



Mifare RFID reader, 13.56M Hz, w/o LED indicator, IEI As sembly Only, R11

# User Manual



# Revision

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25 April, 2014	1.00	Initial release





Integration Corp.

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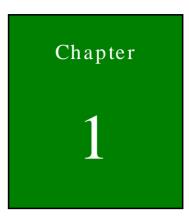


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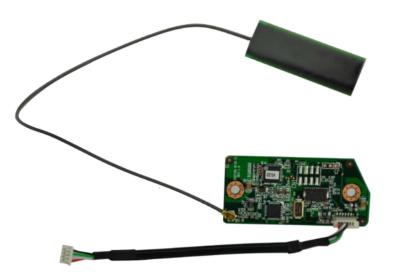
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# Introduction





## 1.1 AFL2-MF-RFID-KIT Series RFID Reader Overview



### Figure 1-1: AFL2-MF-RFID-KIT Series RFID Reader

The AFL2-MF-RFID-KIT Series is a RFID reader for both High Frequency (HF) and Ultra High Frequency (UHF) RFID systems and is compliant with ISO 15693 and ISO 14443 industrial standards. The AFL2-MF-RFID-KIT Series also comes with a utility and a software development kit (SDK) for configuring reader module and writing/reading tags.

## 1.2 Model Variations

The model variations of the AFL2-MF-RFID-KIT Series are listed below.

Models	Series
AFL2-MF-RFID-KIT01-R11	for AFL2-W07A/08A Series
AFL2-MF-RFID-KIT02-R11	for AFL2-W10A/10A/12A/15A/W15B/17A/W19A Series
AFL2-MF-RFID-KIT03-R11	for AFL2-W21A Series

#### Table 1-1: Model Variations

1.2.1 AFL2-MF-RFID-KIT Series Features

The AFL2-MF-RFID-KIT Series has the following features

13.56 MHz radio frequency industrial RFID reading module



- Supports standard protocol ISO 15693 for vicinity card applications reads multiple tags simultaneously
- Tag compatibility: TI, ST, Philips, Tag-it, HF-EPC
- Reader to reader anti-collision
- Reads and writes tags with up to 2Kb
- Single power supply and low power consumption
- Various interfaces to main system
  - O 115.2 Kbps maximum serial communication speeds
  - O USB

## 1.3 Technical Specifications

The specifications for the Intel based embedded systems are listed below.

	AFL2-MF-RFID-KIT Series
Support Protocol	ISO 15693
RF Frequency	13.56 MHz
RF Data Rate	6.62 kbps for ISO 15693
Baud Rate	9600 Kbps ~ 115,200 Kbps
Power Consumption	5V @ 150 mA
Operating Distance	10 cm
Interface	RS-232 serial port or USB
Operating Temperature	0°C ~ 60°C
Operating Humidity	10% ~ 85% RH
Tag Compatibility	RI, ST, Philips, Tag-it, HF-EPC
Driver Support	Windows XP
	Windows XPE
	Windows CE 5.0

**Table 1-2: Technical Specifications** 



# 1.4 Dimensions

The dimensions of the AFL2-MF-RFID-KIT Series are listed below and shown in **Figure 2-2**.

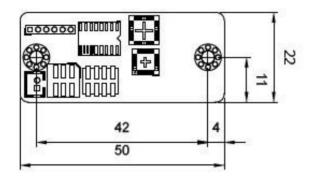
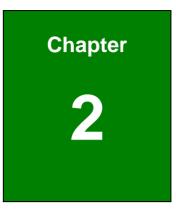


Figure 2-2: AFL2-MF-RFID-KIT Series Dimensions (mm)





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# Connectors



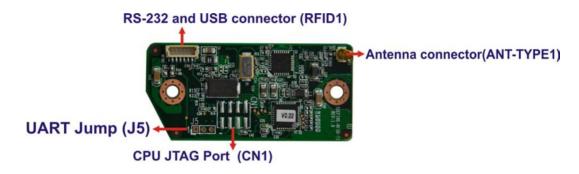
# 2.1 AFL2-MF-RFID-KIT Series RFID Reader Module

The following sections describe the relevant components and jumpers on the RFID reader module.

## 2.1.1 AFL2-MF-RFID-KIT Series Layout

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Figure 2-6 shows the on-board peripheral connectors.



#### Figure 2-1: Connector and Jumper Locations

### 2.1.2 Peripheral Interface Connectors

**Table 2-1** shows a list of the peripheral interface connectors on the AFL2-MF-RFID-KIT

 Series. Detailed descriptions of these connectors can be found below.

Connector	Туре	Label
Antenna connector	IPEX type connector	ANT-TYPE1
RS-232 and USB connector	6-pin header	RFID1
CPU JTAG Port	8-pin	CN1
UART Jump	2-pin	J5

#### Table 2-1: Peripheral Interface Connectors and Indicators

## 2.2 Internal Peripheral Connectors

This section has complete descriptions of all the internal peripheral connectors on the AFL2-MF-RFID-KIT Series.



## 2.2.1 Antenna Connector

CN Location:	See Figure 2-6
CN Type:	IPEX
CN Label:	ANT-TYPE1

The Antenna Connector connects to the 13.56 MHz antenna module.

## 2.2.2 RS-232 and USB Connector (RFID1)

Pin No.	Description
1	USB5V
2	D+_1
3	D1
4	GND
5	RFID_BUZ#
6	EN

#### Table 2-2: RS-232 and USB Connector Pinouts

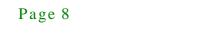
## 2.2.3 CPU JTAG Port (CN1)

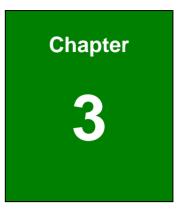
Pin No.	Description
1	с_тск
2	nRST
3	C_TMS
4	+ 3V3
5	C_TDI
6	GND
7	C_TDO
8	GND

# 2.2.4 UART Jump (J 5)

Pin No.	Description
1	ТХД
2	RXD
3	GND

Table 2-4: UART Jump Pinouts





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# Installation



3.1 Anti-static Precautions



If the following anti-static precautions are not followed, a user may be injured and the system irreparably damaged.

Electrostatic discharge (ESD) can cause serious damage to electronic components, including the AFL2-MF-RFID-KIT Series module. (Dry climates are especially susceptible to ESD.) It is therefore critical that whenever the AFL2-MF-RFID-KIT Series is opened and any electrical component handled, the following anti-static precautions are strictly adhered to.

- *Wear an anti-static wristband*: Wearing a simple anti-static wristband can help to prevent ESD from damaging the board.
- Self-grounding: Before handling the board, touch any grounded conducting material. During the time the board is handled, frequently touch any conducting materials that are connected to the ground.
- Use an anti-static pad: When configuring the AFL2-MF-RFID-KIT Series, place it on an antic-static pad. This reduces the possibility of ESD damaging the AFL2-MF-RFID-KIT Series.

## 3.1.1 Unpacking

After the AFL2-MF-RFID-KIT Series is received make sure the following components are included in the package. If any of these components are missing, please contact the AFL2-MF-RFID-KIT Series reseller or vendor where it was purchased or contact an IEI sales representative immediately.

Quantity	Item	Image
1	IRFD-100/IRFR-100	

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1	Utility and manual CD	

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Table 3-1: Package List Contents







# GUI Program

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## 4.1 Chapter Overview

This chapter describes the installation and use of the USB drivers and IRFR-100 module control program.

## 4.2 Software Installations

Do not plug the module into the USB port until instructed to do so. If it is already connected to a USB port, disconnect it now.

Software installation is a two-step process. The first step is the installation of a third-party virtual COM port (VCP) driver, and the second part is the installation of the IRFR-100 GUI program.

#### 4.2.1 Virtual COM Port Driver Installation

To install the virtual driver, unzip the **VCP\_driver.rar** and run the program **CDM\_setup.exe**. When the driver installation is complete, the following confirmation is displayed:



#### Figure 4-1: FTDI Driver Installation Complete

#### 4.2.2 Hardware Installation

At this point, attach the IRFR-100 module to an open USB port. The module can be plugged directly into the port or attached at the end of a USB extension cable (type A, not supplied). At this point, the power LED should be lit. Any RFID tag corresponding to a supported protocol can be detected and is indicated by the corresponding LED.

## 4.2.3 Software GUI Installation

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The software GUI is the file named **IRFR-100.rar**. It can be unzipped using a standard unzip program and is a self-contained executable. Create a folder where desired on the host PC, and unzip the executable into that folder. The program can be run from the folder, or a shortcut can be created and placed on the desktop of the host computer. In most cases, the program automatically detects the COM port. In case the program could not detect the COM port, enter the COM port number (e.g., COM3) in the Select Port window at the bottom right of the GUI as shown following, and click on the **Select Port** button).

#### Support Port: COM1 ~ COM9.

RFR-100 Control			
15693       Find tags         15693       Find tags         Commands       •         •       Inventory         •       Read Single Block         •       Vrite Single Block         •       Lock Block         •       Read Multiple Blocks         •       Write Multiple Blocks         •       Stay Quiet         •       Select         •       Reset to Ready         •       Lock AFI         •       Lock DSFID         •       Lock DSFID	Tag Flags       Data Coding         Double Sub-carrier       1 out of 4         High Data Rate       Full Pow         One slot       Half Pow         Option       Set Protocod         Tag Data       UID         (First) Block Number       Data         Number of Blocks       Data         DSFID       AFI	er er	Special functions AGC on Main channel AM Enable TRF7960
C Get System Info C Get Mult.Blk.Sel Status		Execute	
<			Clear Log

Figure 4-2: IRFR-100 Control COM Ports

To determine the USB serial port that corresponds to the IRFR-100 module, right-click on the My Computer icon on the desktop. When the drop-down menu appears, click on Properties.

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Figure 4-3: Properties

On the properties window, select the Hardware tab:

Syster	n Restore	Autor	tio Updatos	Remote
General	Compute	er Name	Hardware	Advance
Device I	Manager			
X		er. Use the D	the hardware devic evice Manager to c	
			Device M	anager
Drivers				
	Driver Signing le compatible with		sure that installed d	
			/indows Update for	
		onnects to W		drivers.
Hardwar	how Windows c	onnects to W	/indows Update for	drivers.
Hardwar	how Windows c Driver Sig e Profiles	onnects to W gning s provide a v	/indows Üpdate for Windows	drivers.
Hardwar	how Windows c Driver Sig e Profiles Hardware profile	onnects to W gning s provide a v	/indows Üpdate for Windows	drivers.

Figure 4-4: Device Manager

Next, click on *Device Manager*, then click the + sign next to *Ports* to expand the ports:

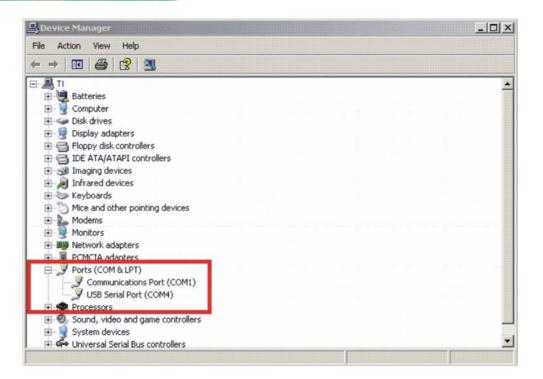


Figure 4-5: Device Manager - Ports

If the driver installation was successful and the module is plugged in, *USB Serial Port* should appear in the list of ports, followed by a port number (in this example, COM4). The actual port number may be different. Make note of the COM port number and enter it in the *Select Port* window of the GUI. Then select the *Select Port* on GUI (do not press the *Enter* key). Note: If the *Enter* key is pressed, the program ends and the GUI closes.

# 4.3 Software Interface

The GUI window is shown following. Each section of the window has a different function. The figure shows the arrangement for the *Protocol 15693* and *Find Tags*.

Protocol. Tab.	Utility Tab	Tag., Flags., /	RSSI. Window.	Special Function
IRFK-100 Control IS633 Find tags Commands Inventory Read Single Block Write Single Block C Uock Block C Read Multiple Blocks C Write Multiple Blocks C Stay Quiet Select Reset to Ready Write AFI C Lock AFI C Write DSFID C Lock DSFID C Lock DSFID C Lock DSFID C	Tag Flags Double Sub-carries High Data Rate AFI is present One slot Dotion Tag Data UID (First) Block Number Number of Blocks Data DSFID AFI		II UID M A	Special functions AGC on Main channel AM Enable TRF7960
C Get System Info			Execute	
Selected. Protocol. Commands	Wind		Tag Data	GUL. Contro

Figure 4-6: Software Interface

## 4.3.1 Program Control Window (Lower Right-Hand Corner)

The Select Port window allows the user to enter manually the USB serial port used by the host computer to communicate with the IRFR-100 module.

Exit button - exits the IRFR-100 control program.

4.3.2 Protocol Tab Window

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The protocol tab window selects tag protocol and program functions. Available option is:

- (ISO/IEC) 15693 vicinity cards
- 4.3.3 Utility Tabs Window

Find Tags – a function that reads tags of protocol 15693

4.3.4 Flags Window

This window allows the user to set flags for the 15693 protocol. Different flags may be available for different commands. The tag window automatically updates available flags depending on the request chosen.

4.3.5 Command (Request) Window

This window shows various request options available for protocol 15693.

#### 4.3.6 Log Window

The log window shows all communication frames from host computer to IRFR-100 module. The tag response is also displayed in the log window. The tag response (register content) is always in parentheses to distinguish it from the host-to-reader data exchange. This information is also stored in the *IRFR-100.log* file, located in the same file directory as IRFR-100.exe, which can be opened by a normal text editor such as Notepad.

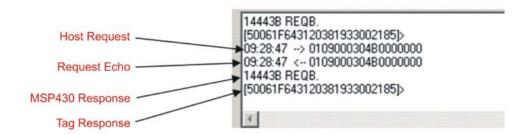


Figure 4-7: Log Window

#### 4.3.7 Tag Data Window

The *Tag Data* window is where the user enters addresses, data, number of bits, and other information required by certain commands. Checking certain flags in the *Flag* window may activate more fields for data entry.

#### 4.3.8 RSSI Window

The RSSI field displays the slot number, UID and the RSSI values of the corresponding tag. If there was a collision and the reader performed a second anticollision procedure, the slot numbers are indicated with an additional character:

A = second procedure B =third procedure and so on.

The main channel, which is **AM**, is used as the primary one, and **PM** is the auxiliary channel. The RSSI maximum value is **7** and minimum value is **0**. The corresponding RSSI values depend on the system design (antenna + reader), and the levels can vary based on the quality of the reception. The specifics of the corresponding input voltage levels to RSSI levels are defined in the TRF7960 data sheet.

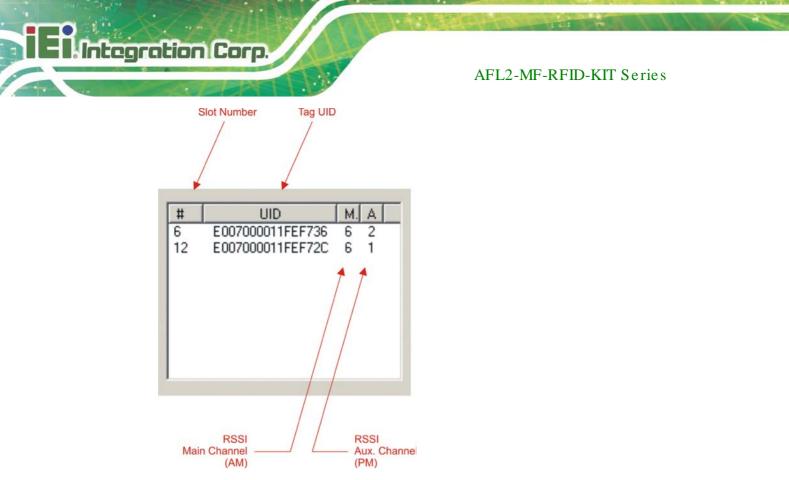


Figure 4-8: RSSI Window

In the preceding example, one can see that the tags in slots #6 and #12 have a main-channel RSSI value of 6, with auxiliary-channel RSSI values of 2 and 1, respectively.

## 4.3.9 Special Functions Window

Special functions, such as AGC on/off, main channel AM, and enable/disable the TRF7960.

The AGC is turned off after the power-on reset (POR) and can be enabled when desired (especially in noisy environments). By default, the input channel is AM and can be switched to PM if the RSSI value for the PM channel is higher than the AM.



## 4.3.10 Other Functions

Other functions on the main IRFR-100 control panel are:

- Set protocol which configures the program for the selected protocol once the protocol tab has been selected
- Execute button which processes the selected command
- Power control (half or full) which can be used to simulate marginal reception conditions. The RF output power selection enables the user to switch between full power (200 mW) and half power (100 mW); however, the antenna matching circuit is tuned to operate with full-power selection, and performance is not optimal in half-power selection. This is due to the matching on the output of the reader IC, which currently is matched for 200 mW. (The load impedance for full power is 4 W and half power is 8 W.)
- Data coding mode which is used in conjunction with the 15693 protocol

## 4.4 Set Protocol

IRFR-100 control program does not automatically set the program to that protocol. The user must manually click on the *Set Protocol* button:



Figure 4-9: Set Protocol

When the *Set Protocol* button is pressed, the software sets the parameters for the corresponding protocol standard.

## 4.5 ISO/IEC 15693 Protocol

This section describes commands for the 15693 protocol. After a command has been selected by clicking on the associated command button in the Commands window, the user should set any flags as needed. If appropriate, enter data in the Tag Data window.

## 4.5.1 Inventory

The Inventory command is used to acquire the unique IDs (UID) of ISO 15693 tags in the read zone. The two inventory methods supported are 16-slotted and single-slot. A single-slot request allows all transponders in the read zone to reply to the Inventory request. In cases where more than one tag is present, such a request would cause a data collision, which in turn causes a reader to send a collision error message to the GUI. A 16-slot inventory sequence decreases the likelihood of a data collision by forcing

compliant transponders to respond in 1 of 16 slots, based on a portion of their UIDs. To perform a slotted sequence, the Slot Marker/End-of-Frame request is used in conjunction with this command. Any collision that does occur in a slotted sequence can be further arbitrated by using the anticollision mask in an algorithm similar to that outlined in the ISO 15693 standard.

To inventory a tag, the user should:

- Step 1: Click the button for Inventory in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Click on Set Protocol
- Step 4: Execute the command

Find tags     Find tags     Inventory     Read Single Block     Write Single Block     Lock Block     Read Multiple Blocks     Write Multiple Blocks	Tag Flags Double Sub-carrier High Data Rate AFI is present One slot Dobion	Data Coding 1 out of 4 • Full Power C Hall Power Set Photocol		IID MAA 118C30D9C 2 5	Special functions
C Stay Quiet C Select Reset to Ready Write AFI C Lock AFI C Write DSFID C Lock DSFID C Get System Info	Tag Data UID E0 (First) Block Number Number of Blocks Data DSFID AFI	3. 271000118C3009C	Tagl	nfo per of Blocks Block Size	Select Port
← Get Mult.Blk.Sel Status	04140601000000			Execute	

Figure 4-10: Inventory

Tag UID .

## 4.5.2 Read Single Block

The Read Single Block command gets the data from one memory block of the responding tag. In addition to this data, a Block Security Status byte can be requested. This byte shows the write-protection of the block specified [e.g., unlocked, (user/factory) locked, etc.].

To read a single block, the user should:

- Step 1: Click the button for Read Single Block in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window and set the Addressed flag (if only one tag is present, only one choice is available)
- Step 4: Enter two hex digits corresponding to the block number in the (First) Block Number field in the Tag Data window
- Step 5: Execute the command.



IRER-100 Control         15693       Find tags         Commands <ul> <li>Inventory</li> <li>Read Single Block</li> <li>Write Single Block</li> <li>Lock Block</li> <li>Lock Block</li> <li>Kead Multiple Blocks</li> <li>Write Multiple Blocks</li> <li>Stay Quiet</li> <li>Select</li> <li>Reset to Ready</li> <li>Write AFI</li> <li>Lock AFI</li> <li>Write DSFID</li> <li>Get System Info</li> <li>Get Multiple Block</li> <li>Stayset Status</li> <li>Multiple Status</li> <li>Select</li> <li>Reset to Ready</li> <li>Write AFI</li> <li>Lock AFI</li> <li>Get System Info</li> <li>Get Multiple Status</li> <li>Status</li> <li>Status</li></ul>	(First) Block Number 0 Number of Blocks	07000018C300.9C 👱	<b>#</b> 12 E00 3.0	UID M V7000018C30D9C 2 Tag Info Number of Blocks Block Size	Com Pot	
15.02.42.890 0108.0003 Request mode [00000DDCC88AA]	ck Number 0418422000000 418422000000 Data AABBCCDD00				2	Clear Log Egit

Data: AABBCCCDD (4 bytes in block 00). Lock Flag: 00 (fifth byte means unlocked; if 01, means locked).

#### Figure 4-11: Read Single Block

#### 4.5.3 Write Single Block

The Write Single Block request writes data to one memory block of the addressed tag(s). In order to successfully write data, the host must know the size of the memory block of the tag. This information is available through the Get System Information request, if supported by the tag. A corrupted response or lack of response from TRF7960 does not necessarily indicate a failure to perform the write operation. Additionally, multiple transponders may process a nonaddressed request. (See Appendix A for more instructions)

To write a single block, the user should:

- Step 1: Click the button for Write Single Block in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window and set the Addressed flag (if only one tag is present, only one choice is available)
- Step 4: Enter two hex digits corresponding to the block number in the (First) Block Number field in the Tag Data window
- Step 5: Enter 8 hexadecimal digits corresponding to the data to be written in the Data field in the Tag Data window
- Step 6: Execute the command

<ul> <li>C Lock Block</li> <li>C Read Multiple Blocks</li> <li>C Write Multiple Blocks</li> <li>C Stay Quiet</li> <li>C Select</li> <li>C Reset to Ready</li> <li>C Write AFI</li> <li>C Lock AFI</li> <li>C Lock DSFID</li> <li>C Get System Info</li> <li>C Get Mult Bik.Sel Status</li> </ul>	19693 Find tags     Commands     Commands     Commentory     Read Single Block      Gr Write Single Block	Tag Flags Double Sub-carrier Figh Data Rate Select Tag Flags Data Coding Mode Tout of 4 Figh Data Rate Figh Data Rate Figh Data Rate	#         UID         M. A           12         E007000018C30D9C         2         5	Special functions AGC on Main channel AM
C Lock DSFID DSFID OO 59 C Get System Info	C Read Multiple Blocks Withe Multiple Blocks Stay Quiet Select Reset to Ready Write AFI C Lock AFI	C Half Power ✓ Option     ✓ Half Power     Set Protocol      Tag Data     UID     E007000018C30D9C      ✓     (First) Block. Number     00     Number of Blocks     Data     11223344	Tag Info Number of Blocks	
15.3816.945 ··· 010F00030418422100443322110000	C Lock DSFID C Get System Info C Get Mult Blk Sel Status	AA TO	Execute	6

Figure 4-12: Write Single Block

### 4.5.4 Lock Block

The Lock Block command write-protects one memory block of the addressed tag(s). A corrupted response or lack of response from the TRF7960 does not necessarily indicate a failure to perform the lock operation. Additionally, multiple transponders may process a non-addressed request.

Used to permanently lock the requested block.

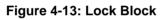
To lock a block, the user should:

- Step 1: Click the button for Lock Block in the Command window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window and set the Addressed flag (if only one tag is present, only one choice is available)
- Step 4: Enter two hex digits corresponding to the block number in the (First) Block Number field in the Tag Data window
- Step 5: Execute the command

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15693   Find tags   Commands C Inventory Read Single Block Write Single Block C Write Single Block C Read Multiple Blocks	Tag Flags Double Sub-carrier High Data Rate Select Addressed	Data Coding Mode 1 out of 4 Full Power C Half Power	# UID 12 E007000019C30	M.A.	Special functions AGC on Main channel AM Enable TRF7960 Com Pot
Write Multiple Blocks  Stay Quiet  Select  Keset to Ready  Kurke AFI  Kurke AFI  Kurke DSFID  Cuck DSFID  Get System Info	(First) Block Number 0 Number of Blocks Data DSFID 0	Set Protocol	Number of b	Blocks 3 k Size 03	Select Port
C Get Mult Blk. Sel Status				Execute	Clear Log Egit





The Option flag of the ISO 15693 defined Request flags must be set for all Write and Lock commands to respond properly.

## 4.5.5 Read Multiple Blocks

The Read Multiple Blocks command gets the data from multiple memory blocks of the responding tag. In addition to this data, a Block Security Status byte can be requested for each block. This byte shows the write-protection of the block specified [e.g., unlocked, (user/factory) locked, etc.].

To read multiple a blocks, the user should:

- Step 1: Click the button for Read Multiple Blocks in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window (if only one tag is present, only one choice is available)
- Step 4: Enter two hex digits corresponding to the starting block number in the (First) Block Number field in the Tag Data window. The blocks are numbered from 00 to FF (0 to 255)
- Step 5: Enter two hex digits corresponding to the number of blocks to be written in the Number of Blocks field in the Tag Data window. The number of blocks in the request is one less than the number of blocks that the tag returns in its response E.g., a value of 06 in the Number of Blocks field requests to read 7 blocks. A value of 00 requests to read a single block

Step 6: Execute the command

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15693 Find tags Commands Cirriventory Read Single Block Write Single Block Cock Block Circle Blocks Circle Blocks Circ	Tag Flags       Data Coding Mode         Double Sub-carrier       Data Coding Mode         W High Data Rate       1 out of 4          Select       Full Power         Addressed       Full Power         Option       Set Protocol         Tag Data       00         UID       M A         If a power       Tag Info         Number of Blocks       03         Data       1122334400000004ABBCCDD000000000000000000000000000000000	Special functions AGC on Main channel AM Com Port Select Port
	418022300030000 418022300030000	Clear Log Egit

Data: 11223344 00000000 AABBCCDD 00000000 (16 bytes in block 00~03 )+

#### Figure 4-14: Read Multiple Blocks

#### 4.5.6 Write Multiple Blocks

The Write Multiple Blocks command writes data to multiple memory blocks of the addressed tags. In order to successfully write data, the host must know the size of the memory block of the tag. Write Multiple Blocks is an optional command, and may not be supported by the tag (see the following screen capture).

To write multiple blocks, the user should:

- Step 1: Click the button for Write Multiple Blocks in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window (if only one tag is present, only one choice is available)



- Step 4: Enter two hex digits corresponding to the starting block number in the (First) Block Number field in the Tag Data window. The blocks are numbered from 00 to FF (0 to 255)
- Step 5: Enter two hex digits corresponding to the number of blocks to be written in the Number of Blocks field in the Tag Data window. The number of blocks in the request is one less than the number of blocks that the tag returns in its response E.g., a value of 06 in the Number of Blocks field requests to read 7 blocks. A value of 00 requests a read of a single block
- Step 6: Enter hexadecimal digits corresponding to the data to be written in the Data field in the Tag Data window
- Step 7: Execute the command

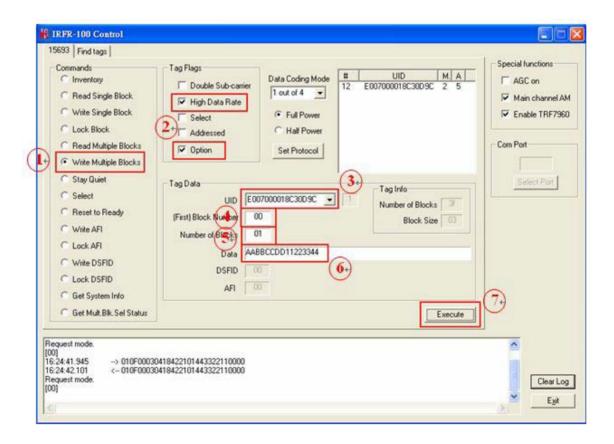


Figure 4-15: Write Multiple Block



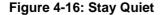
# 4.5.7 Stay Quiet

The Stay Quiet command is used to silence a tag, preventing it from responding to any nonaddressed or inventory related commands. The tag does, however, respond to requests with matching UID. As there is no response to this request from the receiving tag, only request status and errors are reported.

To command a tag to stay quiet, the user should:

- Step 1: Click the button for Stay Quiet in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window and set the Addressed flag (if only one tag is present, only one choice is available)
- Step 4: Execute the command

Commands C Inventory Read Single Block Write Single Block C Lock Block Read Multiple Blocks	Tag Flags ☐ Double Sub-carrier ☑ High Data Rate ☐ Select ☐ Addressed ☐ Option	Data Coding Mode 1 out of 4 Full Power Half Power Set Protocol	# UID 12 E007000018C3009C	M     A       1     5       IV     Main channel AM       IV     Enable TRF7960       Com Port     Com Port
Write Multiple Blocks  Stay Quiet  Select  Reset to Ready  Write AFI  Lock AFI  Write DSFID  Lock DSFID  Get System Info	Tag Data UID EO (First) Block Number Number of Blocks Data DSFID AFI	07000018C30D9C _	3 Tag Info Number of Block Block Siz	
C Get Mult.Blk Sel Status	4140601000000			Execute Clear Log Exet



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If you want to clear Quiet mode, see following instructions:

- Step 1: Click the button for Reset to Ready in the Commands window
- Step 2: Click on addressed flag in the Tag Flags window
- Step 3: Select a tag which is in *Quiet* mode from the UID pulldown list in the Tag Data window
- Step 4: Execute the command

At last, the tag will response to any nonaddressed or inventory related commands.

### 4.5.8 Select

The Select command places the addressed tag in the Select state. In this state, it responds to requests with the ISO 15693 Select Flag set. This flag is directly controlled by the <IsSelectMsg> field present in many ISO 15693 library request messages. Any receiving tag currently in the Select state with UID not matching the value sent in the request command, exits that state and enters the Ready state but does not send a reply. (See Appendix A for more instructions)

To select a tag, the user should:

- Step 1: Click the button for Select in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window and set the Addressed flag (if only one tag is present, only one choice is available)
- Step 4: Execute the command

15693 Find tags Commands Commands C Inventory C Read Single Block	- Tag Flags └── Double Sub-carrier └── High Data Rate	Data Coding Mode	# UID M. 12 E007000018C30D9C 3	
C Write Single Block		Full Power     Hall Power		Enable TRF7960
C Read Multiple Blocks	☐ Option	Set Protocol		Com Port
C Stay Quiet	Tag Dala		3+) TagInfo	Select Port
Select     Reset to Ready	UID First) Block Number	007000018C30D9C 💽	1 Number of Blocks	
C Write AFI	Number of Blocks		Block Size	
C Write DSFID	Data DSFID			
C Lock DSFID Get System Info	AFI	-		(4.)
C Get Muk.Bk.Sel Status			Exec	ute
[.40]				~
	1822259C0D C318000007E 1822259C0D C318000007E			Clear Log

#### Figure 4-17: Select

#### 4.5.9 Reset to Ready

The Reset To Ready command places the addressed tag in the Ready state. In this state, it does not respond to requests with the ISO 15693 Select Tag Flags set, but to any nonaddressed request or request matching its UID.

This command is, in effect, the complement of the Select command, and undoes it.

To reset a tag, the user should:

- Step 1: Click the button for Reset to Ready in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window (if only one tag is present, only one choice is available)
- Step 4: Execute the command



C Inventory C Read Single Block C Write Single Block	Double Sub-carrier	Data Coding Mode		
- (24		1 out of 4 ·	#         UID         M. A           12         E007000018C30D9C         0         1	- Aut on
wine onlye block	🔽 High Data Rate	Contraction of the local data		Main channel AM
C Lock Block	I Select	Full Power		Enable TRF7960
and a second	C Addressed	C Half Power		Com Port
C Read Multiple Blocks	C Option	Set Protocol		ComPort
a sector a s			0	
	Tag Data		Tag Info	Select Port
C Select	UID EO	07000018C30D9C 👱	Number of Blocks	
Reset to Ready	(First) Block Number		Block Size	
C Write AFI	Number of Blocks			
C Lock AFI	Data			
C Write DSFID	DSFID			
C Lock DSFID	AFI			( <b>4</b> )
Get System Info				
Get Mult.Blk.Sel Status			Execut	•
2:06:42:979 < 010800030414 50 15693 Inventory request.	0601000000			<u>^</u>
40] 40]				
40] 40]				Clear Log

Figure 4-18: Reset to Ready

#### 4.5.10 Write AFI (Application Family Identifier)

The Write AFI command records a new value to the AFI register (see Appendix B for AFI codes) of the addressed tag(s). A corrupted response or lack of response from TRF7960 does not necessarily indicate a failure to perform the write operation. Additionally, multiple transponders may process a non-addressed request.

AFI represents the tag application, and is used to extract information from tags meeting the application criteria.

To write a tag's AFI, the user should:

- Step 1: Click the button for Write AFI in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window

- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window (if only one tag is present only one choice is available)
- Step 4: Enter the desired AFI code in the AFI field in the Tag Data window (in hexadecimal)

#### Step 5: Execute the command

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15693 Find tags	Tag Flags			Special functions
C Inventory	Dal	ta Coding Mode	UID M. A	F AGC on
C Read Single Block		out of 4 - 12	E007000018C30D9C 3 5	Main channel Ah
	✓ High Data Rate			
Write Single Block	1 Select	Full Power		Enable TRF7960
C Lock Block	Addressed	Half Power		the second
C Read Multiple Blocks	C Option	Set Protocol		Com Port
C Write Multiple Blocks				
C Stay Quiet		0		Select Port
C Select	Tag Data		TagInfo	objection
	UID E0070000	118C30D9C 💽 🗡	Number of Blocks	
C Reset to Ready	(First) Block Number		Block Size	
Write AFI	Number of Blocks			
C Lock AFI	Data			
C Write DSFID		~		
C Lock DSFID	DSFID	4.)		
C Get System Info	AFI 05	$\smile$		(5.)
G Get Mult.Blk.Sel Status			Execute	
	4184227050000 4184227050000			-
equest mode.	THE PERSON			
0]				Clear Lo
				Clear Log

#### Figure 4-19: Write AFI



The Option flag (bit 7) of the ISO 15693 defined Request flags must be set to 1 for all Write and Lock commands to respond properly.

# 4.5.11 Lock AFI (Application Family Identifier)

The Lock AFI command write-protects the AFI register of the addressed tag(s). A corrupted response or lack of response does not necessarily indicate a failure to perform the lock operation. Additionally, multiple transponders may process a nonaddressed request.

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#### Used to permanently lock the AFI.

To a lock tag's AFI, the user should:

- Step 1: Click the button for Lock AFI in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window (if only one tag is present, only one choice is available)
- Step 4: Execute the command

15693 Find tags	Tag Flags	THE T	tert of	Special functions
C Inventory	Double Sub-carrier	a Coding Mode # 12	UID M. A E007000018C30D9C 3 5	- AGC on
C Read Single Block	✓ High Data Rate	AND DE LA COMPANY		Main channel AM
C Lock Block	2+) Select	Full Power		Enable TRF7960
C Read Multiple Blocks	T Modessed	Half Power		Com Port
Write Multiple Blocks	I Option S	et Protocol		
C Stay Quiet		3.		
C Select	Tag Data	-	Taginio	Select Port
C Reset to Ready	UID E0070000	18030090	Number of Blocks	
C Write AFI	(First) Block Number		Block Size	
C Lock AFI	Number of Blocks			
C Write DSFID	Data			
C Lock DSFID	DSFID			
C Get System Info	AFI 05			(4.)
C Get Mult Blk Sel Status				
· Germur Bik Sei Status			Execute	
8:11:21.282 → 010B00030	184227050000			~
8:11:21.438 < 010800030- Request mode.				
00]				
				Clear Log

Figure 4-20: Lock AFI



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The Option flag (bit 7) of the ISO 15693 defined Request flags must be set to 1 for all Write and Lock commands to respond properly.

### 4.5.12 Write DSFID (Data Storage Format ID)

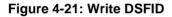
The Write DSFID (data storage format ID) command writes a new value in the DSFID register of the addressed tag(s). A corrupted response or lack of response from the TRF7960 does not necessarily indicate a failure to perform the write operation. Additionally, multiple transponders may process a nonaddressed request.

To write a tag's DSFID, the user should:

- Step 1: Click the button for Write DSFID in the Commands Window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Select a tag from the UID pulldown list in the Tag Data window (if only one tag is present, only one choice is available)
- Step 4: Enter the desired DSFID code in the DSFID field in the Tag Data window (in hexadecimal)
- Step 5: Execute the command



15693 Find tags	Tag Flags	Special functions
C Inventory C Read Single Block C Write Single Block C Lock Block C Read Multiple Blocks C Write Multiple Blocks C Stay Quiet C Select C Select C Reset to Ready C Write AFI C Lock AFI	□ Double Sub-carrier     Data Coding Mode       □ W High Data Rate     □ out of 4 _       □ Select     □ Full Power       □ Addressed     □ Halt Power       □ Option     Set Photocol   Tag Data UID E007000018C30D9C ▼ Tag Info Number of B	MAA D9C 3 5 Main channel AM Com Port
	DSFID 18 AFI 05 4184229180000 4184229180000	Execute Clear Log Ext





The Option flag (bit 7) of the ISO 15693 defined Request flags must be set to 1 for all Write and Lock commands to respond properly.

## 4.5.13 Lock DSFID (Data Storage Format ID)

The Lock DSFID command write-protects the DSFID register of the addressed tag(s). A corrupted response or lack of response from TRF7960 does not necessarily indicate a failure to perform the lock operation. Additionally, multiple transponders may process a nonaddressed request.

#### Used to permanently lock the DSFID.

To a lock tag's DSFID, the user should:

- $S tep \ 1:$  Click the button for Lock DSFID in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window (if only one tag is present, only one choice is available)

Commands C Inventory Read Single Block C Write Single Block C Lock Block C Read Multiple Blocks	Tag Flags Double Sub-carrier Figh Data Coding Mode Tout of 4 Tout	UID M.A. E007000018C30D9C 3 5 Main channel AM Enable TRF7960 Com Port
C Write Multiple Blocks C Stay Quiet C Select C Reset to Ready C Write AFI C Lock AFI C Lock AFI C Write DSFID C Get System Info	Tag Data UID E007000018C30D9C 1 (First) Block Number Number of Blocks Data DSFID 18 AFI 05	Tag Info Number of Blocks Block Size 4+
Get Mult.Blk.Sel Status	4184229180000 4184229180000	Execute Clear Log Egit

#### Step 4: Execute the command

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Figure 4-22: Lock DSFID



The Option flag (bit 7) of the ISO 15693 defined Request flags must be set to 1 for all Write and Lock commands to respond properly.

# 4.5.14 Get System Info

The Get System Info command retrieves identification, application family, data formatting, and memory block sizes as specified in the ISO 15693 standard (if tag supports this command).

To get system information, the user should:

- Step 1: Click the button for Get System Info in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window (if only one tag is present, only one choice is available)
- Step 4: Execute the command

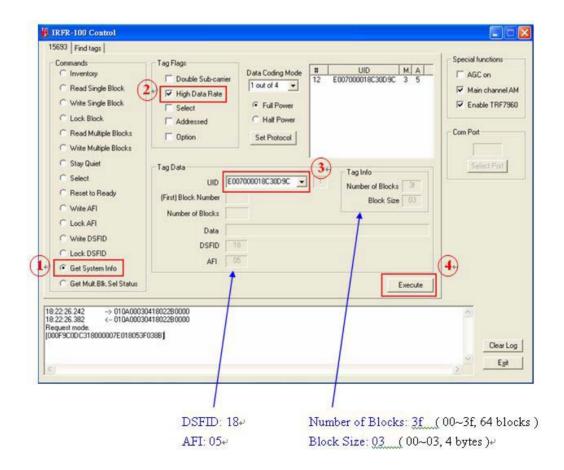


Figure 4-23: Get System Info



# 4.5.15 Get Multiple-Block Security Status (Get Mult\_Blk Sel Status)

The Get Multiple-Block Security Status (Get Mutt. Blk. Sel Status) command gets a block security status byte for each block requested. This byte encodes the write protection of the block specified (e.g., unlocked, (user/factory) locked, etc.).

To get multiple block security status, the user should:

- Step 1: Click the button for Get Mult.Blk.Sel Status in the Commands window
- Step 2: Click on any flags that must be set in the Tag Flags window
- Step 3: Optionally select a tag from the UID pulldown list in the Tag Data window (if only one tag is present, only one choice is available)
- Step 4: Enter two hex digits corresponding to the starting block number in the (First)
   Block Number field in the Tag Data window. The blocks are numbered from 00 to FF (0 to 255)
- Step 5: Enter two hex digits corresponding to the number of blocks to be written in the Number of Blocks field in the Tag Data window. The number of blocks in the request is one less than the number of blocks that the tag returns in its response E.g., a value of 06 in the Number of Blocks field requests to read 7 blocks. A value of 00 requests to read a single block
- Step 6: Execute the command



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Commands C Inventory C Read Single Block	Tag Flags	Data Coding Mode	# UID 12 E007000018		Special functions
C Write Single Block	High Data Rate	Full Power			Enable TRF796
C Lock Block	☐ Select	C Hall Power			J♥ Enable THP730
C Read Multiple Blocks	C Addressed				Com Port
C Write Multiple Blocks	C Option	Set Protocol			
C Stay Quiet	Tag Data		3 + Tag Info		Select Port
C Select	UID E	007000018C30D9C 👱	Number	of Blocks	
C Reset to Ready	(First) Block Number	00	-	Block Size	
C Write AFI	Number of Blocks	03 5.			
C Lock AFI	Data				
C Write DSFID	DSFID				
C Lock DSFID	AFI	<u> </u>			6
C Get System Info	Ari			(	6+)
Get Mult.Blk.Sel Status				Execute	
					1
	418022C00030000 418022C00030000				10
Request mode.	418022000030000				
000000000000000000000000000000000000000					Clear Lo
					Egit

[00 00 00 00 00 ]: block 00~03 are all unlocked (if tag is locked, it will response 01)+

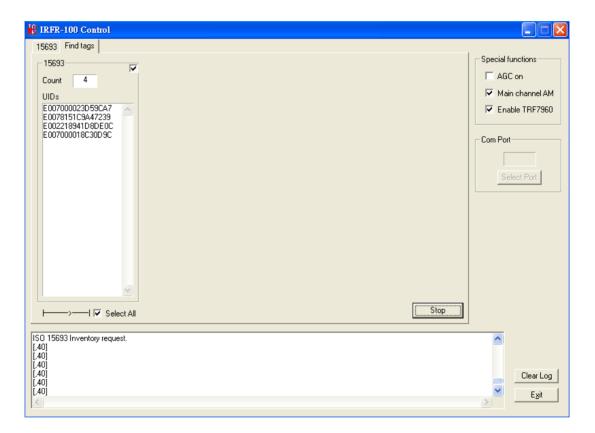
Figure 4-24: Get Multiple-Block Security Status



# 4.6 Find Tags

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The Find tags window enables the query of the RF field for all supported tags. It continuously sends an Inventory request and displays all the tag labels found within the read range of the reader. The user can select the appropriate buttons that correspond to the protocol field.

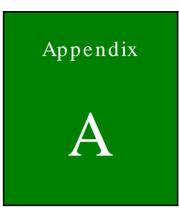




Once the Run button is clicked, the window shows all tags found within its reception area.

This command runs until the Stop button is clicked (shared location with the Run button). An indicator for the supported standards is active when the particular protocol is running. This moving right cursor can be found located left of the Select All button.

This command is recommended for demonstrations, as it requires no specific knowledge of commands/flags for each protocol.



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# Multiple Tags Writing Instruction





# A.1 Inventory Request

C Lock Block	High Data Rate  AFI is present  One slot  Option	<ul> <li>Full Power</li> <li>Half Power</li> <li>Set Protocol</li> </ul>	9 E007	8151C9447239 2		tain channel AN nable TRF7960 'ort
C Stay Quiet C Select C Reset to Ready C Write AFI C Lock AFI C Write DSFID C Lock DSFID C Get System Info	Tag Data UID E00 (First) Block Number Number of Blocks Data DSFID AFI	17000023059CA7 · ·	1.50	Tag Info Number of Blocks Block Size		Select Port
C Get Mult Blk.Sel Status				Exe	cute	

With the Inventory request, all the UIDs from the tags in the reader field are displayed.

# A.2 NON - ADDRESSED Mode

In NON-ADDRESSED mode, users can write data to multiple tags at one time.

- Needn't choosing the UID of the tag
- Un-check the 'Addressed' flag
- Check the 'Option' flag



Write Single Block     Lock Block     Read Multiple Blocks	High Data Rate     Select     Addressed     Option	1 out of 4 9 Full Power Half Power Set Protocol	E0078151C9447239	22 30 State 1 State 33	ain channel AM able TRF7960 rt
C Select	Tag Data UID (First) Block Number 00 Number of Blocks Data 11AA22 DSFID AFI	₹ 3. 88 4.	Block Size		elect Pon

# A.3 ADDRESSED Mode

In ADDRESSED mode, you can write data to a specific tag.

- Choose the UID of the tag
- Check the 'Addressed' flag
- Check the 'Option' flag



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# AFL2-MF-RFID-KIT Series

15693 Find tags	Tas Flam	Special functions
Commands C Inventory Read Single Block Write Single Block C Lock Block Read Multiple Blocks Write Multiple Blocks Stay Quiet Select Reset to Ready Write AFI Lock AFI Write DSFID C Lock DSFID	Tag Flag:     Data Coding Mode       Double Sub-carrier     Data Coding Mode       High Data Rate     1 out of 4       Select     • Full Power       Addressed     • Full Power       Option     Set Protocol       Tag Data     0       Tag Data     0       ID     M.A.       Tag Data     • Full Power       ID     ID       Mail Power     • Full Power       Set Protocol     • Tag Info       Number of Blocks     Block Size       Data     12345678       DSFID     AFI	George Grand Cone George Grand Cone George Cone Com Port Select Port George Cone Select Port
Get System Info Get Mult Blk.Sel Status	Execute	<u>ה</u> ו
4:17:30.735> 011700030	4186221A79CD523000007E000785634120000 4186221A79CD523000007E000785634120000	

Reading back the written data from a specific tag:

- The 'Addressed' flag has to be selected
- The 'Option' flag is optional

If the "Option" flag is set, then the last two digits (when a Read single block is executed) will designate whether the tag is unlocked (00) or locked (01)):

5633     Find tags       Commands     Inventory       Inventory     Read Single Block       Write Single Block     Write Single Block	Tag Flags     Data Coding Mode     #     UID     M. A.       □ Double Sub-carrier     □ out of 4     7     E007000023059CA7     3     6       □ High Data Rater     □ out of 4     •     9     E0078151C9A47239     2     4       □ Select     □ Half Power     □ Half Power     □ Half Power     □     □     □     □     □	Special functions AGC on Main channel A Enable TRF796 Com Pot
Read Multiple Blocks     Write Multiple Blocks     Stay Quiet     Select     Reset to Ready     Write AFI     Lock AFI     Write DSFID     Lock DSFID     Get System Info	☐ Option     Set Protocol       Tag Data     30       UID     E007000023059CA7 ▼       [First] Block Number     00       Number of Blocks     Block Size       Data     12345678       DSFID     AFI	Select Port
	Execute 4182220A79CD 523000007E 0000000 1182220A79CD 523000007E 0000000	Clear Lo Ext

# A.4 SELECTED Mode

Setting a tag in selected state:

- Choose 'Select' command
- The 'Addressed' flag has to be set
- Choose the UID of the preferred tag



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# AFL2-MF-RFID-KIT Series

15693 Find tags Commands	Tag Flags	Data Coding Mode	# UID M. A	Special functions
Inventory     Read Single Block     Write Single Block     Lock Block     Read Multiple Blocks     Write Multiple Blocks     Stay Quiet     Select     Reset to Ready     Write AFI     Lock AFI	Double Sub-carrier     High Data Rate     Select     Addressed     Option     Tag Data     UID E00     (First) Block Number       Number of Blocks     Data	Tout of 4  Full Power  Full Power  Set Protocol  ( 78151C9447239	7         E007000023059CA7         0         1           9         E0076151C3A47239         0         2           3+	AGC on
C Write DSFID C Lock DSFID C Get System Info	DSFID AFI			4
	11822253972A4C9518107E00		Execut	
14:50:17:340 <- 011200030 Request mode. [00]	41822253972A4C9518107E000	000		Clear Log Egit

When a tag is set in selected state, all other requests will not need to choose its UID.

Writing data to a tag, which is in selected state:

- The 'Select' flag has to be set
- Check the 'Option' flag



15693 Find tags		Consideration
Commands C Inventory Read Single Block Write Single Block C Lock Block C Read Multiple Blocks C Write Multiple Blocks C Stay Quiet C Select C Reset to Ready C Write AFI C Lock AFI C Write DSFID C Lock DSFID C Lock DSFID	(T. 1) Ph. ( 1) ( 1) ( 2)	3059CA7 0 1 3447239 0 2 I AlsCon I AlsCon
C Get System Info C Get Mult.Blk.Sel Status		Execute
	118522100CC33FF440000 118522100CC33FF440000	Clear Log

Reading data from a selected tag:

• The 'Select' flag has to be set

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15693 Find tags Commands Cinventory Read Single Block Write Single Block Cuck Block Read Multiple Blocks	Tag Flags ☐ Double Sub-carrier ☑ High Data Rate ☑ Select ☐ Addressed ☐ Option	Data Coding Mode 1 out of 4 • • Full Power • Half Power Set Protocol	# UID 9 E0078151C9A47239 12 E007000018C3009C	M A 3 2 3 3 ₩ N	al functions NGC on Main channel AM Inable TRF7960 Port
Write Multiple Blocks  Stay Quiet  Select  Keset to Ready  Kwite AFI  Lock AFI  Kuite DSFID  Lock DSFID  Get System Info	Tag Data UID (First) Block Number O Number of Blocks Data 44F DSFID AFI		Tag Info Number of Block Block Size		Select Port
	418122000000 4181220000000			Execute	Clear Log Egk

If we want to select the second tag, the first tag (the one in the selected state) has to be deselected first.

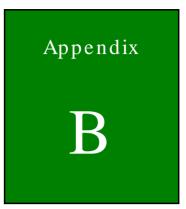
To deselect the first tag:

• The 'Select' flag has to be set

15693 Find tags	Tag Flags			Special functions
C Inventory C Read Single Block Write Single Block Lock Block Read Multiple Blocks Write Multiple Blocks Write Multiple Blocks	Double Sub-carrier     Duble Sub-carrier     High Data Fore     Select     Addressed     Option	Data Coding Mode T out of 4 • • Full Power • Half Power Set Protocol	H UID 7 E00700023059CA3 9 E0078151C9A47239	
C Stay Quiet C Select Reset to Ready C Write AFI	Tag Data UID (First) Block Number Number of Blocks	<u>.</u>	Tag Info Number of Block Block Sig	
C Write DSFID C Lock DSFID C Get System Info	Data DSFID AFI	3		(3)
C Get Mult.Blk.Sel Status				Execute
ISD 15693 Inventory request. [40] [40] [40] [40] [40] [40]				Clear Log

Setting the second tag in selected state, please return to follow the steps of A.4.





# TestDII Program



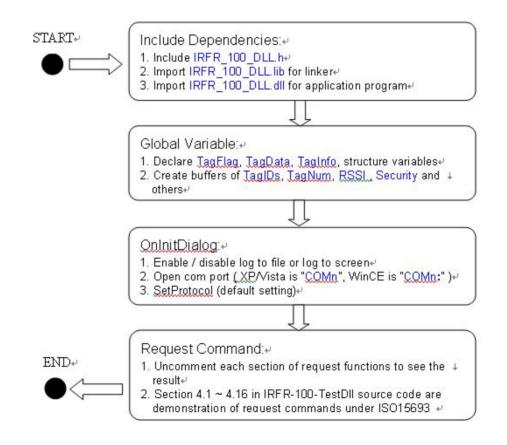
# B.1 Introduction

This document provides the information for application developer to understand the IRFR-100 - TestDII Program architecture and application programming reference. The demo program is developed by using Microsoft Visual Studio .NET 2003. MFC library. And the demo program for WinCE is developed by Microsoft eMbedded Visual C++ 4.0 MFC library.

# B.2 How to use

Before you can utilize the IRFR-100 software application programming interface, you have to do some basic initialization. The SDK package includes one dynamic link library named "IRFR\_100\_DLL.dll". You need to include "IRFR\_100\_DLL.h" in your application header file and set "IRFR\_100\_DLL.lib" in project linker input, then you can use its APIs. IRFR\_100\_TestDII\_C.rar will demonstrate how to use IRFR\_100\_DLL\_C library.

IRFR-100-TestDII Application Architecture :



# B.3 Tag Information Structure

The data structure contains all information about RFID Tag. Below are the declarations of TagFlag, TagData, TagInfo, RSSI and the description of entries.

# B.3.1 Tag Flag

struct	tagflag {	
	taginag (	

- int t15CodingMode;
- int t15bSubCarrier;
- int t15bDataRate;
- int t15bInventory;
- int t15bSelect;
- int t15bAddress;
- int t15bOption;
- int t15iFullPower;

# };

typedef struct tagflag TagFlag;

Variable	Description		
Variable	Value = 0	Value = 1	
t15CodingMode	1 out of 4	1 out of 256	
t15bSubCarrier	single sub-carrier	double sub-carrier	
t15bDataRate	low data rate	high data rate	
t15bInventory	other request	inventory request	
t15bSelect	disable select mode	enable select mode	
t15bAddress	non-addressed mode	addressed mode	
t15bOption	disable option	enable option	
t15iFullPower	full power	half power	

# B.3.2 Tag Data

Struct tagdata{

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char	t15UID [CMD_LEN];
char	t15FirstBN [HEX_LEN];
char	t15NumBl [HEX_LEN];
char	t15Data [CMD_LEN];
char	t15DSFID [DSFID_LEN];
char	t15AFI [HEX_LEN];

};

typedef struct tagdata TagData;

Variable	Description		
t15UID	Tag UID	CMD_LEN = 2048	
t15FirstBN	First block number	HEX_LEN = 4	
t15NumBl	Number of Blocks	HEX_LEN = 4	
t15Data	Block data	CMD_LEN = 2048	
t15DSFID	DSFID number	DSFID_LEN = 4	
t15AFI	AFI number HEX_LEN = 4		

# B.3.3 Tag Info

struct	taginfo{		
char	DSFID [DSFID_LEN];		
char	AFI [HEX_LEN];		
char	NumofBlk [HEX_LEN];		
char	BlkSize [HEX_LEN];		

};

typedef struct taginfo TagInfo;

Variable	Description		
DSFID	DSFID number	DSFID_LEN = 4	
AFI	AFI number	HEX_LEN = 4	
NumofBlk	Number of Blocks	HEX_LEN = 4	

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BlkSize Block size HEX_LEN = 4	
--------------------------------	--

# B.3.4 RSSI

struct re	ssi{	
char	Slot [BUF_LEN];	
char	UID [CMD_LEN];	
char	AM [BUF_LEN];	
char	PM [BUF_LEN];	
};		
typedef struct rssi RSSI;		

Variable	Description	
Slot	Slot number (1 ~ 16)	BUF_LEN = 36
UID	Tag UID	CMD_LEN = 2048
AM	Main channel	BUF_LEN = 36
PM	Sub channel	BUF_LEN = 36

# B.3.5 Request Command Type

These are definitions of request command type used by **IRFR\_RequestExecute()** function

Tunction		
#define	INVENTORY	0
#define	READ_SB	1
#define	WRITE_SB	2
#define	LOCK_B	3
#define	READ_MB	4
#define	WRITE_MB	5
#define	QUIET	6
#define	SELECT	7
#define	READY	8
#define	WRITE_AFI	9
#define	LOCK_AFI	10
#define	WRITE_DSFID	11
#define	LOCK_DSFID	12

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#define	SYSTEM_INFO	13
#define	MBS_STATUS	14

# B.4 Software APIs

# BOOL IRFR\_FindPort (void)

This function can be used to find com port and open it automatically.

[Parameter]

None.

# [Return]

If open IRFR-100 device com port successfully, it return 1, otherwise return 0.

### Example :

IRFR\_FindPort ();

# BOOL IRFR\_FindSinglePort ( char \* Port )

This function can be used to open com port manually.

#### [Parameter]

char \* Port : assign IRFR-100 device com port name.

#### [Return]

If open IRFR-100 device com port successfully, it return 1, otherwise return 0.

#### Example :

XP/Vista : BOOL IRFR\_FindSinglePort ( "COM4" ); WinCE: BOOL IRFR\_FindSinglePort ( "COM4:" );

# int IRFR\_logAddFile ( char \* msg )

This function can be used to write string to user defined log file. Remember to call **IRFR\_SetFilePath()** to set log file pathname first.

#### [Parameter]

char \* msg : assign user defined string.

# [Return]

If write string successfully, it return 0, otherwise return 1 (NULL\_FILE\_PATH).

#### Example :

IRFR\_logAddFile ( "Com Port Found!!" );

# Int IRFR\_logAddScreen (char \* msg)

This function can be used to write string to user defined MFC CEdit control variable and show it on the screen. Remember to call **IRFR\_SetLogger()** to set CEdit control variable first.

### [Parameter]

char \* msg : assign user defined string.

### [Return]

If write string successfully, it return 0, otherwise return 2 (NULL\_LOGGER ).

Example :

IRFR\_logAddScreen ( "Com Port Found!!" );

# void IRFR\_SetFilePath (char \* path)

This function can be used to set log file pathname.

[Parameter]

char \* path : assign user defined file pathname.

[Return]

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None.

Example :

IRFR\_SetFilePath ( "TestDll.log" );

# void IRFR\_SetLogger ( CEdit \*logger )

This function can be used to set MFC CEdit control variable.

[Parameter]

CEdit \*logger : assign user defined CEdit control variable.

# [Return]

None.

# Example :

IRFR\_SetLogger ( &m\_myLogger );

# void IRFR\_SetLogFile ( bool result )

This function can be used to enable or disable log to file feature.

[Parameter]

bool result : assign true to enable log to file feature, or false to disable it.

#### [Return]

None.

#### Example :

IRFR\_SetLogFile ( false );

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# void IRFR\_SetLogScreen ( bool result )

This function can be used to enable or disable log to screen feature.

# [Parameter]

bool result : assign true to enable log to screen feature, or false to disable it.

#### [Return]

None.

#### Example :

IRFR\_SetLogScreen ( false );

# void IRFR\_ClearLog ( void );

This function can be used to clear CEdit control variable buffer and clear screen data.

[Parameter]

None.

# [Return]

None.

### Example :

IRFR\_ClearLog ();

# int IRFR\_SetProtocol (TagFlag tf);

This function can be used to set or update operation flags of IRFR-100 device.

### [Parameter]

TagFlag tf : assign user defined TagFlag structure.

# [Return]

If success, return 0, otherwise return 1.

# Example :

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m_tf -> t15CodingMode = 0;
m_tf -> t15bSubCarrier = 0;
m_tf -> t15bDataRate = 1;
m_tf -> t15bInventory = 1;
m_tf -> t15bSelect = 0;
m_tf -> t15bAddress = 0;
m_tf -> t15bOption = 0;
m tf -> t15iFullPower = 0;

// 1 out of 4
// single sub carrier
// high data rate
// inventory request
// disable select mode
// non-addressed mode
// disable option
// 0:enable full power, 1:half power

IRFR\_SetProtocol ( \*m\_tf );

int IRFR\_RequestExecute ( int cmdno, char \*reply, TagFlag tf, TagData
\*td )

This function can be used to execute request command of ISO 15693. And IRFR-100 response data will be saved in reply buffer.

#### [Parameter]

int cmdno: assign request command type.

char \*reply : assign user defined buffer to save data responded from IRFR-100

# device.

 TagFlag tf :
 assign user defined TagFlag structure.

TagData \*td : assign user defined TagData structure.

### [Return]

If success, return 0, otherwise return 1.

Example :

IRFR\_RequestExecute ( INVENTORY, m\_reply, \*m\_tf, m\_td );

# void IRFR\_FindRun (char \*TagIDs, char \*TagNum)

This function can be used to find the UIDs of all tags (only ISO 15693 support) in the Antenna area automatically.

#### [Parameter]

char \*TagIDs : assign user defined buffer to save all Tags UIDs.



char \*TagNum : assign user defined buffer to save Tag number.

[Return]

None.

Example :

IRFR\_FindRun ( m\_TagIDs, m\_TagNum );

void IRFR\_FindStop (void) This function can be used to stop finding Tags.

[Parameter]

None.

[Return]

None.

Example :

IRFR\_FindStop ();

void IRFR\_GetUIDs (char \*reply, char \*TagIDs[], char \*TagNum) This function can be used to parse the given reply buffer to retrieve Tag UIDs and Tag number.

[Parameter]

char \*reply :assign reply buffer which contains responded data from IRFR-100device.char \*TagIDs[]:assign user defined buffer to save all Tags UIDs.

char \*TagNum : assign user defined buffer to save Tag number.

[Return]

None.

Example :



IRFR\_GetUIDs ( m\_reply, TagIDs, TagNum );

Remember to call **IRFR\_RequestExecute** (**INVENTORY**, **m\_reply**, **\*m\_tf**, **m\_td**) first to get all tags information from IRFR-100 device and save them in the reply buffer.

void IRFR\_GetRSSI(char \*reply, RSSIRSSIs[])

This function can be used to parse the given reply buffer to retrieve RSSI information.

[Parameter]

char \*reply : assign reply buffer which contains responded data from IRFR-100 device. RSSI RSSIs[] : assign user defined RSSI structure to save all Tags RSSI info.

[Return]

None.

Example :

IRFR\_GetRSSI ( m\_reply, RSSIs );

Remember to call **IRFR\_RequestExecute** (**INVENTORY**, **m\_reply**, **\*m\_tf**, **m\_td**) first to get all tags information from IRFR-100 device and save them in the reply buffer.

void IRFR\_GetBlockData (char \*reply, TagData \*td)

This function can be used to parse the given reply buffer to retrieve single block data of specified block index.

[Parameter]

char \*reply : assign reply buffer which contains responded data from IRFR-100 device. TagData \*td : assign user defined TagData structure to save block data.

[Return]

None.

Example :

IRFR\_GetBlockData ( m\_reply, m\_td );

Remember to call **IRFR\_RequestExecute ( READ\_SB, m\_reply, \*m\_tf, m\_td )** first to get specified tag information from IRFR-100 device and save them in the reply buffer.

void IRFR\_GetMultiBlockData (char \*reply, TagData \*td); This function can be used to parse the given reply buffer to retrieve multiple block data of specified block index range.

#### [Parameter]

char \*reply : assign reply buffer which contains responded data from IRFR-100 device. TagData \*td : assign user defined TagData structure to save multiple block data.

[Return]

None.

Example :

IRFR\_GetMultiBlockData ( m\_reply, m\_td );

Remember to call **IRFR\_RequestExecute ( READ\_MB, m\_reply, \*m\_tf, m\_td )** first to get specified tag information from IRFR-100 device and save them in the reply buffer.

void IRFR\_GetTagInfo (char \*reply, TagInfo \*ti, TagFlag tf, TagData td) This function can be used to parse the given reply buffer to retrieve total block number and block size of specified tag.

[Parameter]

char \*reply :assign user defined buffer to save data responded from IRFR-100device.TagInfo \*ti :TagFlag tf :assign user defined TagInfo structure to save tag information.TagFlag tf :assign user defined TagFlag structure.TagData \*td :assign user defined TagData structure.

[Return]

None.



Example :

IRFR\_GetTagInfo ( m\_reply, m\_ti, \*m\_tf, \*m\_td );

Remember to call IRFR\_RequestExecute ( SYSTEM\_INFO, m\_reply, \*m\_tf, m\_td ) first to get

specified tag information from IRFR-100 device and save them in the reply buffer.

#### void IRFR\_GetMultiBlockSecurity (char \*reply, char \*SecurityData)

This function can be used to parse the given reply buffer to retrieve the status (lock or unlock) of multiple blocks.

[Parameter]

char \*reply : assign reply buffer which contains responded data from IRFR-100 device. char \*SecurityData : assign user defined buffer to save the status of multiple blocks.

[Return]

None.

Example :

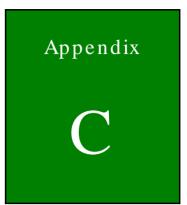
IRFR\_GetMultiBlockSecurity ( m\_reply, m\_SecurityData );

Remember to call **IRFR\_RequestExecute ( MBS\_STATUS, m\_reply, \*m\_tf, m\_td )** first to get specified tag information from IRFR-100 device and save them in the reply buffer.

#### B.5 Example Code

Please extract IRFR\_100\_TestDII\_C.rar (XP/Vista) or IRFR\_100\_TestDII\_MFC\_CE.rar (WinCE) in the "IRFR-100 APPLICATION SDK" package and uncomment one of section B.4 and build the project to show the demo application.





# ISO/IEC 15693 Reference Material



### C.1 UID Format

The tags are uniquely identified by a 64-bit unique identifier (UID). This is used for addressing each tag uniquely and individually during the anticollision loop, and for one-to-one exchange between a reader and a tag. The format of the UID is shown below:

Bits 64 to 57	Bits 56 to 49	Bits 48 to 1		
E0	Manufacturer code IC	serial number		

The UID is composed of:

- The 8 MSBs, which are E0.
- The 8-bit IC manufacturer code
- A unique serial number of 48 bits assigned by the IC manufacturer

# C.2 Tag Memory Organization

Tag memory is organized into blocks of bytes. Addressing is by block only. There is no individual byte addressing for read or write; the whole block is accessed. It is analogous to a spreadsheet with rows and columns, where addressing accesses a whole row at once. The format of tag memory is shown as follows:

Bits 16 to 14	Bits 13 to 9	Bits 8 to 1	
RFU	Block size in bytes	Number of blocks	

- Block size is expressed in 5 bits, allowing up to 32 bytes, i.e., 256 bits. It is one less than the actual number of bytes. E.g., a value of 1F indicates 32 bytes; a value of 00 indicates 1 byte.
- Number of blocks is defined in 8 bits, allowing up to 256 blocks. It is one less than the actual number of blocks. E.g., a value of FF indicates 256 blocks; a value of 00 indicates 1 block.
- The 3 most-significant bits are reserved for future use and are set to zero.

This addressing scheme limits the total storage of the tag to 8K bytes.

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### C.3 Flag Definitions

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- *High Data Rate*: the default data rate is used for maximum detection range. If *High Data Rate* is selected in the *Tag Flags* window, communication with the tag is faster, but the range is reduced.
- *AFI is present*: The default setting for the AFI (Application Family Identifier) is off. If AFI is present is selected in the *Tag Flags* window, AFI is enabled in commands and responses.
- One Slot: the definition of slot, as used in the software, is the number of tags that may be received at a time. The default is 16. If only One Slot is selected in the Tag Flags window, the algorithm detects a flag sooner, but stops after detecting the first tag.
   Other tags in the reception range of the reader are ignored.
- Select: the default is off. Request executed by any tag according to the setting of Addressed flag. If select flag is selected in the Tag Flags window, request executed only by tag in selected state. The Addressed flag is set to 0 and the UID field is not included in the request.
- Addressed: the default setting is off. Request is not addressed. UID field is not included. It can be executed by any tag. If addressed flag is selected in the Tag Flags window, request is addressed. UID field is included. It is executed only by the tag whose UID matches the UID specified in the request.
- Option: Meaning is defined by the command description.

AFI Most Significant	AFI Least Significant	Meaning Tags Respond From	Examples/Note	
Nibble	Nibble			
0	0	All families and subfamilies	No applicable reselection	
x	0	All subfamilies of family X	Wide applicable	
			preselection	
x	Y	Only the Yth subfamily of family		
		х		
0	Y	Proprietary subfamily Y only		
1	0, Y	Transport	Mass transit, bus, airline	
2	0, Y	Financial	IEP, banking, retail	

# C.4 Application Family Identifier (AFI) Definitions

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3	0, Y	Identification	Access control	
4	0, Y	Telecommunication	Public telephony, GSM	
5	0, Y	Medical		
6	0, Y	Multimedia	Internet services	
7	0, Y	Gaming		
8	0, Y	Data storage	Portable files	
9	0, Y	Item management		
А	0, Y	Express parcels		
В	0, Y	Postal services		
С	0, Y	Airline bags		
D	0, Y	RFU	Reserved for future use	
E	0, Y	RFU	Reserved for future use	
F	0, Y	RFU	Reserved for future use	





# Hazardous Materials Disclosure



# D.1 Hazardous Materials Disclosure Table for IPB Products Certified as RoHS Compliant Under 2002/95/EC Without Mercury

The details provided in this appendix are to ensure that the product is compliant with the Peoples Republic of China (China) RoHS standards. The table below acknowledges the presences of small quantities of certain materials in the product, and is applicable to China RoHS only.

A label will be placed on each product to indicate the estimated "Environmentally Friendly Use Period" (EFUP). This is an estimate of the number of years that these substances would "not leak out or undergo abrupt change." This product may contain replaceable sub-assemblies/components which have a shorter EFUP such as batteries and lamps. These components will be separately marked.

Please refer to the table on the next page.

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# AFL2-MF-RFID-KIT Series

Part Name	Toxic or Hazardous Substances and Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (CR(VI))	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
Housing	х	0	0	0	0	Х
Display	х	0	0	0	0	Х
Printed Circuit Board	Х	0	0	0	0	Х
Metal Fasteners	х	0	0	0	0	0
Cable Assembly	х	0	0	0	0	X
Fan Assembly	х	0	0	0	0	Х
Power Supply Assemblies	х	0	0	0	0	Х
Battery	0	0	0	0	0	0
below	the limit	requiremer	nt in SJ/T1136	63-2006	homogeneous mate	

this part is above the limit requirement in SJ/T11363-2006

此附件旨在确保本产品符合中国 RoHS 标准。以下表格标示此产品中某有毒物质的含量符 合中国 RoHS 标准规定的限量要求。

本产品上会附有"环境友好使用期限"的标签,此期限是估算这些物质"不会有泄漏或突变"的 年限。本产品可能包含有较短的环境友好使用期限的可替换元件,像是电池或灯管,这些元 件将会单独标示出来。

部件名称	有毒有害物质或元素					
	铅	汞	镉	六价铬	多溴联苯	多溴二苯
	(Pb)	(Hg)	(Cd)	(CR(VI))	(PBB)	醚
						(PBDE)
壳体	х	0	0	0	0	х
显示	х	0	0	0	0	х
印刷电路板	х	0	0	0	0	х
金属螺帽	х	0	0	0	0	0
电缆组装	х	0	0	0	0	х
风扇组装	х	0	0	0	0	х
电力供应组装	х	0	0	0	0	х
电池	0	0	0	0	0	0
O:表示该有毒有害物质在该部件所有物质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。						
X:表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。						

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