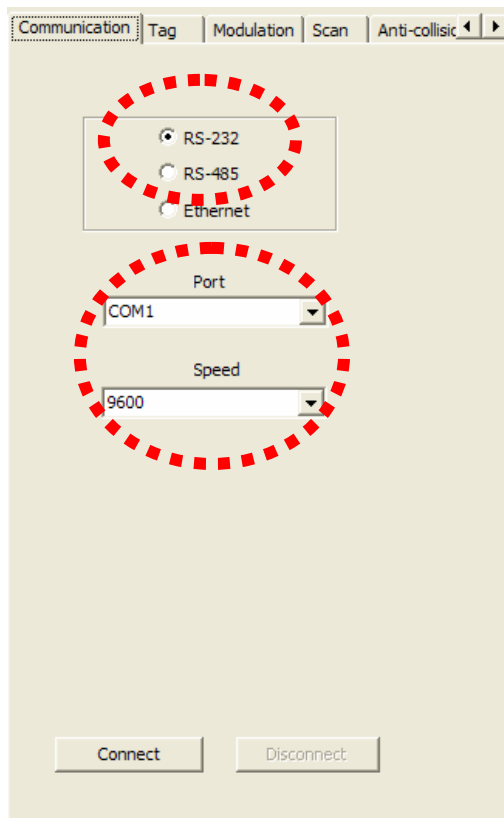
Window for displaying TAG information

CPR-503 program consists of 2 windows. Left windows is tabs for parameter setting, which contains 17 items (Communication, Tag, Modulation, Scan, Anti-collision, MISC, Read, Write, Lock, Configuration, Synchronization, Attenuation, UII write, Time, TID, Tag indicator, Tag Test). You can select a tab using arrow button in the right corner. Right window displays TAG information which a reader recognizes. The information contains Serial No., the reading counter, UII, TAG ID(TID), antenna number and reception time.

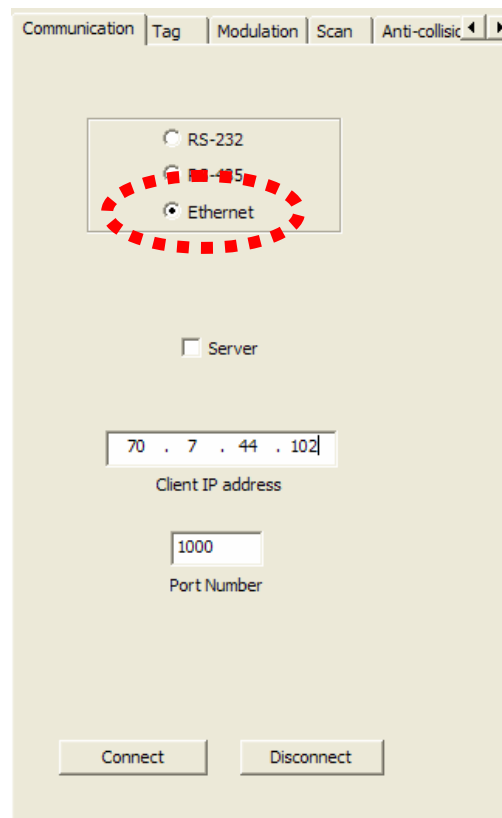
(2) Parameter Setting

(a) Communication

Use communication item in parameter setting tabs to configure the communication environments. The communication method can be RS-232, RS-485 or Ethernet. The selection is committed by pressing the radio button located in left side of each communication method. In case of RS-232 or RS-485, the port number and baud rate should be set, too. (Refer to Figure 14)

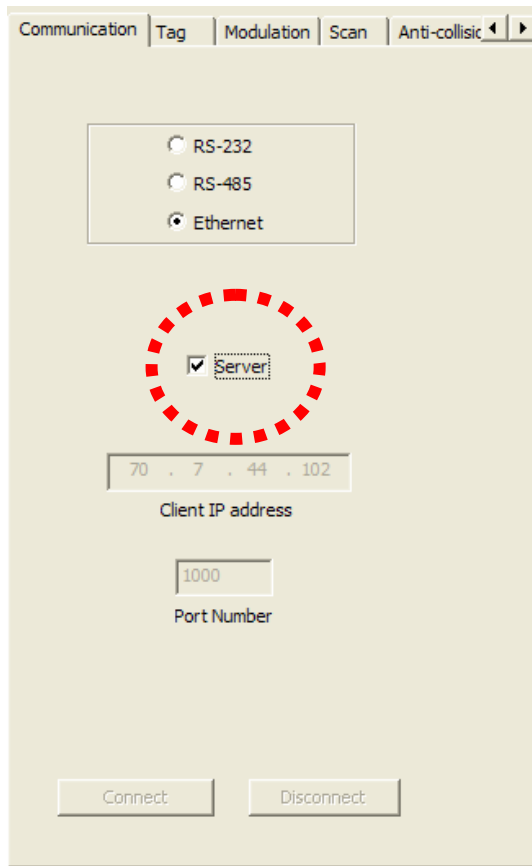


(Figure 14) RS-232, RS-485 Connection



(Figure 15) Ethernet Connection

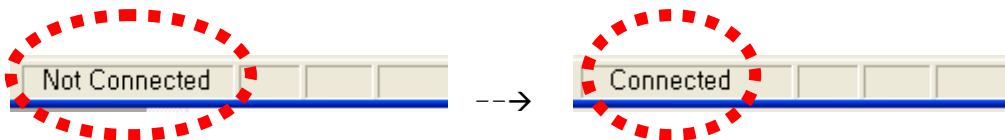
In Ethernet mode, the server mode or the client mode can be selected. In client mode, IP address and port number should be set. (Refer to Figure 15) Now, the port number of TCP is fixed to 1000. If you choose the server mode, the windows for setting IP address and port number will be deactivated. In order to use the server mode, Server (PC) IP address should be set in the RFID reader. (Refer to Figure 16)



(Figure 16) Ethernet (Server mode) Setting

If RS-232, RS-485 or Ethernet client mode is selected, press connect button for communicating with a reader. In case of Ethernet server mode, it is needless to press connect button.

When the connection is completed, the communication status indicator located in right-bottom side of the program will display "Connected" from "Not Connected".



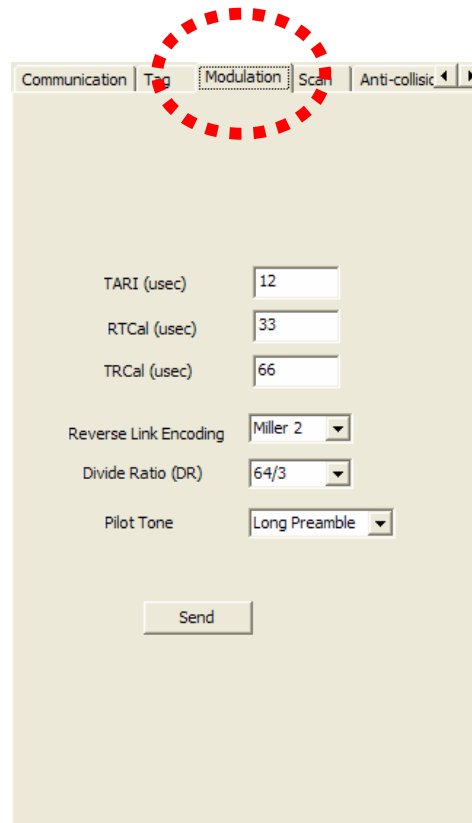
(Figure 17) Communication status indicator

(b) Tag type setting

RFID Reader (CPR-503) supports 3types of RFID tags. The supported types of tags are EM-4122, ISO-6B and GEN2 among which one type should be selected using radio button. By default, GEN2 type is selected. (Refer to Figure 18)



(Figure 18) Tag type setting



(Figure 19) Selection of modulation parameters

(c) Selection of modulation parameters

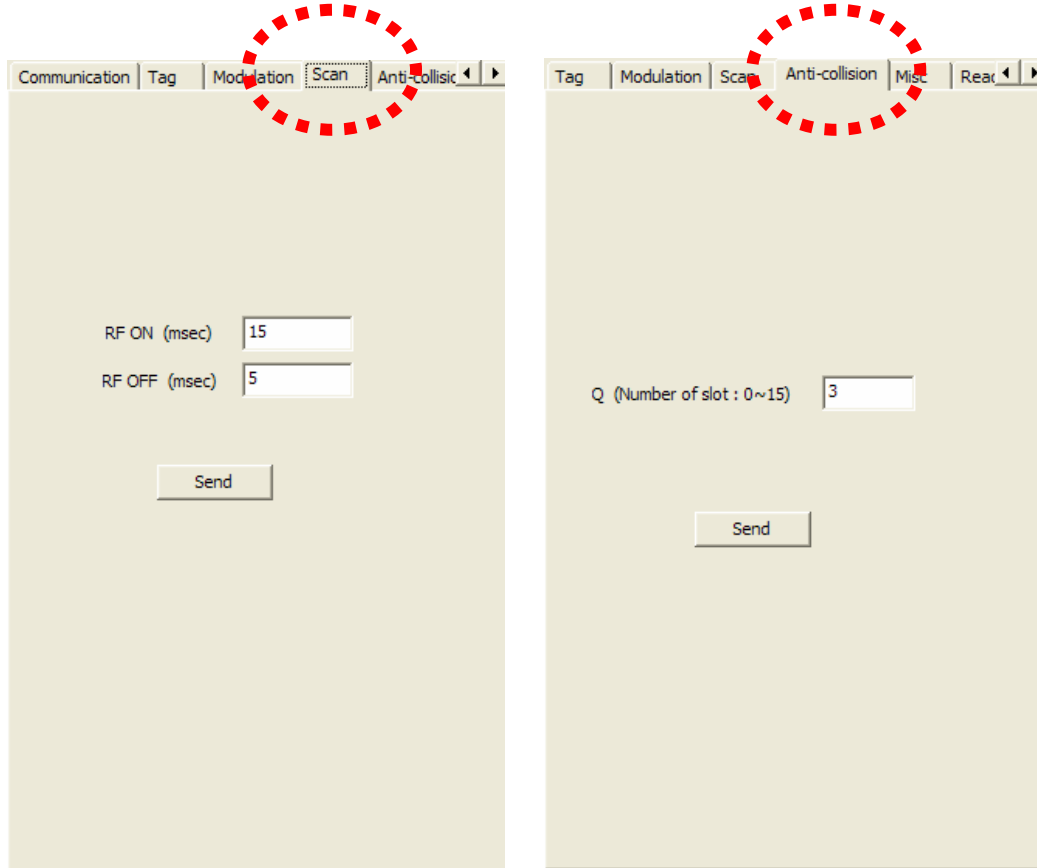
Modulation parameters can be set in modulation tab. (Refer to Figure 19) The modulation tab is only used when selected TAG type is GEN2. Configurable parameters of modulation are TARI, RTCal, TRCal, Reverse link encoding method, Divide ratio (DR), and pilot tone. TARI, RTCal, TRCal value is set by the micro second. Reverse link encoding method can be FM0, Miller2, Miller3, Miller8, but now the CPR-503 reader supports only Miller2 encoding. Divide ratio can be set with 8 or 64/3. Pilot tone determines which preamble is used, short preamble or long preamble. By default, TARI is set to 12micro seconds, RTCal is set to 33micro seconds, TRCal is set to 66micro seconds, Reverse link encoding is set to Miller 2, Divide ratio is set to 64/3 and Pilot tone is set to long preamble.

[CAUTION] Except of a special case, do not change default modulation parameters.

(d) Setting of duty cycles of RF power

In order to set the duty cycles of RF power of a reader, the scan item can be used. RFID uses RF power which is turned on/off periodically. The period of ON/OFF state of RF power can be set with milli-second. However, if, in the RF ON period, a tag is already read or it is determined that no more tag can be read (As such a case, It will be possible that although query message and query-repeat message in all slots allocated

for anti-collision are sent, tag id cannot be received), RF ON period will be switched to RF Off period. Therefore, RF ON period is flexible within the period user sets, but RF OFF period is fixed as same as the period user sets.



(Figure 20) Setting of RF power duty cycle (Figure 21) anti-collision setting

(e) Anti-collision setting

When GEN2 protocol is used, anti-collision function is permitted using Q value in Query message which can be set in the Anti-collision item in parameter setting tabs of CPR-503 program. (Refer to Figure 21)

Using the Q value, GEN2 tag generates random number for choosing slot in which it sends its TAG ID. After RFID reader transmits Query message, it sends $(2^Q - 1)$ Query Repeat messages. If TAG receives the message, it decreases its slot number by 1 and if the slot number reaches to 0, the TAG responds to the message by transmitting its TAG ID. Q value can be set from 0 to 15. Value of 0 means that anti-collision function is disabled.

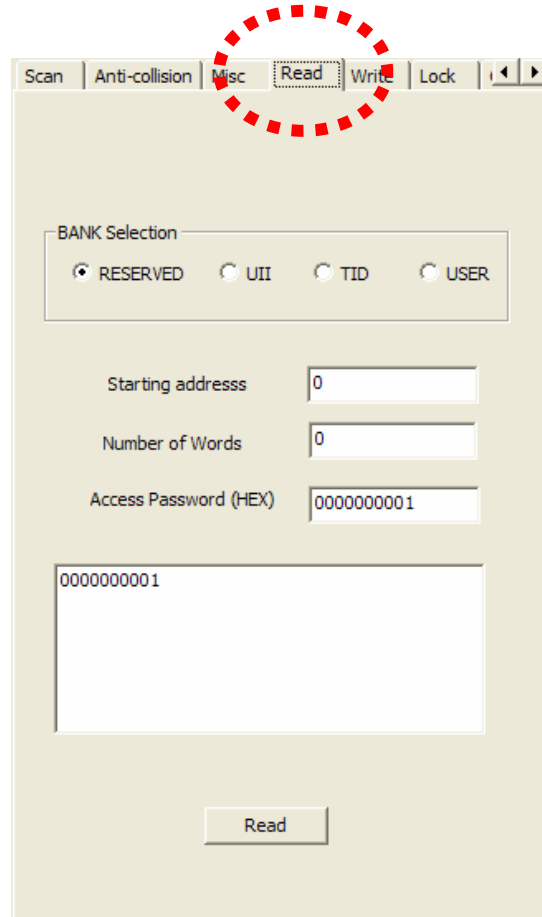
(f) **Buzzer Setting**

In order to make the buzzer ring when a reader receives a TAG ID, you can set Buzzer item in MISC tab of parameter configuration tabs. (Refer to Figure 22)

If you want to ring the buzzer on receiving the tag id, you can select ON in combo button, and if you want the buzzer to remain silently, you can select OFF in combo button.



(Figure 22) Buzzer Setting



(Figure 23) TAG Data Reading

(g) **Reading of TAG Data**

To read data in GEN2 tag, use the read item in parameter configuration tabs.

Gen2 tag has 4 memory banks. (Reserved, UII, TID and User)

To read data in each memory bank, you should choose memory bank using radio button in bank selection and input memory start address to be read in an edit window next to Starting address item. You should input memory size to be read by the word (2bytes) into an edit window next to Number of Words item. If a tag uses access password, access password should be inserted into an edit window with HEX format next to Access Password item. If a tag don't use access password, 0 is input in that window.

If all configurable parameters for reading data in a tag are set, press Read button. When reading is successful, the read data is displayed in the edit window between Access password item and Read button.

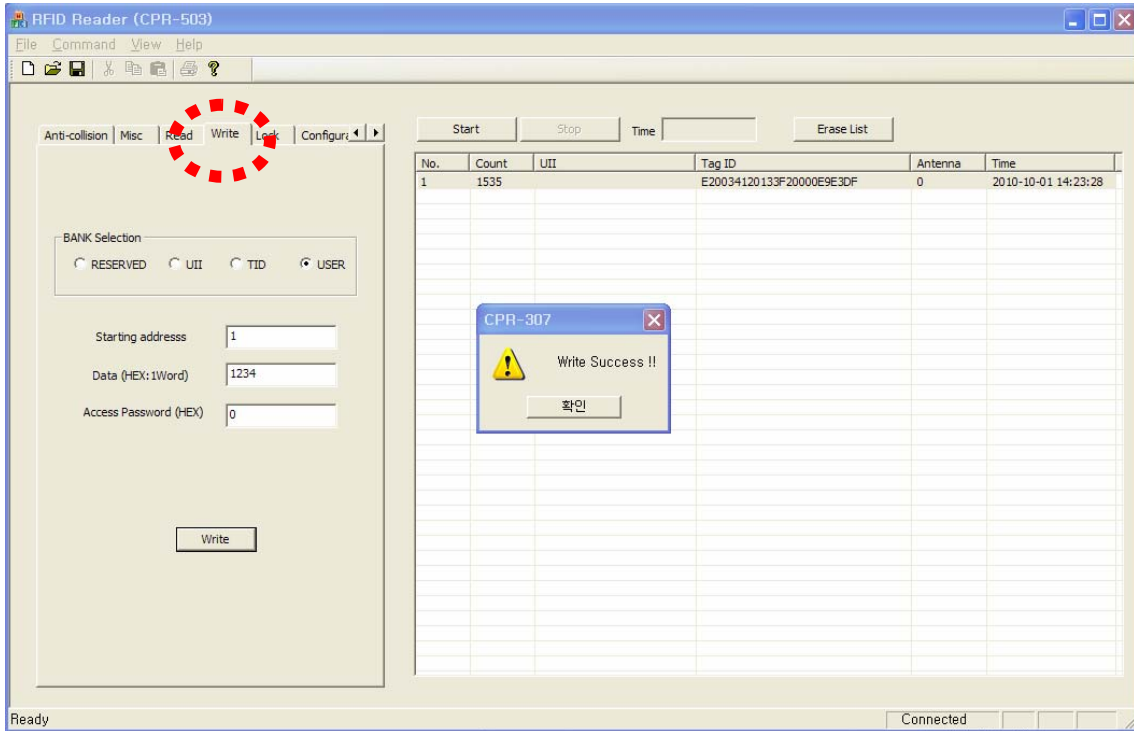
(h) Writing TAG Data

In order to write data in GEN2 tag, use Write item in parameter configuration tabs. (Refer to Figure 24). In case of GEN2 tag, data can be written in 4 memory banks.

To write in each 4 memory banks, choose memory bank in BANK Selection item with a radio button and input the starting address to write in the edit window next to Starting address item. The data to be written is inserted into edit box next to Data item. Access password is inserted in an edit window next to Access Password item with HEX format. If a tag don't use access password, 0 should be written in that window. If all configurable data are input, press Write button. If the writing is successful, Write success message will appear (Refer to Figure 25)

The image shows a software interface window titled "Write". The window has a menu bar with "Scan", "Anti-collision", "Misc", "Read", "Write", and "Lock". The "Write" tab is selected and highlighted with a red dashed circle. Below the menu bar, there is a "BANK Selection" section with four radio buttons: "RESERVED", "UII" (selected), "TID", and "USER". Below this, there are three input fields: "Starting address" with the value "0", "Data (HEX: 1Word)" with the value "1234", and "Access Password (HEX)" with the value "0". At the bottom center, there is a "Write" button.

(Figure 24) Writing Tag Data



(Figure 25) Success of the writing data in a tag

(i) Tag Lock Setting

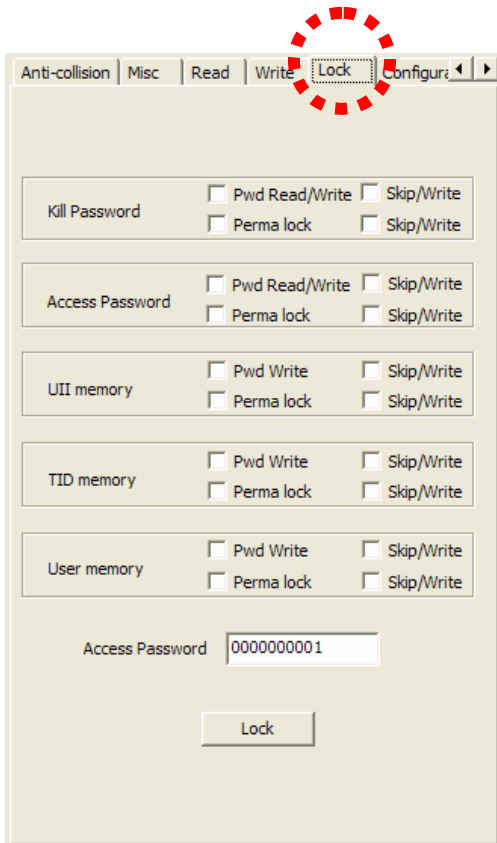
With GEN2 tag, 4 banks can be selected for locking using Lock item in parameter configuration tabs. (Refer to Figure 26)

Reserved memory bank can be locked in kill password memory or access password memory. Lock status is determined with pwd-read/write item and permalock item as follows

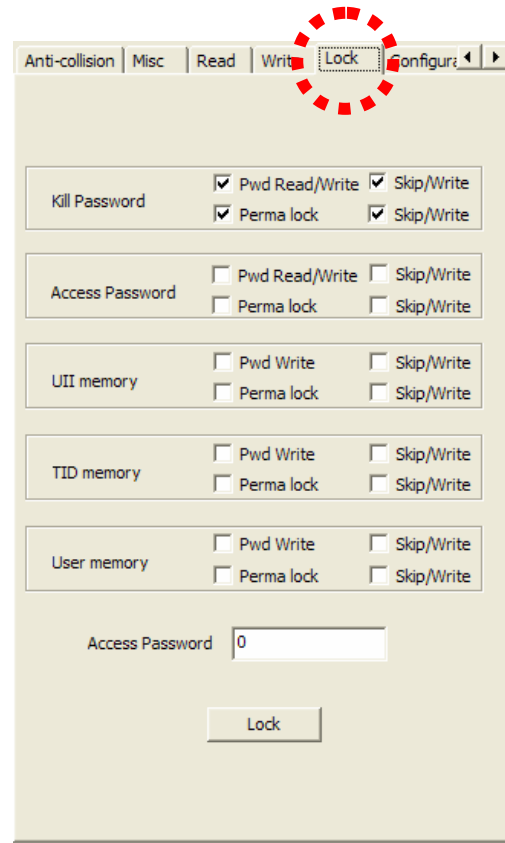
pwd-write	permalock	Description
0	0	Associated memory bank is writeable from either the open or secured states.
0	1	Associated memory bank is permanently writeable from either the open or secured states and may never be locked.
1	0	Associated memory bank is writeable from the secured state but not from the open state.
1	1	Associated memory bank is not writeable from any state.
pwd-read/write	permalock	Description
0	0	Associated password location is readable and writeable from either the open or secured states.
0	1	Associated password location is permanently readable and writeable from either the open or secured states and may never be locked.
1	0	Associated password location is readable and writeable from the secured state but not from the open state.
1	1	Associated password location is not readable or writeable from any state.

Above status is the case when Password Read/Write and Permalock is checked by skip/write item. That is, if skip/write is checked, the lock item left to the skip/write button is applied and if not checked, the lock status left to the skip/write item is maintained as it was.

In case of Figure 27, it shows that Kill password is locked permanently.

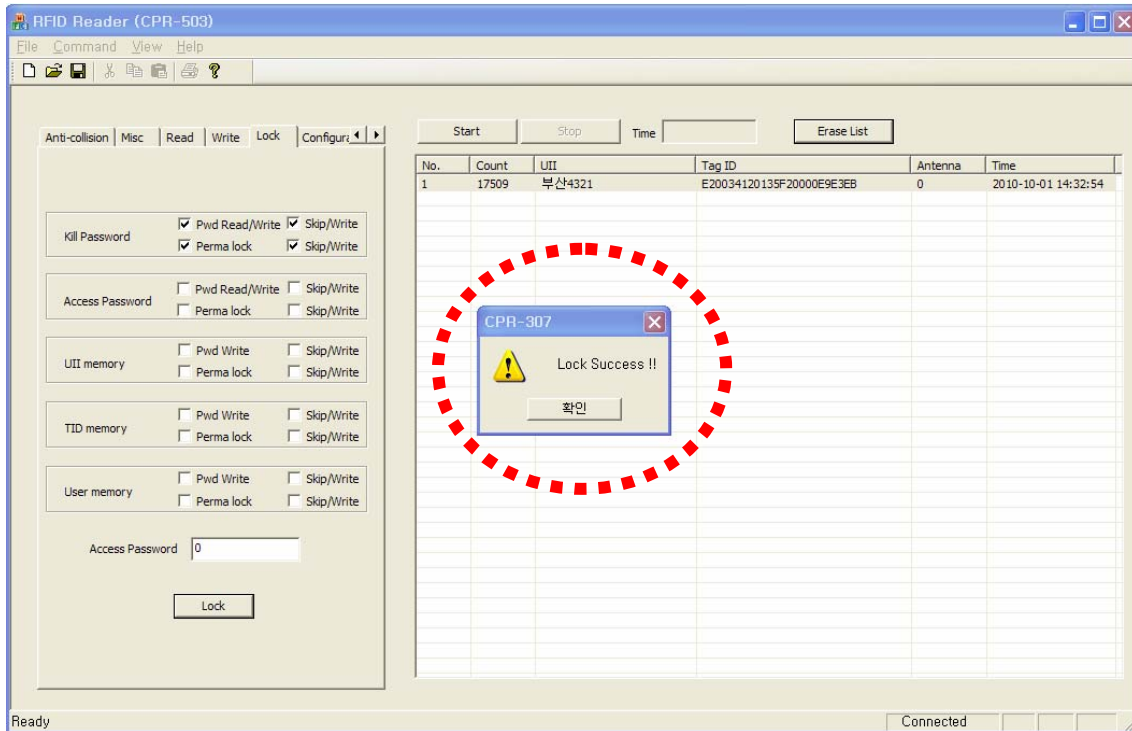


(Figure 26) Locking GEN2 Tag



(Figure 27) Locking Kill Password

In order to lock configuration is activated, you should press Lock button. If lock is successful, the Lock success message window appears like Figure 28.



(Figure 28) Successful case of Lock

(i) Reader Configuration

To configure the parameters of a reader, use Configuration item in parameter configuration tabs. (Refer to Figure 29)

1) Selection of Frequency Range

To select frequency range of a reader, use a combo-box of Frequency item. The selectable frequency ranges are KOREA, Europe and U.S. After selecting the frequency range in combo-box, press Send button.

2) Antenna Configuration

RFID Reader (CPR-503) supports up to 4 antennas. Therefore you can choose which antenna is used. You can select to use 4antennas, 3antennas, 2antennas or 1st antenna, 2nd antenna, 3rd antenna, 4th antenna with antenna combo box. After selecting which antenna is used, if you press send button, the antenna configuration is completed.

3) Selecting Reader ID

After writing ID in the edit box right to the ID item, press Send button.. Up to 2 digits is permitted as ID.

4) Configuration of serial communication

If serial communication is selected as a connection method of RFID reader with a PC, a user can use combo-box next to the Serial Comm. item for selecting RS-232 or RS-485

as a serial communication protocol. After setting serial communication method, if a user presses Send button, the configuration of serial communication method between a RFID reader and a PC is completed.

5) Baud rate setting

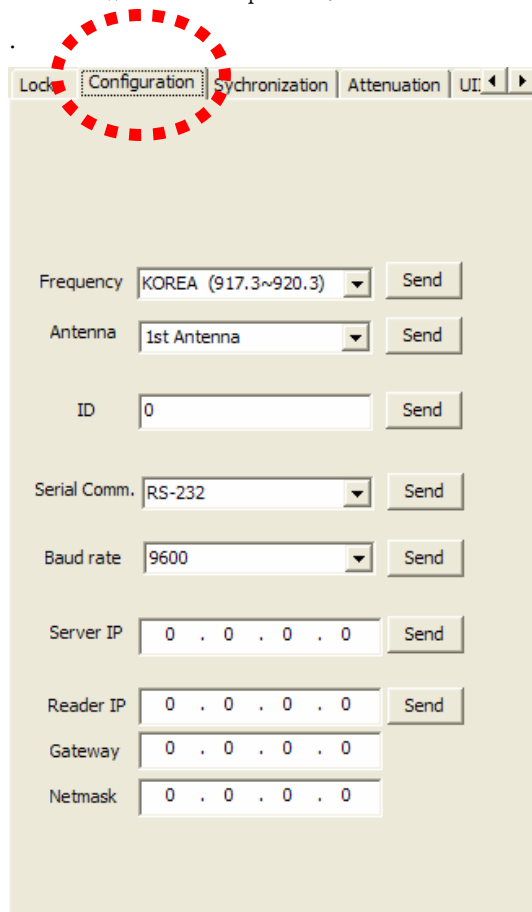
Combo-box next to Baud rate item is used to configure a baud rate of serial communication. After setting a baud rate item, if a user presses Send button, the configuration of baud rate is completed.

6) IP address setting of PC Server

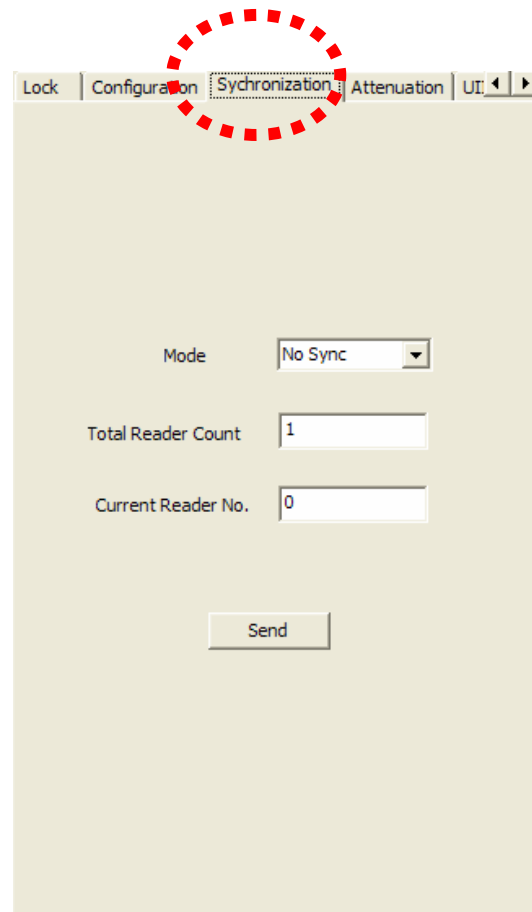
When a RFID Reader (CPR-503) program is operating as a Server mode, Reader should know of IP address of CPR-503 program. After setting IP address of server, if a user presses Send button, the IP address setting of PC server is completed. Then, a Reader will re-boot and try to connect to the server.

7) Changing IP address of RFID Reader

To change IP address of RFID reader, input new IP address into the Reader IP item, and set the Gateway and Netmask. Press Send button and the IP address setting of RFID reader will be completed.



(Figure 29) Setting of Reader Configuration



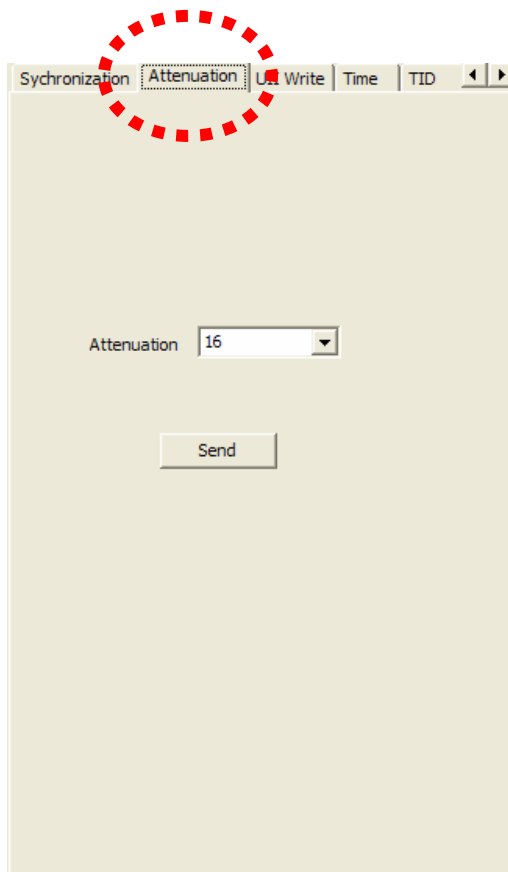
(Figure 30) Synchronization Setting

(k) Synchronization Setting

TBD

(1) Adjustment of Reader RF Output power

To change RF power of a reader, Attenuation item in parameter configuration tabs is used. Attenuation value is permitted from 0 to 31. The greater is the number, the less is the RF power. That is, if attenuation value is set to 0, the RF power is maximum and if attenuation value is set to 31, the RF power is minimum. Use combo-box next to Attenuation item to adjust RF power and press Send button to finish the process. (Refer to Figure 31)



(Figure 31) Adjustment of RF Power

(m) UII 쓰기

To write data in UII memory area of GEN2 tag, UII Write item of parameter configuration tabs can be used. (Refer to Figure 32)

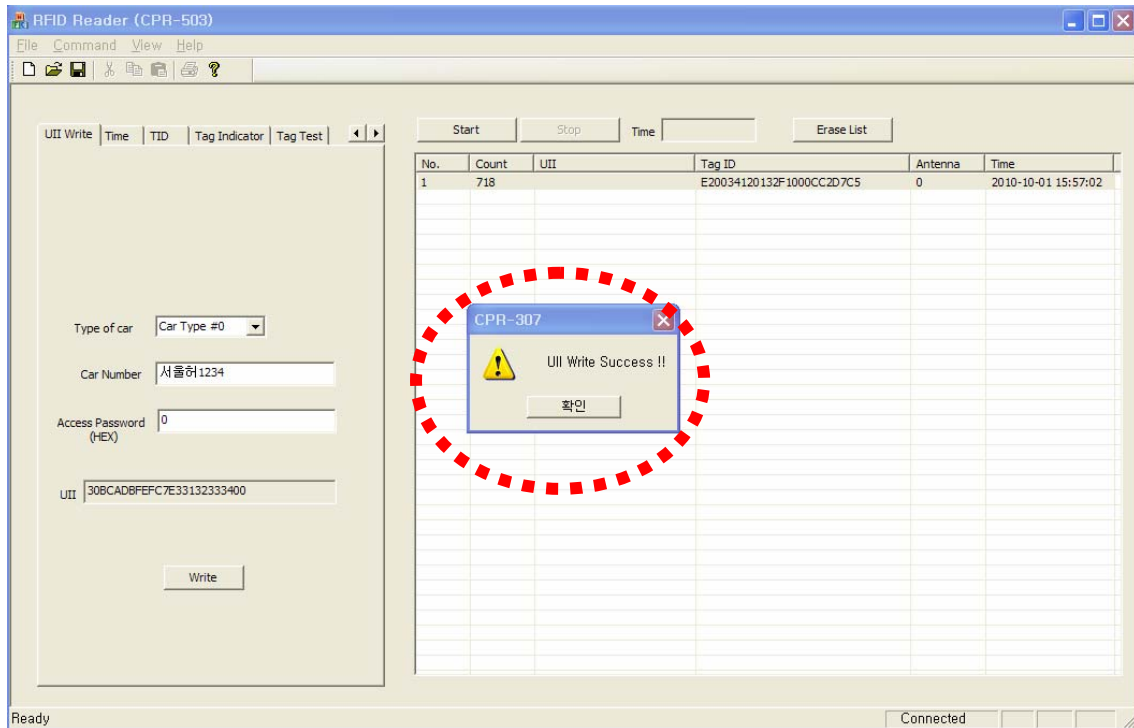
The purpose is to save an information of car in UII memory for ETCS.

Car Type #0 ~ Car Type #9 is selected in Type of Car item to write the type of car. That is the first byte of UII data. Input Car number in edit box of Car Number item. Those are saved from 2nd byte of UII. If Tag is locked with an access password, input access password into the edit box next to the Access Password item with the HEX format or if not, input 0. UII data is made from the car type and the car number which a user inputs.

That Hex code is displayed in UII item with text type. If input is completed, press Write button. If a writing process is completed, the message window shows UII Write Success. (Refer to Figure 33)

The screenshot shows a software window titled "UII Write". The window has a title bar with the text "UII Write" and navigation arrows. Below the title bar, there are four input fields and a button. The first field is a dropdown menu labeled "Type of car" with "Car Type #0" selected. The second field is a text box labeled "Car Number" containing the Korean text "서울허1234". The third field is a text box labeled "Access Password (HEX)" containing the hexadecimal string "0000000001". The fourth field is a text box labeled "UII" containing the hexadecimal string "30BCADBFEFC7E33132333400". At the bottom center of the window is a button labeled "Write". A red dashed circle highlights the "UII Write" title bar.

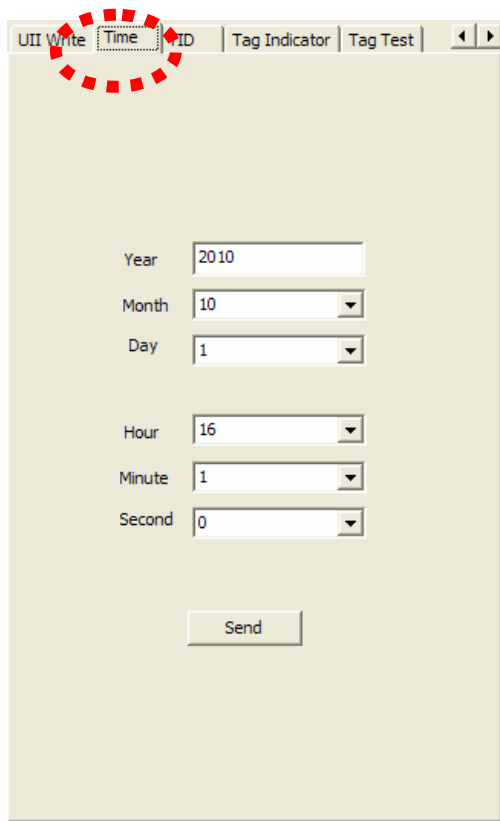
(Figure 32) Writing UII Data



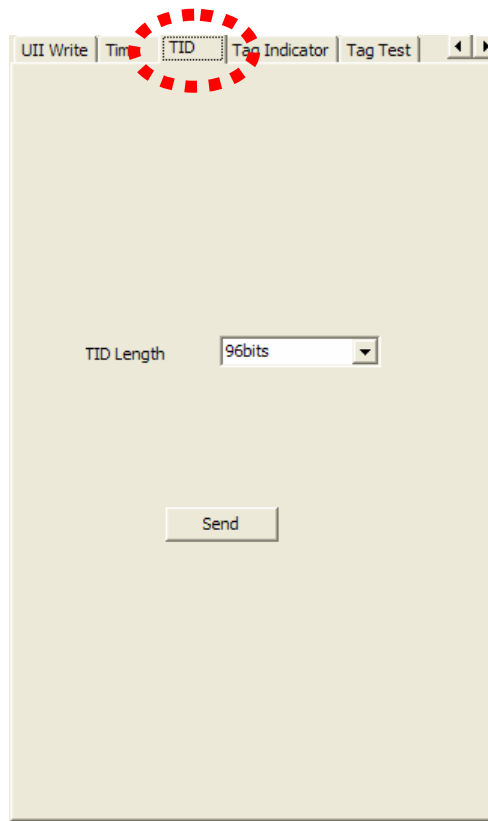
(Figure 33) The case of success in writing UII data

(n) Time setting

To change the clock time of a RFID reader, use Time item of parameter configuration tabs. Year, Month, Day, Hour, Minute and Second can be set. (Refer to Figure 34)



(Figure 34) Setting of Clock time



(Figure 35) Setting of TID Length

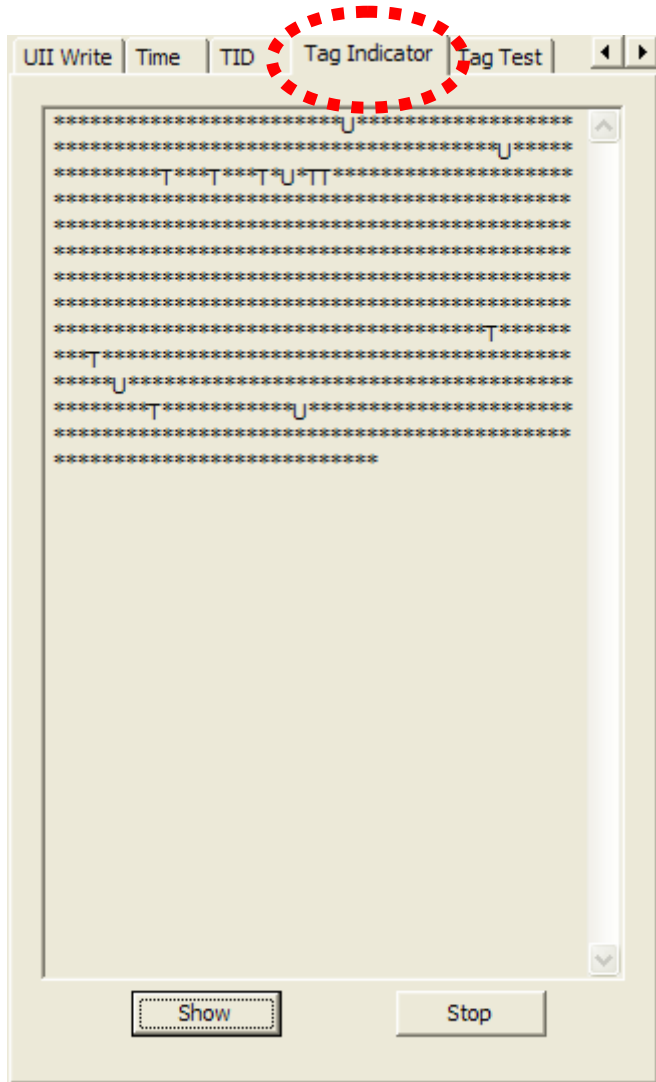
(o) **Setting of TID Length**

To determine the length of TAG ID, which is read from GEN2 tag, use the TID item of parameter configuration tabs. The length can be 64bits or 96bits. (Refer to Figure 35)

(p) **TAG Indicator**

Tag Indicator item of parameter configuration tabs shows if TAG ID is received or not. (Refer to Figure 36)

If Show button is pressed, star(*) mark is displayed in edit box when TAG ID is received. U indicates the CRC error when UII is received and T indicates the CRC error when TID is received. To stop displaying indicator, press Stop button.



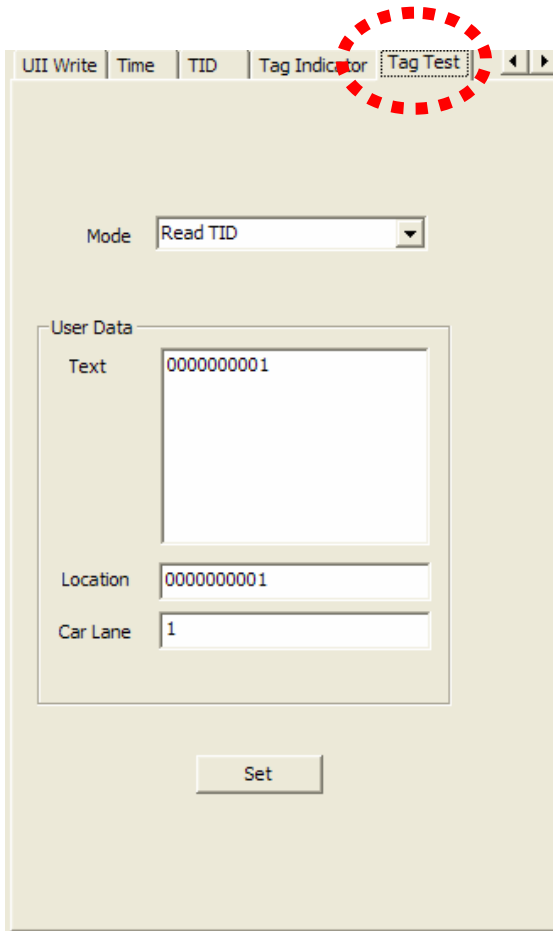
(Figure 36) Indicator of TAG ID

(4) Tag Test

In GEN2 Tag, 2 types of IDs exist, which are UII and TID. To determine which ID is received, use Tag Test item of parameter configuration tabs.

With Comb-box right to Mode item, Read UII, Read TID, Entrance Mode or Exit Mode can be selected. Read UII Mode is for receiving UII only and Read TID mode is for receiving UII and TID. Entrance Mode & Exit Mode is used for writing and reading User data in User Data memory area as functions of entrance and exit of toll gate system.

Text, Location, Car Lane of User Data item contains the information of toll gate.



(Figure 37) Setting of Read mode of a Tag and Writing User Data

(3) Displaying Tag Information

The list item of Figure 38 indicates an information of received TAG IDs.

No. item is serial number, Count item is the number of received tags, UII item is the UII of a tag. Tag ID indicates TID and Antenna item indicates the number of an antenna which receives the TAG IDs. Time is the clock time when the TAG ID is received.

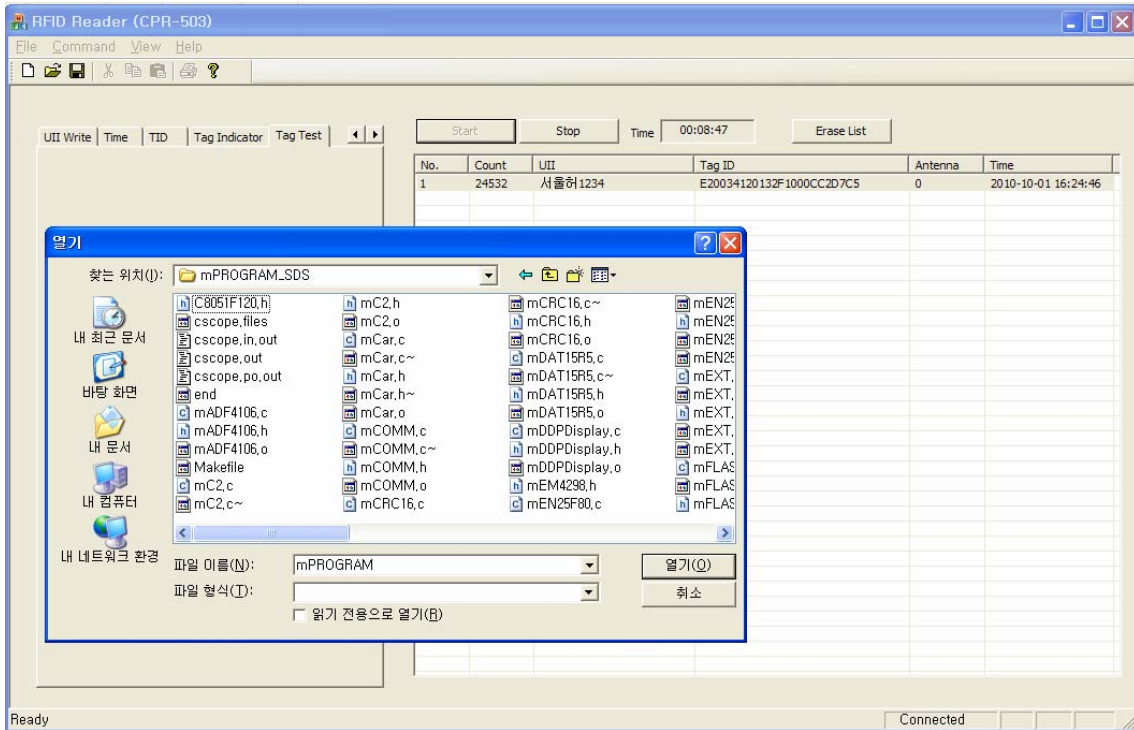
If Start button is pressed, the time is counted from the time when the button is pressed.

This is for the purpose of measuring how many TAG is received during the given time.

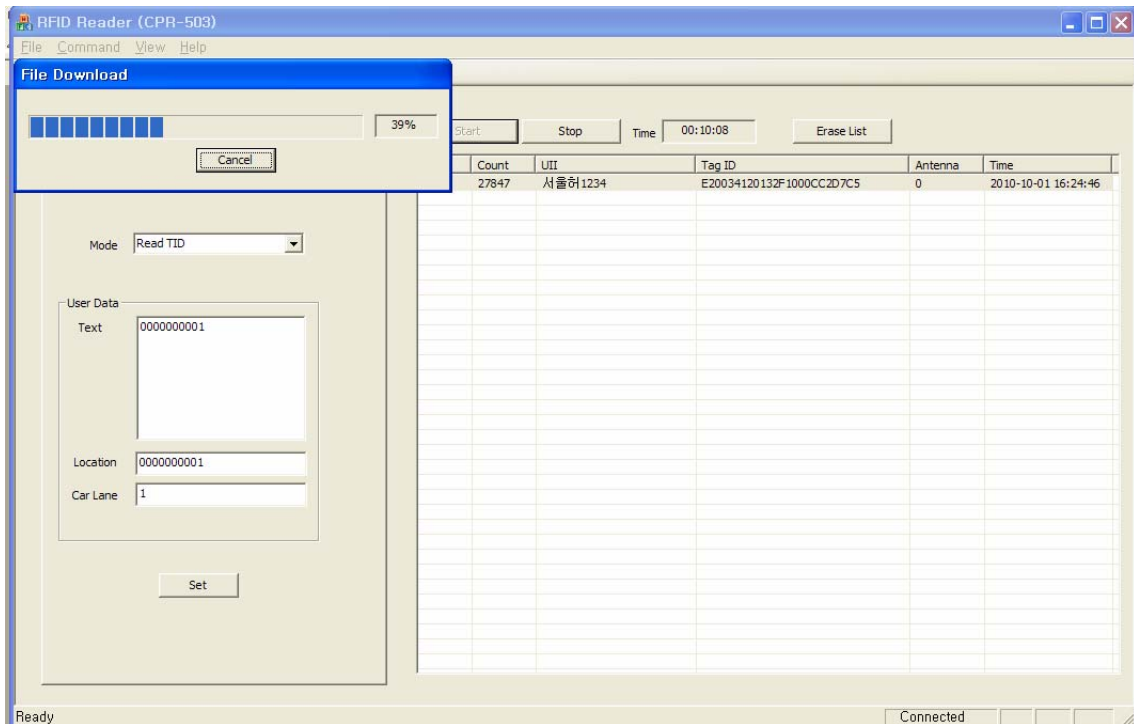
If Stop button is pressed, the reception of TAG ID is stopped.

Erase button is used for erasing the tag list.

displays the percentage of process. (Refer to Figure 41) If Cancel button in Progressive Bar is changed to OK button, it means the transmission is finished.



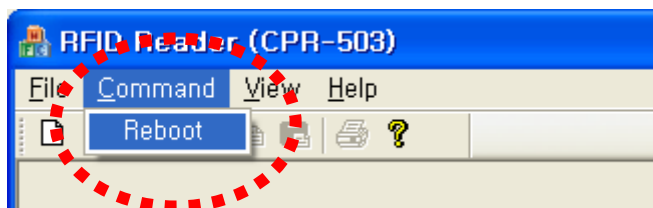
(Figure 40) Dialog window for selecting file



(Figure 41) Progressive Bar

(5) Reset RFID Reader

To reset RFID reader, press Reboot button in Command item of menu. (Refer to Figure 42)



(Figure 42) Reset RFID reader

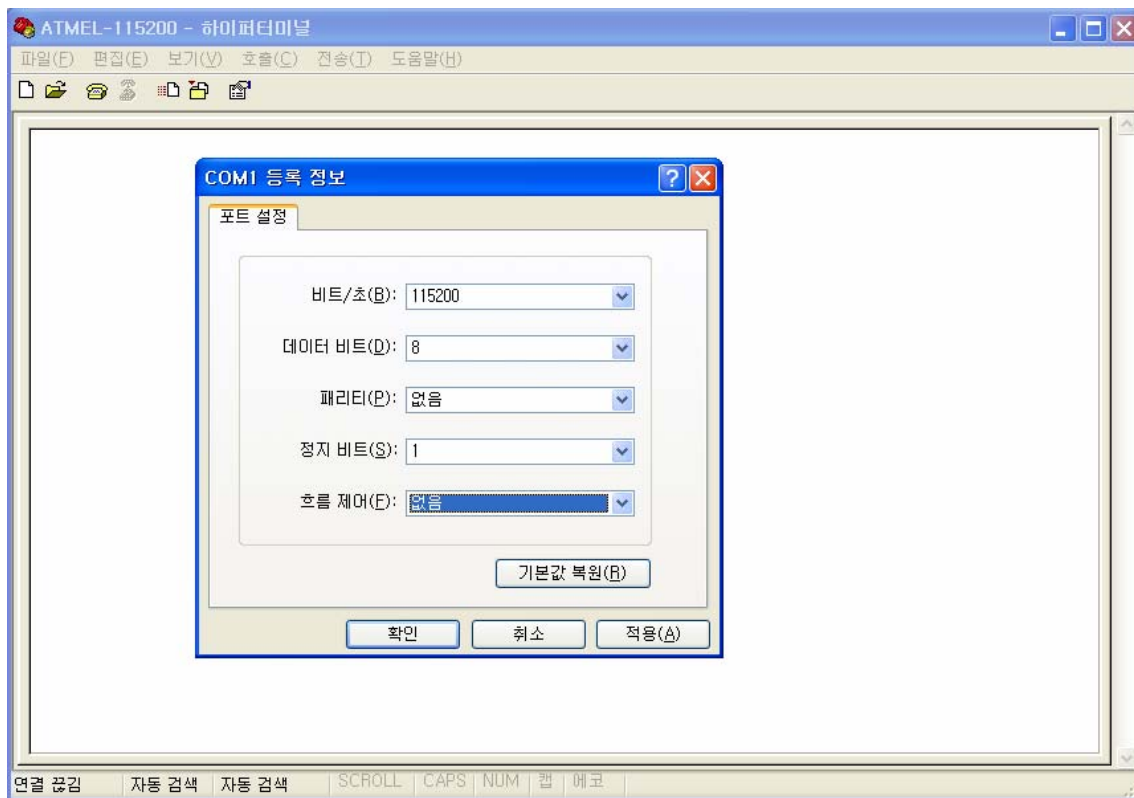
9. Test method of RFID Reader with DEBUG port

(1) Communication Connection

The procedure for parameter setting and testing for RFID reader using DEBUG port (RS-232) is as follows.

(a) Execute HyperTerminal and configure the communication parameters.

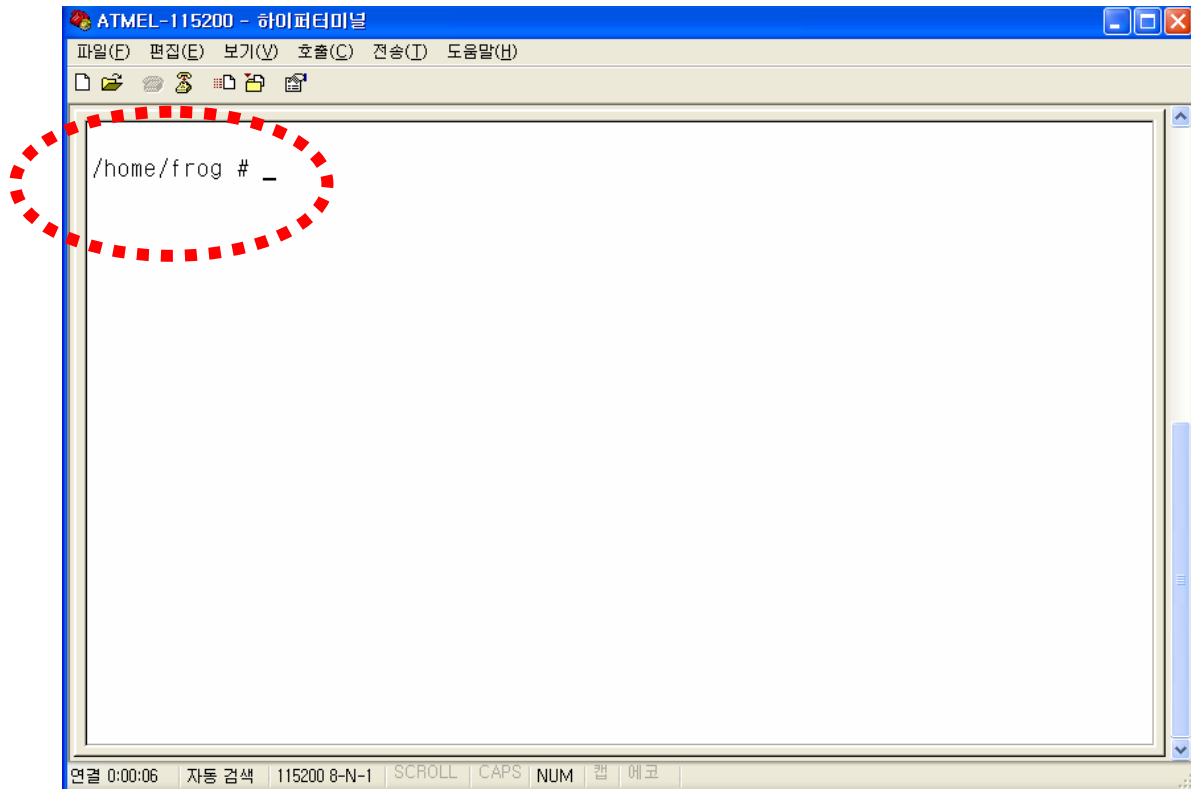
- baud rate : 115200bps
- Data bits : 8 bits
- Parity : None
- Stop bit : 1 bit
- Flow control : None



(Figure 43) Configuration of communication parameters

(b) Connect RS-232 cable between PC and DEBUG port in RFID reader.

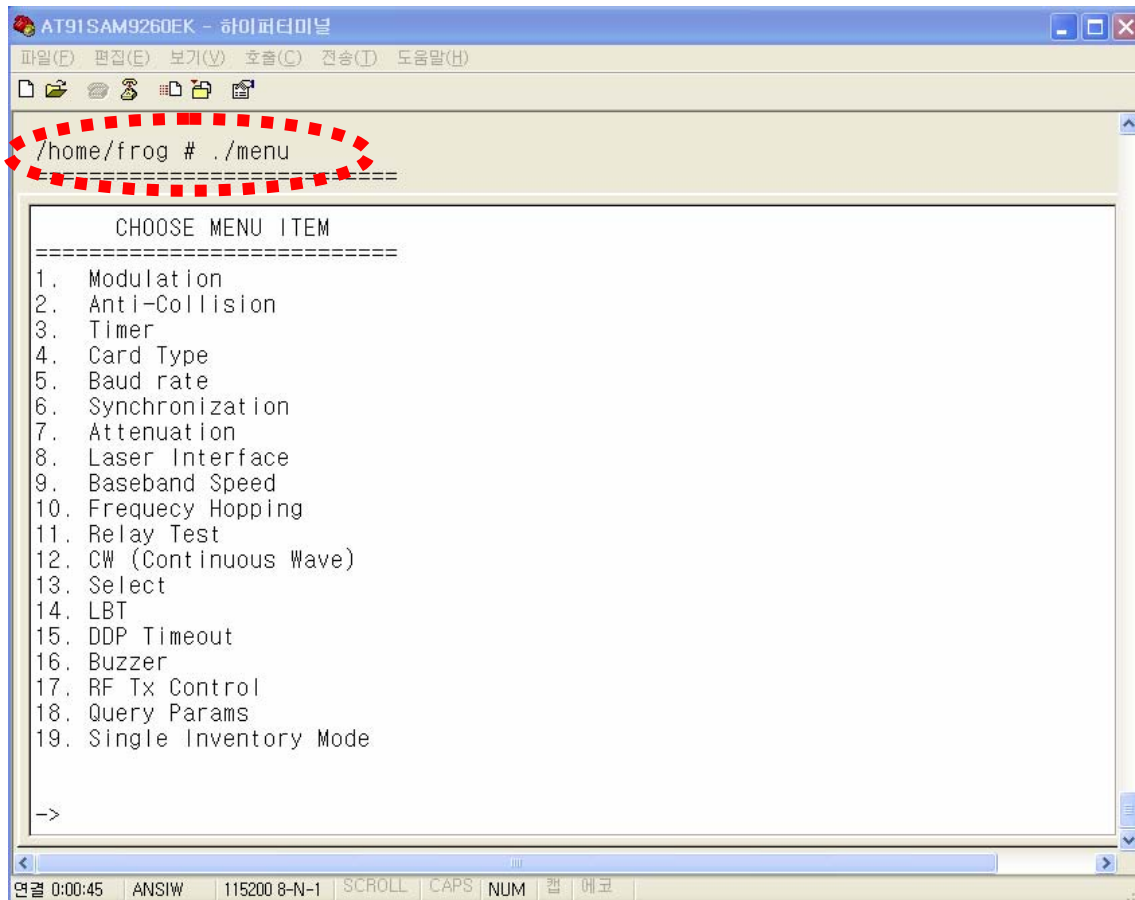
(c) If connection is finished, press ENTER key and be sure that /home/frog# prompt appears as below Figure 44 (When reader is booting, the booting message will appear and it also means connection is completed)



(Figure 44) Connection of serial communication

(2) Menu

if /home/frog # prompt appears, press ./menu and press enter key. The menu like below Figure will be displayed. (Refer to Figure 45)



(Figure 45) menu

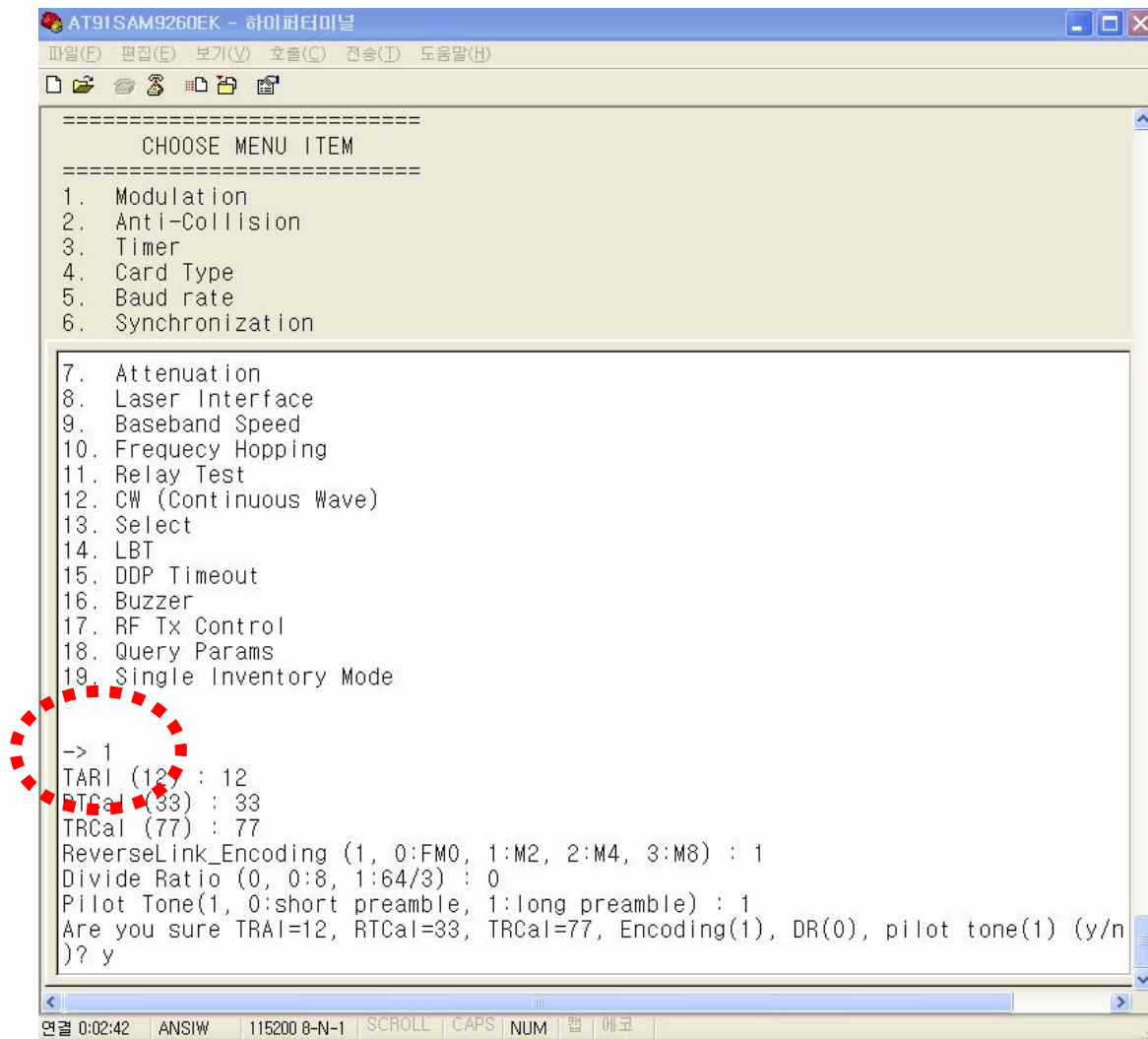
(a) **Setting of modulation parameters**

To set modulation parameters of GEN2, press 1 and press enter key in menu.

Configurable parameters of modulation are TARI, RTCal, TRCal, Reverse link encoding method, Divide ratio (DR), and pilot tone. TARI, RTCal, TRCal value is set by the micro second. Reverse link encoding method can be FM0, Miller2, Miller3, Miller8, but now the CPR-503 reader supports only Miller2 encoding. Divide ratio cab be set with 8 or 64/3. Pilot tone determines which preamble is used, short preamble or long preamble. By default, TARI is set to 12micro seconds, RTCal is set to 33mirco seconds, TRCal is set to 66micro seconds, Reverse link encoding is set to Miller 2, Divide ratio is set to 64/3 and Pilot tone is set to long preamble.

The numbers in () of each item means current values.

[CAUTION] Except of a special case, do not change default modulation parameters.



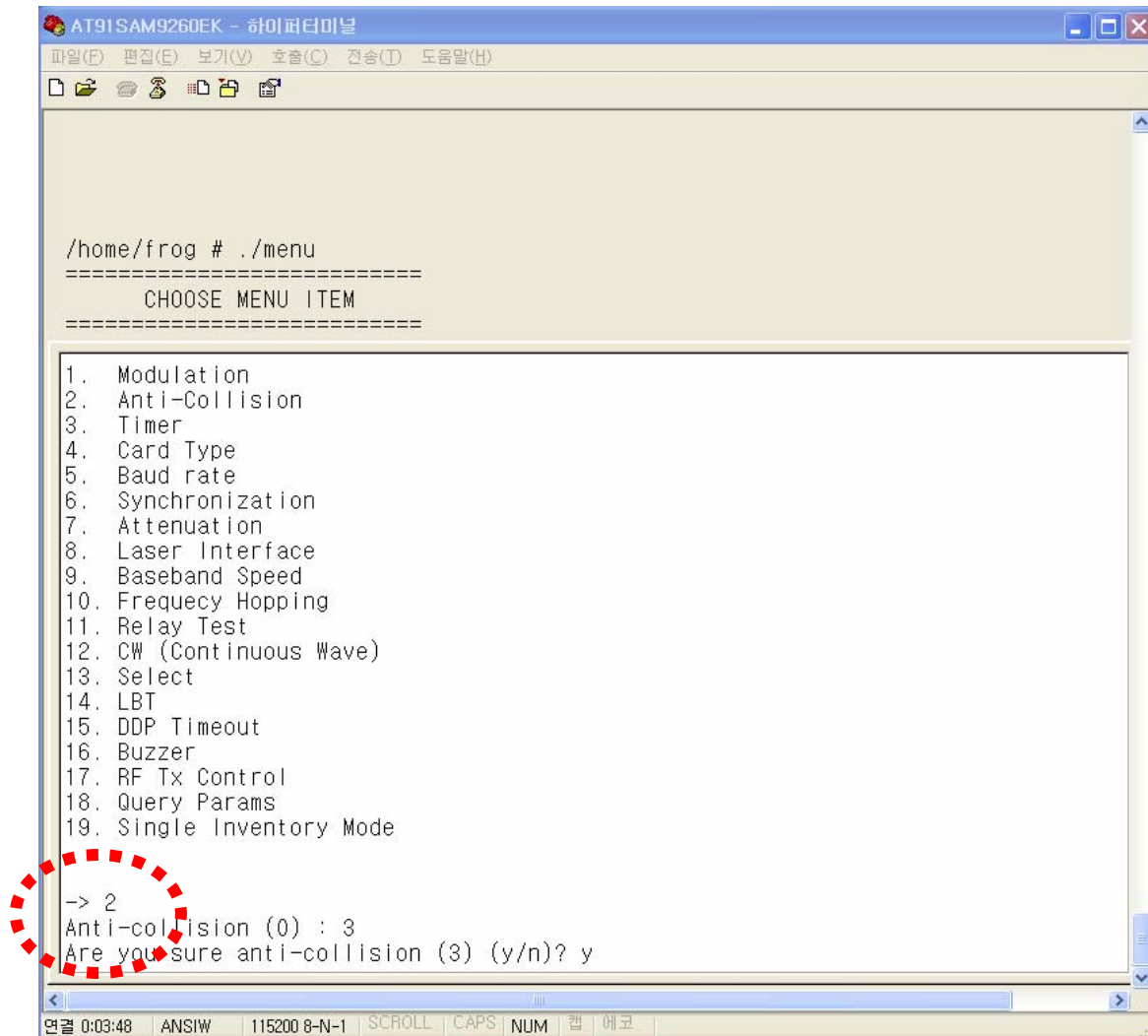
(Figure 46) Setting of modulation parameters

Select TARI, RTCal, TRCal, Reverse Link Encoding, Divide Ratio and Pilot Tone and select y for confirmation question.

(b) Anti-collision

When GEN2 protocol is used, anti-collision function is permitted using Q value in Query message which can be set in 2nd menu item. (Refer to Figure 47)

Using the Q value, GEN2 tag generates random number for choosing slot in which it sends its TAG ID. After RFID reader transmits Query message, it sends (2^Q-1) Query Repeat messages. If TAG receives the message, it decreases its slot number by 1 and if the slot number reaches to 0, the TAG responds to the message by transmitting its TAG ID. Q value can be set from 0 to 15. Value of 0 means that anti-collision function is disabled. The below picture shows the Q value is set to 3.



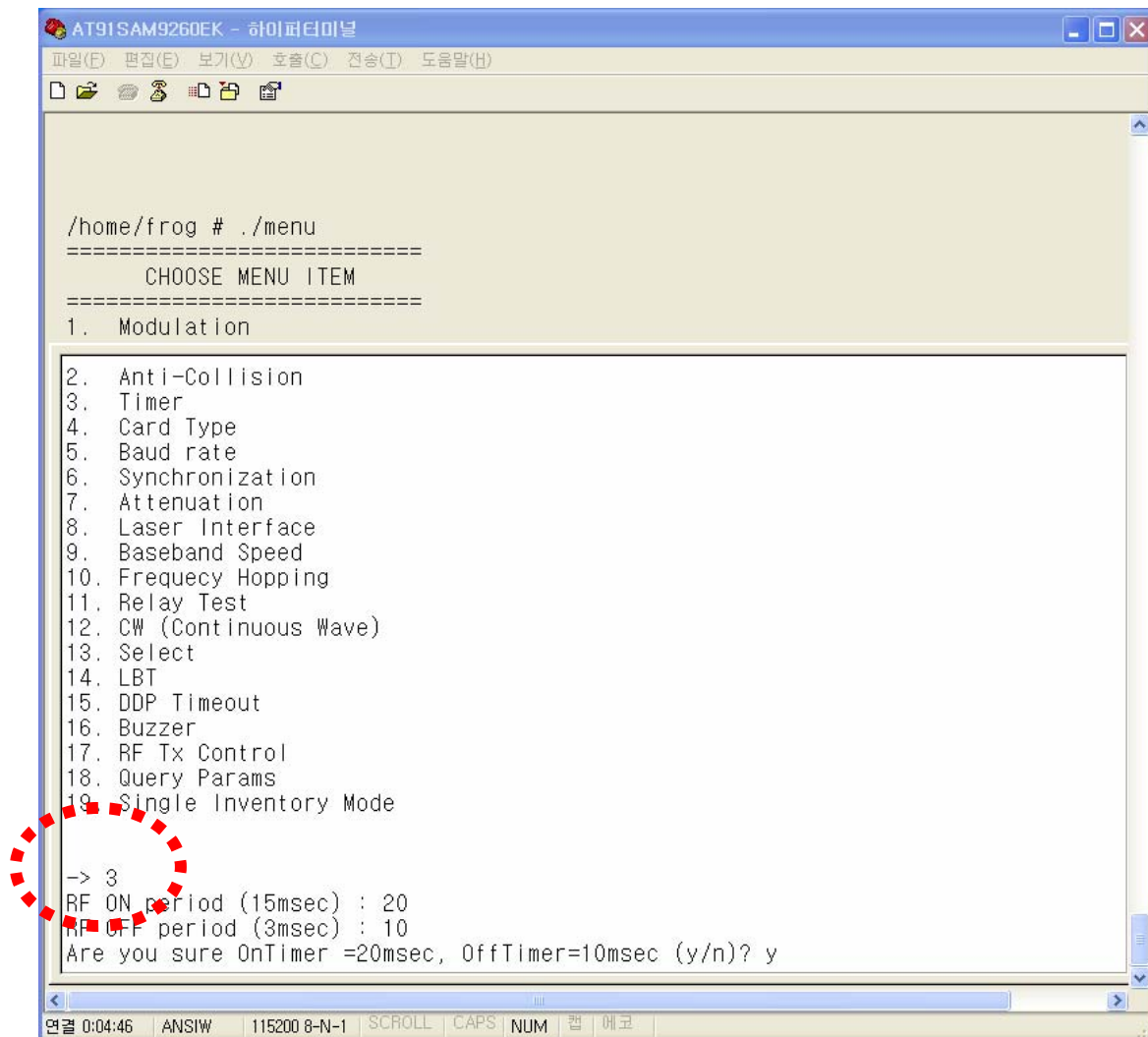
(Figure 47) Anti-collision setting

(c) Timer Setting

In order to set the duty cycles of RF power of a reader, select 3 item in menu.

RFID uses RF power which is turned on/off periodically. The period of ON/OFF state of RF power can be set with milli-seconds. However, if, in the RF ON period, a tag is already read or it is determined that no more tag can be read (As such a case, It will be possible that although query message and query-repeat message in all slots allocated for anti-collision are sent, tag id cannot be received), RF ON period will be switched to RF Off period. Therefore, RF ON period is flexible within the period user sets, but RF OFF period is fixed as same as the period user sets.

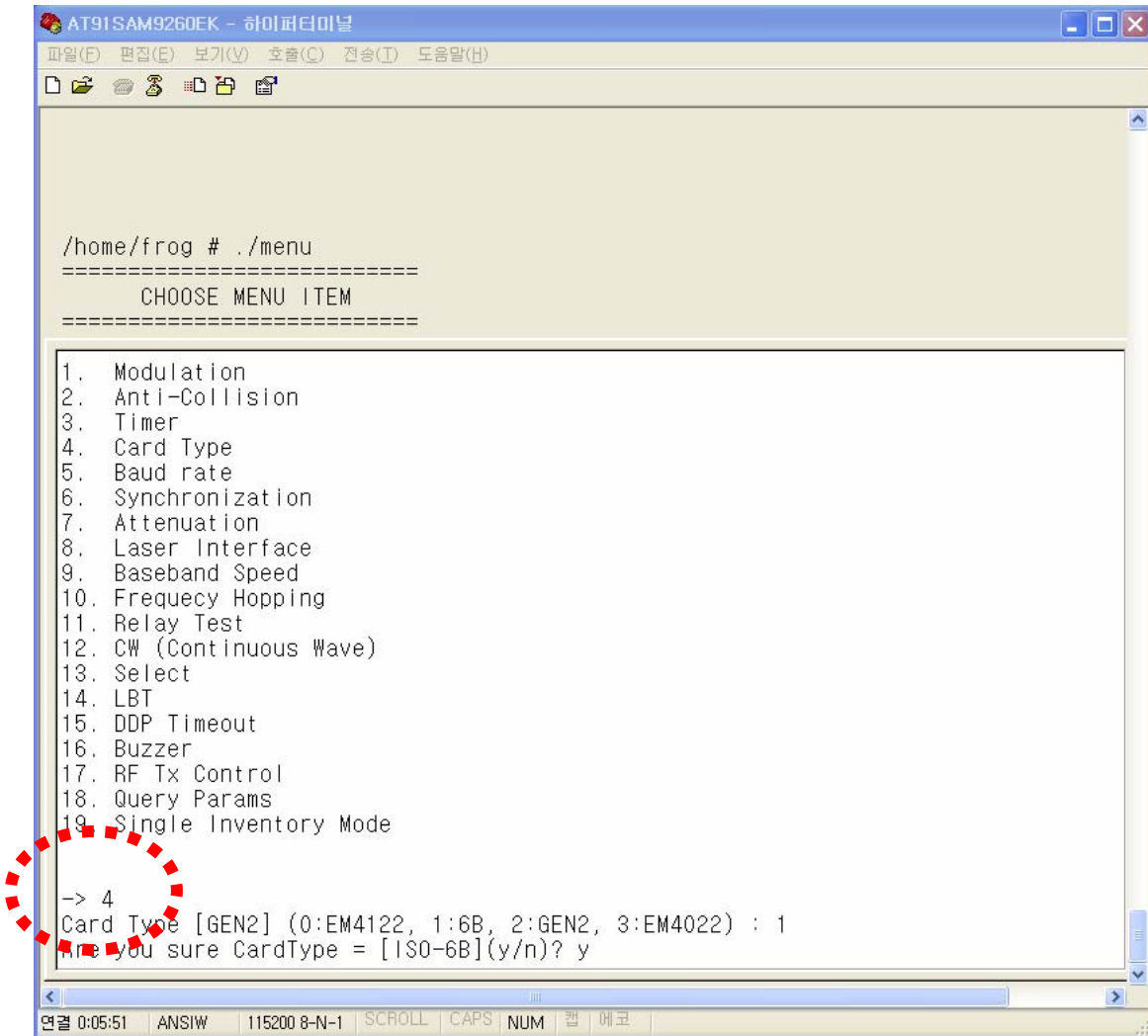
Below picture shows that RF ON time was 15msec and RF Off time was 3msec and they are changed to 20msec and 10msec respectively.



(Figure 48) Setting of Time of TAG Scan period

(d) Setting of TAG Type

RFID Reader (CPR-503) supports 3types of RFID tags. The supported types of tags are EM-4122, ISO-6B and GEN2, among which one type should be selected using 4th item in menu. By default, GEN2 type is selected. Figure 49 shows that Tag type is changed from GEN2 type to ISO-6B.



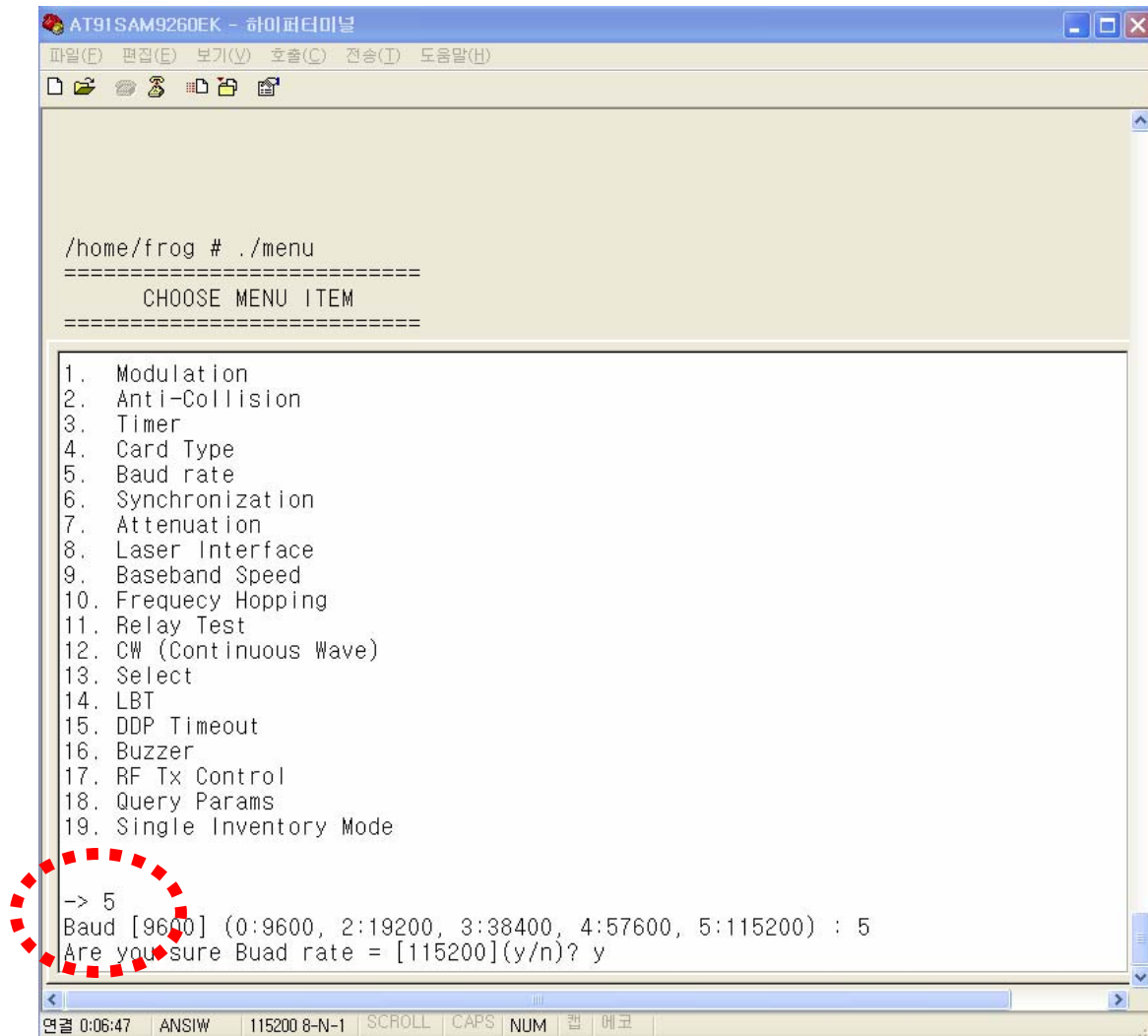
(Figure 49) Setting of Tag Type

(e) **Setting of Serial Communication Baud rate**

Select 5th item in menu to set baud rate for serial communication.

Supported speeds are 9600bps, 19200bps, 38400bps, 57600bps and 115200bps.

Figure 50 shows that baud rate is changed from 9600bps to 115200bps.



(Figure 50) Setting of Serial communication speed

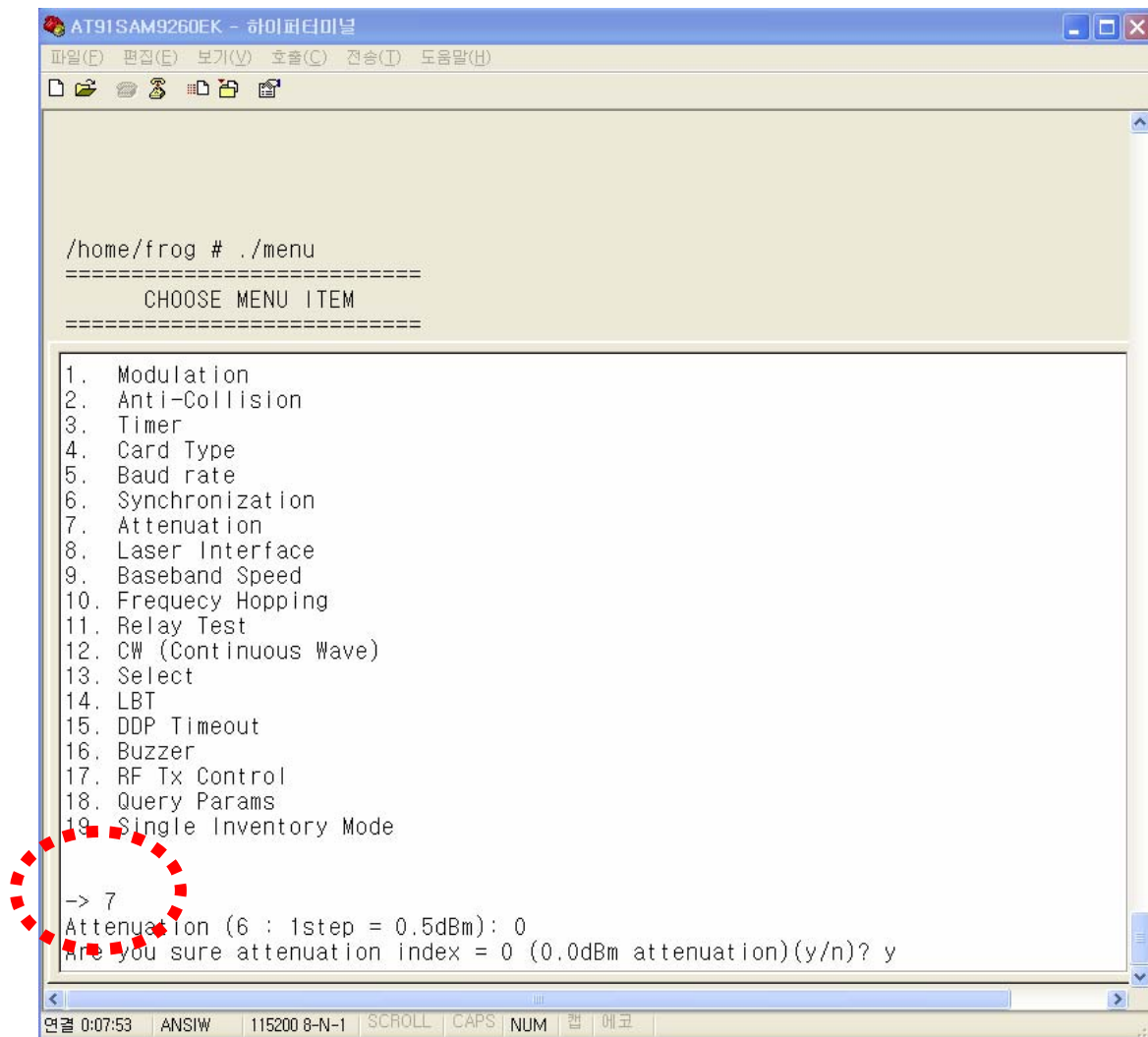
(f) Synchronization

TBD

(g) Adjustment of RF Power

To change RF power of Reader, 7th item in menu is used. Attenuation value is permitted from 0 to 31. The greater is the number, the less is the RF power. That is, if attenuation value is set to 0, the RF power is maximum and if attenuation value is set to 31, the RF power is minimum.

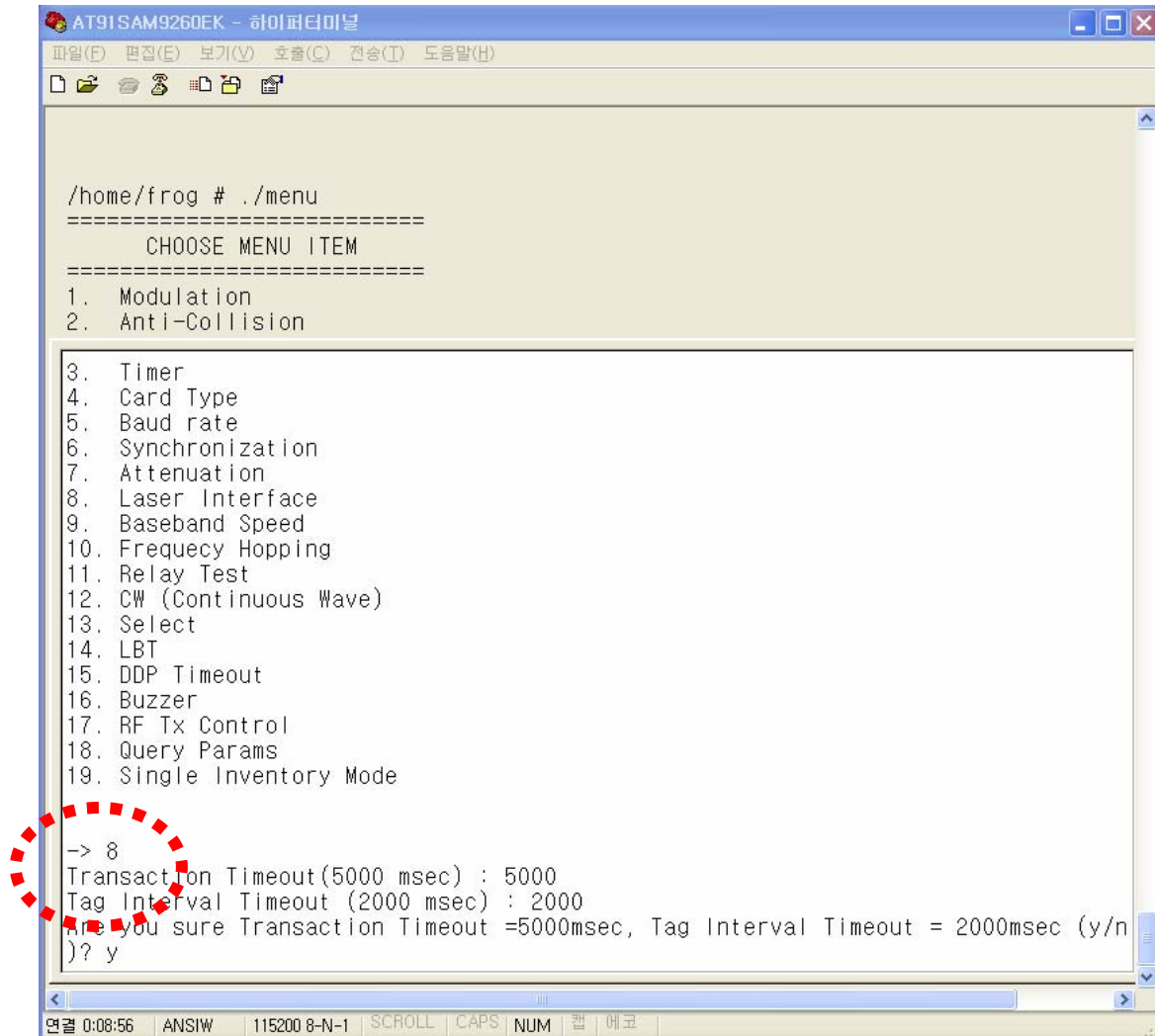
Figure 51 shows attenuation value is changed from 16 to 0.



(Figure 51) Adjustment of RF Power

(h) Adjustment of Laser Interface Timing

TBD



(Figure 52) Transaction Timeout and Tag Interval Timeout

(i) Baseband Speed Setting

TBD

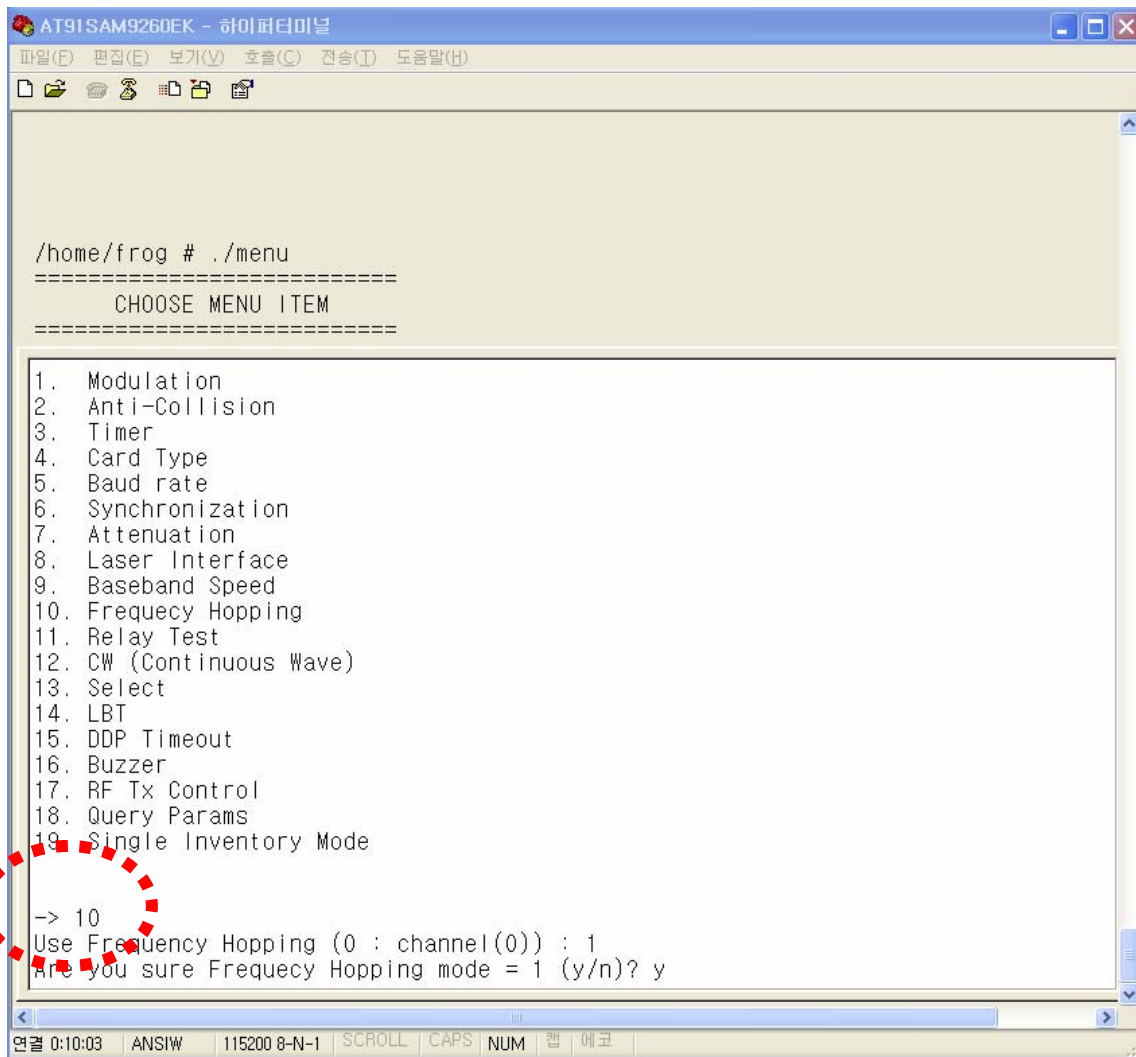
(j) Frequency Hopping Setting

To set Frequency Hopping mode, select 10th item in menu. (Refer to Figure 53)

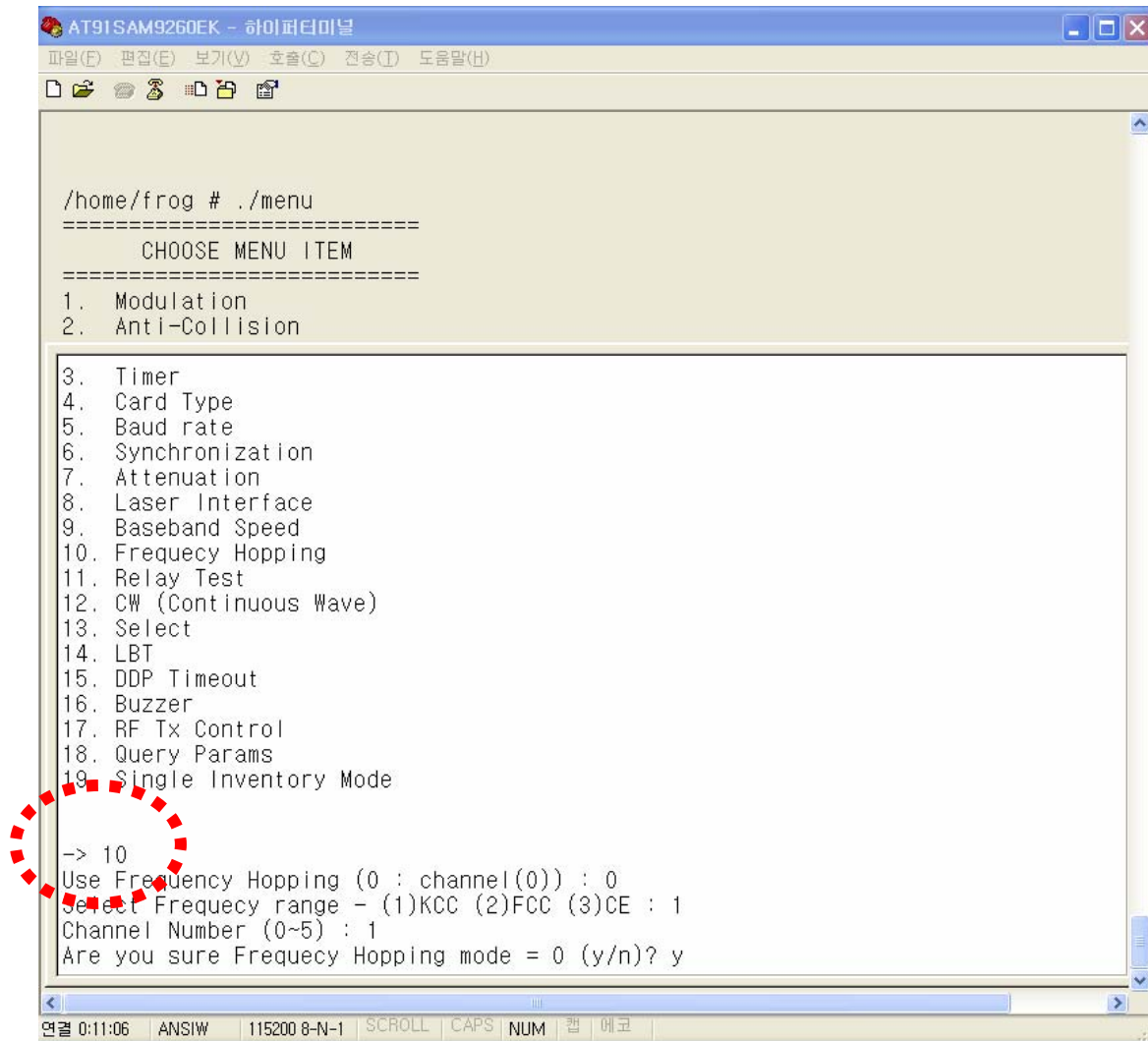
If 1 is set to Use Frequency Hopping item, a reader becomes frequency hopping mode.

To fix the frequency, Set 0 to Use Frequency Hopping item and select channel number.

Figure 54 shows that the frequency is fixed to 1st channel.



(Figure 53) Setting of frequency hopping mode



(Figure 54) Setting of fixed frequency mode

(k) Relay Test

To make Relay ON/OFF, use 11th item in menu.

If 1 is selected in RELAY item, Relay becomes ON, and if 0 is selected, Relay becomes OFF.

```
/home/frog # ./menu
=====
      CHOOSE MENU ITEM
=====
1. Modulation

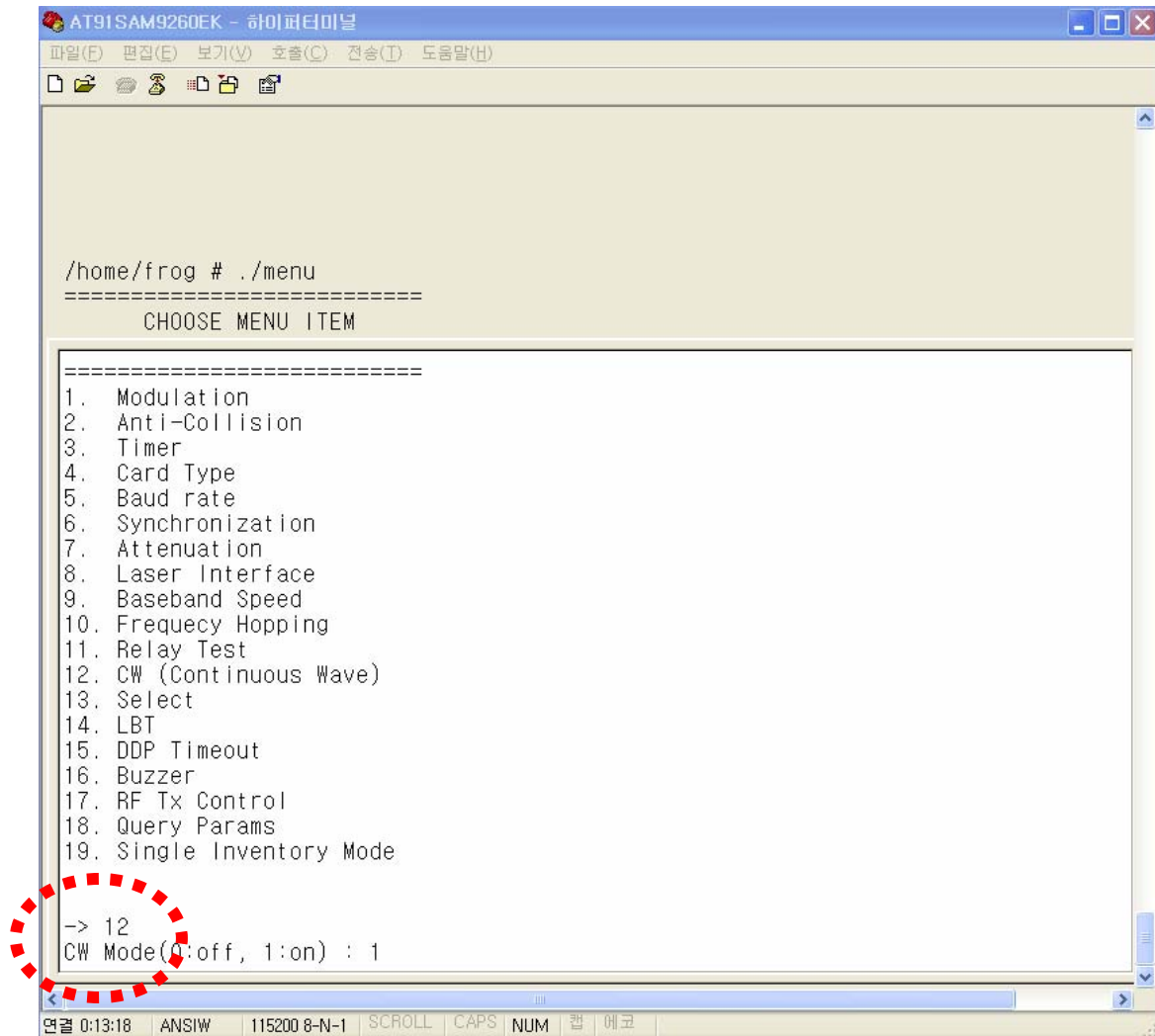
2. Anti-Collision
3. Timer
4. Card Type
5. Baud rate
6. Synchronization
7. Attenuation
8. Laser Interface
9. Baseband Speed
10. Frequency Hopping
11. Relay Test
12. CW (Continuous Wave)
13. Select
14. LBT
15. DDP Timeout
16. Buzzer
17. RF Tx Control
18. Query Params
19. Single Inventory Mode

-> 11
RELAY (0:off, 1:on) : 1
/home/frog # RLY_CMD_ON
```

(Figure 55) Relay menu

(1) CW (Continuous Wave) mode

To set RF Continuous Wave mode which don't modulate RF signal, use 12th item in menu. If 1 is selected in CW Mode item, a reader operates as Continuous Wave mode and if 0 is selected, a reader operates in normal mode which modulates RF signals.



(Figure 56) CW mode setting

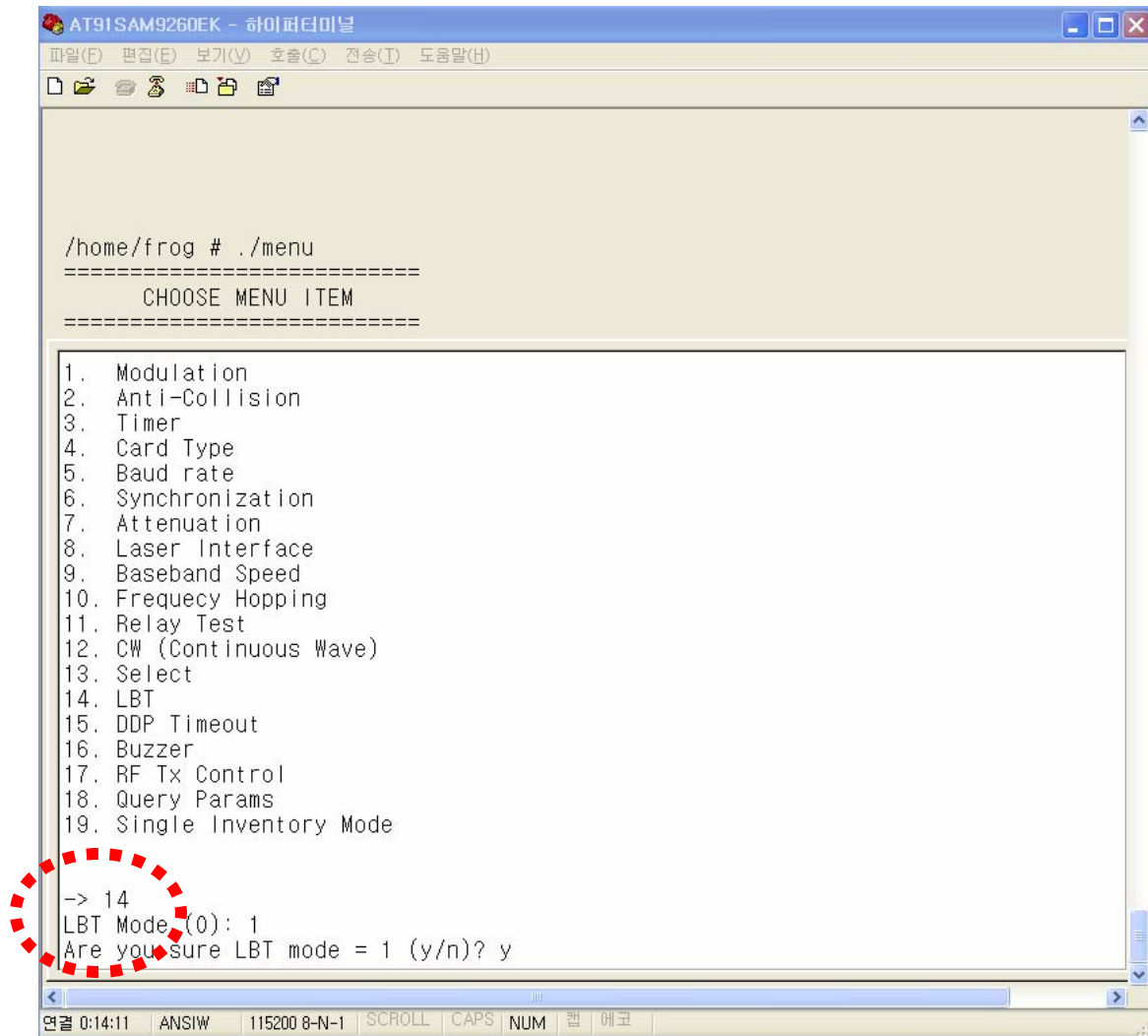
(m) **Select message transmission**

TBD

(n) **LBT setting**

To set LBT mode, use 14th item in menu.

If 1 is set in LBT mode item, LBT mode is enabled and if 0 is set, a reader operates in a normal mode.



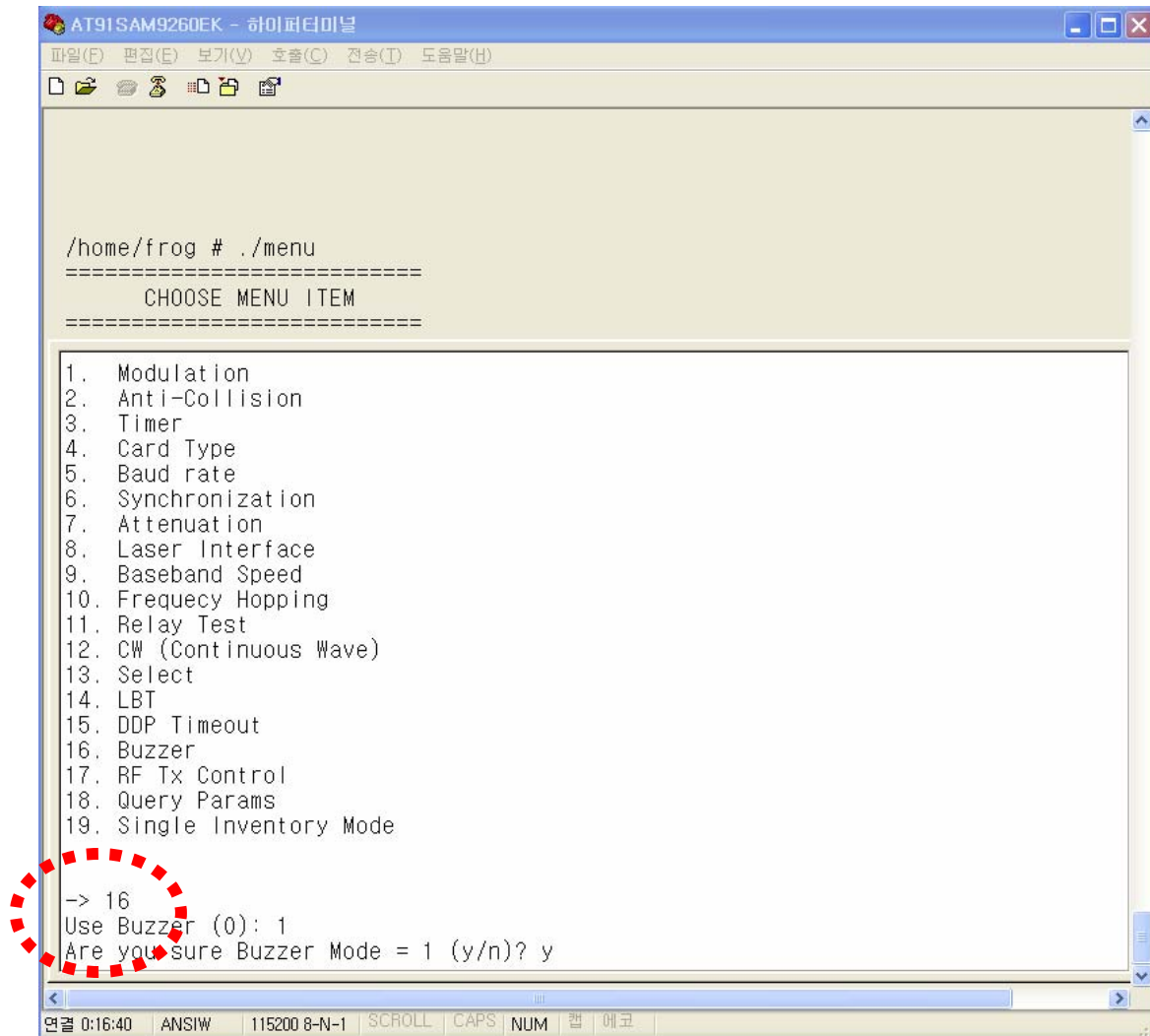
(Figure 57) LBT mode setting

(o) DDP Timeout setting

TBD

(p) Buzzer setting

To determine whether Buzzer rings when TAG ID is received or not, use 16th item in menu. If 0 is set to Buzzer mode, Buzzer mode will be OFF and Buzzer will not ring when TAG ID is received. If 1 is set to Buzzer mode, Buzzer mode will be ON and Buzzer will ring when TAG ID is received.

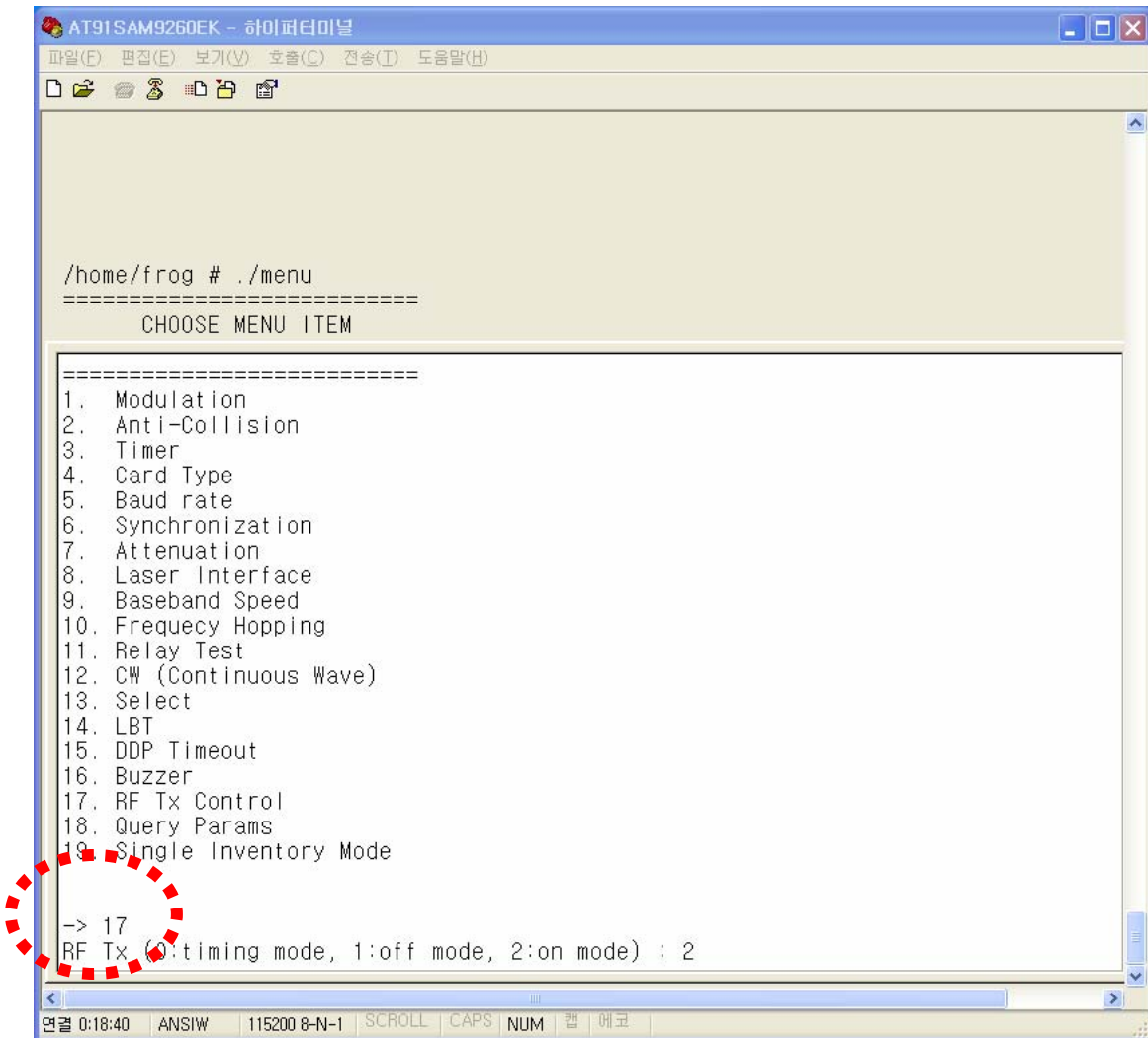


(Figure 58) Setting of Buzzer mode

(4) RF Tx Control

To determine whether to always maintain RF power ON or always maintain RF power OFF or set ON/OFF time period, use 17th item in menu.

If 0 is set, timing mode is enabled and a reader turns on RF power during ON time period and turns off RF power during OFF time period. The ON/OFF timing is set in 3rd item in menu. If 1 is set, RF power is always maintained as OFF. If 2 is set, RF power is always maintained as ON.



(Figure 59) Rx Tx Control mode setting

(r) Query Params

TBD

(s) Single Inventory Mode

TBD

10. RFID Reader Specification

Items	Specification and Fucntions
Main Board	<ul style="list-style-type: none"> • 32bit ARM CPU • 64M RAM • 256M NAND Flash
Operating Frequecy	<ul style="list-style-type: none"> • KCC : 917 ~ 923.5 MHz • FCC : 902 ~ 928 MHz • CE : 865 ~ 868 MHz
RF Output Power	27.94dBm
Channel Bandwidth	<ul style="list-style-type: none"> • KCC, CE : < 200 kHz • FCC : < 250KHz
Frequency Selection	<ul style="list-style-type: none"> • KCC, FCC: FHSS • CE : LBT
Recognition Distance	< 10m
Indicators	<ul style="list-style-type: none"> • LED : RUN, Tag, Ant1, Ant2, Ant3, Ant4 • Beep
Protocols	<ul style="list-style-type: none"> • ISO 18000-6B • ISO 18000-6C (EPC Class1 Gen2)
Communication Interfaces	RS-232 or RS-485, RS-422, 100M LAN, Synchronization Port
IO	<ul style="list-style-type: none"> • GPIO(1 digital input lines) • Relay
Operating Temperature	-30~ 70℃
Operating Humidity	0 ~ 90%
Operating Voltage	24V DC
Power Consumption	17W
Power Adaptor	110~250VAC, 50/60Hz, 1.3A
Size	275 x 220 x 55 mm

WARNING STATEMENT

“Change or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.” (Part 15.21)

“NoTE: This equipment has been tested and found to comply with the limits for a Class B digital device, purchant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.**
- Increase the separation between the equipment and receiver.**
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.**
- Consult the dealer or an experiencedradio/TV technician for help.”**

RF Exposure (OET Bulletin 65)

To comply with FCC RF exposure requirements for mobile transmitting devices, this transmitter should only be used or installed at locations where there is at least 21.9Cm separation distance between the antenna and all persons.