台揚科技股份有限公司
MICROELECTRONICS TECHNOLOGY INC.

ISO 9001 Certified

MTI RFID Explorer
User Manual
Version 2.0.1

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Table of Contents

1 Introduction 9

1.1 Overview 9

2 Explorer Installation 10

2.1 Installation Requirements 10

2.2 Installation 10

2.2.1 Installation Procedure 10

2.2.2 Removal Procedure 11

2.2.3 Configuring for Serial Operation 11

3 Explorer Usage 12

3.1 Explorer Appearance 12

3.2 Detect a Device and Select a Mode 13

3.2.1 Detect a Device 13

3.3 Controlling a Device 13

3.3.1 Inventory Rules 14

3.3.2 Tag Access 14

3.3.2.1 Access Type Read 14

3.3.2.2 Access Type Write 11

3.3.2.3 Access Type Kill 13

3.3.2.4 Access Type Lock 14

3.3.2.5 Access Type BlockWrite 14

3.3.2.6 Access Type BlockErase 16

3.3.2.7 Access Type LargeRead 17

3.4 RFID Data Views 18

3.4.1 Overview 18

3.5 Exporting Data 19

3.6 Logging Data 20

3.7 Accessing and Changing Reader Configuration 22
3.7.1 Settings Page 23
3.7.2 Antenna Configuration Page 23
3.7.3 Select Criteria Page 25
3.7.4 Inventory Algorithm Panel 26
3.7.5 Post Singulation Criteria Page 27
3.7.6 GPIO Pin Configuration Page 29
3.7.7 About Reader Page 30
3.7.8 Troubleshooting Panel 30
3.7.9 Register Access Panel 32
3.7.9.1 Register Type Mac 32
3.7.9.2 Register Type MacBank 34
3.7.9.3 Register Type Bypass 35
3.7.9.4 Register Type OEM 37
3.8 NXP Authenticate 38
3.8.1 Key Insertion and Activation 40
3.8.2 Key Authentication 46
3.9 CB-2 Tag Access 49
3.9.1 Antenna Setting 51
3.9.2 Configure Function 51
3.9.3 Control Function 55
3.10 RF Test 58
3.11 Return Loss 61
3.11.1 Formula 61
3.11.2 Single Channel 62
3.11.3 Multiple Channels 62
3.12 Command Test 62
3.12.1 Single Test 63

3.12.2 Script Test 64

3.12.3 Command Script File Format 66

4 Known Issues 67

5 Revision history 67

Figure

Figure 1: Select COM port 11

Figure 2: Explorer User Interface Main Window 12

Figure 3: The status bar 13

Figure 4: Reader Control bar 13

Figure 5: Inventory Rule 14

Figure 6: Tag Access dialog box, Access Type Read selected 14

Figure 7: Tag Access dialog box, Access Type Write selected 11

Figure 8: Tag Access dialog box, Access Type Kill selected 13

Figure 9: Tag Access dialog box, Access Type Lock selected 14

Figure 10: Tag Access dialog box, Access Type BlockWrite selected 14

Figure 11: Tag Access dialog box, Access Type BlockErase selected 16

Figure 12: Tag Access dialog box, Access Type LargeRead selected 17

Figure 13: View Menu Options – During Reader Command Execution 18

Figure 14: Data Logging 20

Figure 15: Log File Example 20

Figure 16: Accessing the Reader Configuration Dialog 22

Figure 17: Reader Configuration Dialog Box 22

Figure 18: Antenna Configuration 23

Figure 19: Antenna Logical Settings 24

Figure 20: Select Criteria View 25

Figure 21: Select Criteria Edit Dialog 25

Figure 22: Algorithm Settings View Page 26

Figure 23: Inventory Algorithm Edit Page 26

Figure 24: Post Singulation Criteria View Page 27

Figure 25: Post Singulation Criteria Edit Dialog 28

Figure 26: GPIO Pin Page 29

Figure 27: About Reader Page 30
Figure 28: Troubleshooting Page 30
Figure 29: MAC Registers Page 32
Figure 30: MAC Banked Registers Page 34
Figure 31: MAC Banked Register Read Status Example 34
Figure 32: MAC Banked Register Read and Write Status Example 35
Figure 33: MAC Bypass Registers Page 35
Figure 34: OEM Registers Page 37
Figure 35: NXP Authenticate – Select NXP Authenticate 38
Figure 36: NXP Authenticate – Tag Access Rules 39
Figure 37: NXP Authenticate – Key Access and Authenticate 40
Figure 38: Key Insertion and Activation – Get Key0 41
Figure 39: Key Insertion and Activation – Get Key1 42
Figure 40: Key Insertion and Activation – Insert Key0 43
Figure 41: Key Insertion and Activation – Insert Key1 44
Figure 42: Key Insertion and Activation – Activate Key0 45
Figure 43: Key Insertion and Activation – Activate Key1 46
Figure 44: Key Authentication 47
Figure 45: Key Authentication – TAM1 Authenticate 48
Figure 46: Key Authentication – TAM2 Authenticate 49
Figure 47: CB-2 Tag Access – Select CB-2 Tag Access 50
Figure 48: CB-2 Tag Access – Main Function 50
Figure 49: Antenna Setting – Main Function 51
Figure 50: Configure Function – Main Function 52
Figure 51: Configure Function – Inventory CB-2 Tag & Get NVM Data 53
Figure 52: Configure Function – Access CB-2 Tag NVM configurations 54
Figure 53: Configure Function – Get CB-2 Tag NVM configurations 55
Figure 54: Control Function – Main Function 56

Figure 55: Control Function – Inventory CB-2 Tag 57
Figure 56: Control Function – Set Control Functions 58
Figure 57: RF Test – Select RF Test 58
Figure 58: RF Test – Support full function in Single Channel 59
Figure 59: RF Test – Tag information is showed in the main views 60
Figure 60: RF Test – Keep inventory after received error 61
Figure 61: Return Loss – Select Return Loss 61
Figure 62: Return Loss – Multiple channels Broken Line Graph 62
Figure 63: Command Test – Select Command Test 62
Figure 64: Command Test – Main function 63
Figure 65: Single Test – Test and verify a command 64
Figure 66: Script Test 65
Figure 67: Script Text – Execute and obtain a command script file 66
Figure 68: Script Text – Command Script File Example 67

Tables

Table 1: Live Data Views.....18

Table 2: Log File Field Definitions.....21

Table 3: Revision history 67

1 Introduction

1.1 Overview

Explorer application is a .NET-based graphical user interface (GUI) tool. It can exercise the functionality of the reader platform, a platform that is based on the MTI R1000 chip, and firmware respectively. Explorer also support test functions to confirm the performance.

2 Explorer Installation

2.1 Installation Requirements

Explorer relies on release 2.0 of the Microsoft .Net Framework. The Explorer setup program checks to ensure that the correct version of the .Net Framework is installed. If the correct version is not installed, the Explorer setup program offers to install it. The user may also download and install a copy of the .Net Framework from the Microsoft Windows Update Site (http://update.microsoft.com/) or the Microsoft Download Center (http://www.microsoft.com/downloads/).

To take advantage of the data import/export feature, Microsoft Excel 2003 is required.

2.2 Installation

It is possible for multiple versions of Explorer to co-exist on a single system, so long as a unique install path is used for each, such as the default installation directory.

2.2.1 Installation Procedure

To install the Explorer tool:

1. Double click the Explorer installer file, MTI RFID Explorer [Version].msi, to launch the installation wizard.
2. When prompted, designate the desired installation directory. The default is [Program Files]\MTI\MTI RFID Explorer [version]\.
3. Installation includes the C++ runtime libraries and adds a desktop shortcut to the Explorer application.
4. To Start the Explorer application:
    - Double click the desktop shortcut, or Use the Start Menu. For example, if installed to the default directory:

    Click Start, Select All Programs, MTI, MTI RFID Explorer [version], Click Explorer.
    - Open the Explorer installation folder and double click Explorer.exe.

For those whom running on Windows 7 platform, please do the setup as following:

1. Right click on the short cut of MTI RFID ME HW GUI in "Start" menu and select "Properties".
2. Click on the tab "Compatibility" and select "Window XP Service Pack 3" in the pull down menu of "Compatibility Mode".

2.2.2 Removal Procedure

To uninstall the Explorer tool:

1. Click Start, Select All Programs, MTI, MTI RFID Explorer [version], click Uninstall Explorer.
2. When prompted to uninstall this product, click **Yes**.

Alternatively:

1. Open the Control Panel and select **Add or Remove Programs**.
2. Select the entry for the Explorer version to uninstall and click **Change/Remove**.
3. When prompted to remove this product, click **Yes**.

2.2.3 Configuring for Serial Operation

1. Open Explorer and select "**Tools**", **"Set COM port"** option in the tool bar.
2. Type COM port number.
3. Click **Set**.
4. Select Yes or No.

This window contains the COM port number. Explorer will use this number to connect the device. If this setting is changed, Explorer will close. With Serial operation, only a single reader can be controlled.

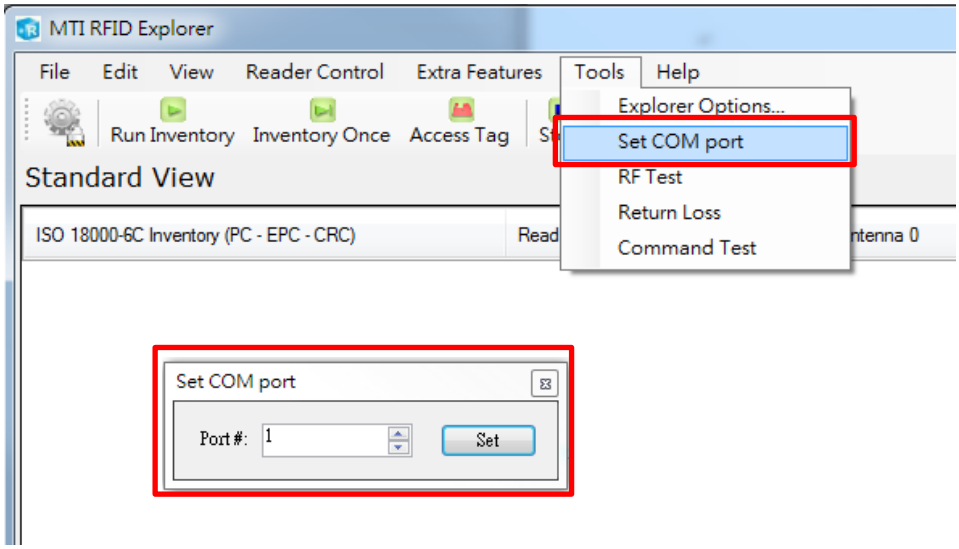


Figure 1: Select COM port

3 Explorer Usage

This section describes the features of the Explorer Application.

Explorer has been adapted with reader platform differences in mind. Consequently, Explorer supports the RU-861-based reader, hereafter referred to as the reader.

3.1 Explorer Appearance

The Explorer consists of a main display window See figure below.

- The main window contains a menu and a main display area used to show different views of the data received from the reader.
- The control bar is used to start, stop, pause inventory rounds, and to perform other reader actions.

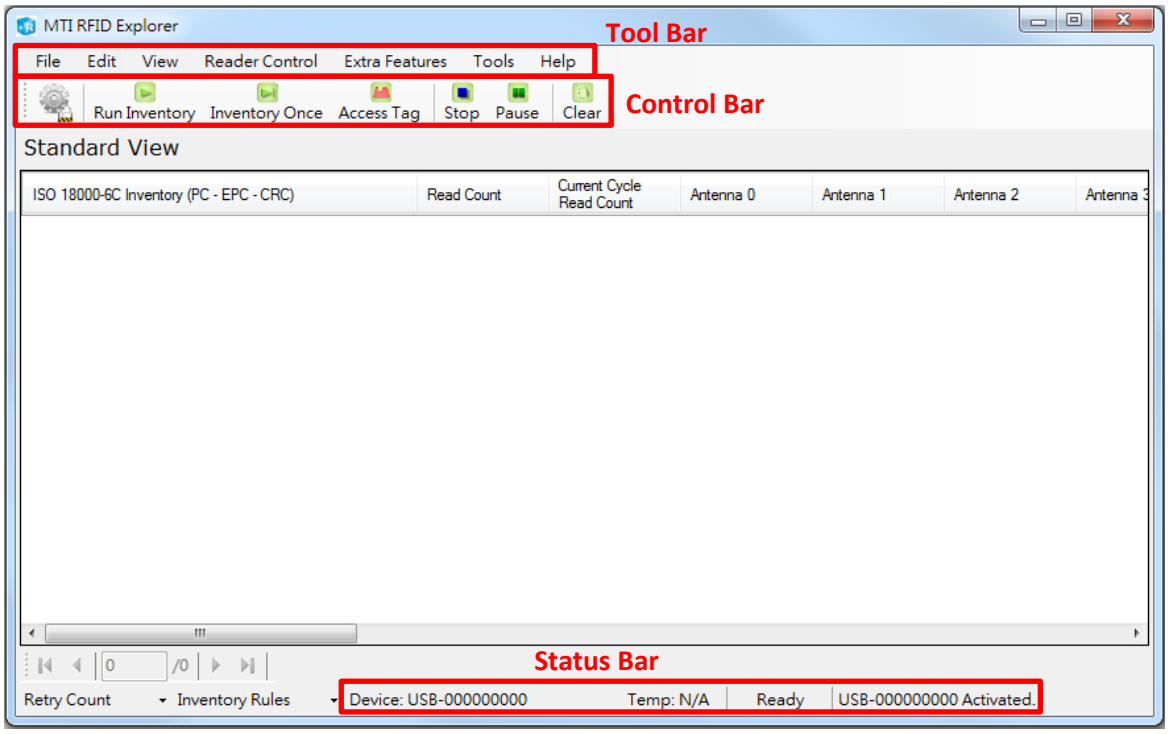


Figure 2: Explorer User Interface Main Window

3.2 Detect a Device and Select a Mode

3.2.1 Detect a Device

When the Explorer application starts, it attempts to open one attached readers. Explorer detects USB Interface first. If no reader is found by USB, Explorer starts to detect the serial port.

If any reader is found, it shows **Device Interface** (USB or Serial) and **serial number**. Otherwise, it shows "No Device".

Figure 3: The status bar

3.3 Controlling a Device

After detecting the reader, you can control the reader from the **Reader Control** menu or from the **Control Bar**. The figure below shows the **Control Bar** buttons and describes the actions they perform.

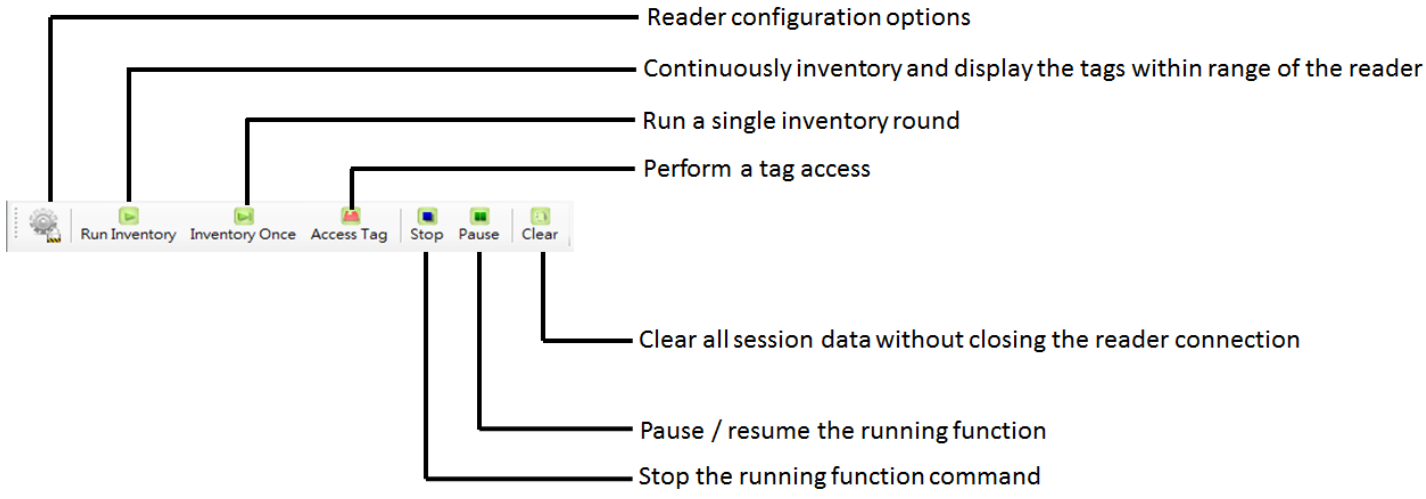


Figure 4: Reader Control bar

3.3.1 Inventory Rules

The **Select Criteria** and **Post Singulation** control whether the select and post singulation criteria that have been configured should be utilized during inventory operations. The **Extended Info** control whether the extension data is displayed during inventory operation.

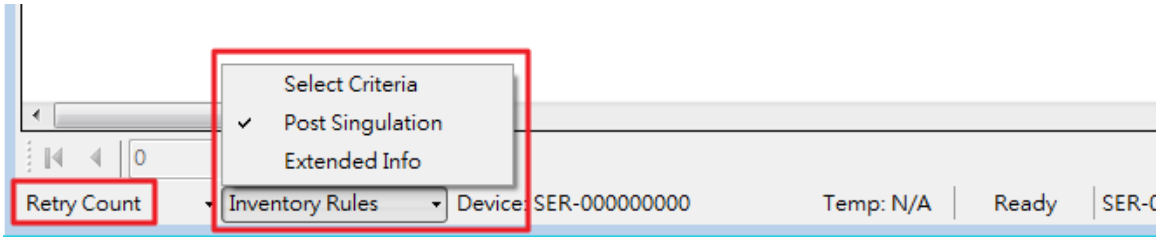


Figure 5: Inventory Rule

3.3.2 Tag Access

Selecting the **Tag Access** option presents the user with the configuration dialog shown in the figure below.

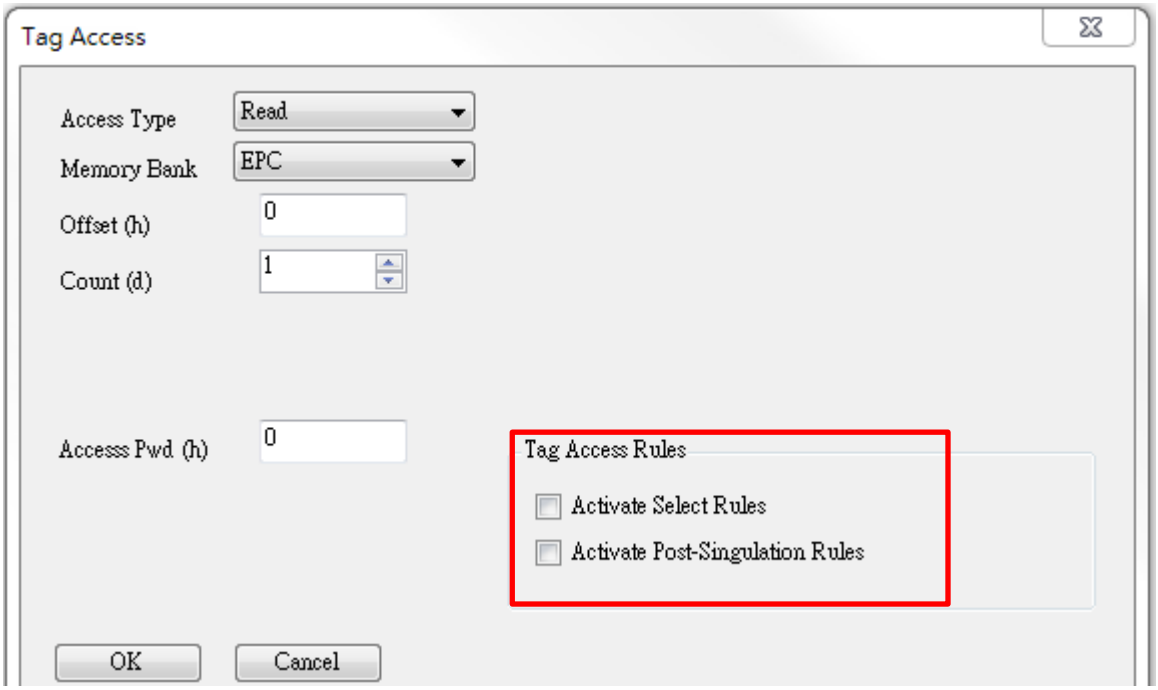


Figure 6: Tag Access dialog box, Access Type Read selected

From the **Tag Access** dialog box, the user can perform many different access operations against tags as follows.

The **Activate Select Rules** and **Activate Post-Singulation Rules** checkboxes control whether the select and post singulation criteria that have been configured should be utilized during read, write, and similar operations.

3.3.2.1 Access Type Read

Selecting the **Read** Access Type option displays the configuration dialog shown in the figure above.

From this dialog, the user can perform a read operation against tags and can provide the following configurable parameters:

- **Memory Bank**—the target for the read operation, has selectable values of either the EPC, TID, User, or Reserved memory bank
- **Offset**—the offset in hexadecimal of the first 16-bit word to read from the target memory bank
- **Count**—the number of 16-bit words to read, starting at **Offset**
- **Access Pwd**—the previously applied access password for the target tag, or no entry for tags with no access permissions

Output from read operations is directed to the primary application window.

3.3.2.2 Access Type Write

Selecting the **Write** Access Type option displays the configuration dialog shown in the figure below.

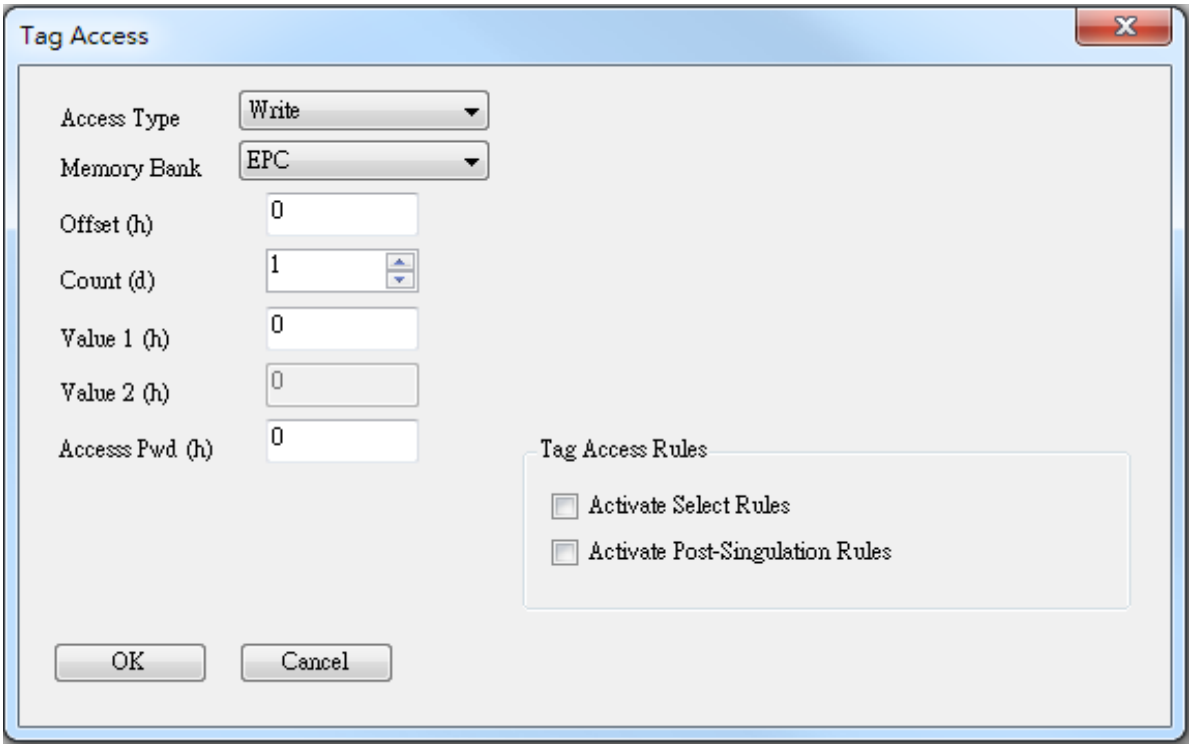


Figure 7: Tag Access dialog box, Access Type Write selected

From this dialog, the user can perform a write operation against tags and can provide the following configurable parameters:

- **Memory Bank**—the target for the write operation, has selectable values of either the EPC, TID, User, or Reserved memory bank
- **Offset**—the offset in hexadecimal of the first 16-bit word to write from the target memory bank
- **Count**—the number of 16-bit words to read, starting at **Offset**
- **Value 1**—the hexadecimal value of the 16-bit word to write at **Offset**
- **Value 2**—the hexadecimal value of the 16-bit word to write at **Offset+1**, applicable if

Count is 2

- **Access Pwd**—the previously applied access password for the target tag, or no entry for tags with no access permissions

Output from write operations is directed to the primary application window.

3.3.2.3 Access Type Kill

The kill operation allows the user to render any tag with a matching access and kill password as permanently non-functional. Selecting the **Kill** Access Type option displays the configuration dialog shown in the figure below.

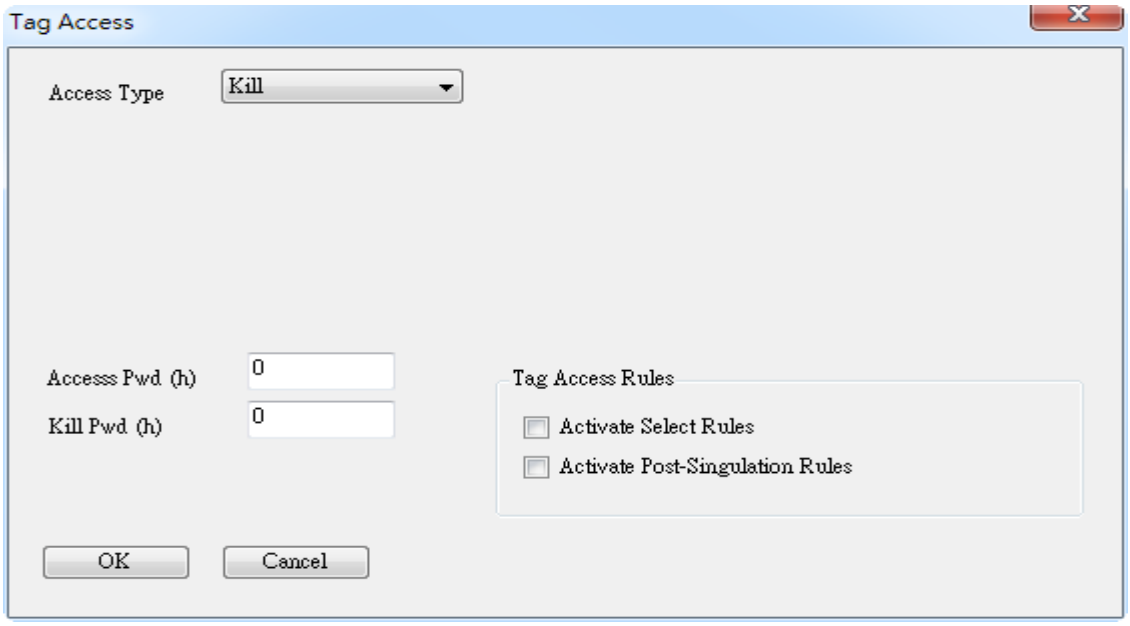


Figure 8: Tag Access dialog box, Access Type Kill selected

Note: Tags with a value of zero for their password are not expected to respond to the kill command.

3.3.2.4 Access Type Lock

The lock operation allows the user to specify the desired exposure of tag kill and access password permissions. It also allows the user to specify write permission and condition levels for the EPC, TID, and User memory banks. Selecting the **Lock** Access Type option displays the dialog box shown in the figure below.

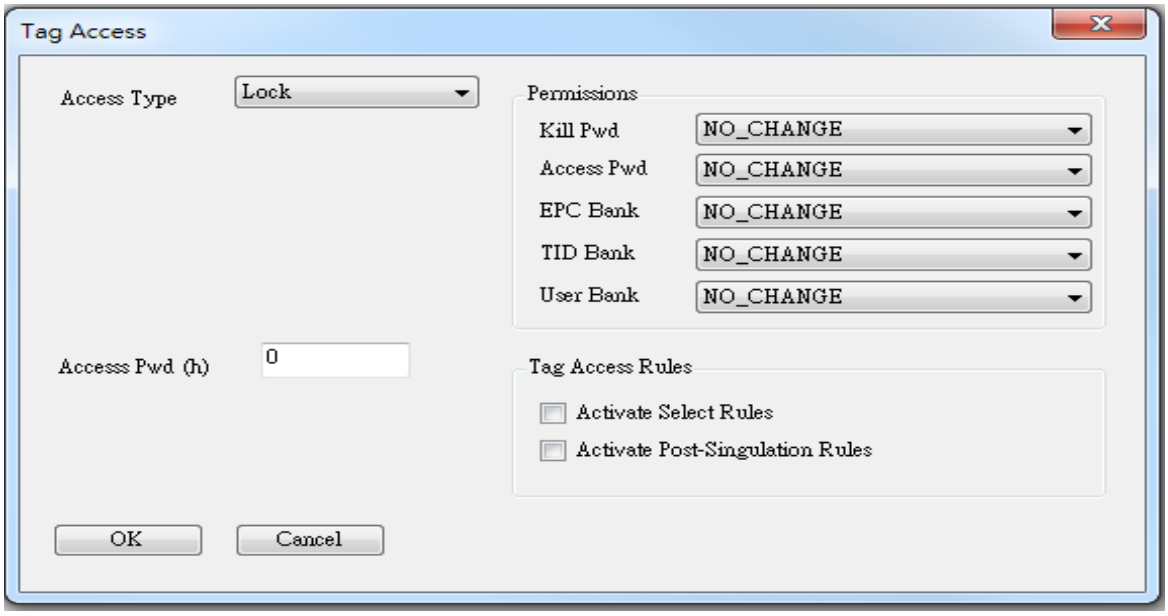


Figure 9: Tag Access dialog box, Access Type Lock selected

Note that all permissions are set in a single operation. In many circumstances, it may be desirable to leave one or more of the target passwords or permissions in an unmodified state. To do this, select the NO_CHANGE option for those targets.

3.3.2.5 Access Type BlockWrite

Selecting the **BlockWrite** Access Type option displays the configuration dialog shown in the figure below.

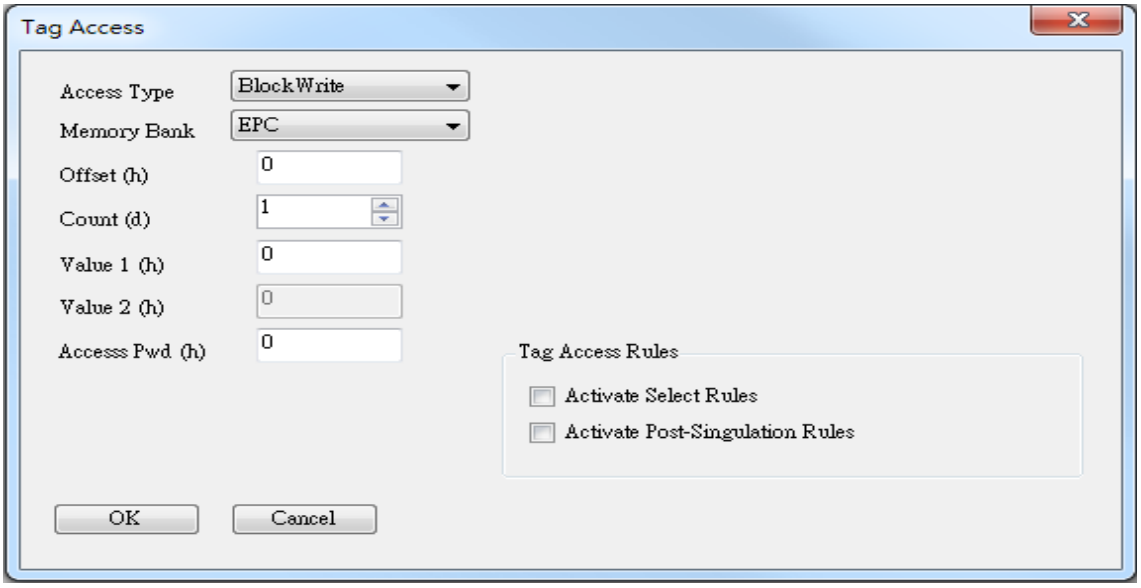


Figure 10: Tag Access dialog box, Access Type BlockWrite selected

From this dialog, the user can perform a block write operation against tags and can provide the following configurable parameters:

- **Memory Bank**—the target for the read operation, has selectable values of either the EPC, TID, User, or Reserved memory bank
- **Offset**—the offset in hexadecimal of the first 16-bit word to read from the target memory bank
- **Count**—the number of 16-bit words to read, starting at **Offset**
- **Value 1**—the hexadecimal value of the 16-bit word to write at **Offset**
- **Value 2**—the hexadecimal value of the 16-bit word to write at **Offset+1**, applicable if Count is 2.
- **Access Pwd**—the previously applied access password for the target tag, or no entry for tags with no access permissions

Output from block write operations is directed to the primary application window.

3.3.2.6 Access Type BlockErase

Selecting the **BlockErase** Access Type option displays the configuration dialog shown in the figure below.

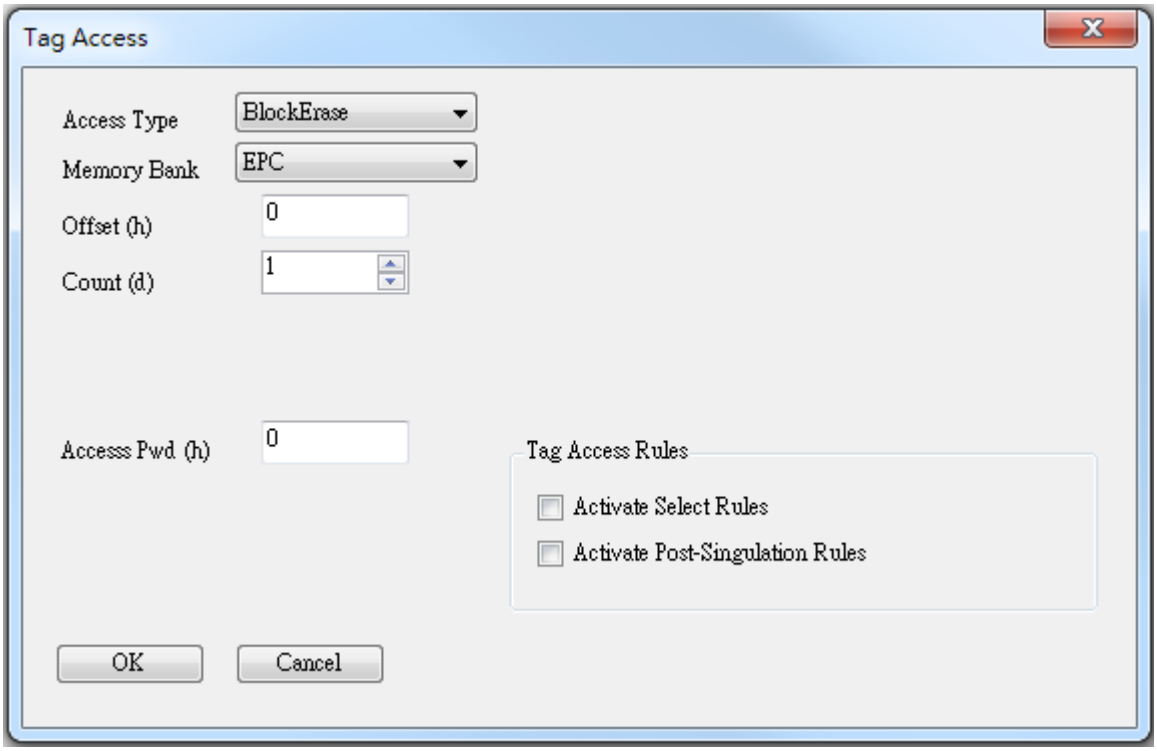


Figure 11: Tag Access dialog box, Access Type BlockErase selected

From this dialog, the user can perform a block erase operation against tags and can provide the following configurable parameters:

- **Memory Bank**—the target for the read operation, has selectable values of either the EPC, TID, User, or Reserved memory bank
- **Offset**—the offset in hexadecimal of the first 16-bit word to erase in the target memory bank
- **Count**—the number of 16-bit words to erase, starting at **Offset**
- **Access Pwd**—the previously applied access password for the target tag, or no entry for tags with no access permissions

Output from block erase operations is directed to the primary application window.

3.3.2.7 Access Type LargeRead

Selecting the **LargeRead** Access Type option displays the configuration dialog shown in the figure below.

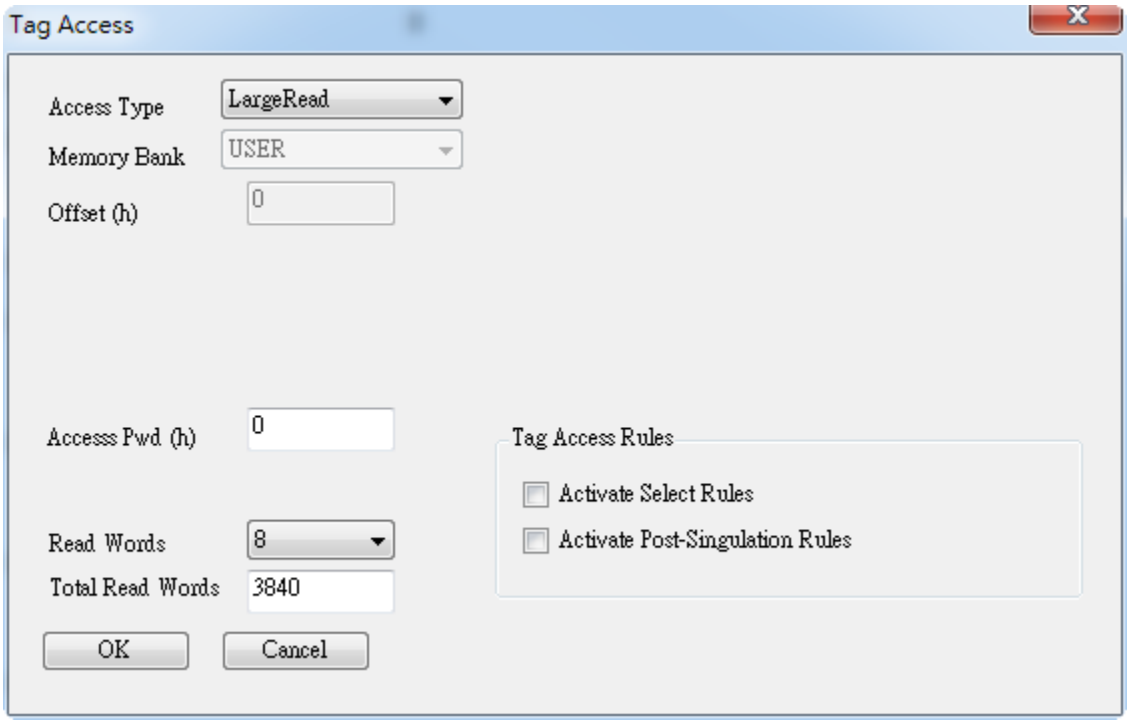


Figure 12: Tag Access dialog box, Access Type LargeRead selected

From this dialog, the user can perform a large read operation against tags and can provide the following configurable parameters:

- **Read Words**— the number of bytes to read each time (default value is 8)
- **Total Read Words**— the total of bytes to read (default value is 3840)
- **Access Pwd**—the previously applied access password for the target tag, or no entry for tags with no access permissions

3.4 RFID Data Views

3.4.1 Overview

The Explorer provides two views that allow users to examine RFID data from different perspectives. Use the **View** menu (on the main window) to select different views.

Explorer provides the live data views which are captured in real-time from the reader of data views.

The live data views display data as the packets arrive from the reader. The application applies minimal processing to this live data. The following table describes the two live data views that are available.

Table 1: Live Data Views

View Name	Contents
Standard View	A list of unique tag singulations (tag id inventoried) in the session and a count of the number of times the id was read (inventoried).
Protocol Trace	A graphical view of the packet data for the current (active) command broken out by the packet fields. The packets are logic packets. Not physical packets.

Note that while a reader is actively executing a command, such as Inventory, only live data views are available.

While the command is running, users can switch between any of the two live views (Standard and Protocol Trace). See the figure below.

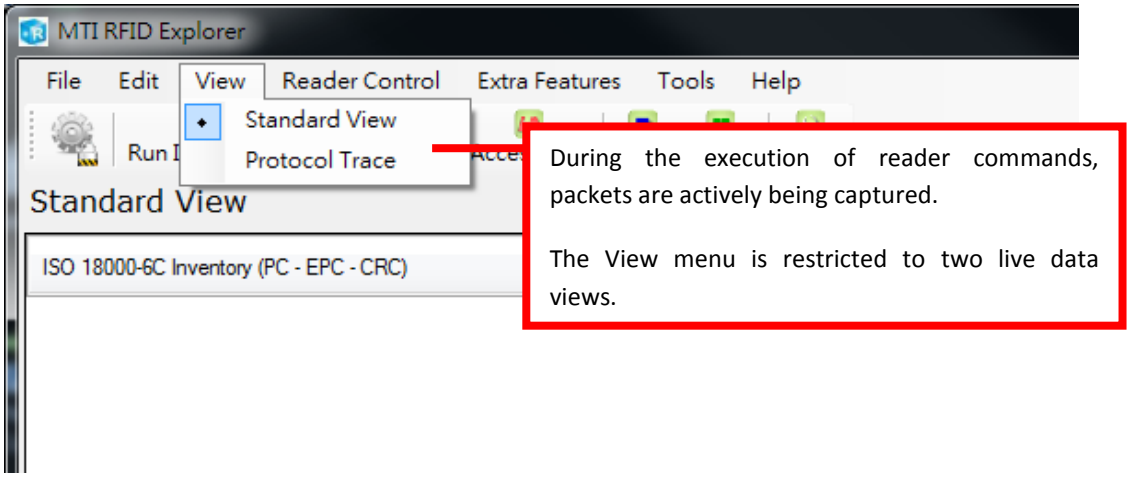


Figure 13: View Menu Options – During Reader Command Execution

3.5 Exporting Data

The Explorer application allows users to export data to Microsoft Excel 2003. To export data:

- From the **File** menu, click **Export**. A dialog box opens and users can export the Standard View.

The application saves exported files in the user's directory. After the export completes, Explorer invokes Microsoft Excel, or the associated application for xml format worksheets, to open the exported data file.

Note: Microsoft Excel allows only the first 65536 rows in each view to be exported. If a session is too big for Excel, you can always view it in the Explorer application.

3.6 Logging Data

Explorer supports the logging to a text file of all packets received from readers. See figure below to enable logging:

1. From the **Tools** menu, click **Explorer Options**. This opens the Explorer Options dialog box.
2. In the Explorer Options dialog box, click the **Data Logging** tab.
3. Select the **Enable Logging** check box.
4. If desired, specify an alternative directory in which log files should be stored.

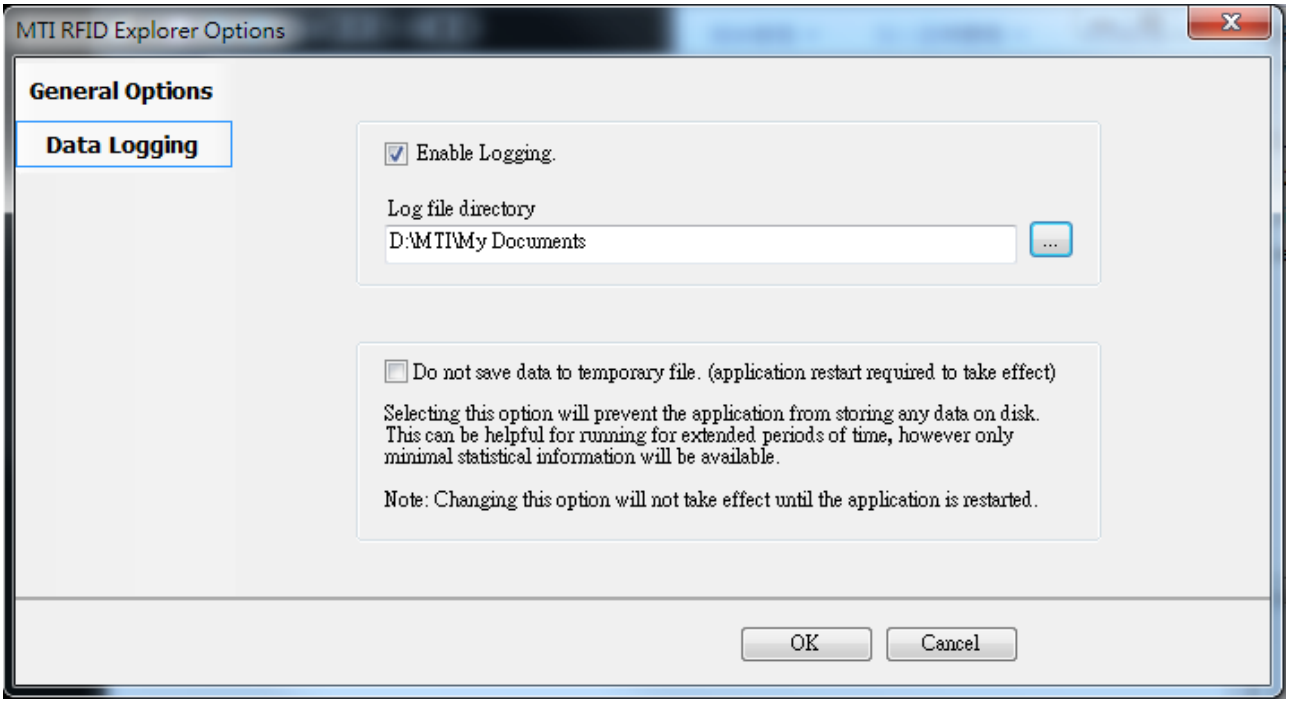


Figure 14: Data Logging

The log files created by Explorer are named `rfidxxxx.log`, where `xxxx` is a four digit sequence number. The figure below shows an example of log file content.

```
00      1962797  "Cmd Begin"      01-00-00-00-02-00-00-00-0F-00-00-00-05-00-00-00
00      1962797  "Cyc Begin"      01-00-02-00-00-00-00-00
00      1962797  "Ant Begin"      01-00-03-00-01-00-00-00-00-00-00-00
00      1962797  "Inv Begin"      01-00-04-00-00-00-00-00
00      1962797  "Inventory"      01-00-05-00-03-00-29-41-2D-A8-09-00-10-00-00-00-00-00-00-EB-6B
00      1962797  "Inventory"      01-00-05-00-03-00-29-41-2D-A8-09-00-10-00-00-00-00-00-01-FB-4A
00      1962798  "Inventory"      01-00-05-00-03-00-29-41-2D-A8-09-00-10-00-00-00-00-00-02-CB-29
00      1962798  "Inventory"      01-00-05-00-03-00-29-41-2D-A8-09-00-10-00-00-00-00-00-03-DB-08
00      1962798  "Inventory"      01-01-05-00-01-00-00-00-06-00-00-00
00      1962798  "Inv End"  01-00-09-00-00-00-00-00
00      1962798  "Inv Begin"      01-00-04-00-00-00-00-00
```

Figure 15: Log File Example

The log file contains four fields separated by tab characters. These fields are defined in the following table.

Table 2: Log File Field Definitions

Field	Contents
Radio Index	A unique serial number for the reader.
Time stamp	Elapsed time in milliseconds from the start of the session.
Symbolic Name	The symbolic name for the packet.
Packet Data	The packet data in hexadecimal format.

3.7 Accessing and Changing Reader Configuration

The Explorer application allows the user to configure many of the settings of the attached readers. To access the configuration panel:

- From the **Reader Control** menu, select **Configure Reader**. Alternatively, from the **Tool Bar,** select **Configure Reader.** See the figure below. This opens the **Explorer Reader Configuration** dialog box.

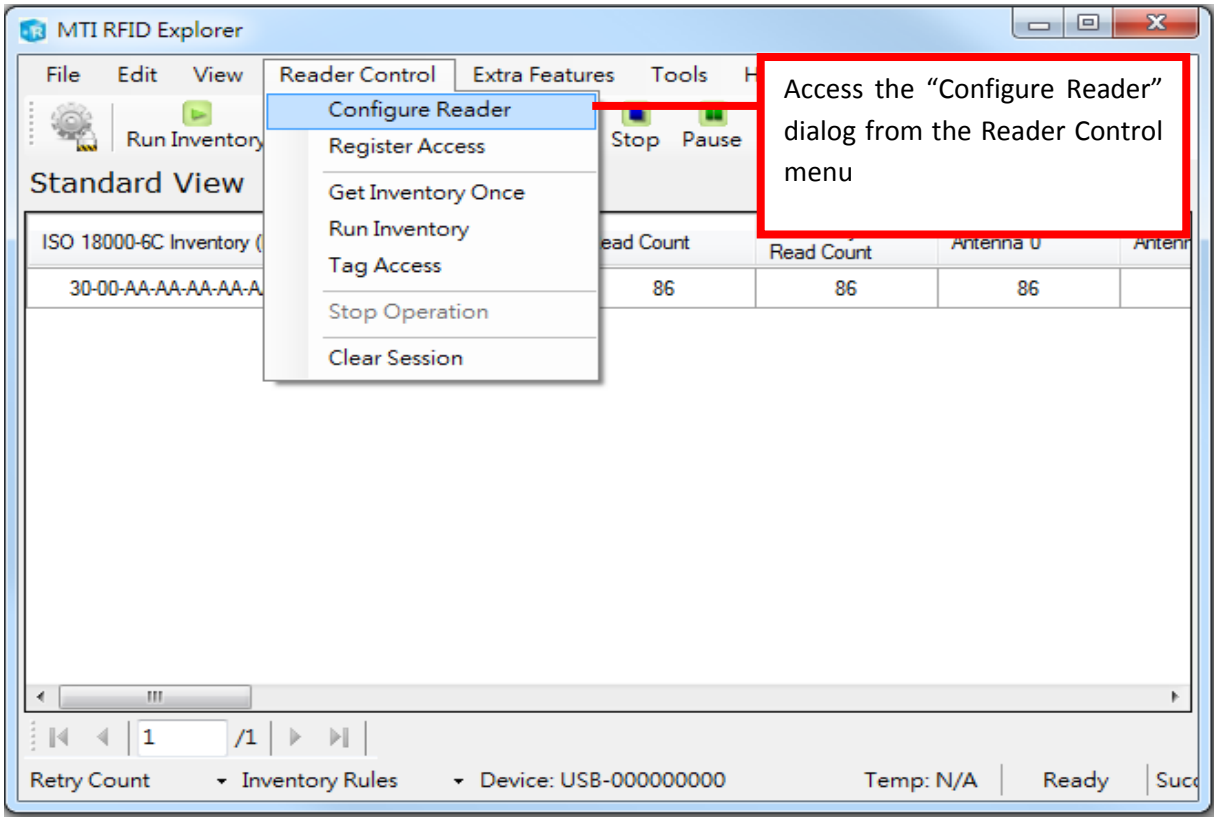


Figure 16: Accessing the Reader Configuration Dialog

The **Explorer Reader Configuration** dialog contains many function-specific pages, each of which is listed on the left-hand side selection bar. The current selection is always indicated by a visual highlight. For example, in the figure below, the **Settings** page is active.

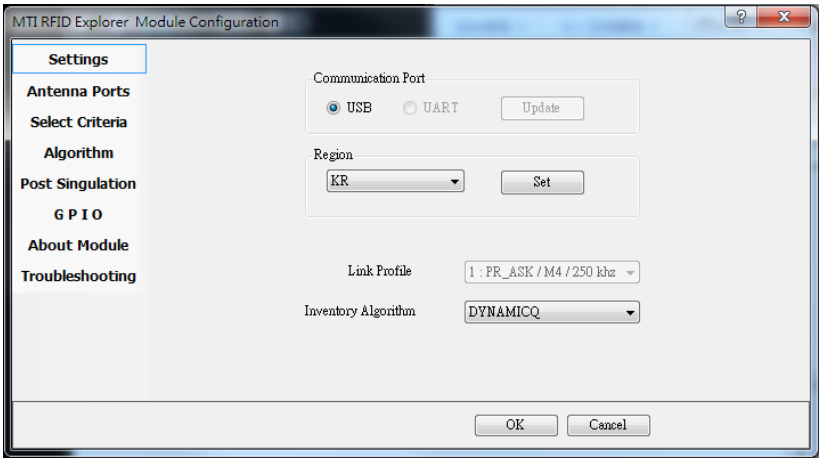


Figure 17: Reader Configuration Dialog Box

3.7.1 Settings Page

When the **Reader Configuration** dialog first opens, it displays the **Settings** page shown in the figure above. The settings displayed are the current settings on the reader.

From this page, you can view and/or configure the following items:

- Communication Port
  Set the reader communication to USB or Serial. If clicks "Update", Explorer will be closed. Need to restart the reader.
- Operating Region
- Link Profile (Read only)
- Inventory Algorithm (Fixed Q or Dynamic Q)

Note: RU-824 Reader doesn't support UART function. If connect RU-824, Explorer will disable Update UART function.

3.7.2 Antenna Configuration Page

From the **Antenna Configuration** page, you can configure the reader's 16 logical antenna ports. As the figure below shows, this page displays the current antenna configuration within a grid.

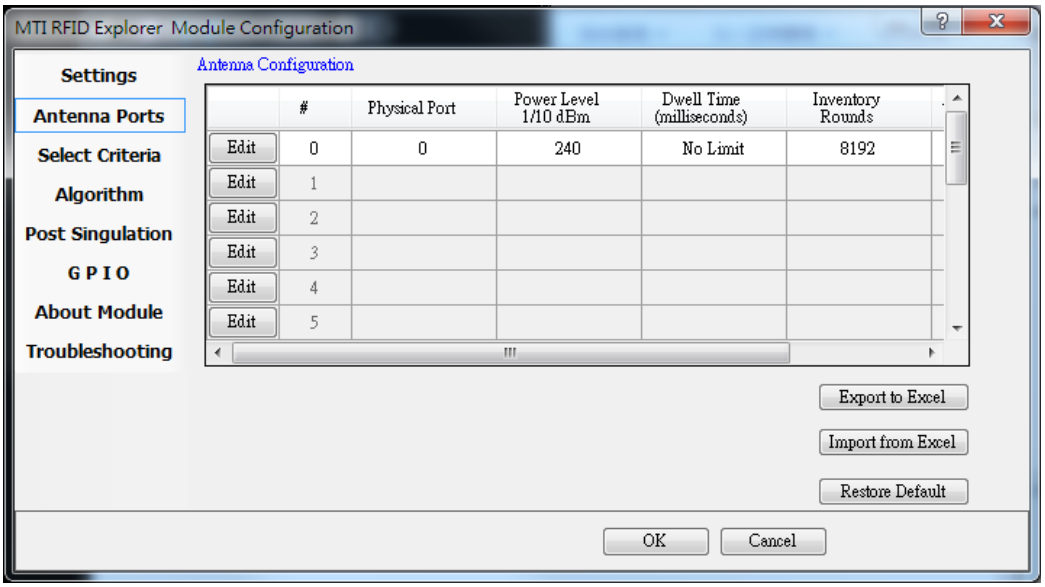


Figure 18: Antenna Configuration

The **Import** and **Export** buttons allow the antenna data to be manipulated by Microsoft Excel and then imported back into the reader.

To change the setting for a logical antenna, click its associated **Edit** button in the first column of the grid. This displays the dialog box shown in the figure below.

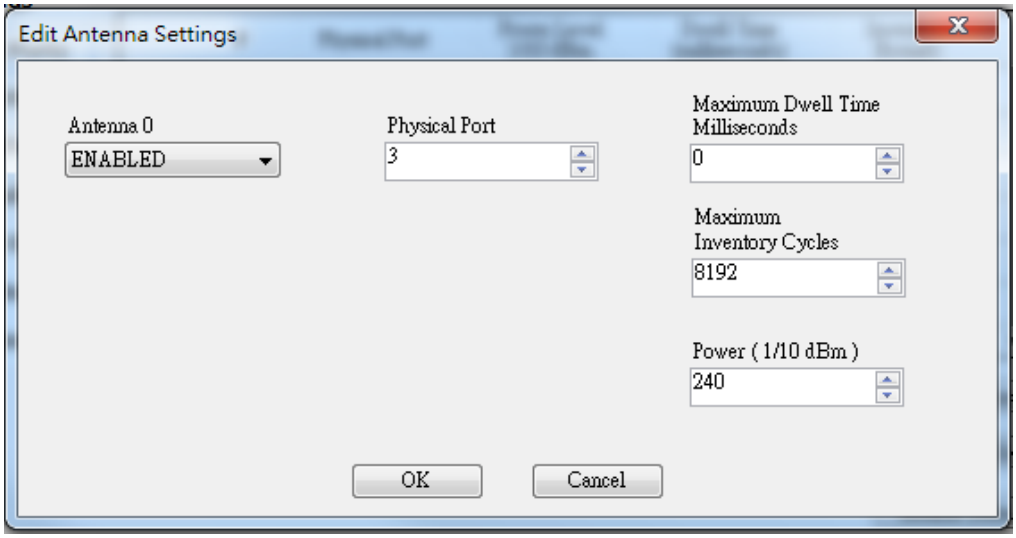


Figure 19: Antenna Logical Settings

Configurable parameters for individual antennas are:

- Physical Port indicating the physical connector (0 thru 3) to which the logical antenna is bound for transmission of data.
- Maximum Dwell Time indicating the maximum number of milliseconds that may be spent on the logical antenna during a single cycle.
- Maximum Inventory Cycles specifying the maximum number of inventory cycles that will be spent on the logical antenna before a switch to the next one available.
- Antenna transmission Power in 1/10 dBm increments.

Note: The dwell time and inventory cycles may not both be set to a value of zero. If the user attempts to perform such an operation, Explorer will response error message.

3.7.3 Select Criteria Page

Use the **Select Criteria** page to view and configure the selection criteria query settings that can be used for any tag–protocol operations. As shown in the figure below, this page displays the active selection criteria of the current reader.

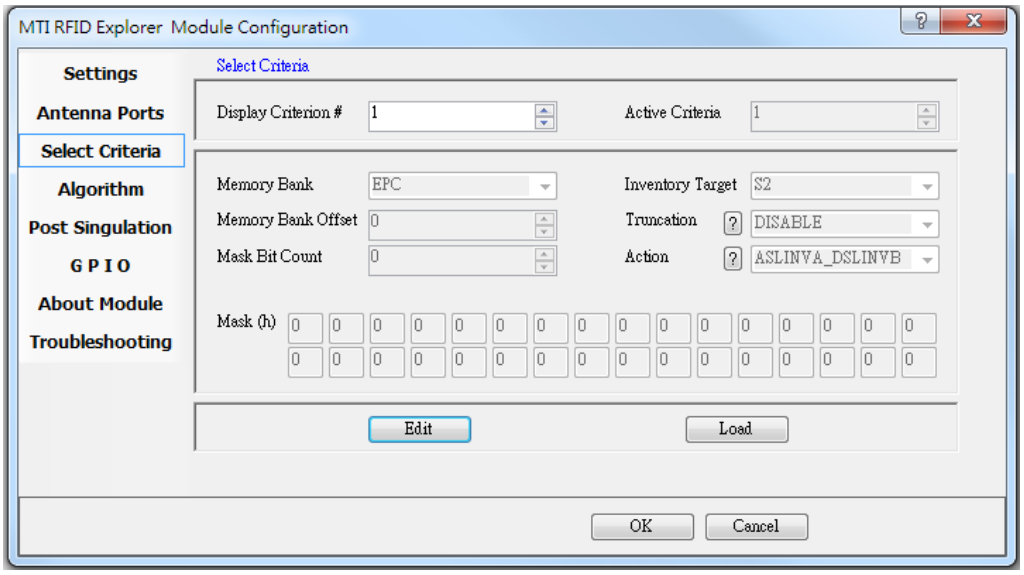


Figure 20: Select Criteria View

The **Display Criterion #** spin box allows you to select the criteria currently being viewed. It has a range of one (1) up to the value displayed under **Active Criteria**.

The **Load** button causes the application to perform a direct query to the current reader and reload the page with the retrieved select criteria settings.

To change the select criteria parameters for the active reader, click the **Edit** button. This displays the dialog box shown in the figure below.

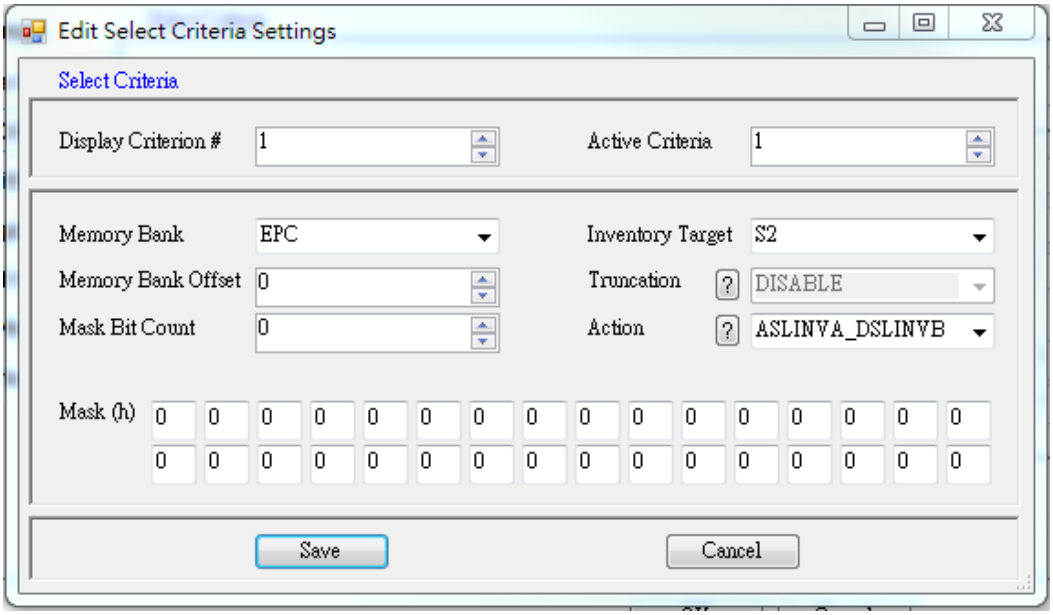


Figure 21: Select Criteria Edit Dialog

This panel allows configuration of individual select criterion parameters.

Note : Truncation is not supported in the MTI firmware at this time. The **Truncation** parameter should be set to **DISABLE**.

3.7.4 Inventory Algorithm Panel

The Inventory Algorithm panels are used to view and configure the reader's query settings. The figure below shows an example of the Inventory Algorithm View panel.

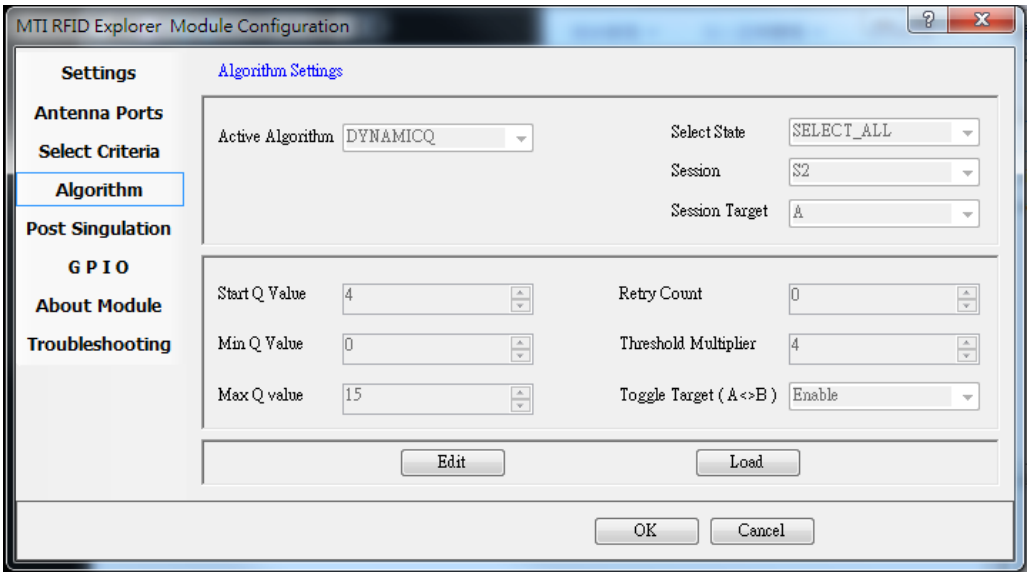


Figure 22: Algorithm Settings View Page

The **Load** button queries the current reader and refreshes the values displayed on the **Algorithm Settings** page.

To modify the algorithm settings for the current reader, click the **Edit** button. This opens a dialog box similar to the one shown in the figure below.

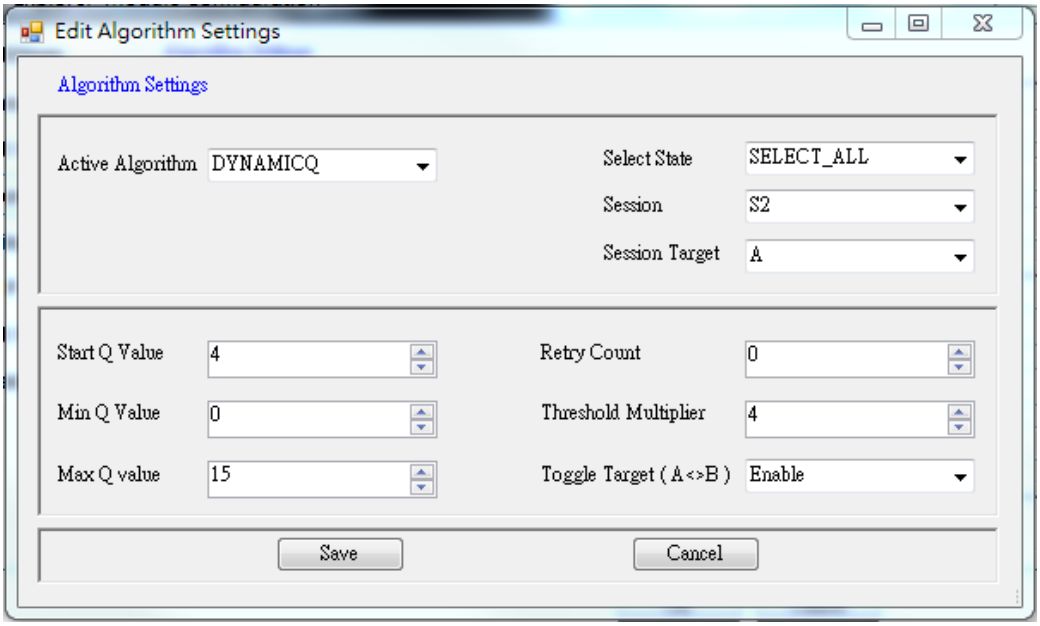


Figure 23: Inventory Algorithm Edit Page

In the **Active Algorithm** dropdown box, you can select between the Fixed Q and Dyanmic Q algorithm. When you select a new algorithm, the configurable fields display in the center sub-panel change to match those available with the selected algorithm.

3.7.5 Post Singulation Criteria Page

Use the **Post Singulation** page to view and configure reader settings that define the manner in which tags and post singulation are filtered (based on all or part of the tag's EPC).

The figure below shows an example of the page displayed when the **Post Singulation Criteria** option is chosen.

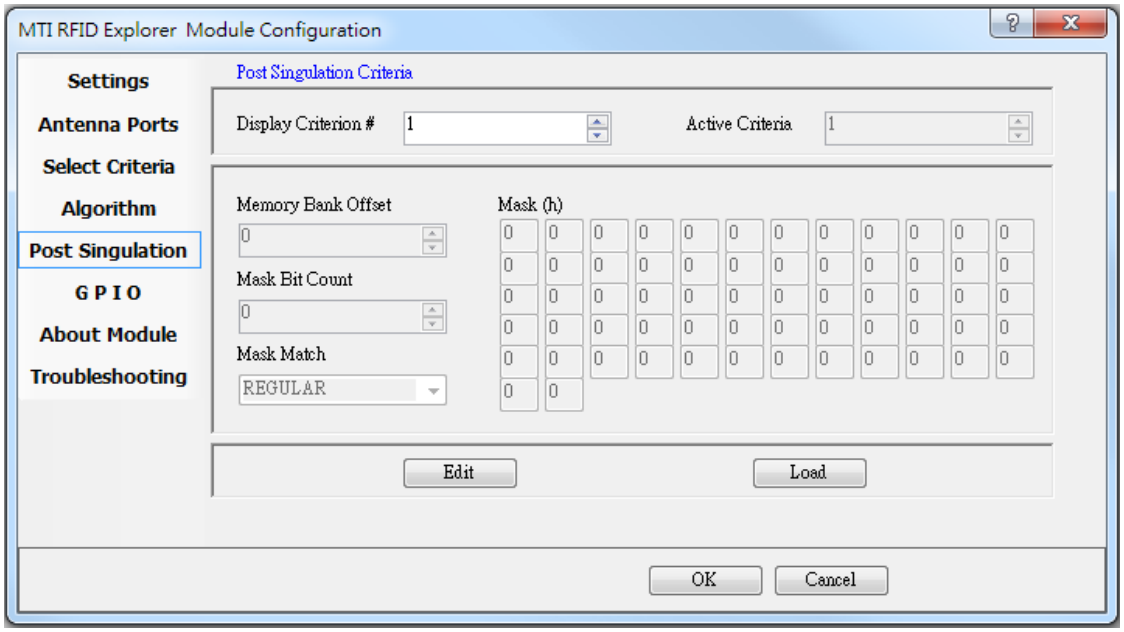


Figure 24: Post Singulation Criteria View Page

The **Display Criterion #** spin box allows you to select the criteria currently being viewed. It has a range of one (1) up to the value displayed under **Active Criteria**.

The **Load** button causes the application to perform a direct query to the current reader and reload the page with the retrieved post singulation criteria settings.

To change the post singulation criteria parameters for the active reader, click the **Edit** button. This displays the dialog box shown in the figure below.

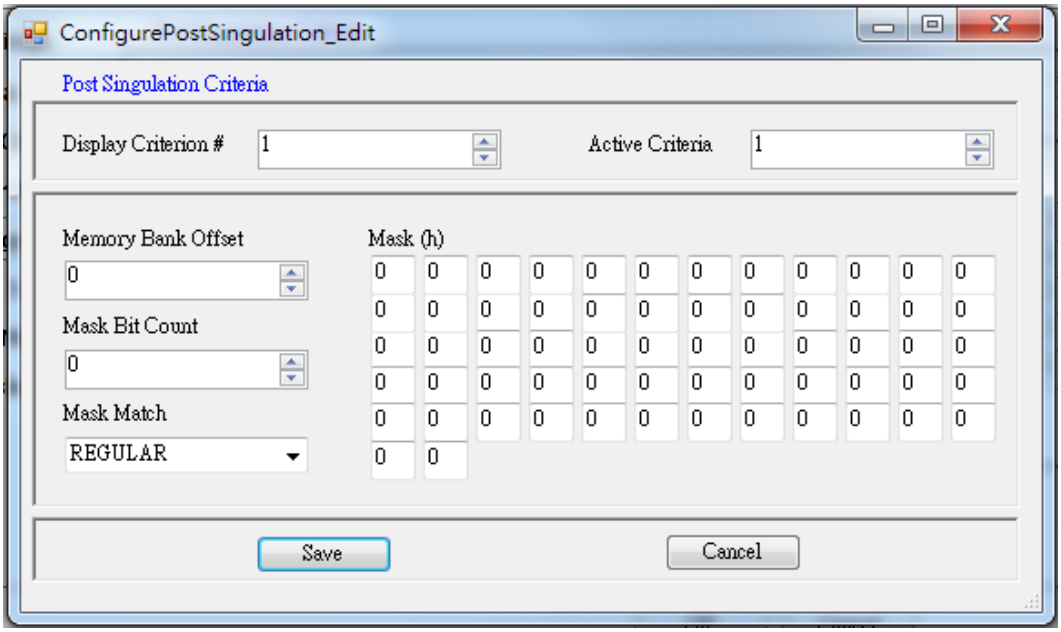


Figure 25: Post Singulation Criteria Edit Dialog

This page allows configuration of individual post singulation criterion parameters.

Note: Only one active post singulation criteria is allowed at this time. Attempts to set the **Active Criteria** count greater than one (1) in the **Edit** dialog result in an Invalid Parameter error. This error is generated and displayed when the **Save** button is clicked.

3.7.6 GPIO Pin Configuration Page

Use the **GPIO Pin Configuration** page to set and retrieve the current values of General Purpose Input/Output (GPIO) pins which are accessible to the user on the MTI Firmware microcontroller. The figure below shows the GPIO panel.

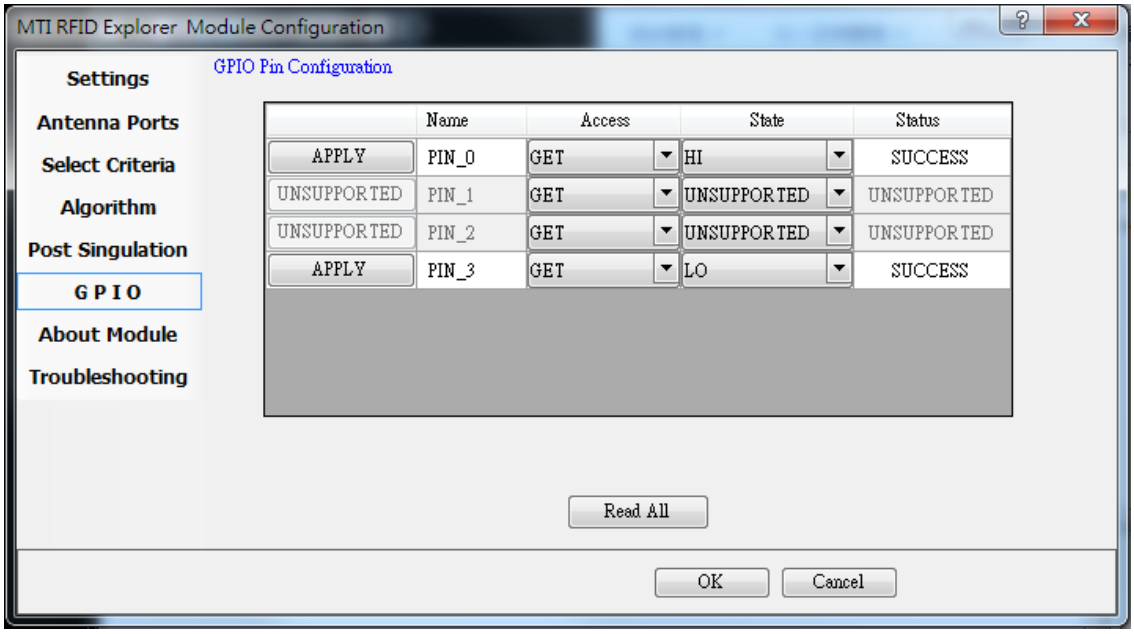


Figure 26: GPIO Pin Page

To retrieve the current value for a specific GPIO pin:

1. Set the **Access** value to **GET**.
2. Click the associated **Apply** button. The **State** column then indicates the retrieved value — **LOW** for a binary value of zero or **HI** for a binary value of one. If the operation fails, the **Status** field indicates this and the displayed state changes to **Unsupported**.

To retrieve the current values of all GPIO pins:

- Click the **Read All** button. This operation sets all pins to **GET** mode and retrieves the current values from the system.

To set a value for a specific GPIO pin:

1. Change the **Access** value to **SET**.
2. Change the **State** field to the desired value.
3. Click the associated **Apply** button.

3.7.7 About Reader Page

The **About Reader** page is a static page that provides versioning information for the MTI components of the reader. It provides a single place to find the version information for the MTI device, MTI Firmware, and MTI BootLoader. The figure below shows a sample About Page.

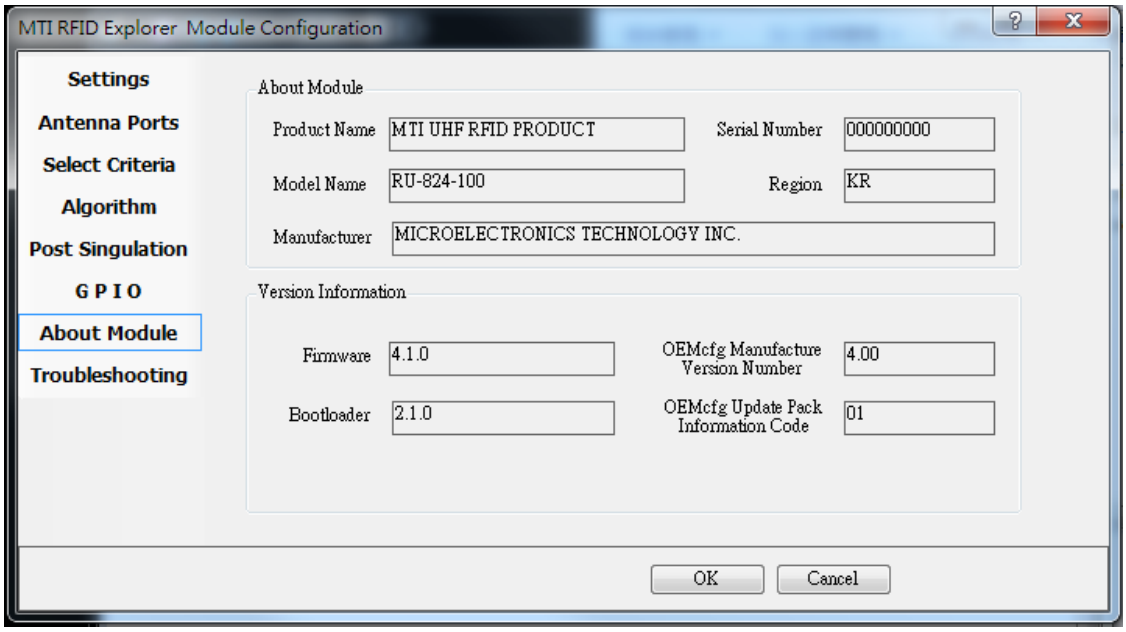


Figure 27: About Reader Page

3.7.8 Troubleshooting Panel

The **Troubleshooting** page provides access to the MTI Firmware error register as well as the ability to clear the error and reset the MTI Firmware. See the figure below.

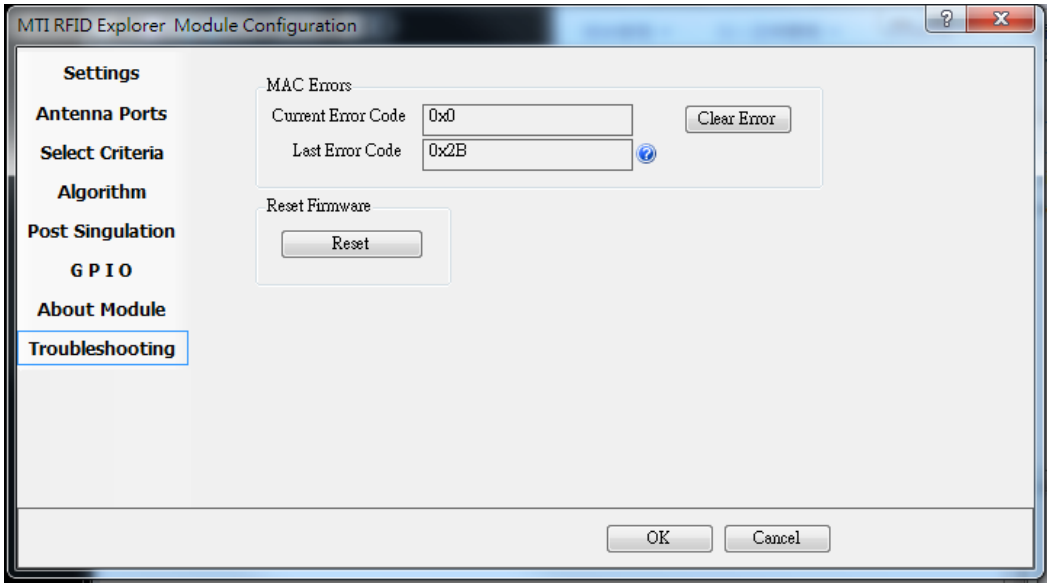


Figure 28: Troubleshooting Page

Note: Performing a **Reset Firmware** operation causes a reset of the connection to the current

reader. The reader will no longer be accessible via the application until the application is restarted.

3.7.9 Register Access Panel

It is recommended that you have a very strong understanding of the behavior of the underlying MTI Firmware prior to modifying register values directly via this method.

For the purpose of controlling and configuring the reader, the Explorer application allows the user to read and write the various MTI Firmware registers.

3.7.9.1 Register Type Mac

Selecting the **Mac** Register Access option displays the dialog shown in the figure below. From this dialog, the user can perform read and write access to MAC Registers.

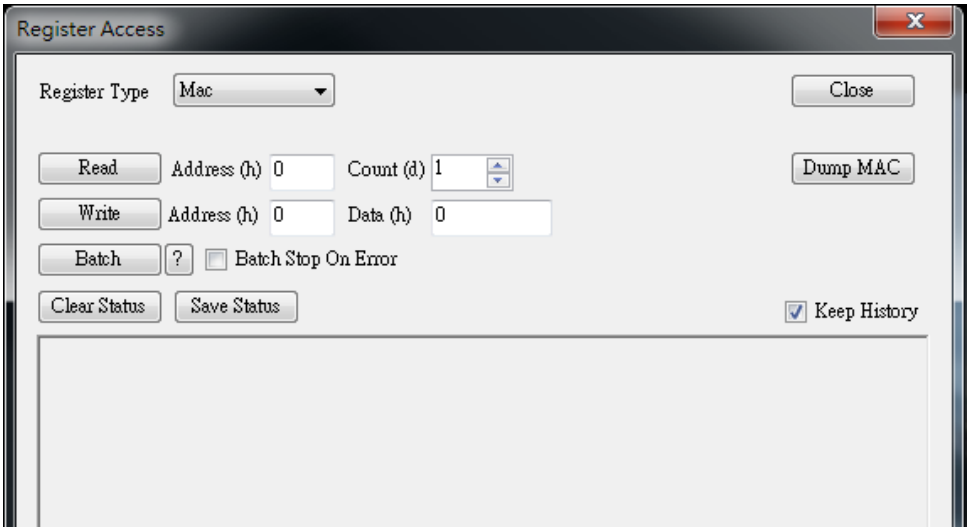


Figure 29: MAC Registers Page

To read an individual MAC register value:

- Enter the hexadecimal start address and the total number registers to read.
- Click the **Read** button. If a register cannot be read, for example because of an invalid address entry or the register is write-only, a read fail result will be displayed in the status window.

To write an individual MAC register value:

- Enter the hexadecimal start address and the hexadecimal value to write.
- Click the **Write** button. If a register cannot be written, for example because of an invalid address entry or the register is read-only, a write fail result will be displayed in the status window.
- The **Batch** button allows for batch processing of multiple registers. Select the **?** button for Register Access Batch Help and file format.
- The **Dump MAC** button reads all MAC registers and dumps the data in the status window.
- The **Clear Status** button clears the status window.
- The **Save Status** button allows the content of the status window to be saved to a file.
- Check **Keep History** to retain all access history in the status window. Uncheck **Keep History** to

retain only the last access record in the status window.

3.7.9.2 Register Type MacBank

Selecting the **MacBank** Register Access option displays the dialog shown in the figure below. This dialog reduces the user input required to perform read and write access to MAC Banked Registers.

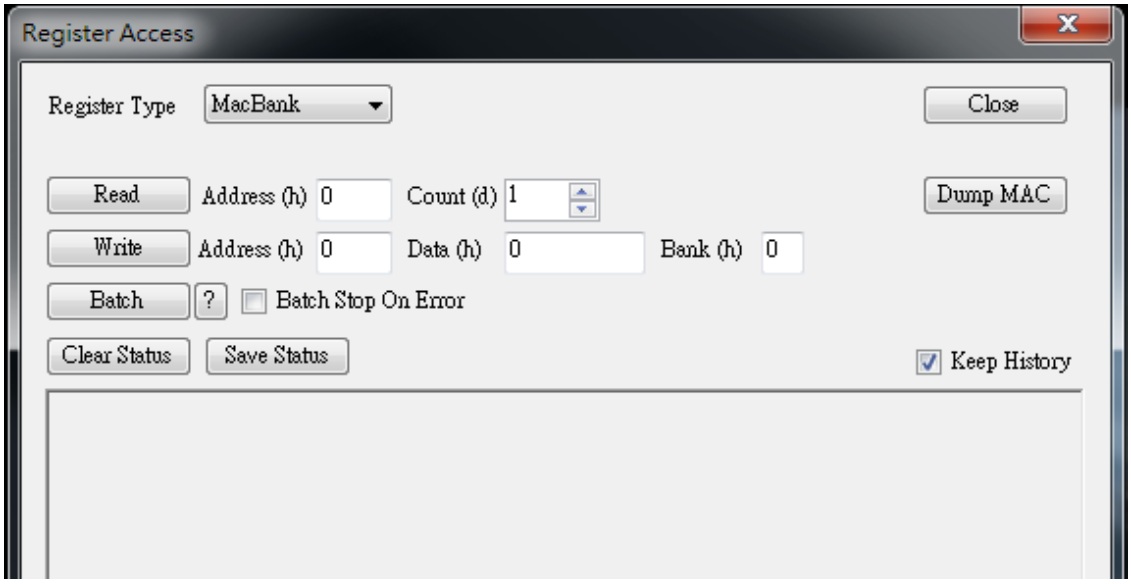


Figure 30: MAC Banked Registers Page

The configurable parameters for MAC Banked Register read operations are identical to Mac Register read. The figure below shows the status window for a valid banked register read, detailing the currently selected bank, the applicable selector address, and the content of all banks.

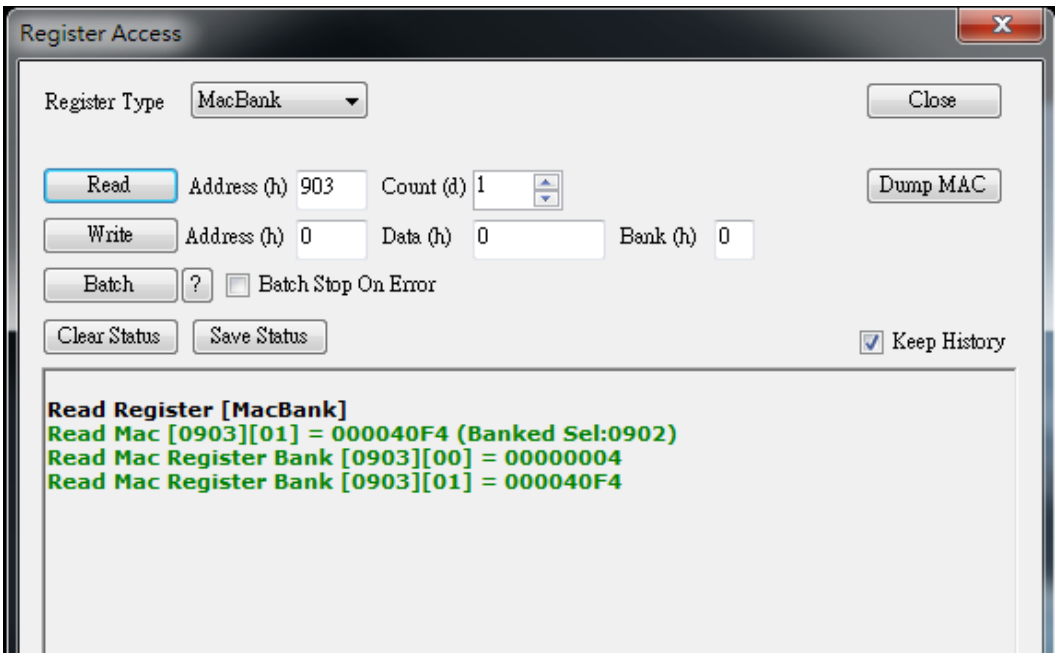


Figure 31: MAC Banked Register Read Status Example

The configurable parameters for MAC Banked Register write operations are identical to MAC Register write, except that an additional bank parameter is provided. This alleviates the need to utilize the Mac Register Access dialog to select the desired bank via the bank selector register before performing banked register operations. The figure below shows the status window for a valid banked register read, detailing the currently selected bank, the applicable selector address, and the content of all banks. This is followed by a write to each bank by simply changing the bank index.

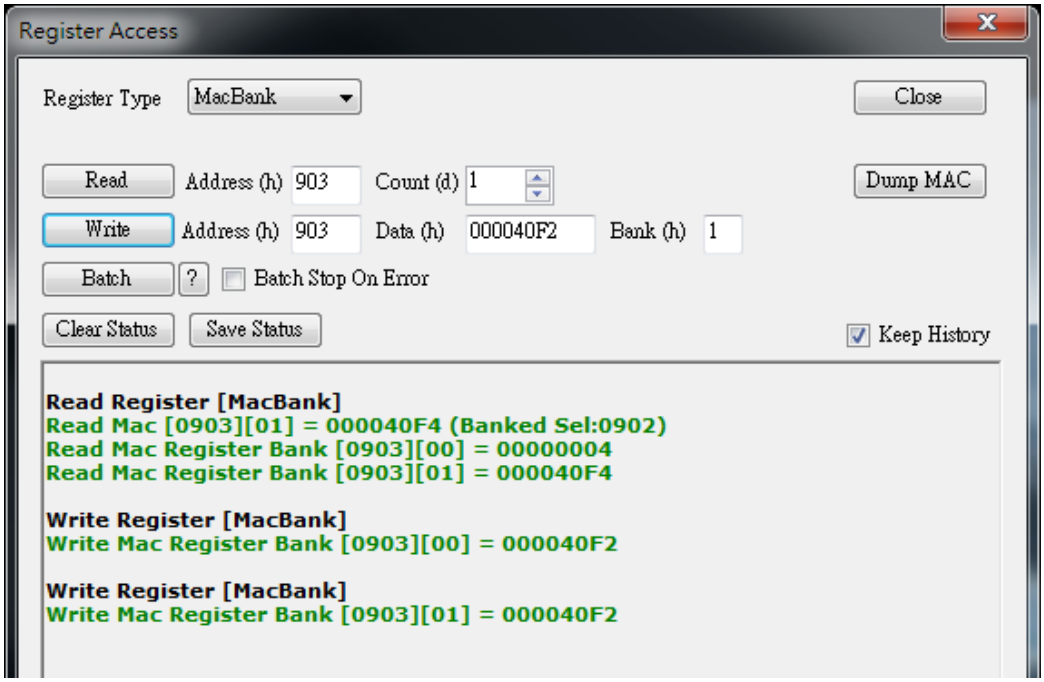


Figure 32: MAC Banked Register Read and Write Status Example

3.7.9.3 Register Type Bypass

Selecting the **MacBypass** Register Access option displays the dialog shown in the figure below. From this dialog, the user can perform read and write access to Registers.

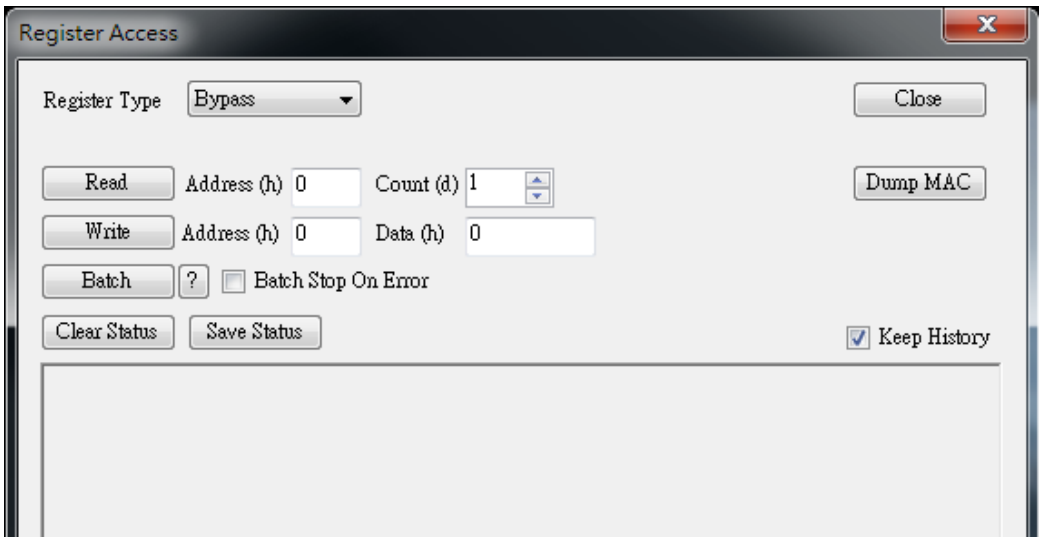


Figure 33: MAC Bypass Registers Page

The configurable parameters for Bypass Register read and operations are identical to Mac Register read.

3.7.9.4 Register Type OEM

Selecting the **OEM** Register Access option displays the dialog shown in the figure below. From this dialog, the user can perform read and write access to the OEM Registers.

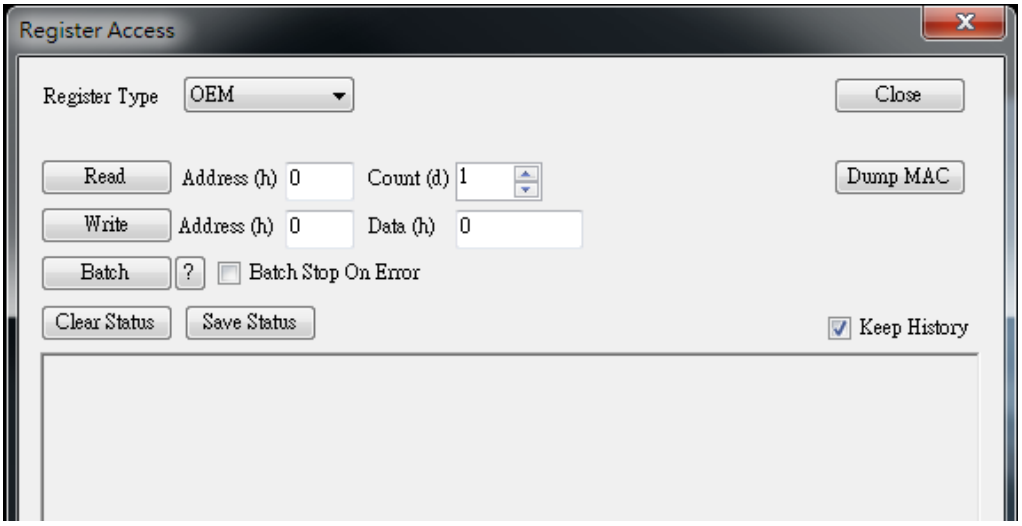


Figure 34: OEM Registers Page

The configurable parameters for OEM Register read and operations are identical to those in section Mac Register write.

Note: RU00-M03-X RFID module support four baud rate settings: 115200 bps, 230400 bps, 460800 bps and 921600 bps. For high baud rate (not include 115200 bps), Explorer only support FTDI UART control library. Please make sure use FTDI UART cable to access RU00-M03-X module before setting OEM data to change to high baud rate – otherwise the Explorer can't control RFID module anymore.

3.8 NXP Authenticate

MTI supports “NXP Authenticate” to provide user to authenticate the tag by using Advanced Encryption Standards (AES) with the secret key and access the secret keys of NXP UCODE DNA Tag. Select **Extra Features** option. Click **NXP Authenticate**. The NXP Authenticate dialog window will be displayed.

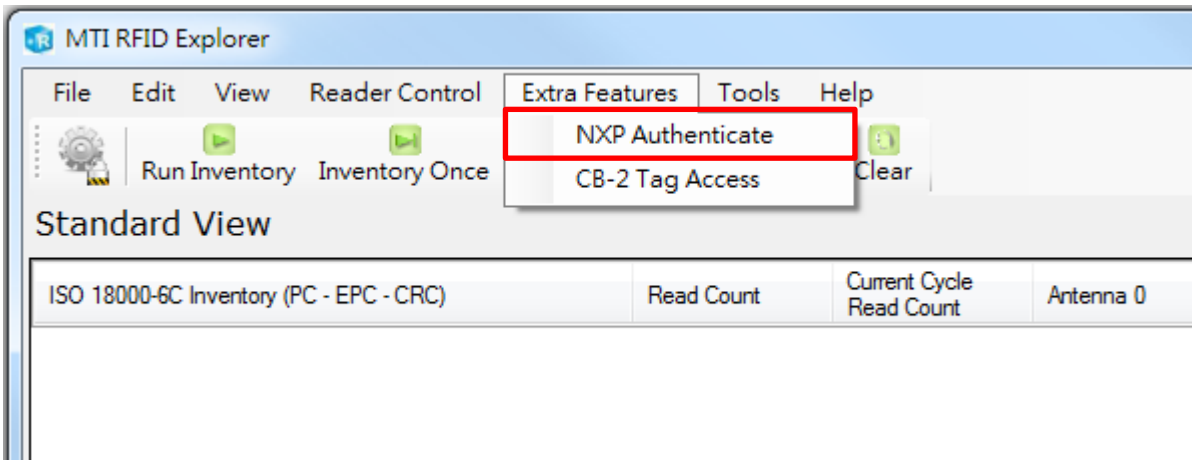


Figure 35: NXP Authenticate – Select NXP Authenticate

The NXP Authenticate provides **Activate Select Rules**, **Activate Post-Singulation Rules** and **Accesss Pwd (h)** tag access rule functions. The **Activate Select Rules** and **Activate Post-Singulation Rules** checkboxes control whether the select and post singulation criteria that have been configured should be utilized during read, write, and similar operations. The **Accesss Pwd (h)** is that the previously applied access password for the target tag, or no entry for tags with no access permissions in the figure below:

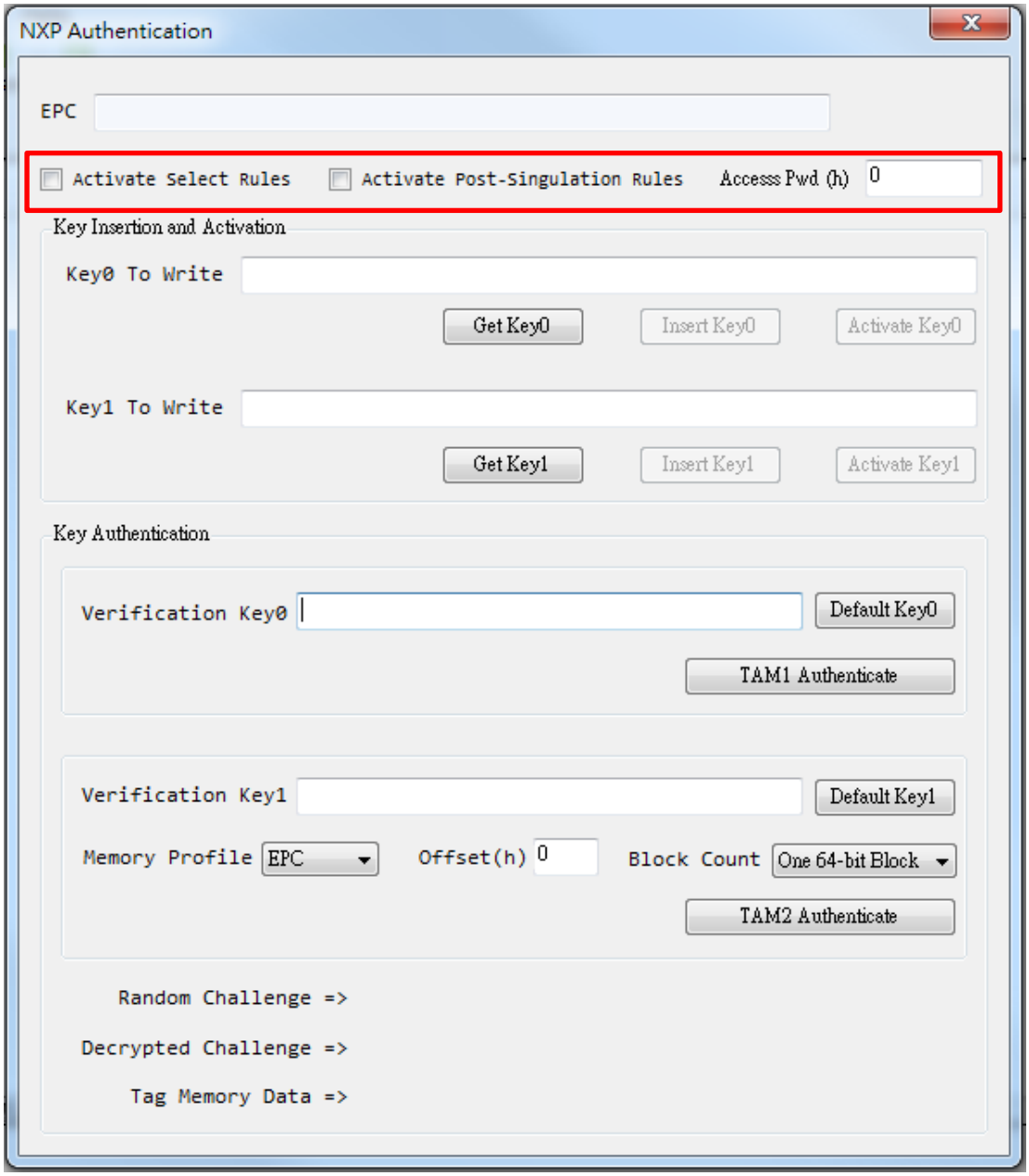


Figure 36: NXP Authenticate – Tag Access Rules

The NXP Authenticate includes of two functions in the figure below:

- Key Insertion and Activation: Access the authenticated Key0 or Key1.
- Key Authentication: Authenticate the tag by using the Key0 or Key1.

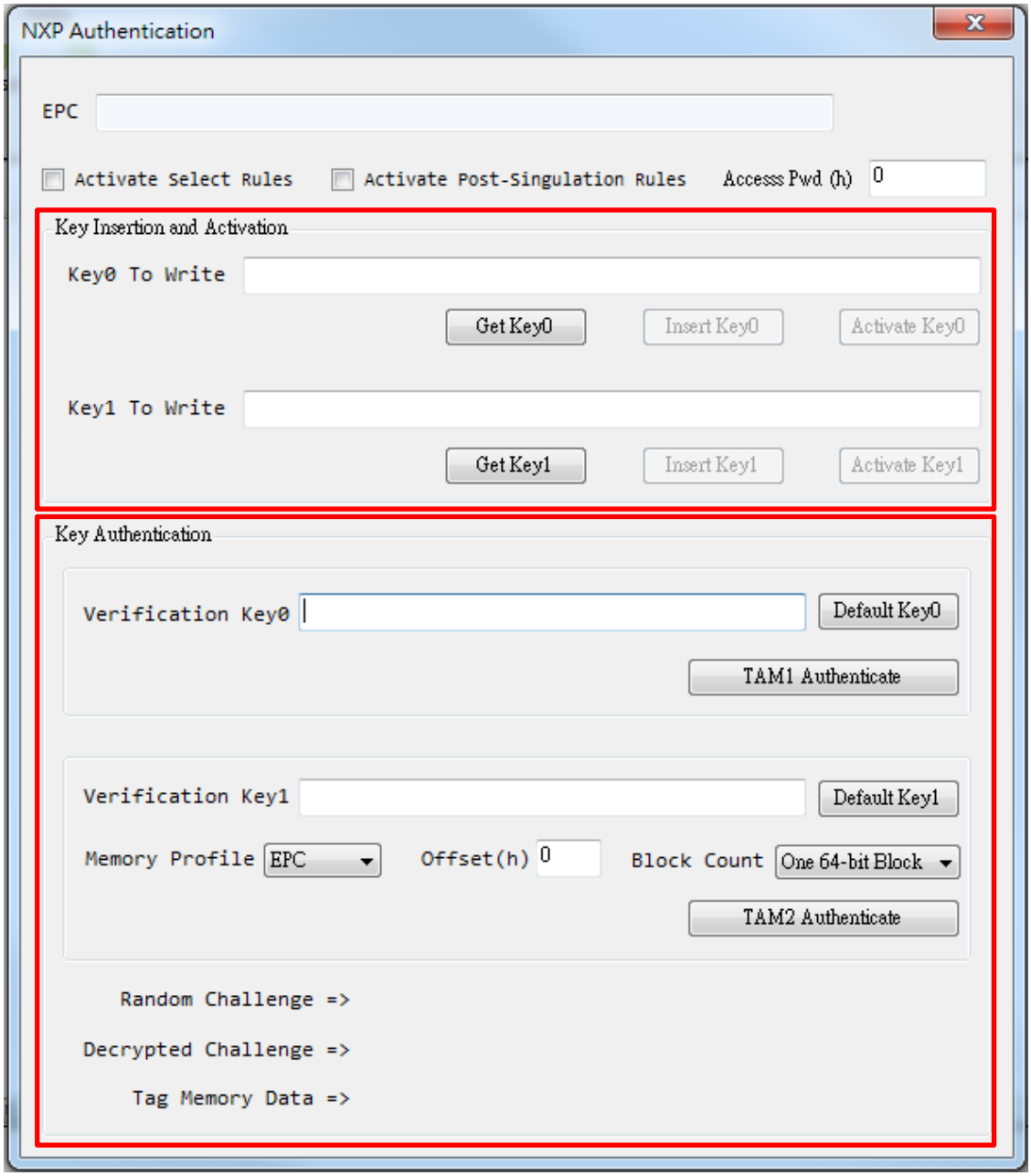


Figure 37: NXP Authenticate – Key Access and Authenticate

3.8.1 Key Insertion and Activation

The **Key Insertion and Activation** provides **Get**, **Insert** and **Activate** functions to access the NXP UCODE DNA Tag. Click the **Get Key0** button to get the secret Key0 form NXP UCODE DNA Tag which is in the antenna magnetic field. Likewise, click the **Get Key1** button to get the secret Key1. If get the secret Key0 or Key1 successful, the corresponding **Insert** and **Activate** functions can be used. On the other hand, if the Key0 or Key1 is activated, the corresponding secret key can't be read anymore.

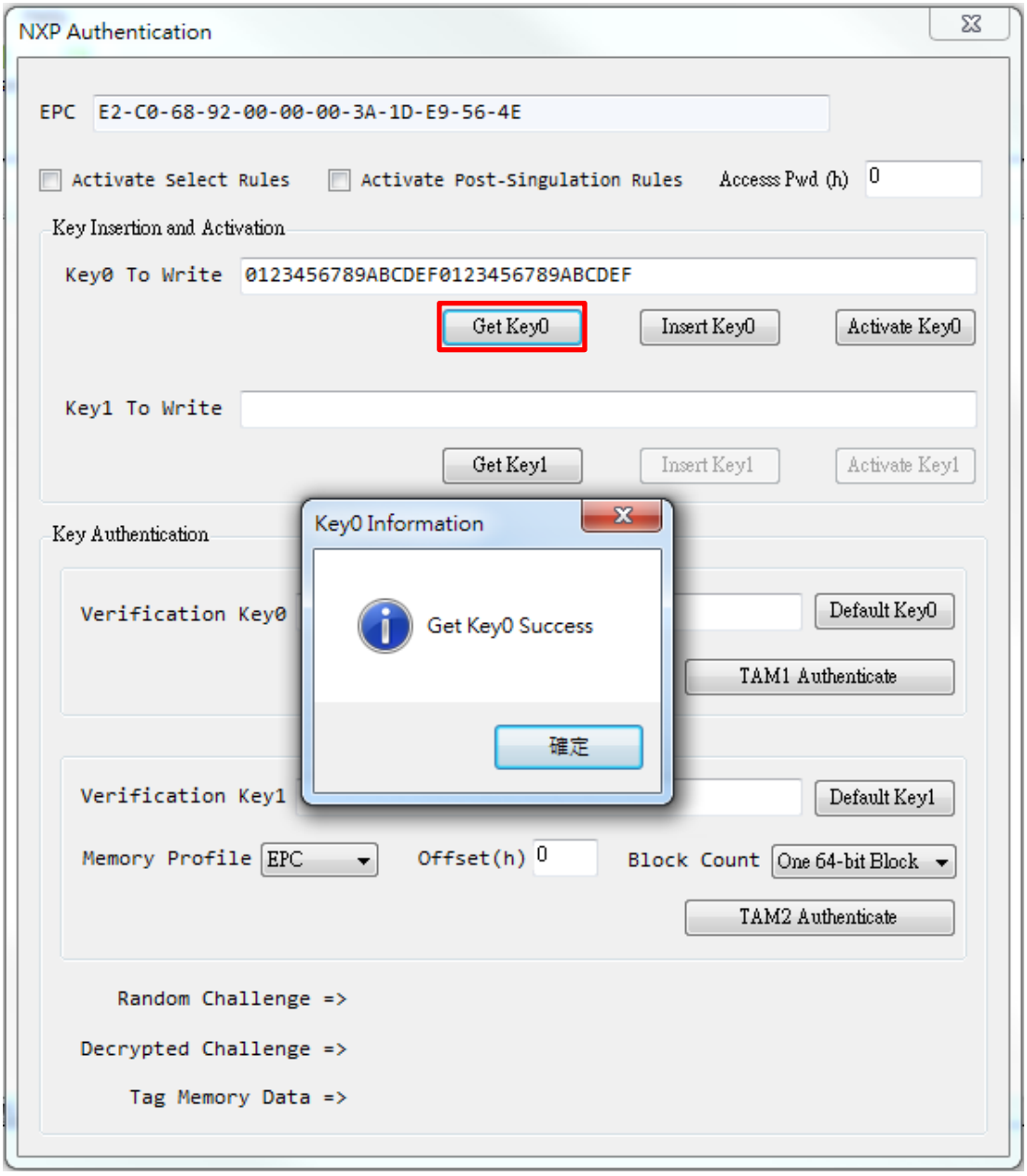


Figure 38: Key Insertion and Activation – Get Key0

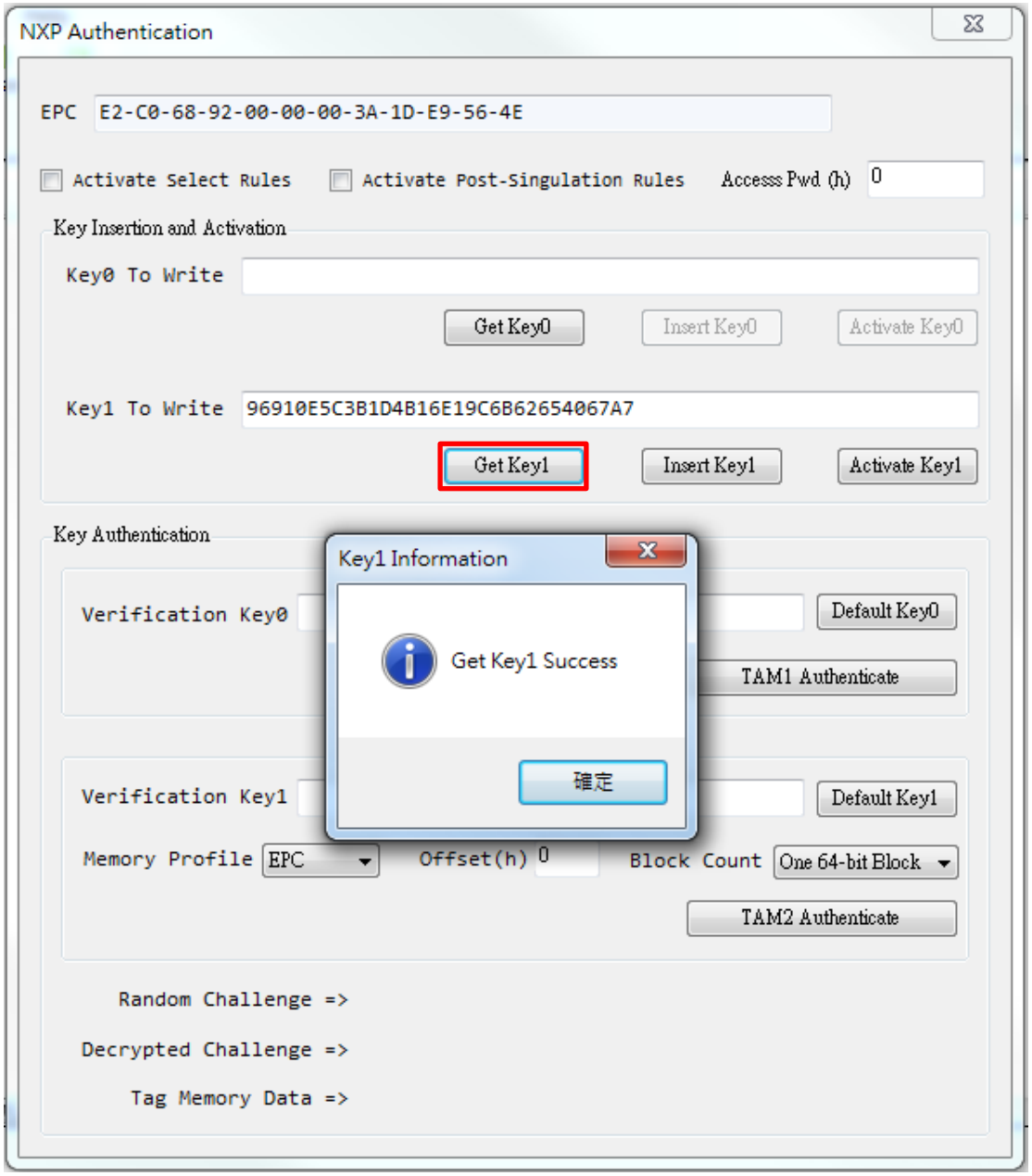


Figure 39: Key Insertion and Activation – Get Key1

Edit the Key0 or Key1 which is 16 bytes hexadecimal value in the data field. If click **Insert Key0** button, the value of Key0 data field will be written to NXP UCODE DNA Tag. Likewise, click **Insert Key1** button, the value of Key1 data field will be written.

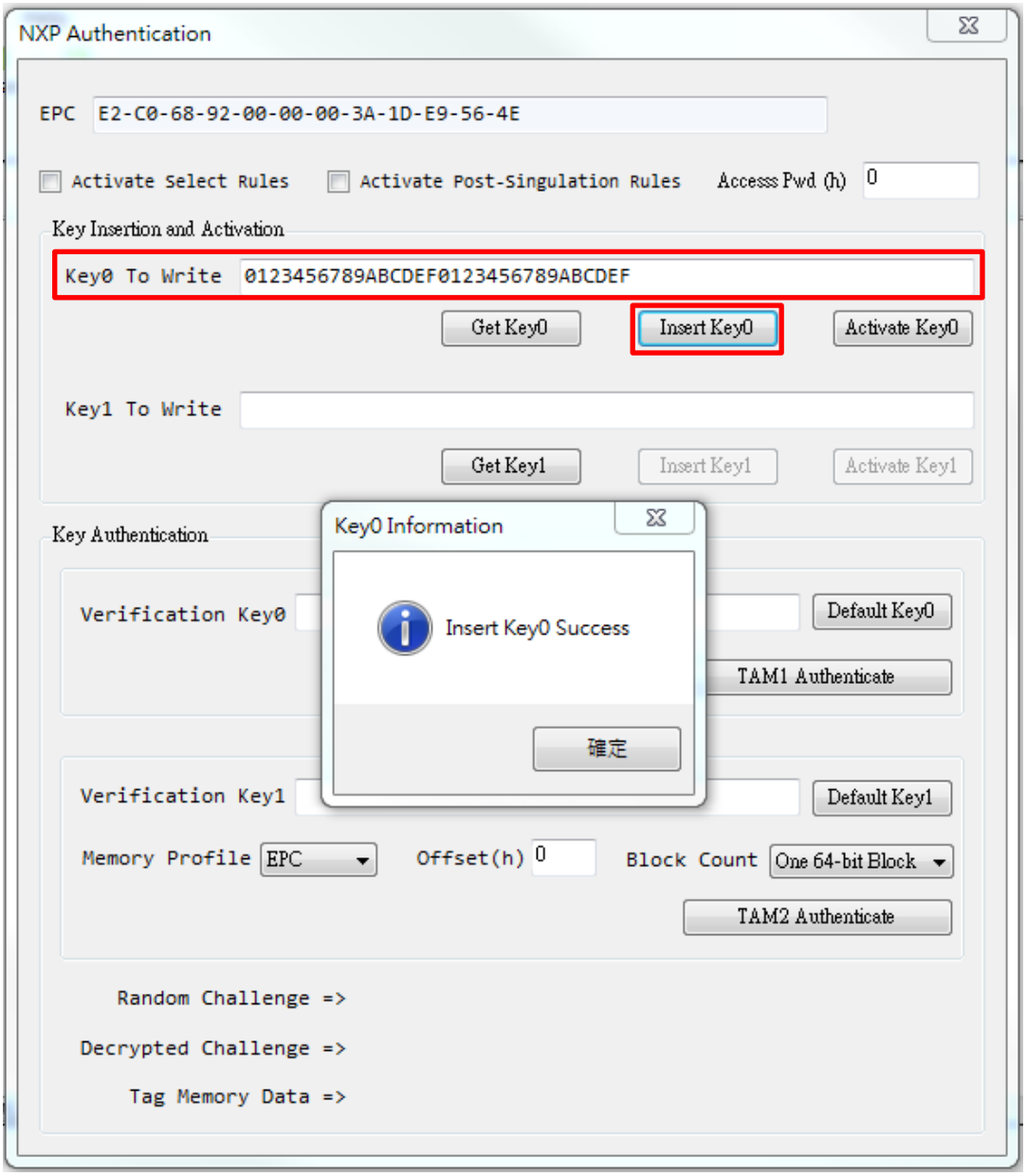


Figure 40: Key Insertion and Activation – Insert Key0

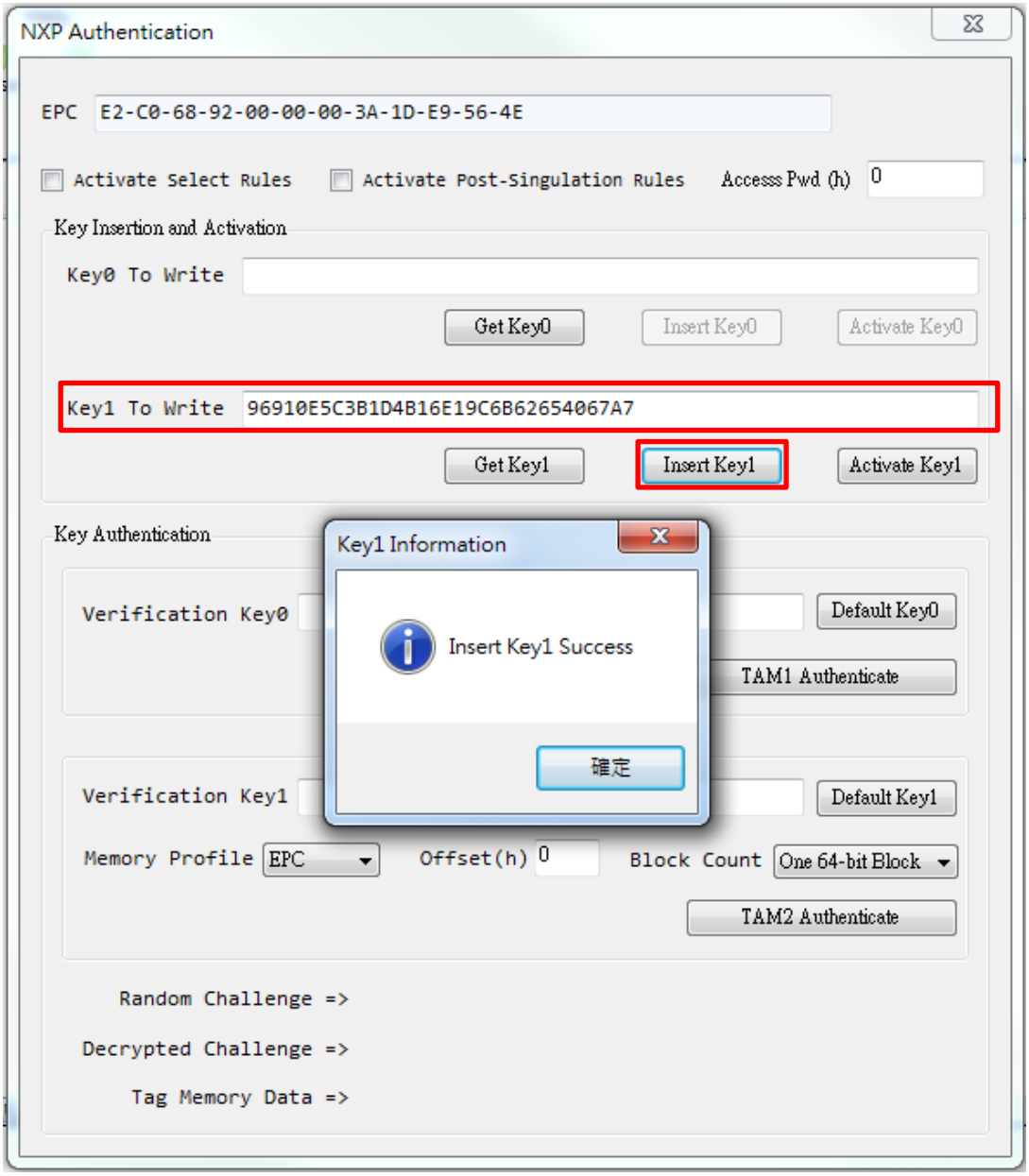


Figure 41: Key Insertion and Activation – Insert Key1

If click **Activate Key0** button, the Key0 which is 16 bytes hexadecimal value in the NXP UCODE DNA Tag will be activated. Likewise, If click **Activate Key1** button, the Key1 which is 16 bytes hexadecimal value will be activated. Once the Key0 or Key1 is activated, it can't be accessed anymore.

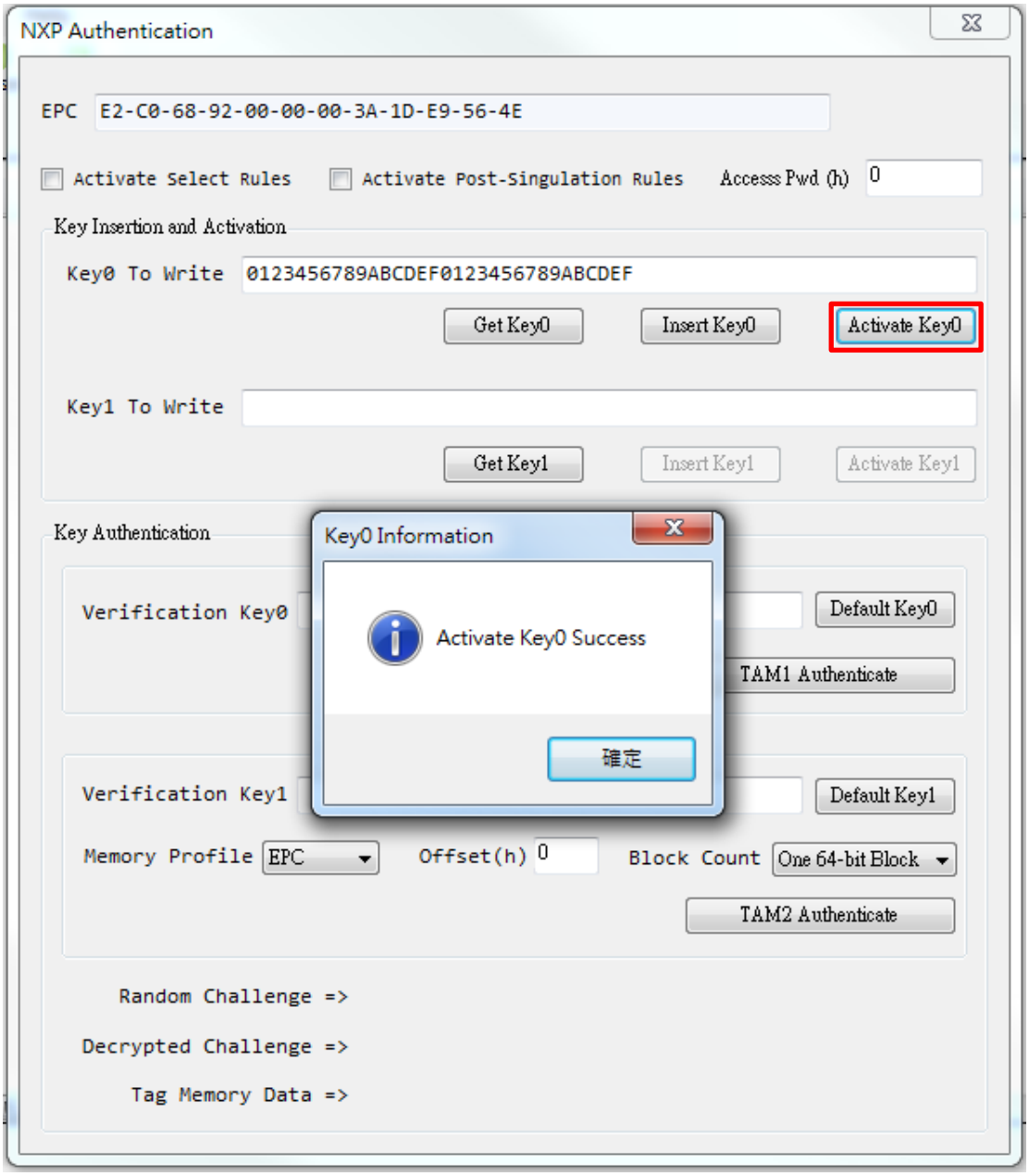


Figure 42: Key Insertion and Activation – Activate Key0

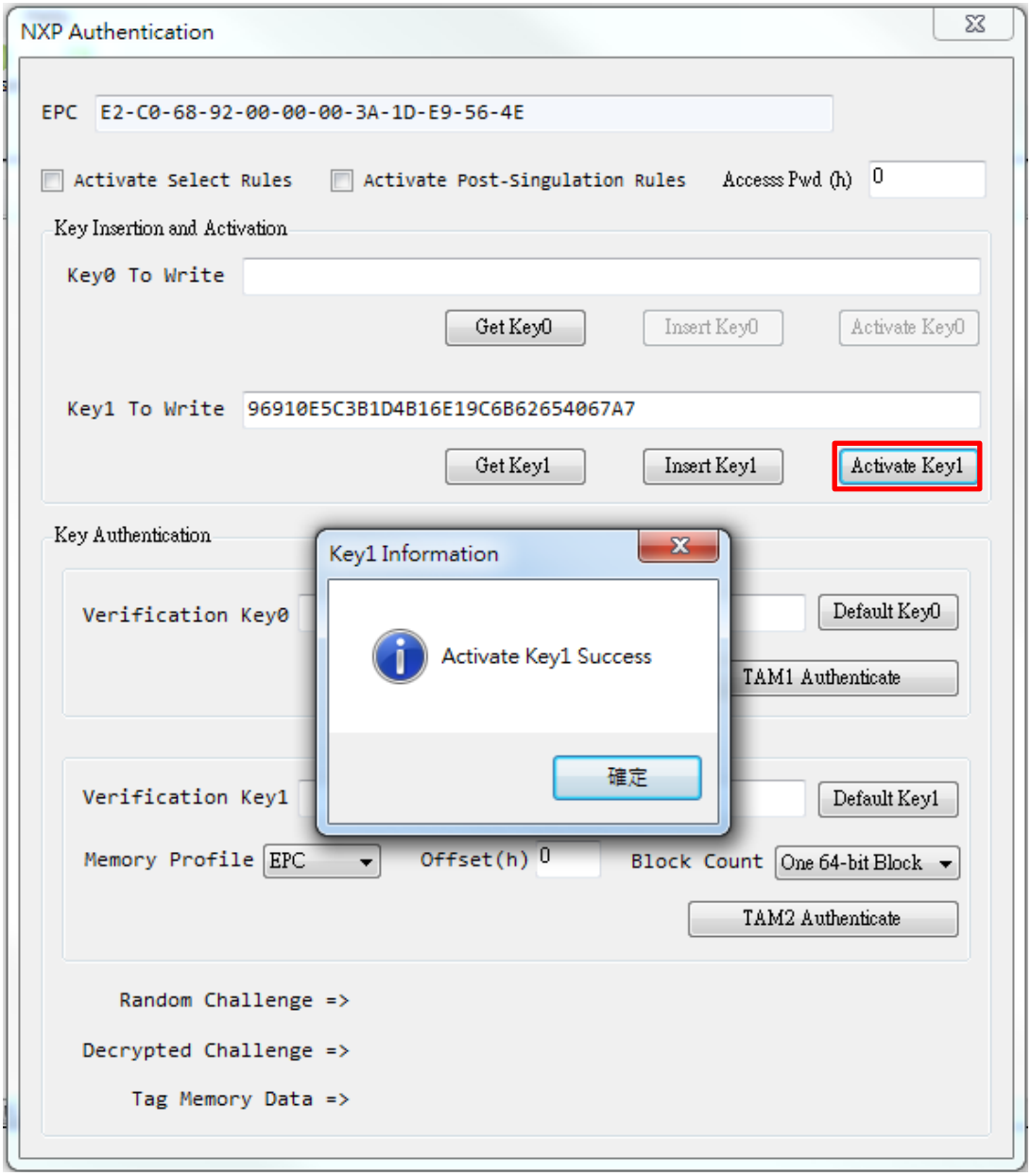


Figure 43: Key Insertion and Activation – Activate Key1

3.8.2 Key Authentication

The **Key Authentication** performs two authentication functions: **TAM1 Authenticate** and **TAM2 Authenticate**. These authentications use Advanced Encryption Standards (AES) with the secret keys which is activated in the NXP UCODE DNA Tag. The NXP UCODE DNA Tag authentication mechanism is that the reader sends a random challenge string to the tag, the tag uses its key to encrypt the challenge, and sends the result back. **Explorer** then uses the key to decrypt the result, if the decrypted result is the value which reader to tag, the tag is authentic.

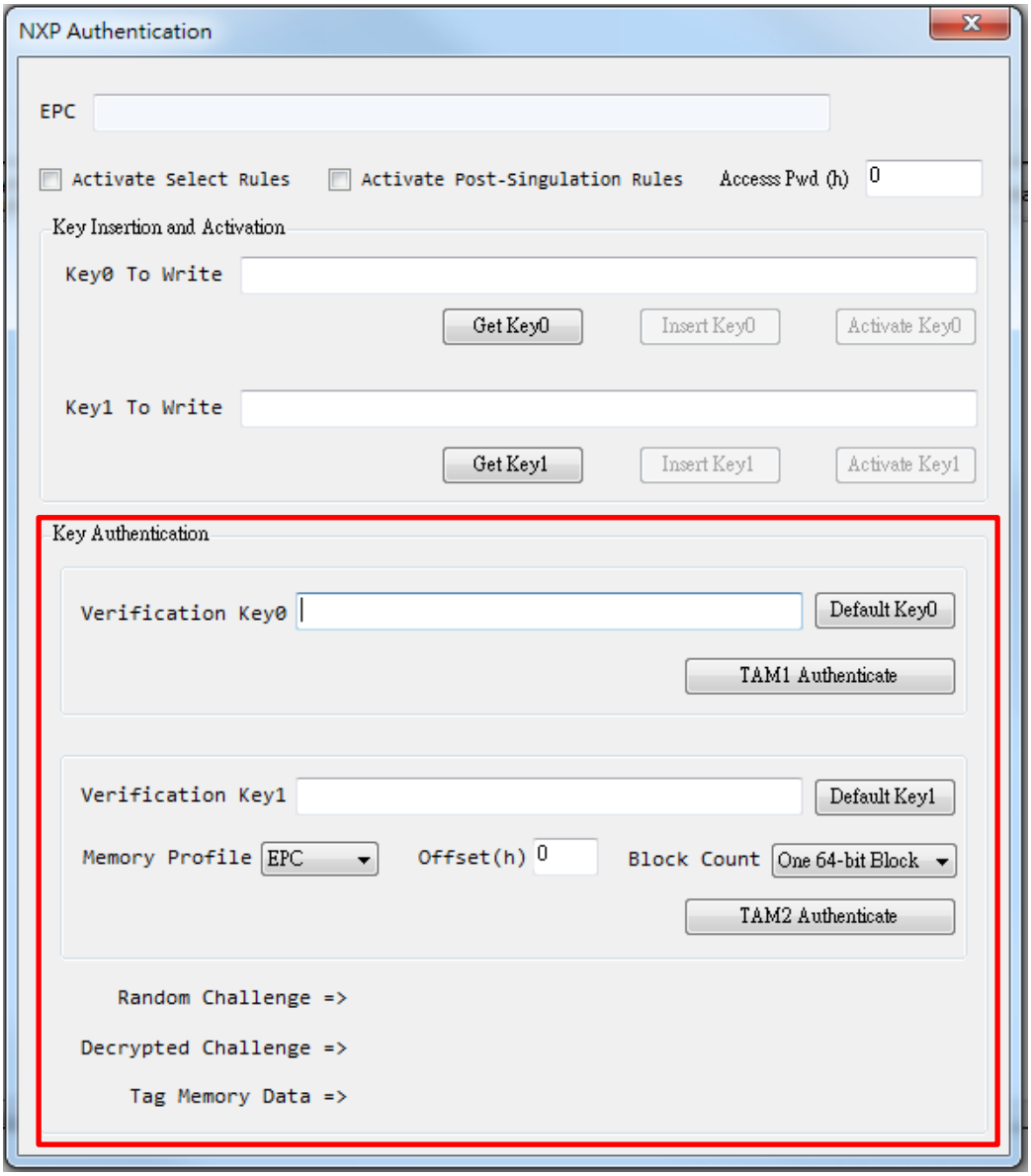


Figure 44: Key Authentication

The **TAM1 Authenticate** authenticates the NXP UCODE DNA Tag by the **Key0**. If clicks the **Default Key0** button, the **Verification Key0** data field will display the MTI default key0 value: **0123456789ABCDEF0123456789ABCDEF**. The **TAM1 Authenticate** is successful when the same **Random Challenge** value as the **Decrypted Challenge**.

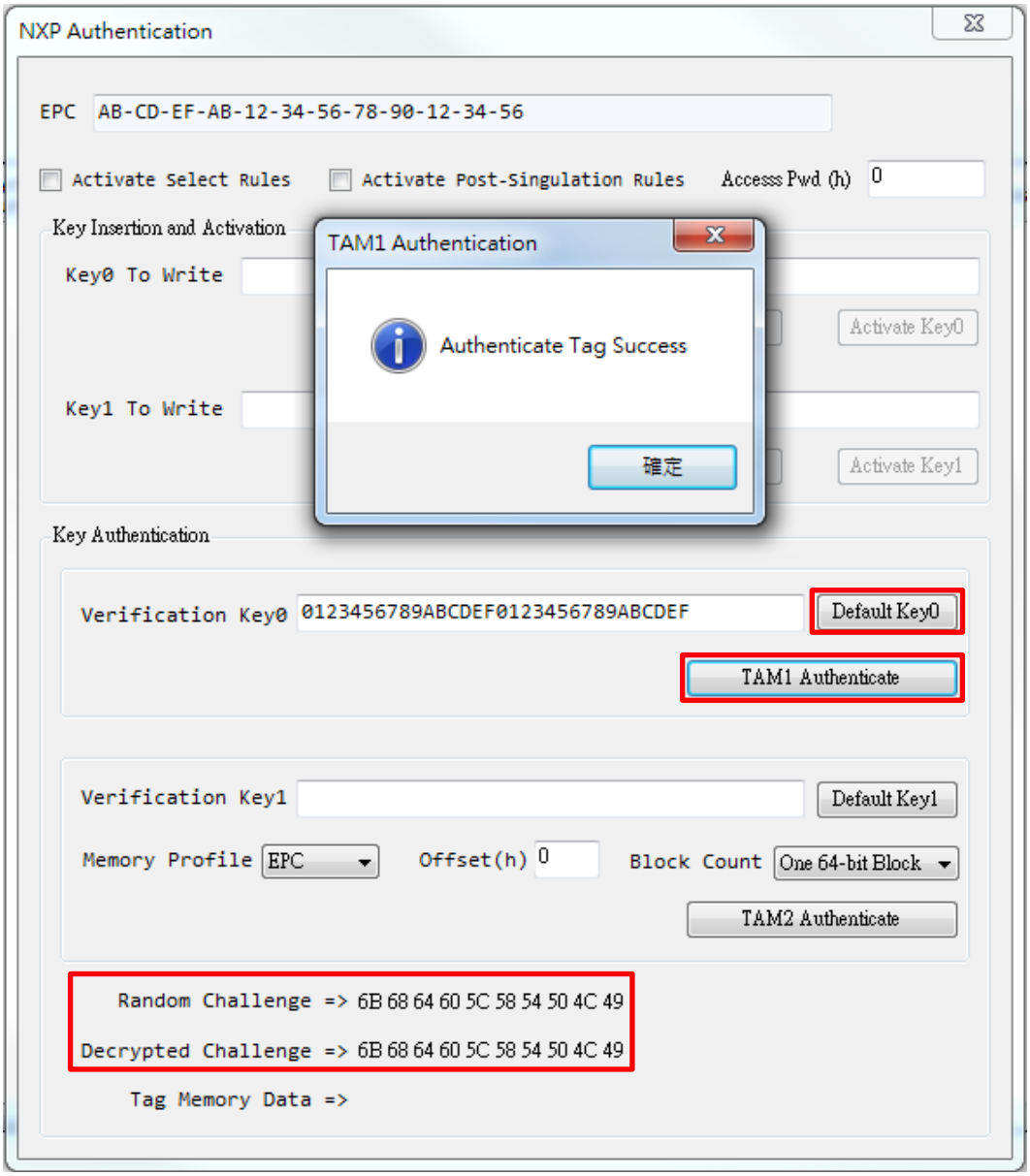


Figure 45: Key Authentication – TAM1 Authenticate

The **TAM2 Authenticate** authenticates the NXP UCODE DNA Tag by the **Key1**. If clicks the **Default Key1** button, the **Verification Key1** data field will display the MTI default key1 value: **96910E5C3B1D4B16E19C6B62654067A7**. Select the **Memory Profile** which want returned, the reader also encrypt the selecting **Memory Profile**. The **Block Count** is the number of valid 64-bit blocks to be returned. As for Authenticate, the **TAM2 Authenticate** is successful when the same **Random Challenge** value as the **Decrypted Challenge** and the **Tag Memory Data** is the selecting **Memory Profile** value**.**

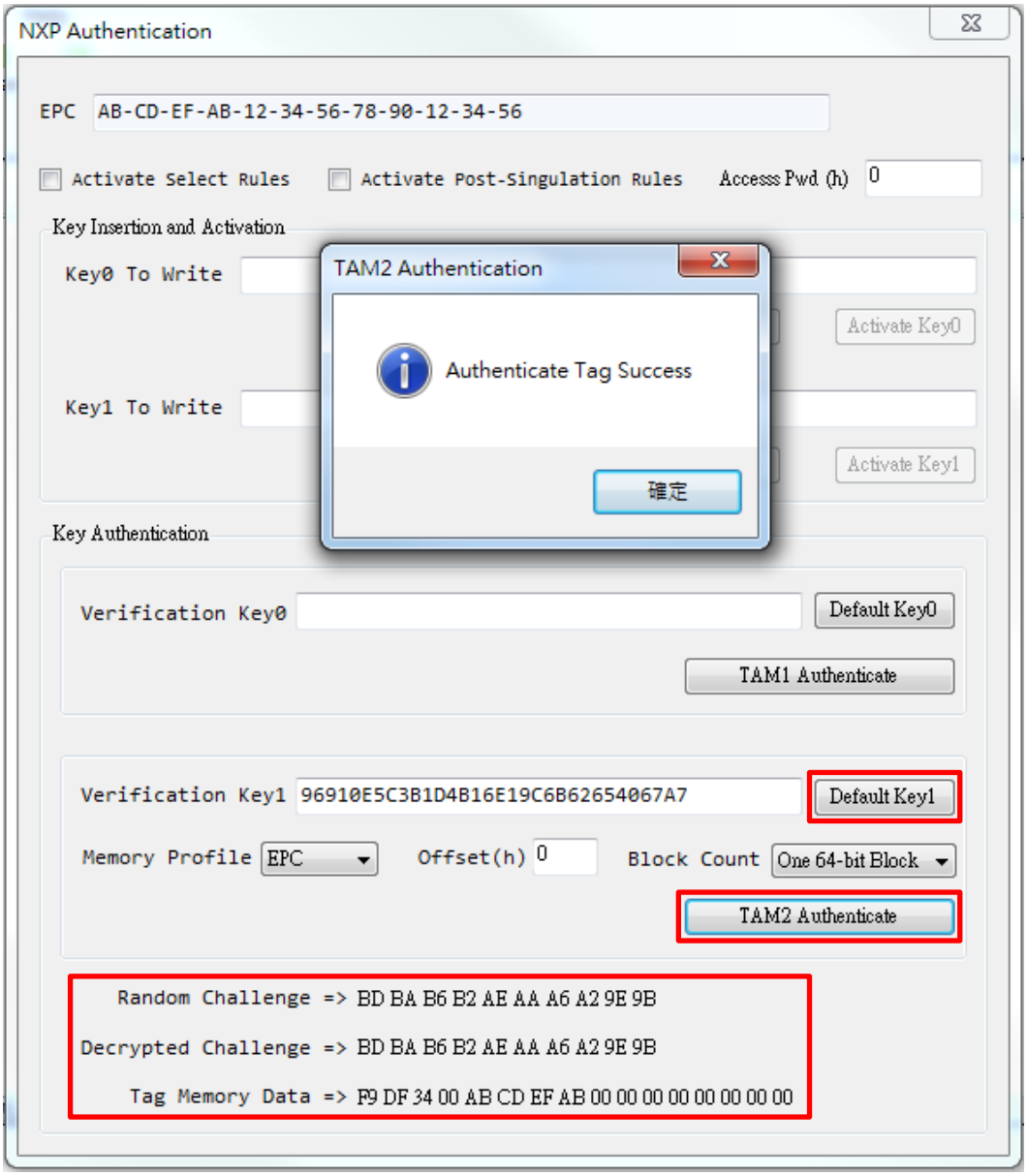


Figure 46: Key Authentication – TAM2 Authenticate

3.9 CB-2 Tag Access

MTI supports "CB-2 Tag Access" to provide user to access the CB-2 tag. The CB-2 Tag Access consists of three features: **Antenna Setting**, **Configure Function** and **Control Function**. Select **Extra Features** option. Click **CB-2 Tag Access**. The CB-2 Tag Access dialog will be showed.

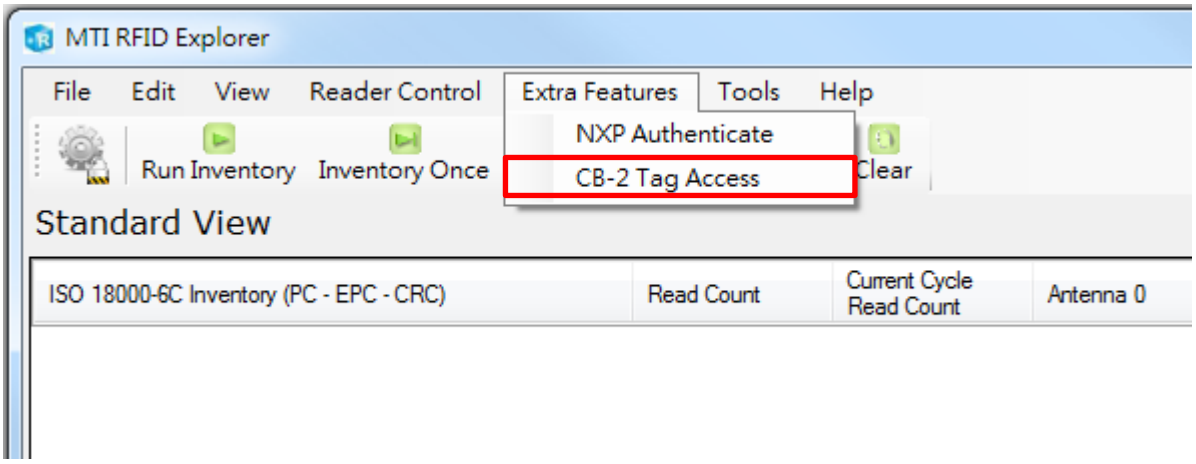


Figure 47: CB-2 Tag Access – Select CB-2 Tag Access

The CB-2 Tag Access consists of three features in the figure below：

- **Antenna Setting**：Set antenna.
- **Configure Function**：Access these NVM(Non-Volatile Memory) configurations.
- **Control Function**：Provide CB-2 tag control features for tri-color LED blink, battery assist control, selection between FF ANT and NF ANT, etc.

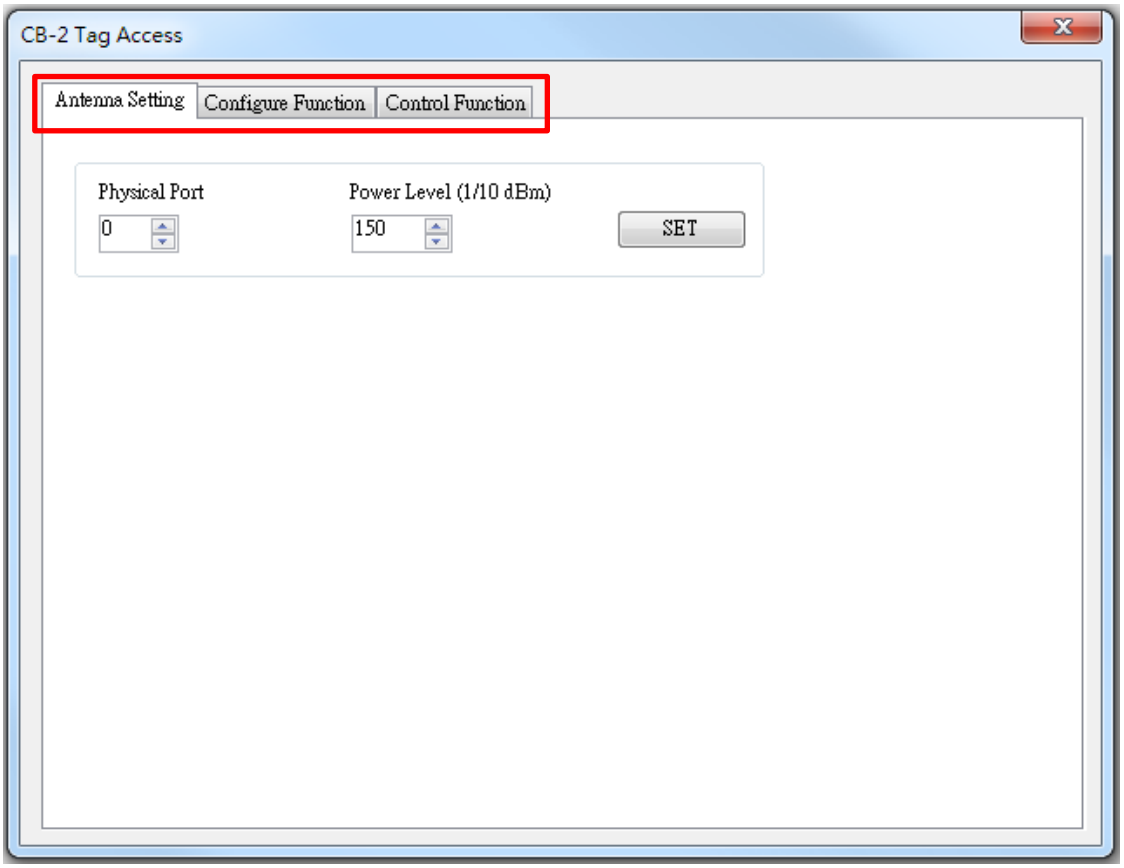


Figure 48: CB-2 Tag Access – Main Function

3.9.1 Antenna Setting

From the **Antenna Setting** tab, user can set the antenna physical port and power level as the figure below.

Parameters for antenna are：

- **Physical Port** indicating the physical connector to which the logical antenna is bound for transmission of data.
- **Power Level** set antenna transmission power in 1/10 dBm increments.

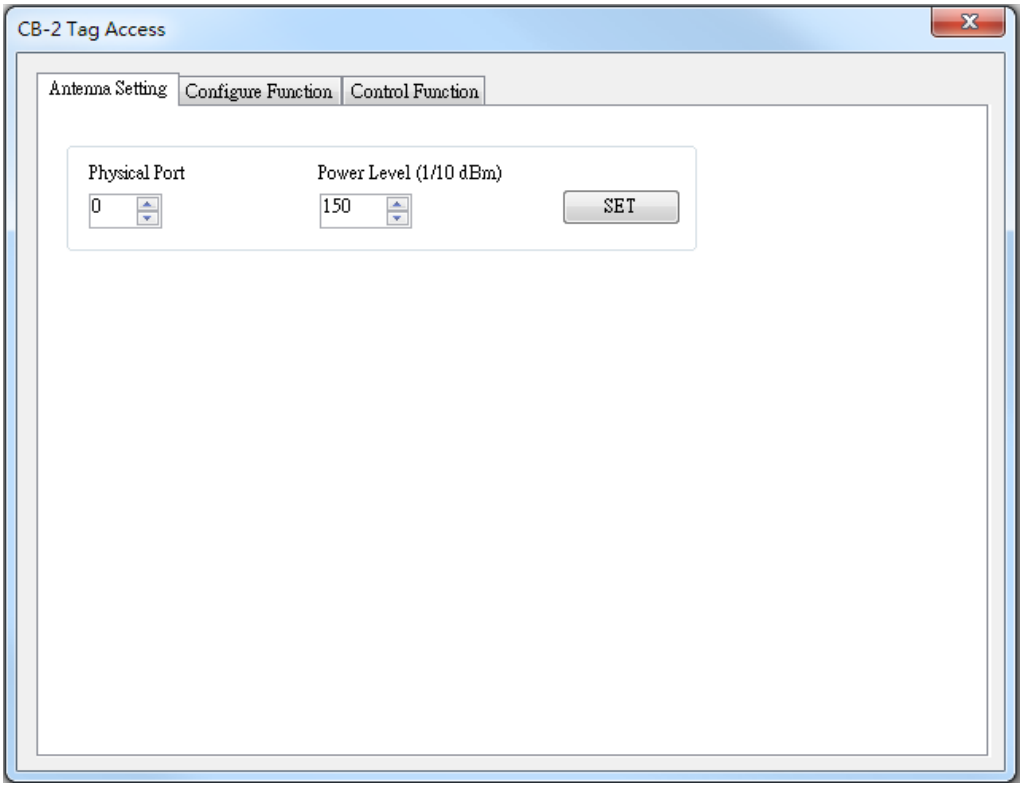


Figure 49: Antenna Setting – Main Function

3.9.2 Configure Function

The CB-2 Tag Access provides a configure function to change these NVM configurations (CFG_DAT1 / CFG_DAT0).

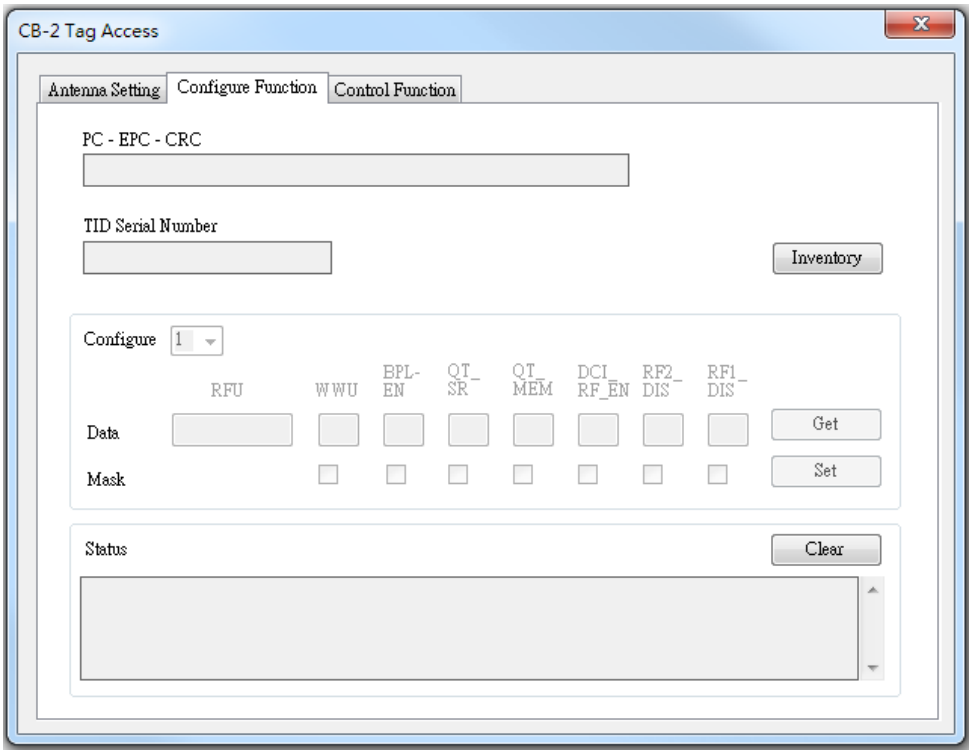
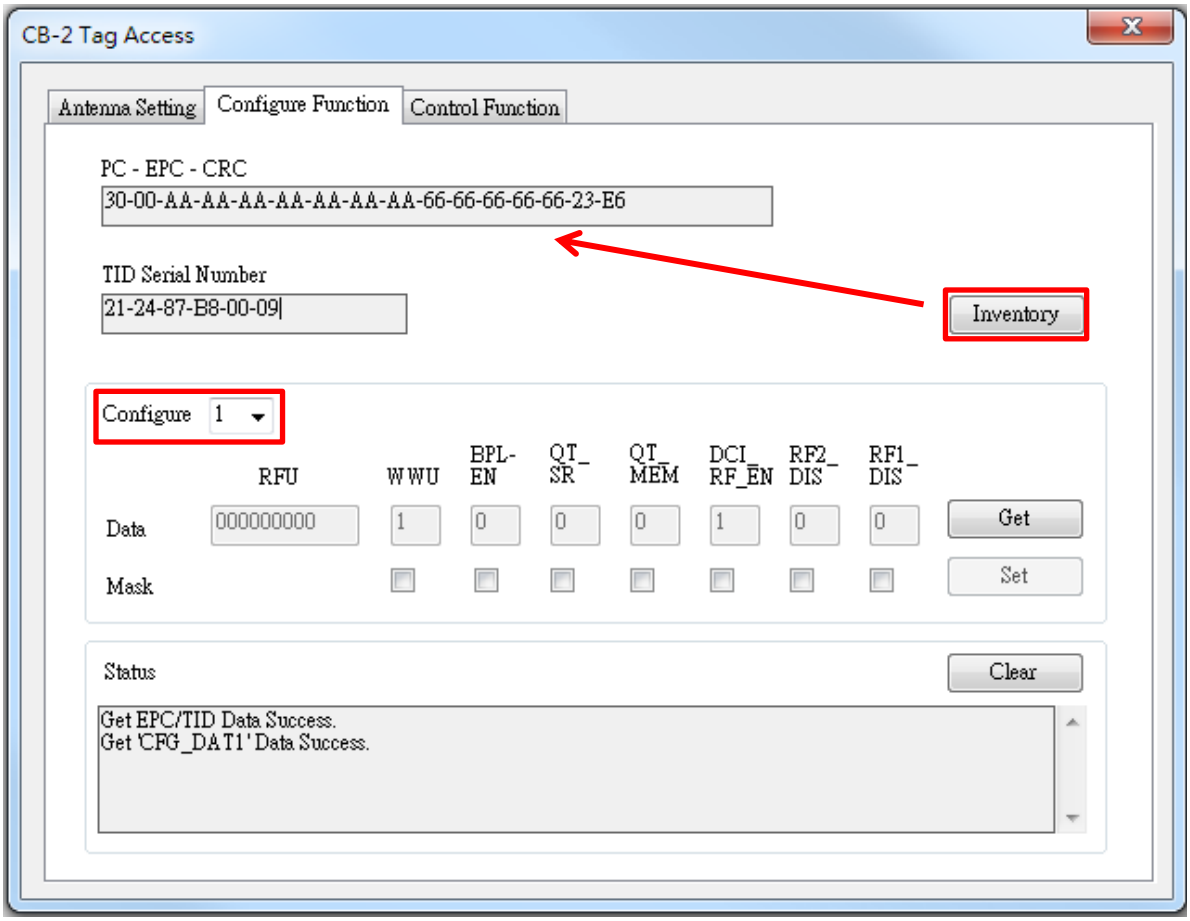


Figure 50: Configure Function – Main Function

Click **Inventory** button to get a CB-2 tag which is in the antenna magnetic field. If get CB-2 tag successful, the CFG_DATA1 of NVM will be obtained. User can click **Configure** drop-down list to switch NVM configurations data between CFG_DAT1 and CFG_DAT0.



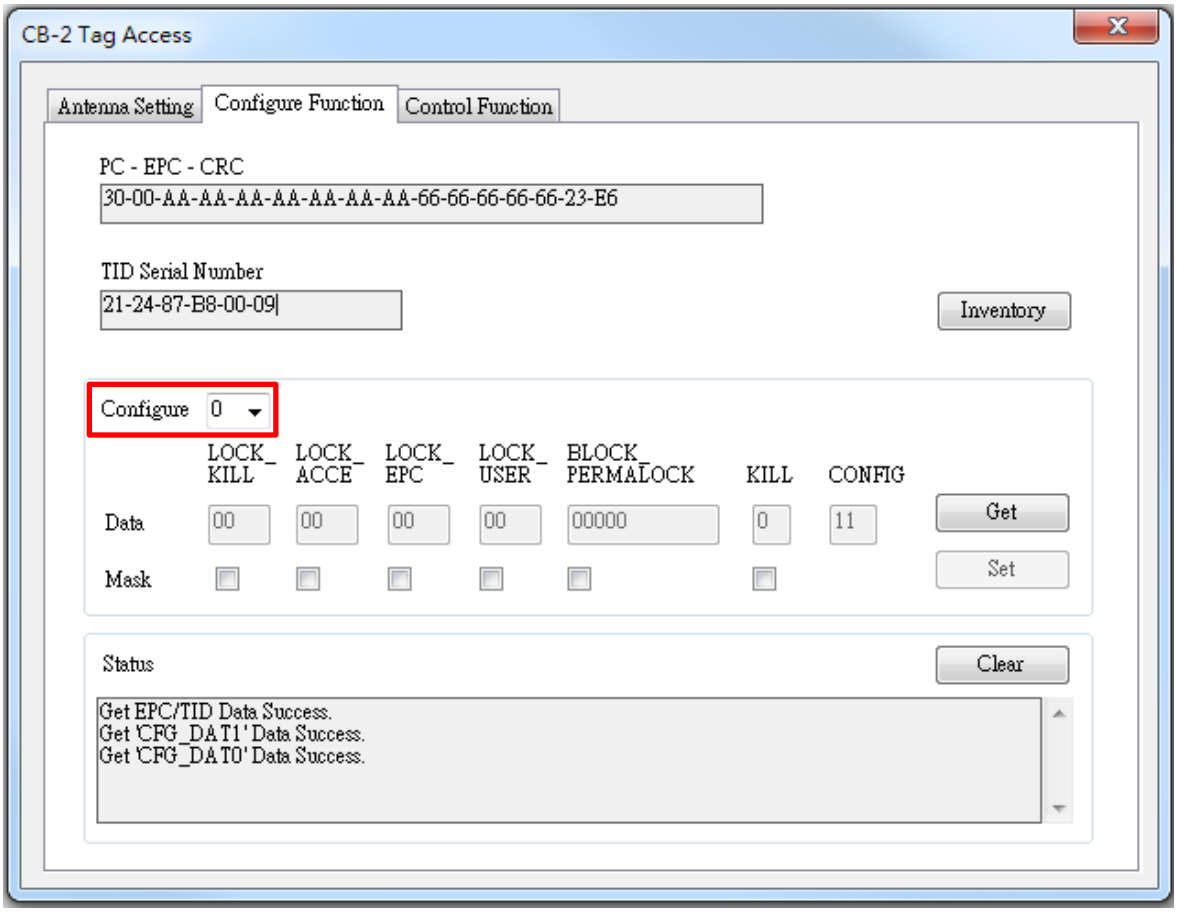


Figure 51: Configure Function – Inventory CB-2 Tag & Get NVM Data

Enable the **Mask** checkbox to activate **Data** field. If clicks **Set** button, the value of **Data** fields will be written to NVM if the associated mask is checked.

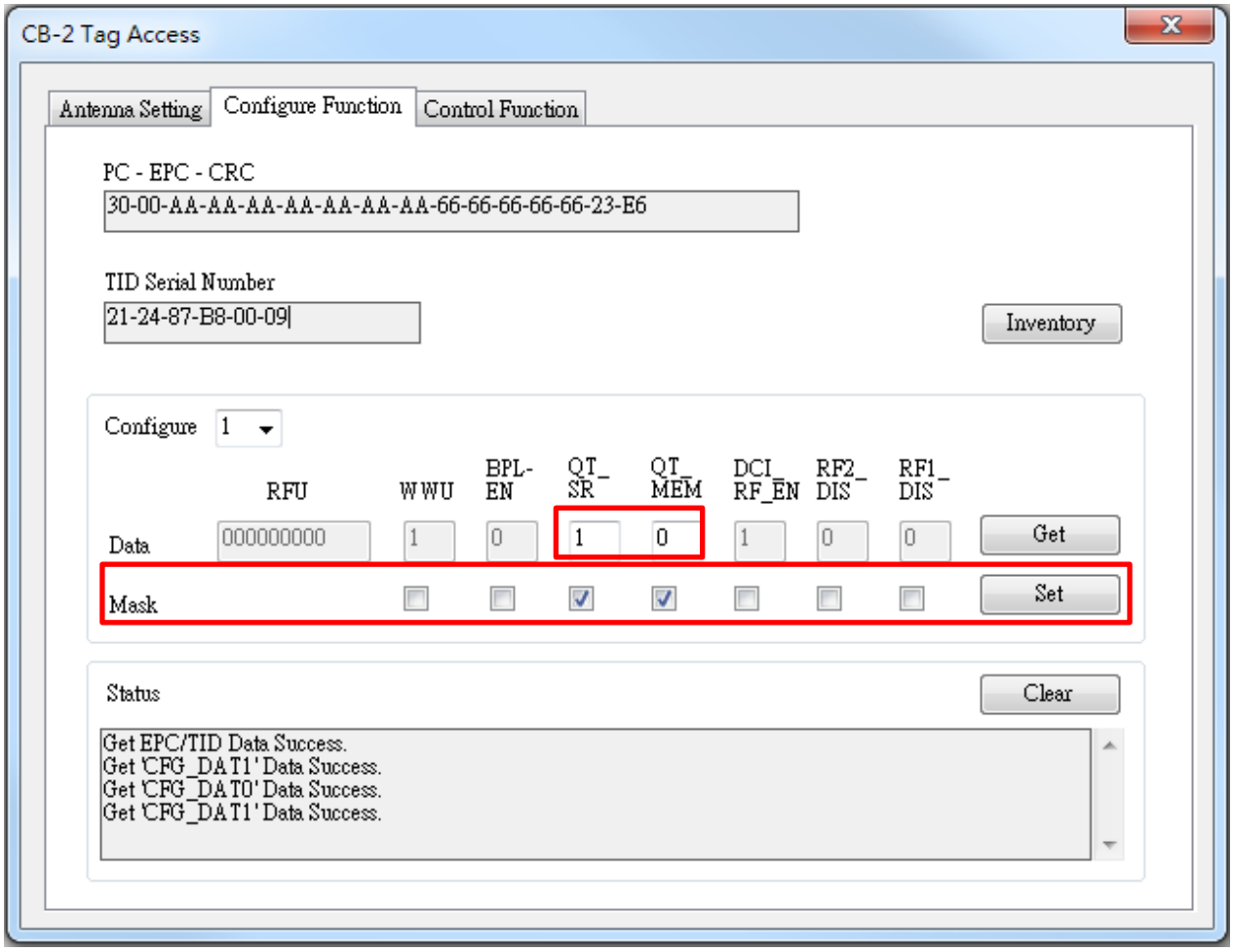


Figure 52: Configure Function – Access CB-2 Tag NVM configurations

Get button is used to get the NVM configurations data. Status area displays the execution result. **Clear** button is used to clear the execution result messages in the status area.

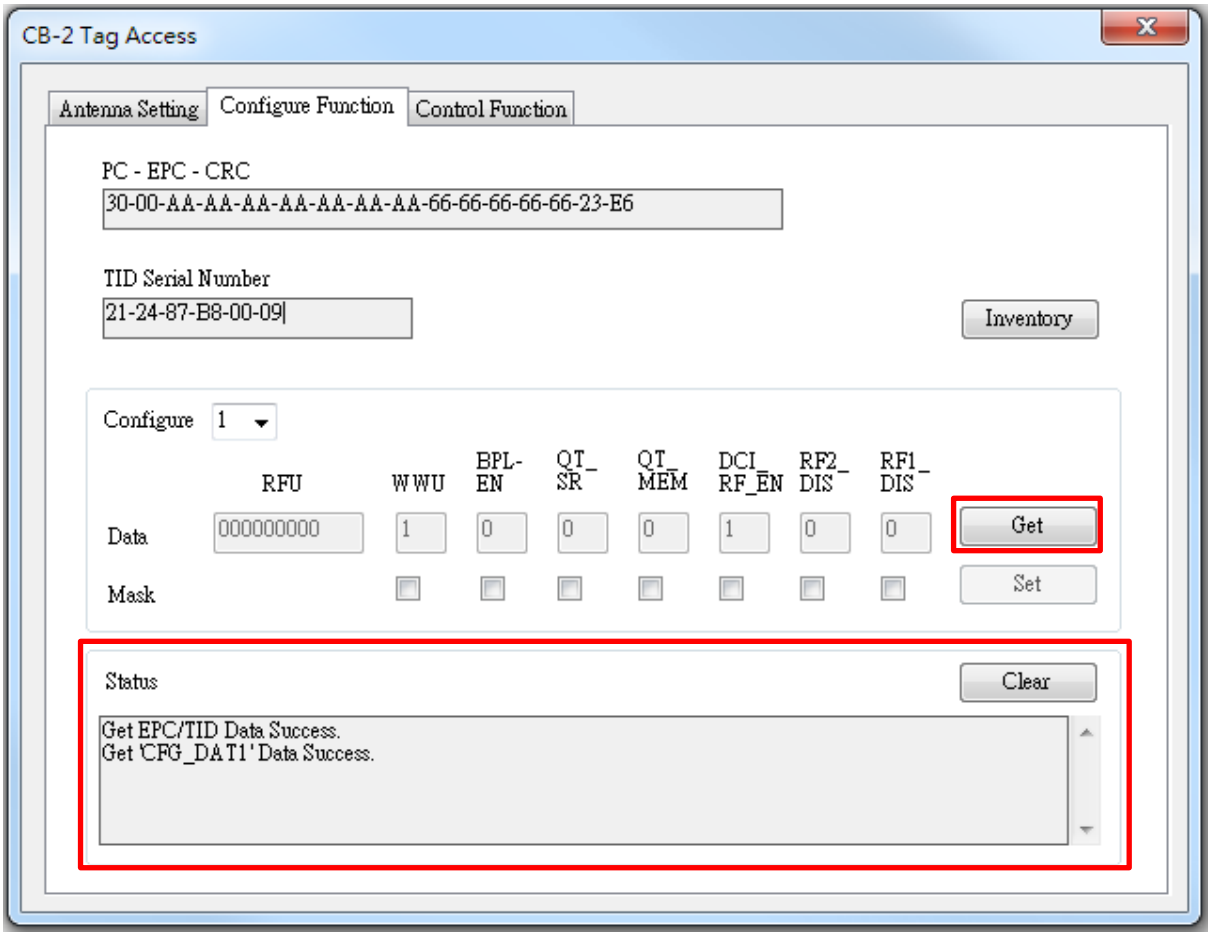


Figure 53: Configure Function – Get CB-2 Tag NVM configurations

3.9.3 Control Function

The CB-2 Tag Access provides CB-2 control features for tri-color LED blink, battery assist control, selection between FF ANT and NF ANT, etc. Before performing these control functions, there should be a CB-2 tag in the antenna magnetic field in the figure below.

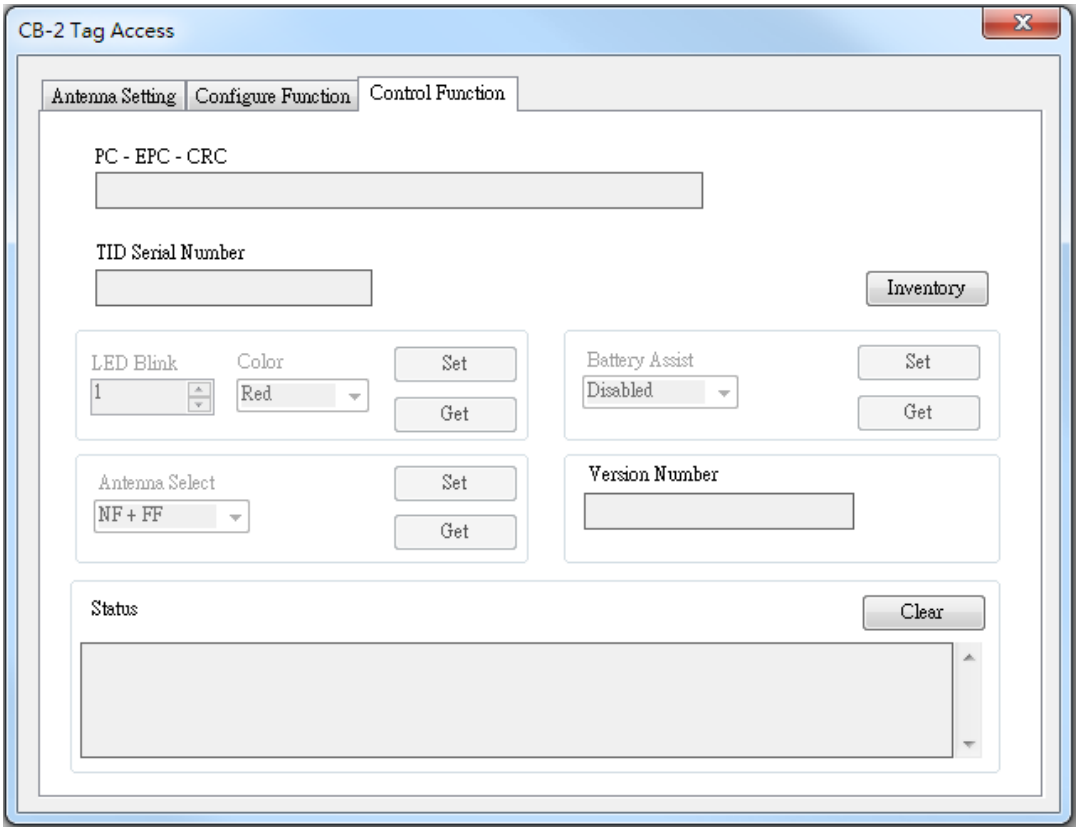


Figure 54: Control Function – Main Function

Click **Inventory** button to get a CB-2 tag which is in the antenna magnetic field. If get CB-2 tag successful, the **LED**, **Battery**, **Antenna** and **Version Number** value will be obtained from the CB-2 tag.

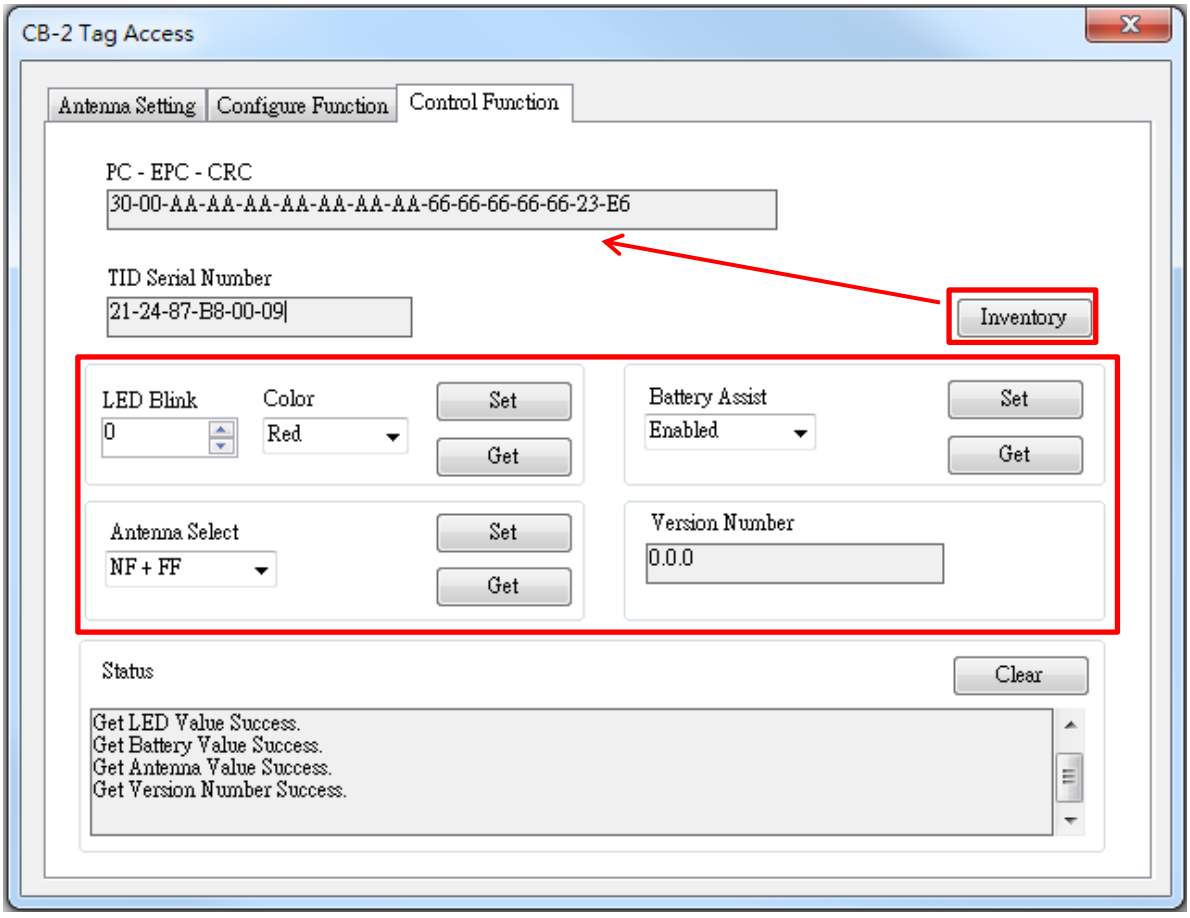


Figure 55: Control Function – Inventory CB-2 Tag

Introduce these control functions as below：

- LED：The **Set** button is used to set trigger tri-color LED. The **LED Blink** parameter is indicated to the seconds for LED blinking. When MCU receives a new setting of LED blink during previous LED setting is still in processing, MCU will cancel previous LED behavior and overwrite with new setting.

  Parameter：Color(Red、Green、Blue)、Blink(0~8191 second).

  The **Get** button is used to obtain the current LED setting that contains color and remaining blink seconds.

- Battery Assist：This function is used to enable or disable battery assisted to DCI line as power supply.

  Parameter：Enabled、Disabled.

  The Get button is used to obtain the current battery setting.

- Antenna Select：This function is used to set CB-2 tag antenna type.

  Parameter：NF+FF(Near Field + Far Field)、NF(Near Field)、FF(Far Field).

  The Get button is used to obtain the current antenna setting.

- Version Number：This is version number of firmware.

Status area displays the execution result. **Clear** button is used to clear the execution result messages in the status area.

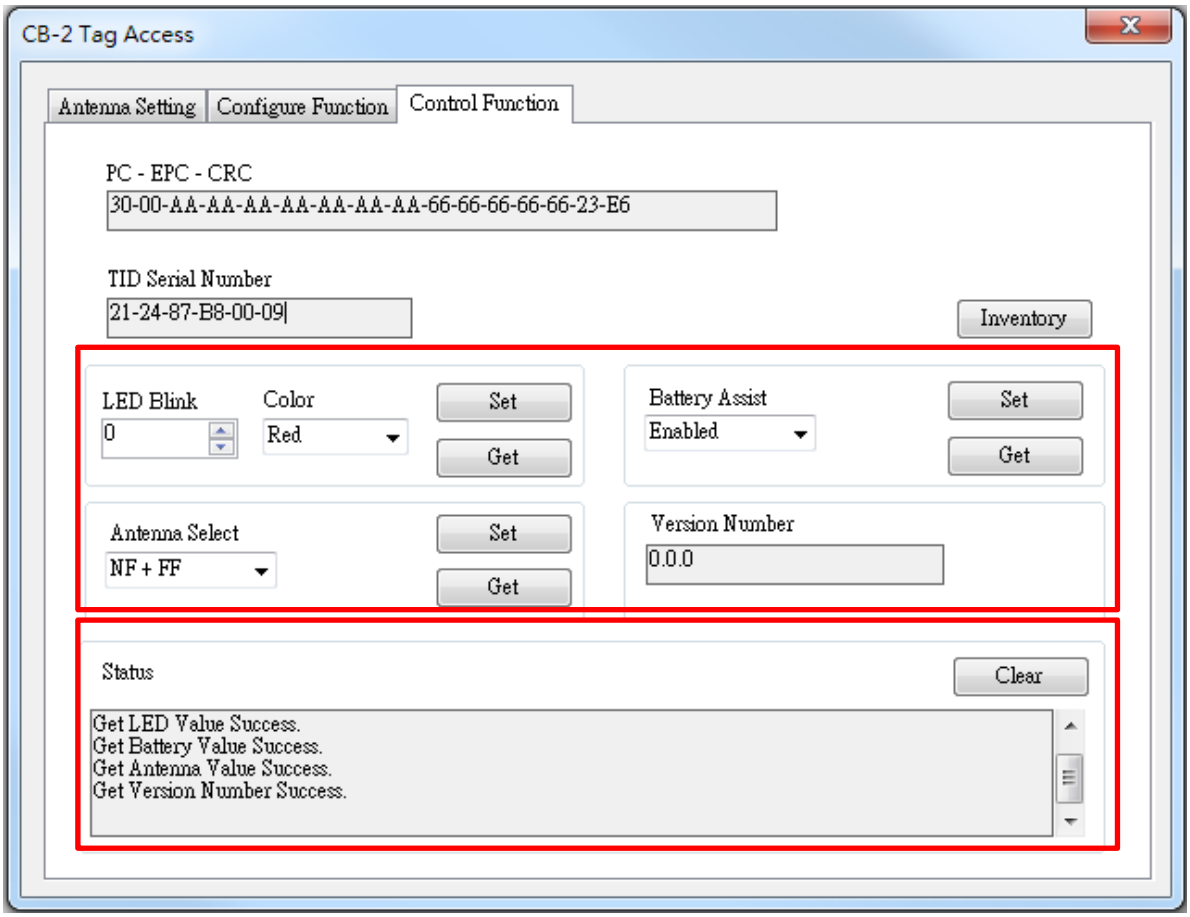


Figure 56: Control Function – Set Control Functions

3.10 RF Test

MTI supports 3 functions which are “Inventory”, ”RF On/Off” and ”Pulse” to help user to perform the device. Select **Tool** option. Click **RF Test**. The RF Test dialog will be show.

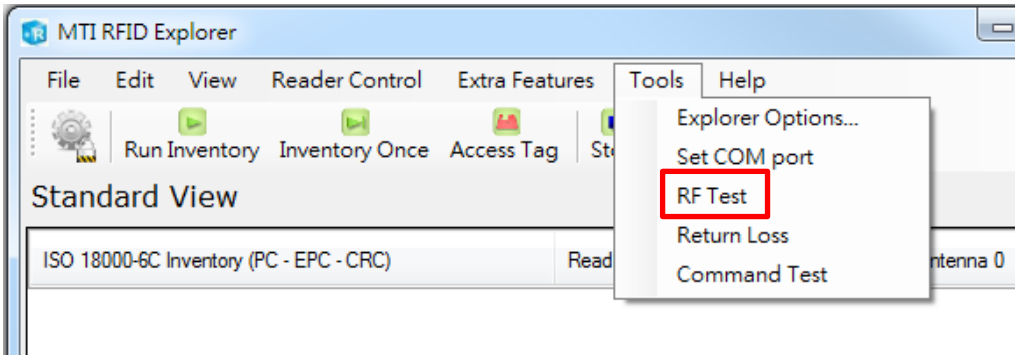


Figure 57: RF Test – Select RF Test

In the “Hopping” Channel, only support “Inventory”. In the “Single” Channel, support full function to perform the device.

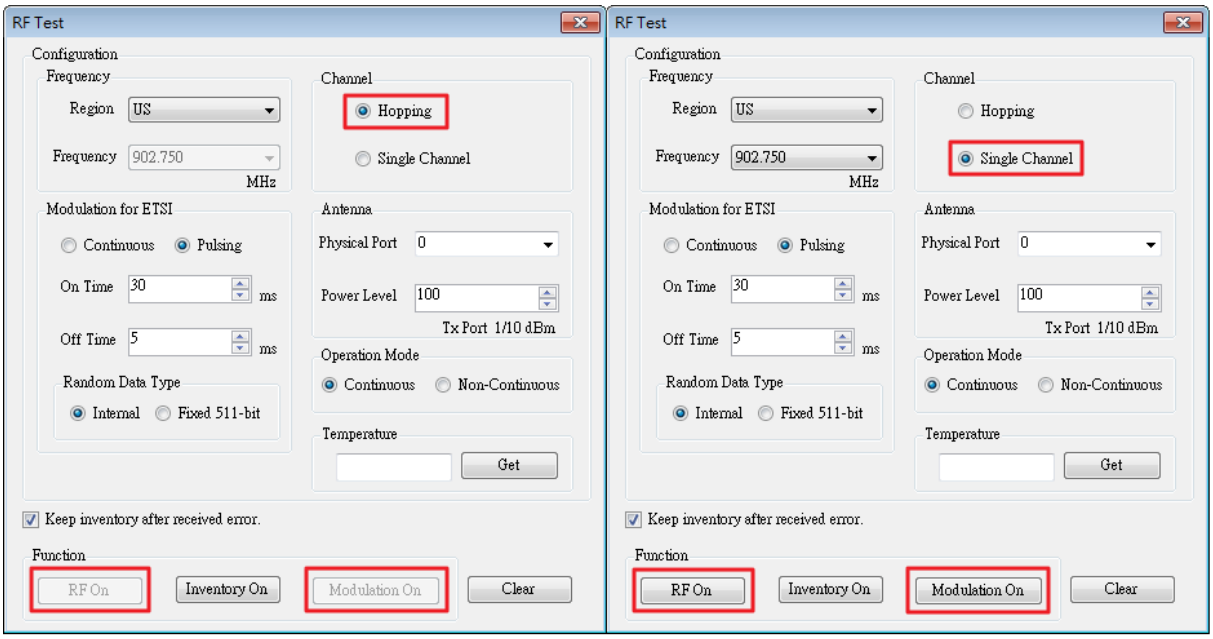


Figure 58: RF Test – Support full function in Single Channel

Start one test flow at one time. Another buttons become disable status until stop the test flow. In the test time, Explorer doesn’t allow user to exit the dialog.

The temperature of RFID reader/module can be gotten by clicking **Temperature** button, but the temperature will be updated by executing the command of power on or off (e.g., RF on, RF off, inventory, etc.)

To click **RF On/Off** button will execute the CW On/Off flow. To click **Modulation On/Off** button, the RFID reader/module will transmit random data base on **Modulation for ETSI** setting. To click **Inventory On** button with **Continuous** option can start continuous inventory and display the tags information in the main views. To click **Inventory Off** button can stop the running function. Click **Inventory On** button with **Non-Continuous** option can run a single inventory round according to antenna port settings and can also display the tag information in the main views.

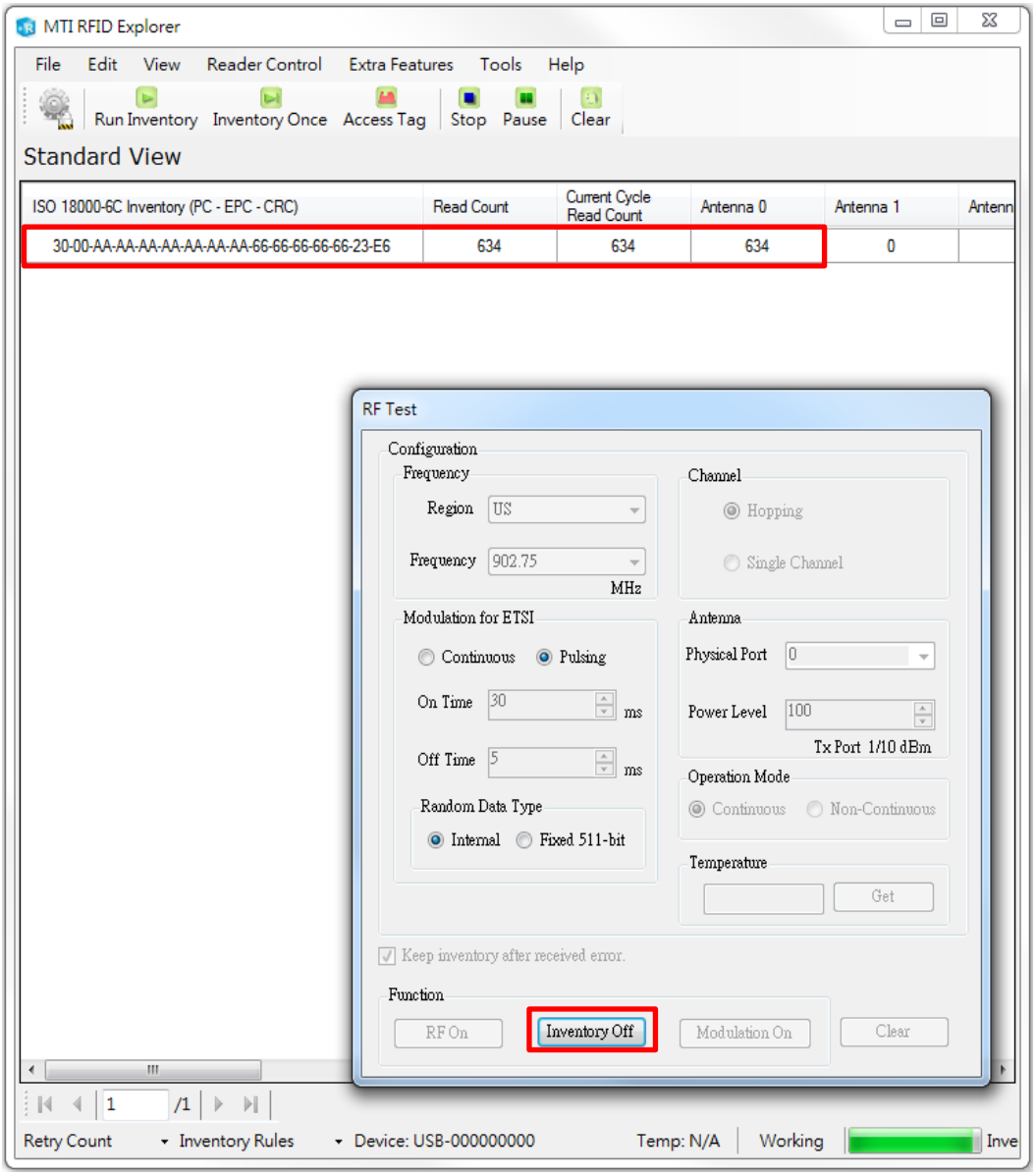


Figure 59: RF Test – Tag information is showed in the main views

If you want Explorer to run continually after received error, click the box “Keep inventory after received error”. In normal mode, after receive error message in the End Packet, Inventory will stop. In this test mode, Inventory stop soon, then run again automatically.

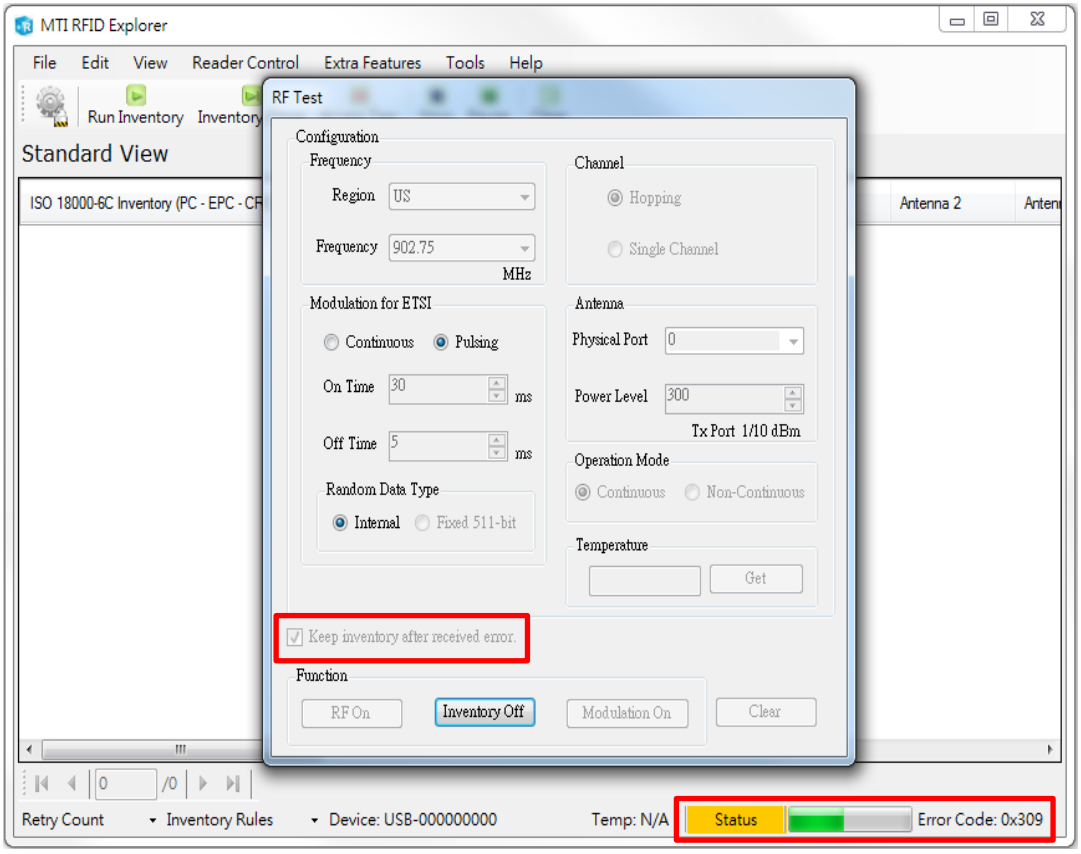


Figure 60: RF Test – Keep inventory after received error

3.11 Return Loss

MTI supports “Return Loss” to help user to perform the device. Select **Tool** option. Click **Return Loss**. The Return Loss dialog will be show.

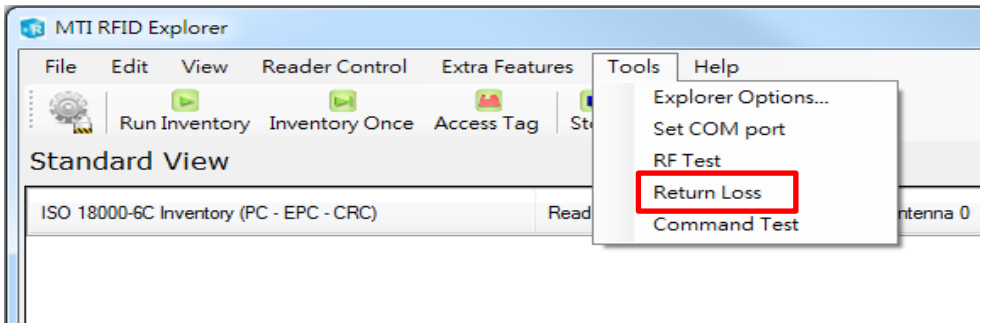


Figure 61: Return Loss – Select Return Loss

3.11.1 Formula

Return Loss = **Reflected Power Level** (0xB04) – **PA Power Level** (0xB00).

3.11.2 Single Channel

Explorer has Frequency tables which is support-region. Choose one single in Frequency Box, and click “Run” Button. Explorer will show the channel information in the window.

Note: If your region is “Customer”, you should type the frequency by yourself. Explorer doesn’t know the frequency that you want.

3.11.3 Multiple Channels

Click **CHANNEL_ALL** in the frequency Box. Click **Run** button. Explorer will show all channels and paint Broken Line Graph.

Note: “Customer” region doesn’t support this function.

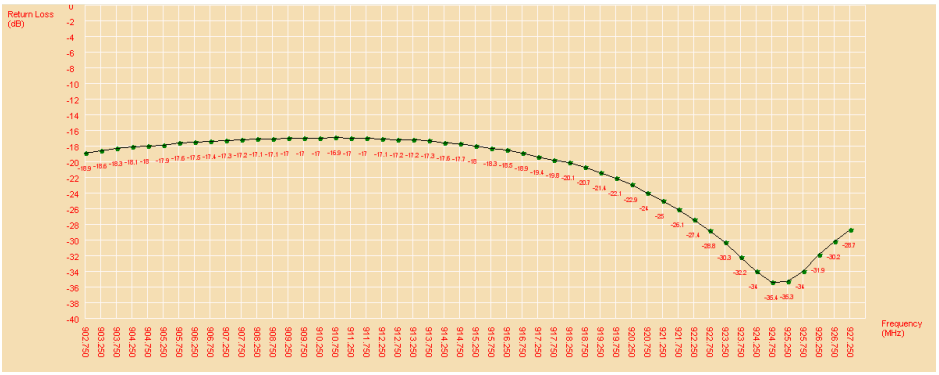


Figure 62: Return Loss – Multiple channels Broken Line Graph

3.12 Command Test

MTI supports “Command Test” to help user to input command and obtain the response. Select **Tool** option. Click **Command Tset**. The Command Test dialog will be show.

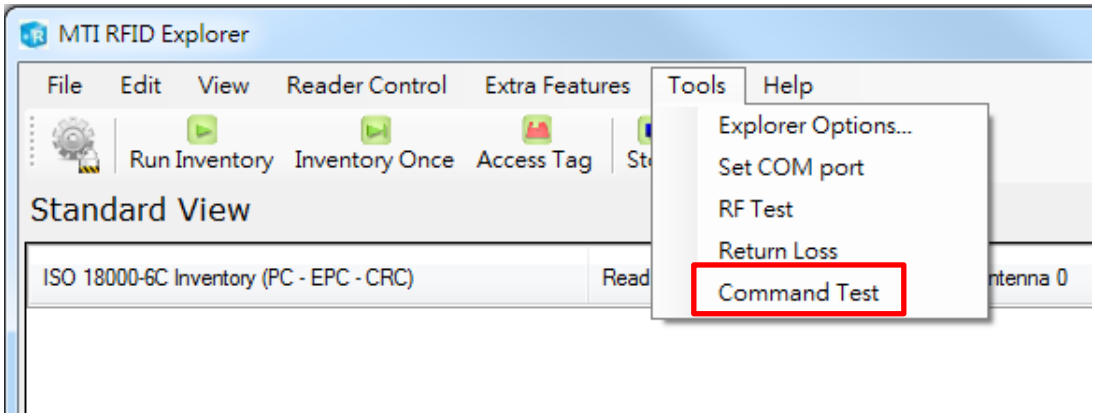


Figure 63: Command Test – Select Command Test

The Command Test includes of two features in the figure below:

- Single Test: Execute single command and obtain the response.
- Script Test: Execute a command script file and obtain those responses.

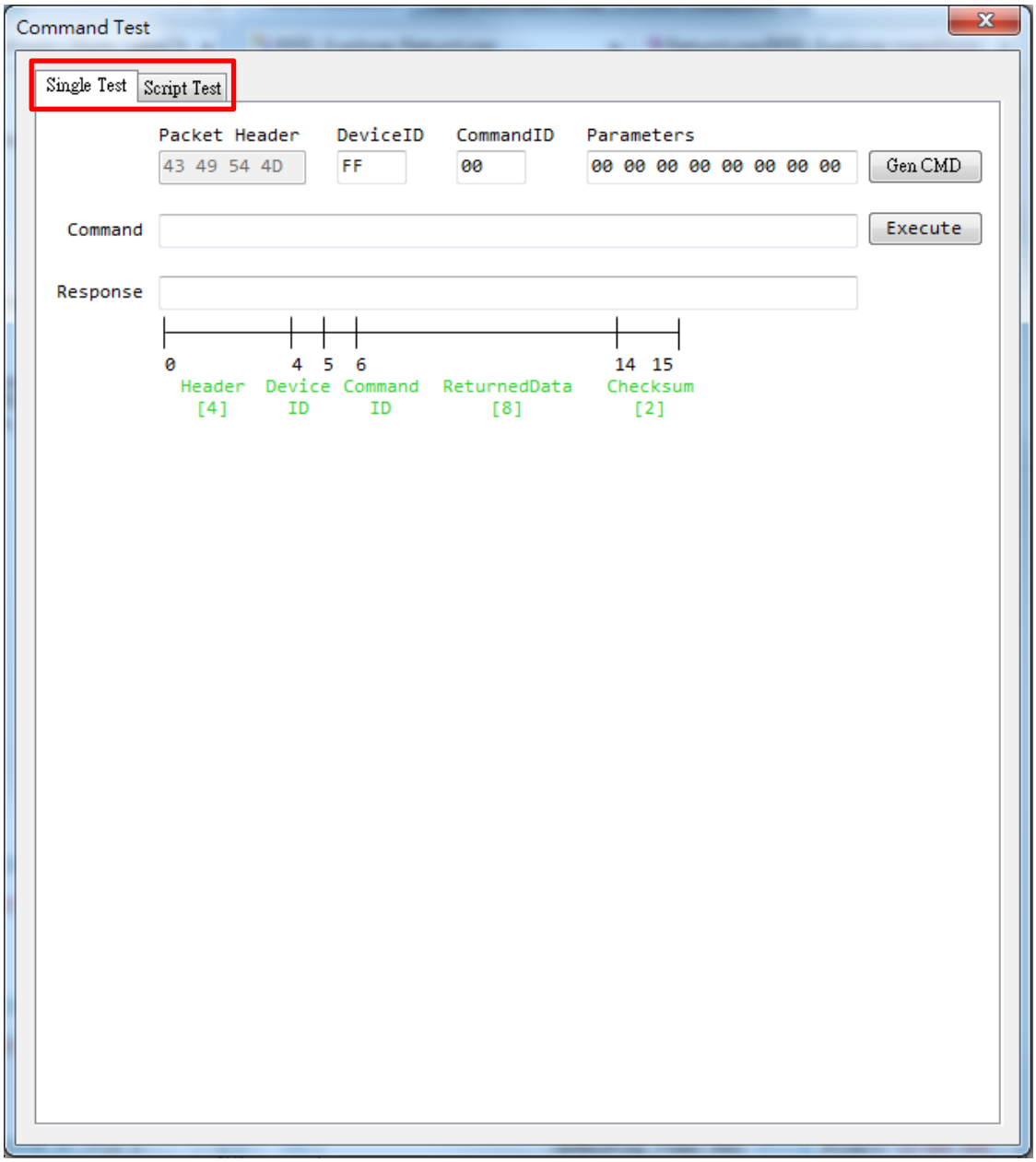


Figure 64: Command Test – Main function

3.12.1 Single Test

User can generate an input command and obtain the response by this function. There are two ways to generate a command. One is to fill in the "Device ID", "Command ID" and "Parameters" fields then click “Gen CMD”; the other is to fill the full command in "Command" field. Finally, click the “Execute” button to transmit command.

Note: This function does not support command ID 0x40~0x4F and 0x8B.

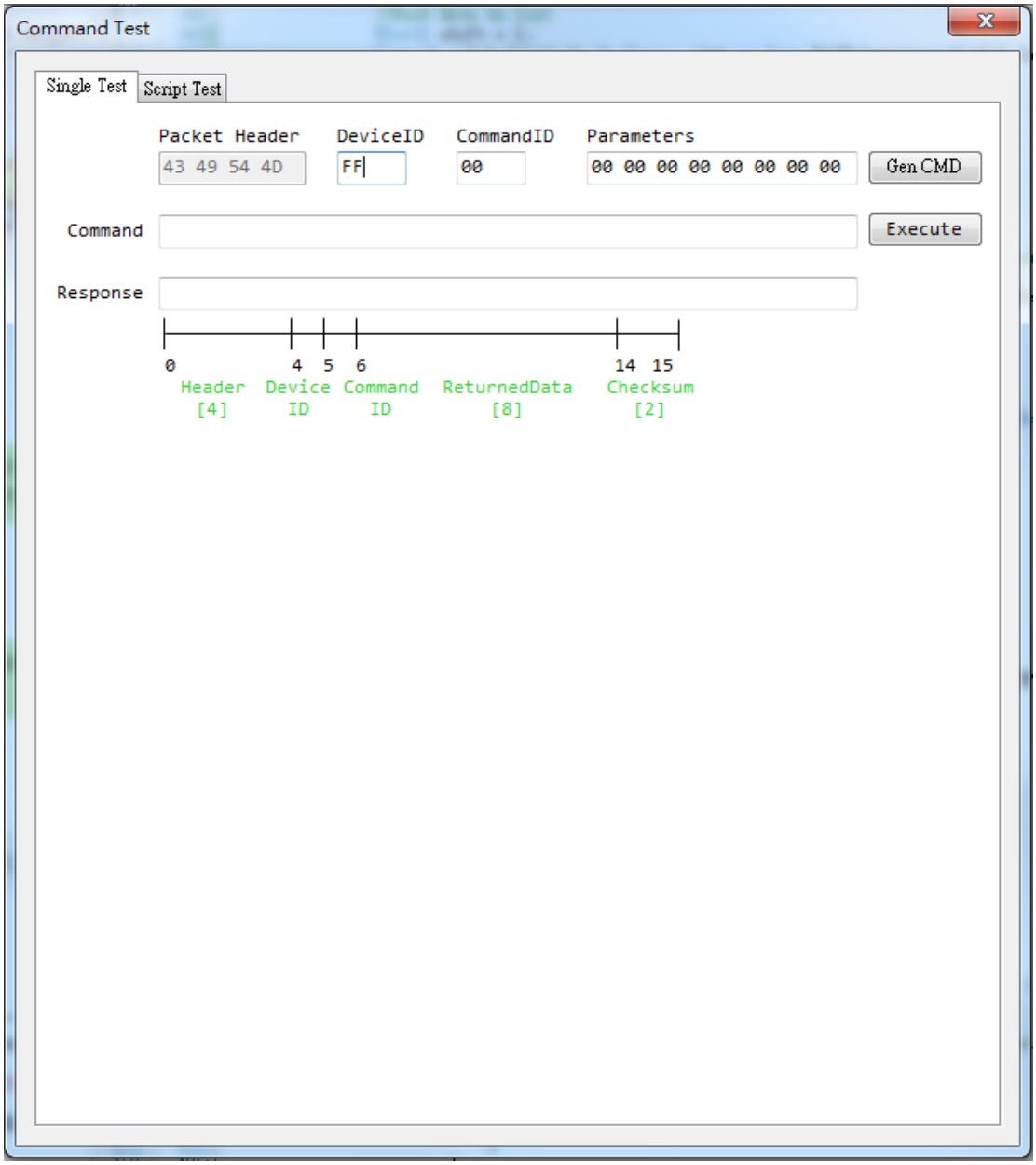


Figure 65: Single Test – Test and verify a command

3.12.2 Script Test

User can load and execute a command script file, and obtain the results from those executed commands. The Script Test includes three parts as below：

- **Script Description**：Illustrate the script usage.
- **Script Content**：Display the commands in the script.
- **Response**：Reply the result which command executed.

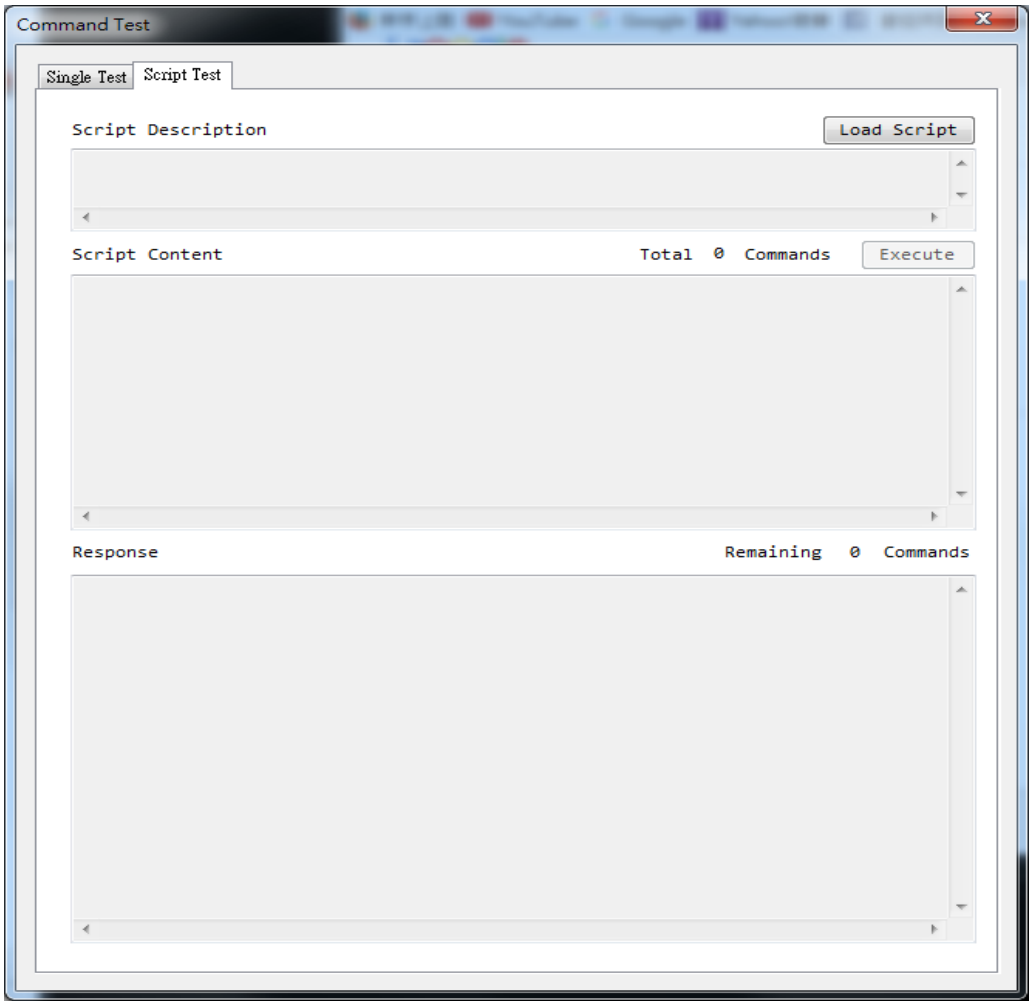


Figure 66: Script Test

Click the **Load Script** button to load command script file. Click the **Execute** button to execute commands and delay function of the **Script Content** section. The results will be displayed to **Response** section.

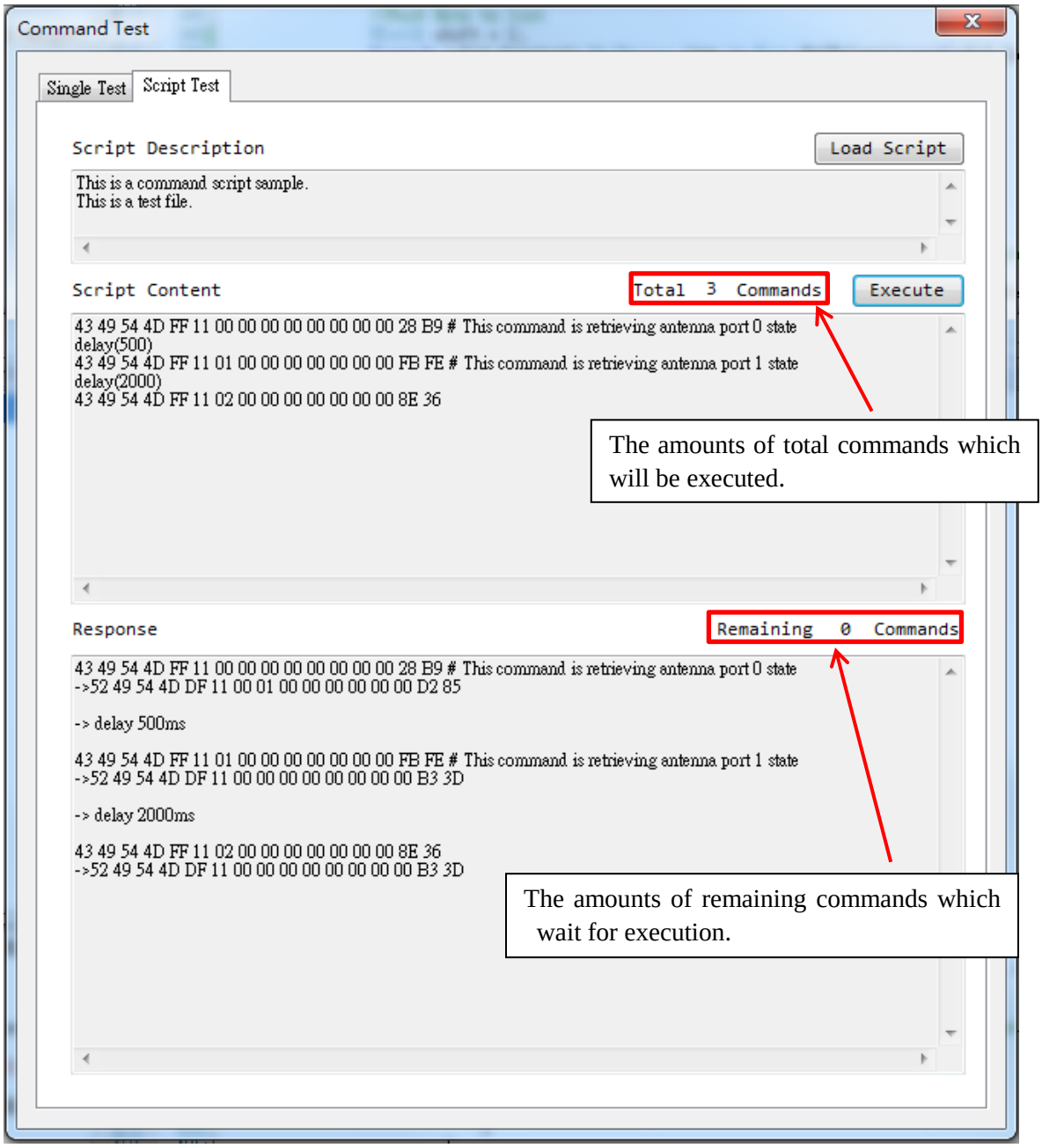


Figure 67: Script Text – Execute and obtain a command script file

3.12.3 Command Script File Format

The extension of command script file must be ".txt". The format includes three parts as below：

#MTI RFID Command Script
#This is a sample. #This is a test code.

43 49 54 4D [DeviceID] [CommandID] [Parameters] #This is sample command.
delay([delaytime])

- **#MTI RFID Command Script**：This sentence is necessary that it is cipher text for command script file.

- **#This is a sample. #This is a test code.**：Illustrate the command script file usage, the first char must be "#" of each description line.
- **43 49 54 4D [DeviceID] [CommandID] [Parameters]**：It is command script content.
  - **43 49 54 4D**：It is fixed format for RFID LLCS command header.
  - **[DeviceID]**：The general device ID number is 0xFF for broadcasting, the length of this field is fixed 1 byte.
  - **[CommandID]**：This command ID does not support 0x40~0x4F and 0x8B, user can inquire the command set summary from RFID module command reference manual, the length of this field is fixed 1 byte.
  - **[Parameters]**：Effective parameters size of each command is different, the length of this field is fixed 8 bytes.
  - **#This is sample command.**：It is explanation of RFID LLCS command, the first char must be "#".
- **Delay([delaytime])**：It is delay function.
  - **delaytime**：It is must be integer, the unit is millisecond.

The example are as below：

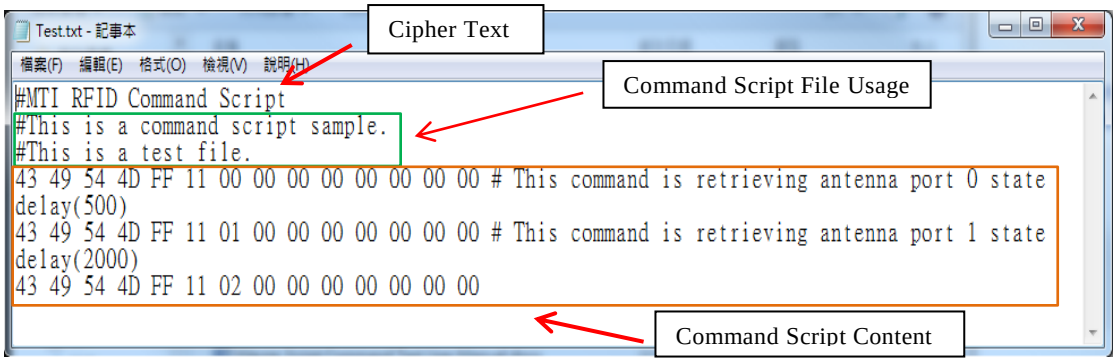


Figure 68: Script Text – Command Script File Example

4 Known Issues

5 Revision history

Table 3: Revision history

Version Number	Description	Revision Date
1.0.0	First release of document. The revision is used on software version 1.0.4.	Oct 6, 2011
1.0.1	1. Adding LargeRead function. 2. Adding Operation Mode function. 3. Adding get Temperature function. 4. Adding determine module function for RU00-M02-X. 5. Bug fixed. The revision is used on software version 1.1.6.	Mar 12, 2014
1.1.0	1. Modifying RF On/Off function. 2. Bug fixed. The revision is used on software version 1.1.7.	May 30, 2014

1.1.1	1. Add control options of modulation testing in RF Test page. 2. Add Command Test function. 3. Correct texts and figures. The revision is used on MTI RFID Explorer version 1.2.2.	April 2, 2015
1.1.2	1. Add command script test function. 2. Correct texts and figures. The revision is used on MTI RFID Explorer version 1.2.6.	January 24, 2017
2.0.0	1. Add NXP Authenticate function. 2. Add CB-2 tag access function. The revision is used on MTI RFID Explorer version 2.0.0.	March 20, 2018
2.0.1	1. Enhance NXP authentication function. 2. Delete Summary View function. The revision is used on MTI RFID Explorer version 2.0.1.	April 12, 2018