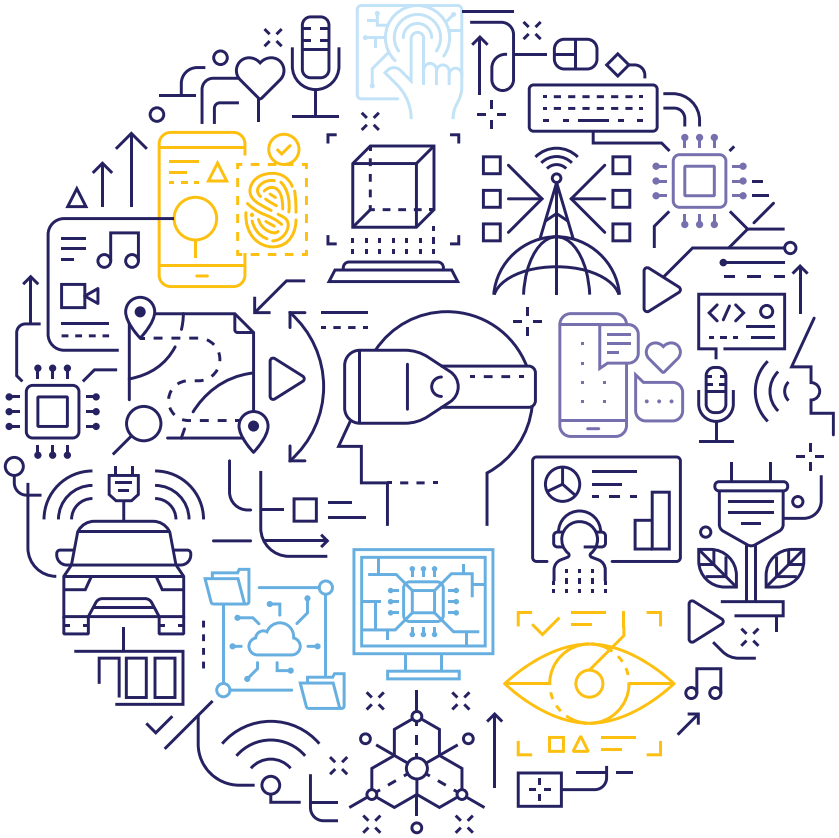
USER MANUAL

RE31/RE41 Development Kit

Description

Rev 1.0 (02, 2025)

This document describes how to use RE31/RE41 Development Kit with command line for exploring various features of RE31/RE41.



Revision History

Revision	Date	Description
1.0	07-Feb-2025	1st Release

The information herein is for product information purposes. While the contents in this publication have been carefully checked; no responsibility, however, is assumed for inaccuracies. Silicon Craft Technology PLC. reserves the right to make changes to the products contained in this publication to improve design, performance, or reliability.

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1. Introduction

RE31/RE41 are single chip reader IC for 13.56MHz RFID contactless standard protocols including ISO14443A/B, ISO15693, Felica. The RE31/RE41 contain efficient power saving modes: hard power down, soft power down, standby and receive power down mode.

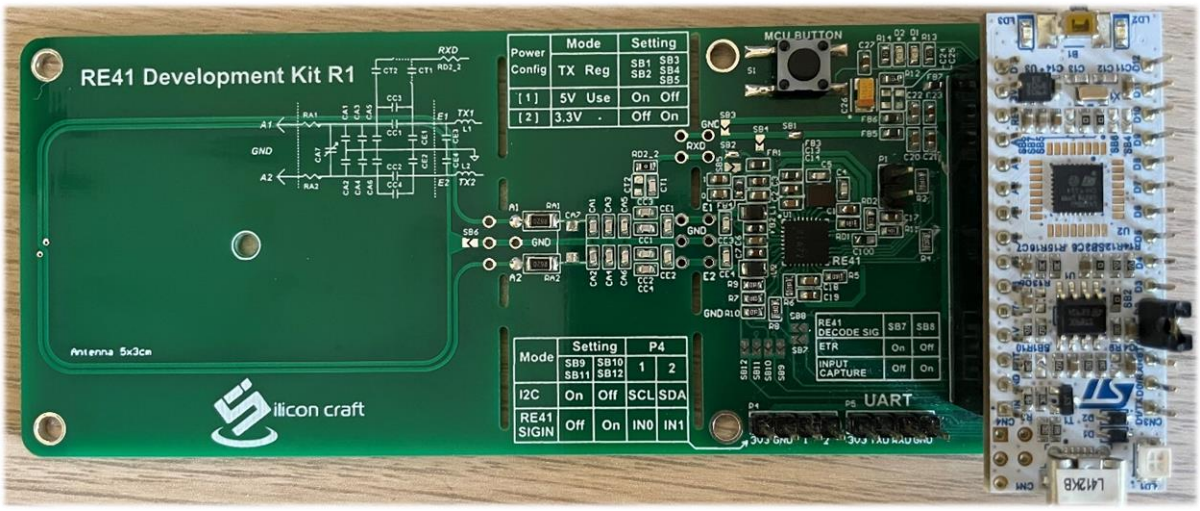


Figure 1-1 RE31/RE41 Development Kit

Silicon Craft Technology had developed RE31/RE41 Development Kit for trial and evaluation. This development kit consists of RE31/RE41 boards, standard antenna and MCU module.

2. Getting Start

To operate RE31/RE41 Development Kit, System environment and software installation are required per below:

2.1. System and Hardware requirements

- Computer : PC with USB Port
- Operating System : Window XP, Window 7, 8, 10
- Software Requirement : Hyper Terminal, Tera Term, Putty, MobaXterm, etc.
- Others : ISO14443A/B or ISO15693 Card or Tag.

2.2. Software setup

2.2.1. Serial Communication Configuration

Serial communication configuration for RE31/RE41 Development Kit is required below:

- Serial Port : Select COM Port which match to USB to UART converter
- Baud Rate : 115200 bps
- Data : 8 bits
- Parity bit : None
- Stop bit : 1 bit

2.2.2. Terminal Software (MobaXterm)

To interact with RE31/RE41 Development Kit, terminal is required for setup and controlling. MobaXterm is used as a terminal software to communicate with RE/31RE41 Development Kit.

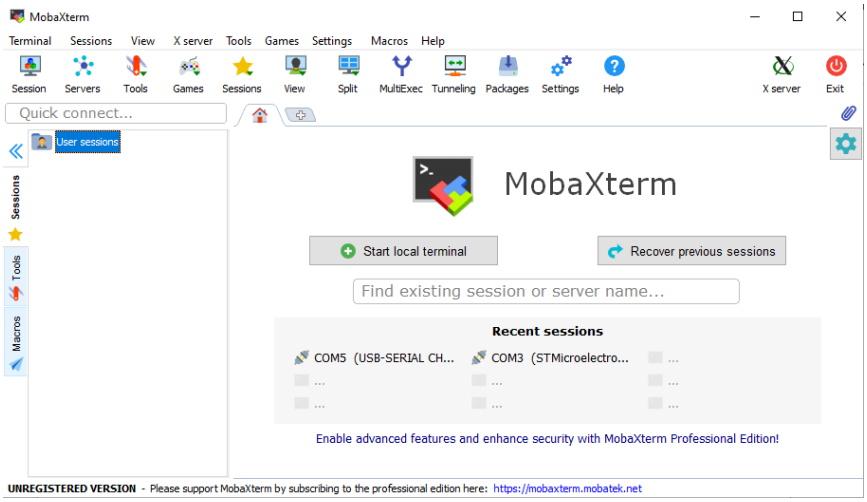


Figure 2-1 MobaXterm

2.2.3. Download and Install MobaXterm

1. Please download MobaXterm installation file via this link:
   https://mobaxterm.mobatek.net/
   then, click the tab "Download" as shown in **Figure 2-2**.

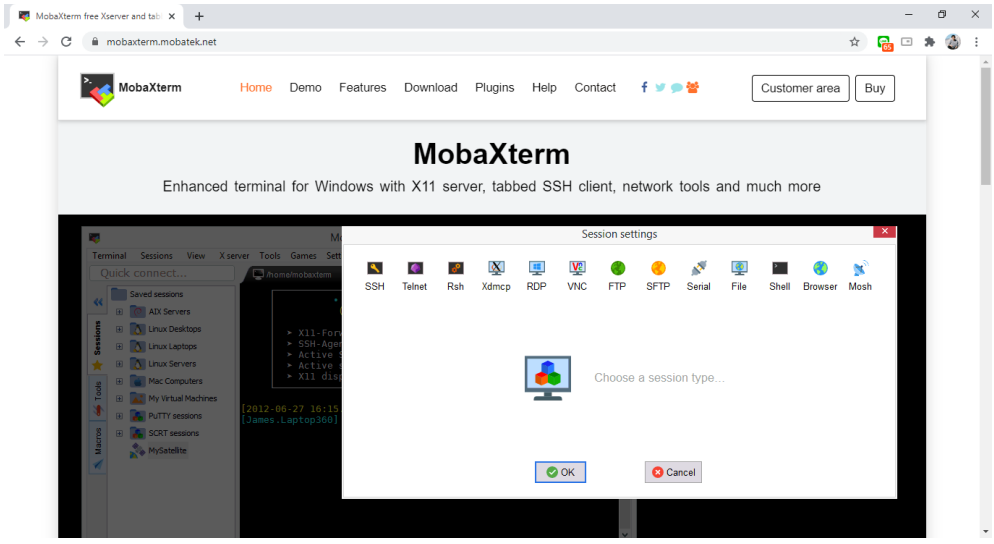


Figure 2-2 MobaXterm Website

2. At download page, click at “Download now” to go to home edition download page as shown in **Figure 2-3**.

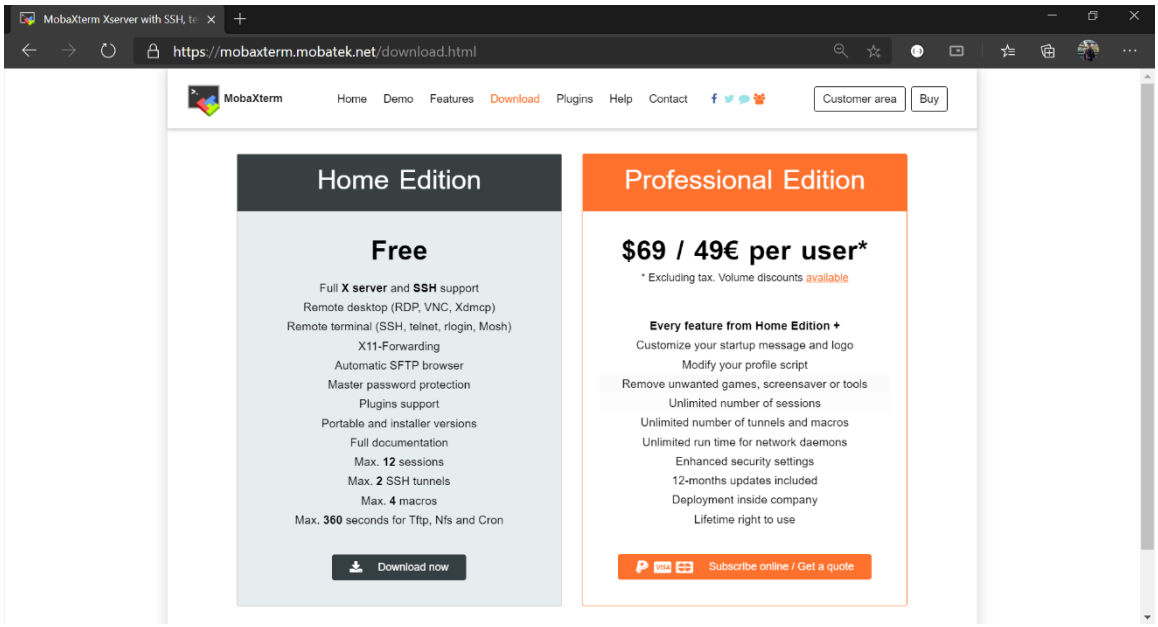


Figure 2-3 MobaXterm Download Page

3. At Home Edition download page, click at “MobaXterm Home Edition v20.2 (Installer Edition)” to download the installer as shown in Figure 2-4.

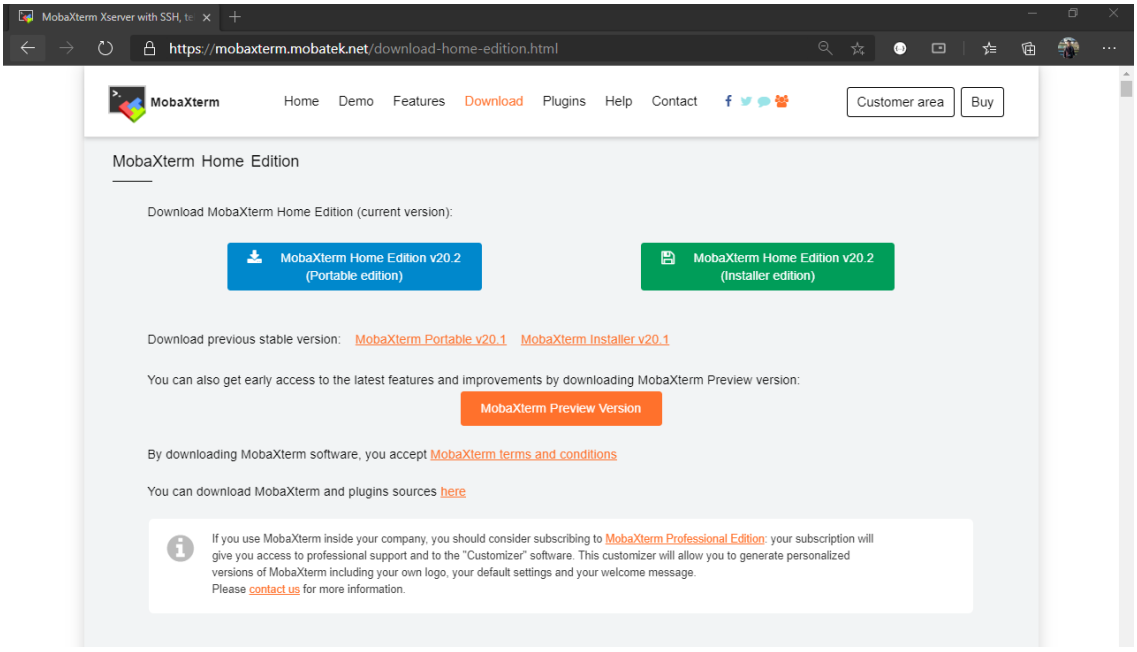


Figure 2-4 MobaXterm Home Edition Download Page

4. When the download is complete, extract the installer.
5. Inside the extracted folder, double click at “MobaXterm_installer_20.2.msi” to begin installation.
6. The installation window will pop up, click “Next” as shown in **Figure 2-5**.

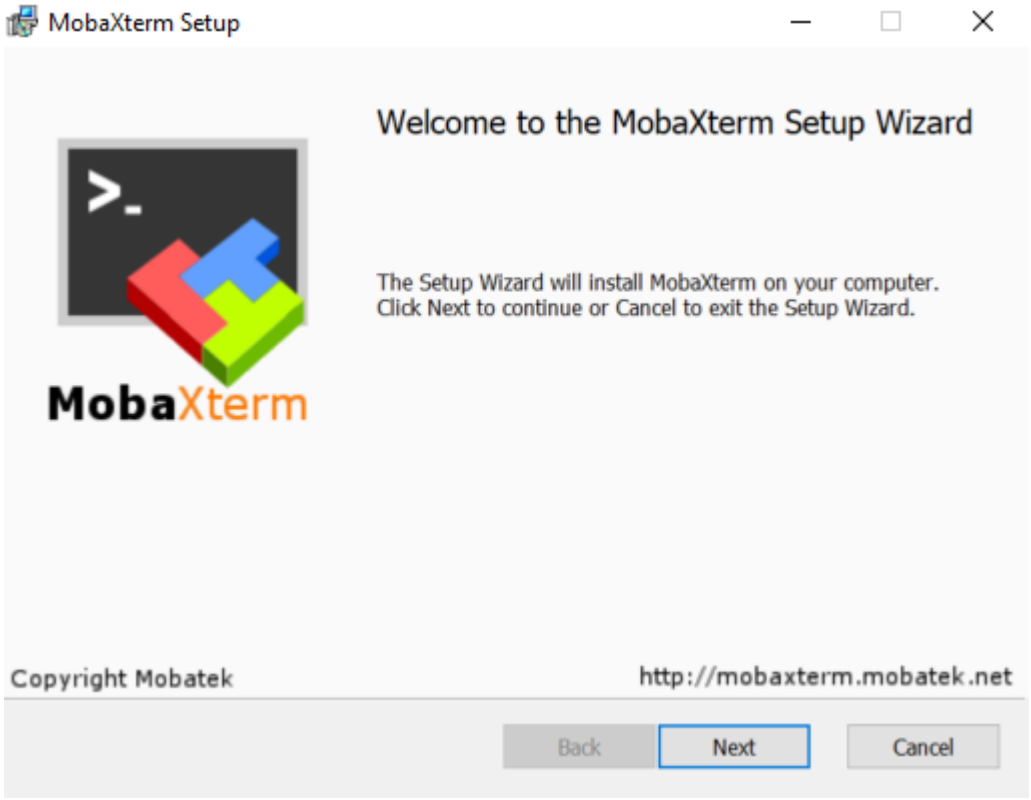


Figure 2-5 MobaXterm Installation Window

7. At End-User License Agreement page, select the accept box and then click “Next”.
8. The window will prompt for installation folder destination. Select the path to install the program then click “Next”.
9. Click “Install” to begin installation.
10. Click “Finish” when the installation is completed.

2.2.4. Connect PC

In order to communicate with the reader, a serial connection must be initialized. The steps below describe how to properly connect the reader with a PC.

1. Connect the reader to PC using a micro USB cable.
2. Open MobaXterm.

3. On the menu bar at the top left of the program, click at “Session” to create a new session.

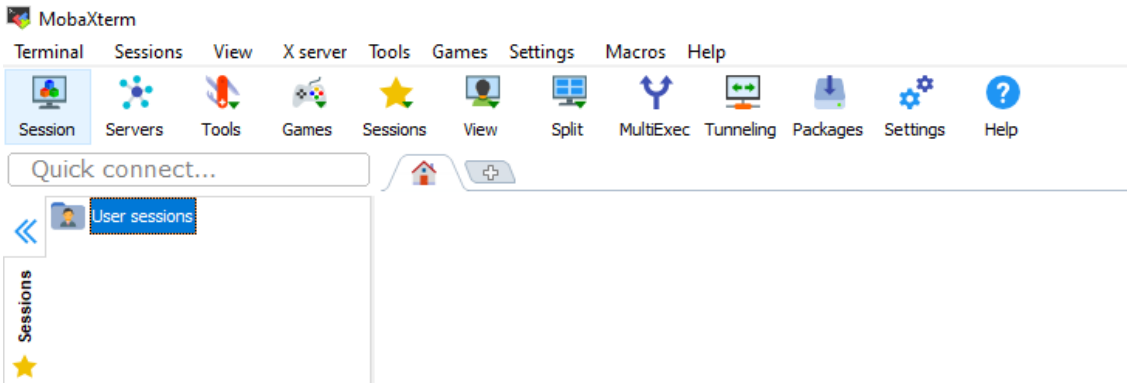


Figure 2-6 MobaXterm Create new Session

4. The program will pop up a new window called “Session settings”, click on “Serial” to set up a new serial monitor.

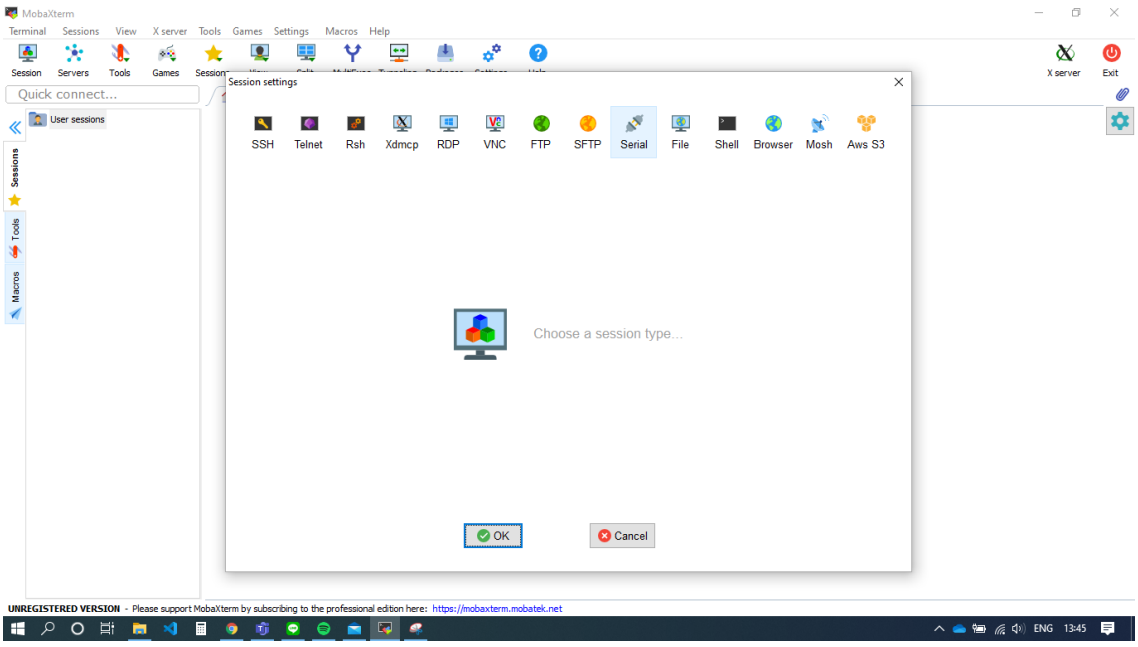


Figure 2-7 Session Setting

5. **Figure 2-8,** under the tab “Basic Serial settings”, click at the drop-down menu “Serial port” to select a port to connect. If the reader is already connected with the PC then the correspondent port number should be automatically shown up here. Otherwise, try restarting MobaXterm.

6. Click at the drop-down menu “Speed (bps)”, select “115200” and then click OK to start session.

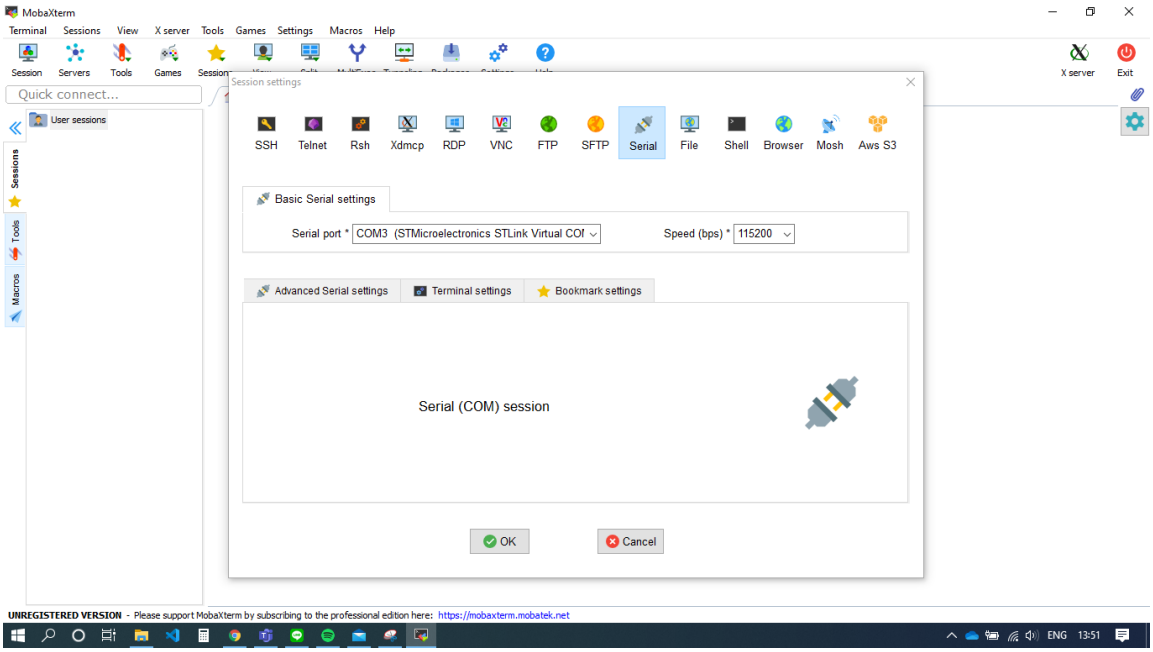


Figure 2-8 Basic Serial setting

7. Press enter to check SIC Command Line interface that start with “SIC CLI>”.

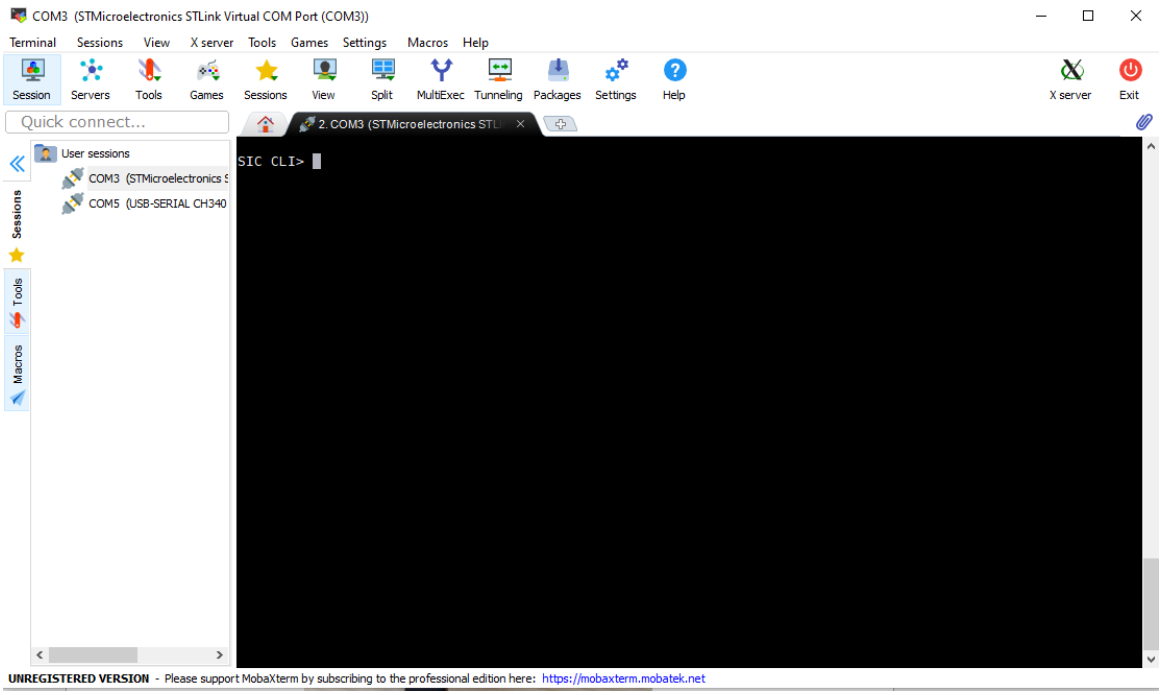


Figure 2-9 Successfully Created Serial Session

2.3. Hardware setup

Refer to **Figure 2-10**, please follow below steps:

1. Connect RE31/RE41 Development kit with mini USB cable to PC,
2. Open software and set up according to section 2.2.
3. Push RESET button on the left to initial hardware.

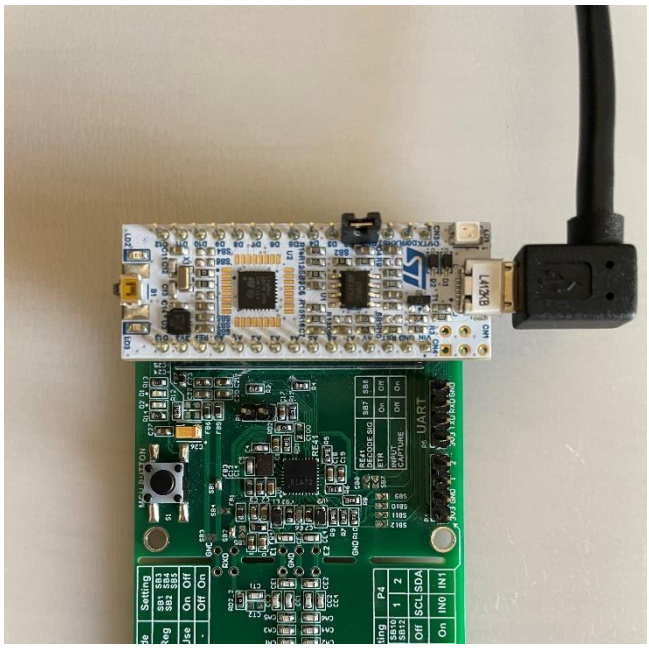


Figure 2-10 USB connection

3. Command Line

RE31/RE41 Development Kit are controlled via command line through serial communication port to operate all functions of RE31/RE41 IC. There are 2 groups of command line as below.

1. Basic Command
2. Complex Command

3.1. Basic Command

Basic commands are the command for RE31/RE41 Development Kit setup reader and read UID of tag.

3.1.1. Help

Help command to show all available commands for RE31/RE41 Development Kit.

```
SIC-CLI> help
CMD: help,  DESC: List available commands
CMD: info,  DESC: Print out device informations
CMD: reg,   DESC: Command for reading and writing register on RE41
CMD: rf,    DESC: Control RF field of reader
CMD: a,     DESC: Command for ISO14443A tag type
CMD: b,     DESC: Command for ISO14443B tag type
CMD: v,     DESC: Command for ISO15693 tag type
CMD: f,     DESC: Command for FELICA tag type
CMD: scan,  DESC: Read Tag's UID (ISO1443A, ISO14443B, ISO15693, FELICA)
CMD: mifare,DESC: Combo command for reading/writing tag mifare type
CMD: t2t,   DESC: Combo command for reading/writing tag 2 type

Use <command> -h for showing the argument of each command
OK
```

Figure 3-1 Help Command

3.1.2. Board Information

This command is for showing the information of RE31/RE41 Development Kit, MCU model and firmware version.

```
SIC-CLI> info
MCU: STM32L412KB
RE41 revision: BF (RE41 CODE2)
Purpose: This firmware is RE41 DevKit board
Firmware version : 4.2.0
OK
```

Figure 3-2 Hardware and firmware information

3.1.3. Read and Write Register

This command is for reading and writing register from RE31/RE41 IC. All operation of read and write command are shown in **Table 3-1**. All inputs and display values are Hexadecimal format.

Table 3-1 List of read and write register

Command	Input Data	Description
reg -h	-	Display all options of "reg" command.
reg -rd	<address (HEX)>	Read register of section 0.
	-all	Read value from all registers in RE31/RE41 IC
reg -wr	<address (HEX)> <data (HEX)>	Write register value in defined address at section 0 only.
	-default	Reset all register value to be default.

Example of "reg" command to read specific register is shown as **Figure 3-3**.

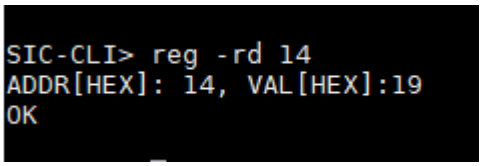


Figure 3-3 Example read register command

3.1.4. RF ON and OFF

This command is to control carrier frequency from RE31/RE41 Development Kit to turn ON, turn OFF and reset RF field with fixed time (OFF RF for 6 ms and then turn ON RF).

Table 3-2 List of RF command

Command	Input Data	Description
rf -h	-	
rf -on	-	Turn on carrier frequency of RE31/RE41 Development Kit
rf -off	-	Turn off carrier frequency of RE31/RE41 Development Kit
rf -reset	-	Turn off carrier frequency of RE31/RE41 Development Kit for 6 ms and then turn on.

3.1.5. Get Tag ID

This command is for scanning tag and getting tag UID of all card type: ISO14443A, ISO14443B and ISO15693. **Table 3-3** is shown operation of scan command.

Table 3-3 List of scan command

Command	Input Data	Description
scan -h	-	Display all options of "scan" command.
scan -l	-	Use for scanning tag for ISO1443A/B, ISO15693 or Felica. The scan loop will stop when the reader can read a tag.
scan -f	-	Use for scanning tag for ISO1443A/B, ISO15693 or Felica as loop scanning.

Figure 3-4 shows result of scan -l command when RE31/RE41 Development Kit detect a tag.

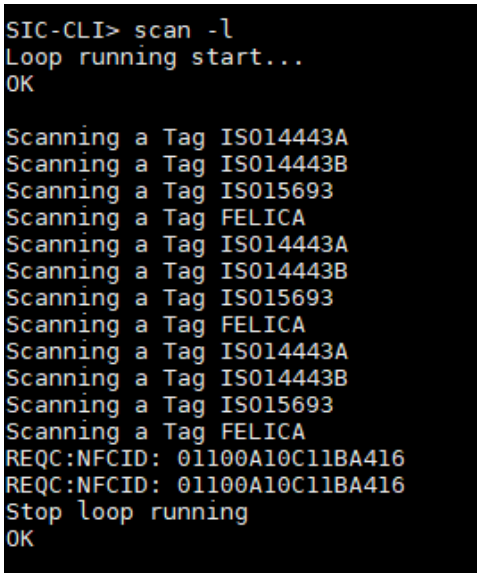


Figure 3-4 Example scan command

3.2. Complex Command

3.2.1. ISO14443A Command

Set of command to communicate with ISO14443A tag as standard command and specific command in transparent mode which selectable with or without CRC.

Table 3-3 List of ISO14443A command

Command	Input Data	Description
a -h	-	Display all options of ISO14443A command
a -setup	-	Set up RE31/RE41 register for ISO14443A standard
a -wupa	-	ISO14443A wake up command
a -reqa	-	ISO14443A request command
a -halta	-	ISO14443A halt command
a -anticol	<level 1- 3>	ISO14443A Anti-collision command with cascade level
a -sel	<level 1- 3>	ISO14443A Select command with cascade level
a -getuid	-	Combo command to get tag UID
a -trans -crc	<data in HEX>	Transparent command with CRC
a -trans -nocrc	<data in HEX>	Transparent command without CRC

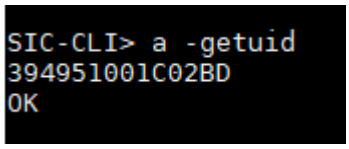


Figure 3-5 Example ISO14443A command

3.2.2. ISO14443B Command

Set of command to communicate with ISO14443B tag as standard command and specific command in transparent mode which selectable with or without CRC.

Table 3-4 List of ISO14443B command

Command	Input Data	Description
b -h		Display all options of ISO14443B command
b -setup		Set up RE31/RE41 register for ISO14443B standard
b -reqb		ISO14443B request command
b -wupb		ISO14443B wake up command
b -attrib	<PUPI 4 bytes>	ISO14443B ATTRIB command
b -halt	<PUPI 4 bytes>	ISO14443B halt command
b -trans -crc	<data in HEX>	Transparent command with CRC
b -trans -nocrc	<data in HEX>	Transparent command without CRC

3.2.3. ISO15693 Command

Set of command to communicate with ISO15693 tag as standard command and specific command in transparent mode which selectable with or without CRC.

Table 3-5 List of ISO15693 command

Command	Input Data	Description
v -h		Display all options of ISO15693 command
v -setup		Set up RE31/RE41 register for ISO15693 standard
v -inv1	<AFI, 00 for all families>	ISO15693 Inventory 1 slot command
v -inv16	<AFI, 00 for all families>	ISO15693 Inventory 16 slot command
v -quiet	<UID>	ISO15693 quiet command
v -rd	<address in HEX> <UID, 00 for optional>	Read ISO15693 tag memory
v -wr	<address in HEX> <data in HEX> <UID, 00 for optional>	Write ISO15693 tag memory
v -trans -crc	<data in HEX>	Transparent command with CRC
v -trans -nocrc	<data in HEX>	Transparent command without CRC

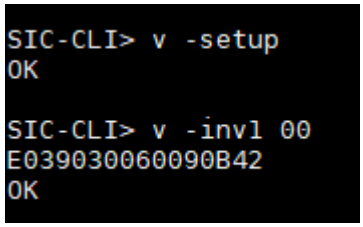


Figure 3-6 Example ISO15693 command

3.2.4. Felica Command (only RE41)

Set of command to communicate with Felica tag as standard command and specific command in transparent mode which selectable with or without CRC.

Table 3-7 List of Felica command

Command	Input Data	Description
f -h		Display all options of Felica command
f -setup		Set up RE41 register for Felica standard
f -reqc	< SLOT (1, 2, 4, 8, 16)>	Felica request command with specified the number of slot
f - read	<NFCID2 16-bytes in ASCII-HEX> <blockNum in DEC>	Felica read without encryption
f -write	<NFCID2 16-bytes in ASCII-HEX> <blockNum in DEC> <blockData 32-bytes in ASCII-HEX>	Felica write without encryption

```
SIC-CLI> f -read 012e44a7a50fba58 6
1D07012E44A7A50FBA5800000100000000000000000000000000000000
LEN: 1D
Response Code: 07
NFCID2: 012E44A7A50FBA58
Status Flag1: 00
Status Flag2: 00
Number of block: 01
Block Data: 00000000000000000000000000000000
OK

SIC-CLI> f -write 012e44a7a50fba58 6 30313233343536373839414243444546
0C09012E44A7A50FBA580000
LEN: 0C
Response Code: 09
NFCID2: 012E44A7A50FBA58
Status Flag1: 00
Status Flag2: 00
OK
```

Figure 3-7 Example Felica command

3.2.5. Mifare Command

Specific command for Mifare card is available as **Table 3-8** both of read and write with encryption key.

Table 3-6 List of Mifare command

Command	Input Data	Description
mifare -h	-	Display all options of mifare command
mifare -cread	<ka, kb> <KeyValue> <Block no. in DEC>	Mifare card read command with selectable key type. This command is require encryption key and destination block to read data.
mifare -cwrite	<ka, kb> <KeyValue> <Block no. in DEC> <DataValue in HEX>	Mifare card write command with selectable key type. This command is require encryption key and destination block to read data.

3.2.6 Tag 2 Type Command

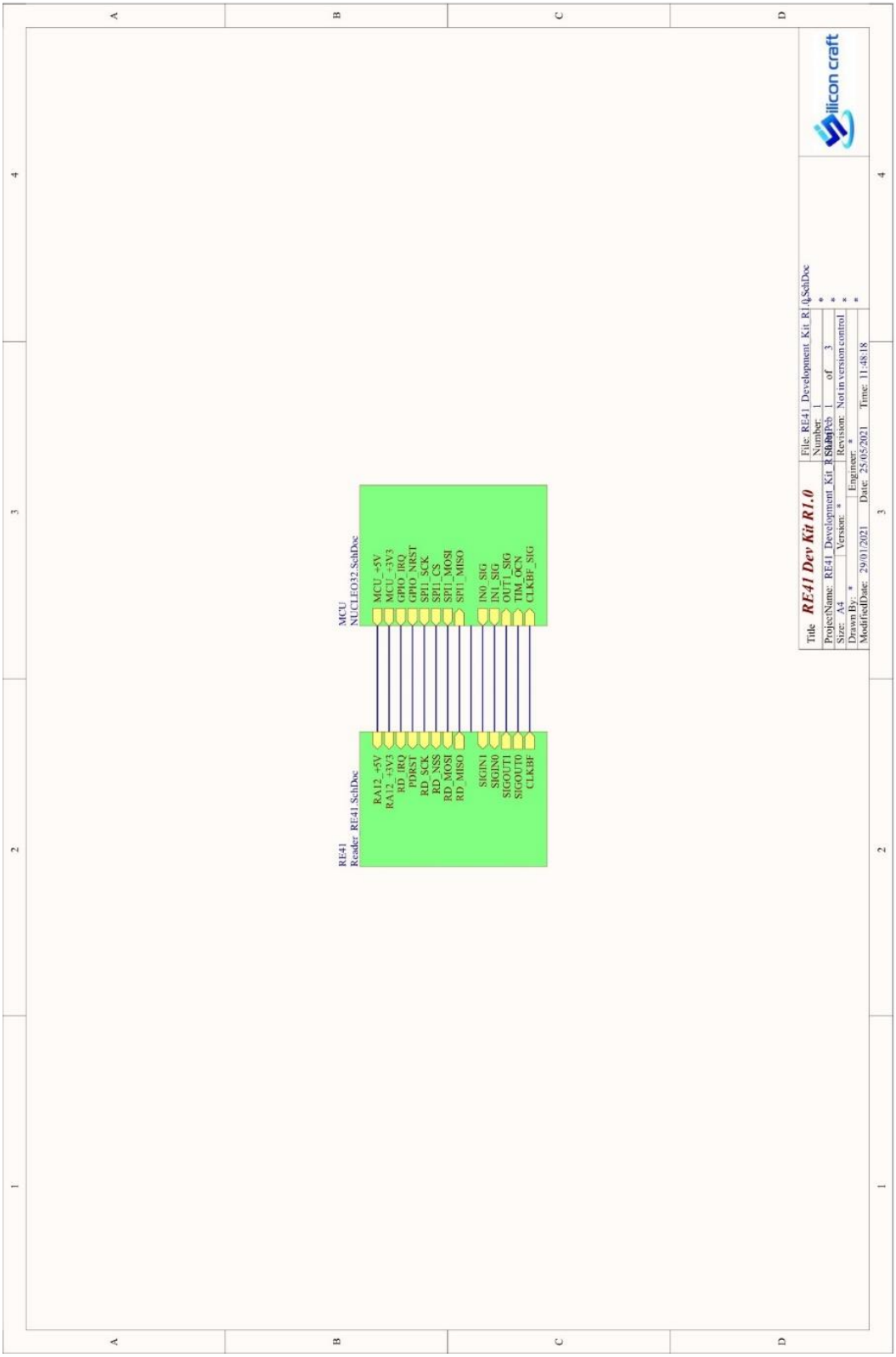
Table 3-9 is shown standard command for NFC Tag 2 Type as read 16 bytes data and write 4 bytes data per block.

Table 3-7 List of Tag 2 Type command

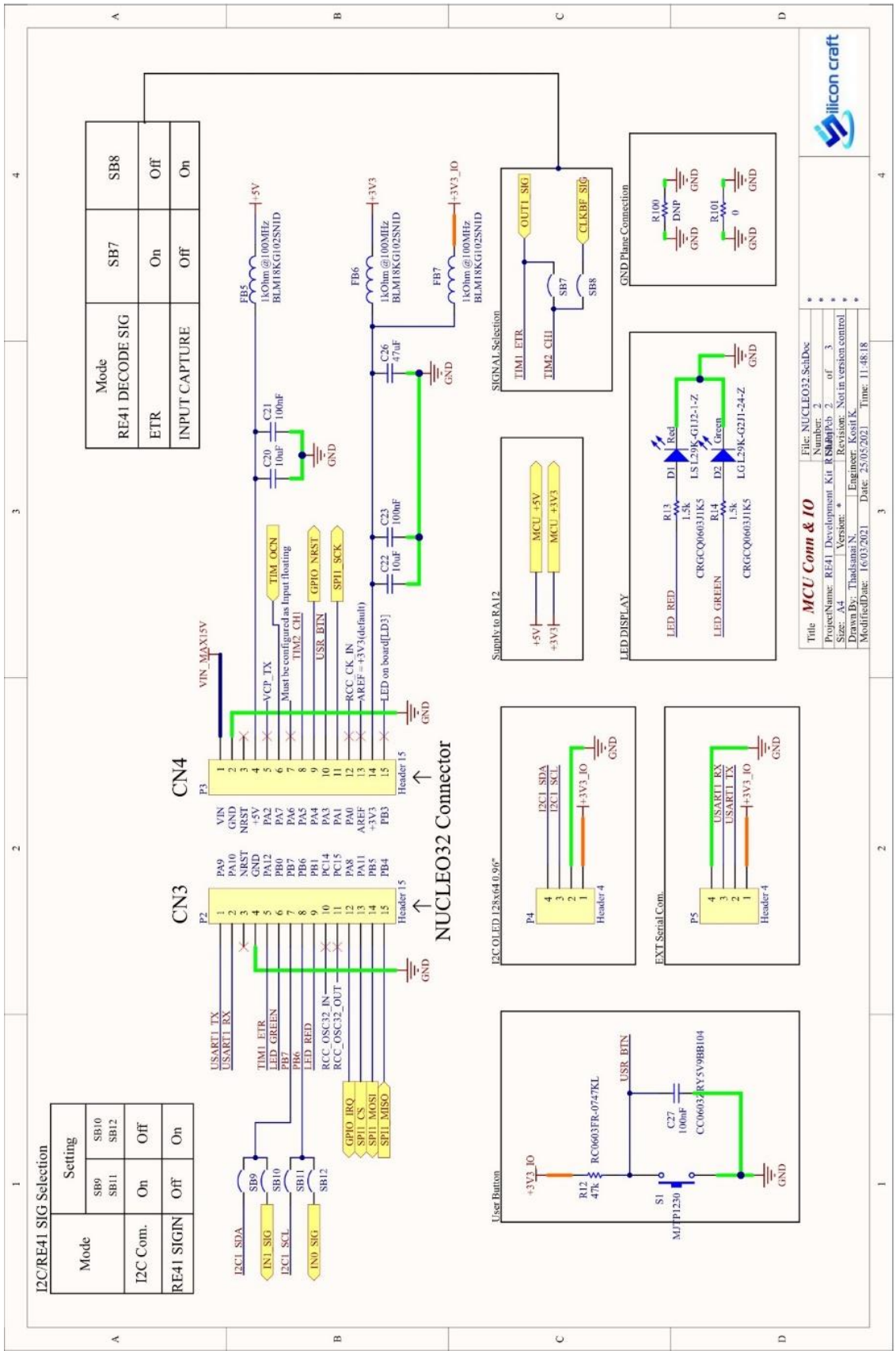
Command	Input Data	Description
t2t -h	-	Display all options of t2t command (Tag 2 Type)
t2t -rd	<block address HEX>	Read block command, response data is 16 bytes
t2t -wr	<block address HEX> <data in HEX>	Write block command with data 4 bytes/block

4. Schematic

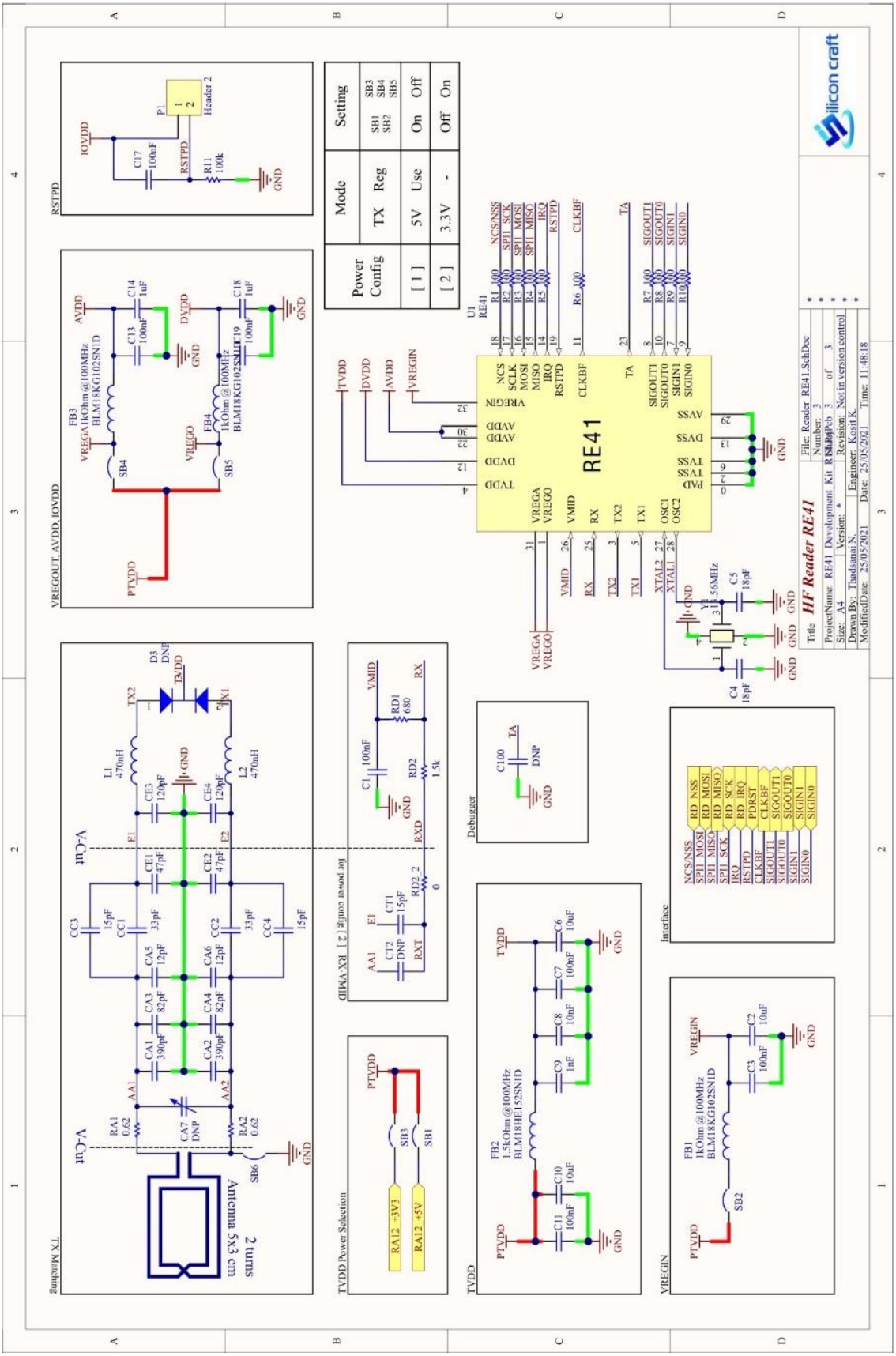
4.1. RE31/RE41 Development Kit



4.2. MCU Part



4.3. RE31/RE41 Part



5. Update Firmware

5.1. Software

To update new firmware of RE31/RE41 Development Kit, STM32 ST-LINK Utility is required. Software installer can download via this link: https://www.st.com/en/development-tools/stsw-link004.html

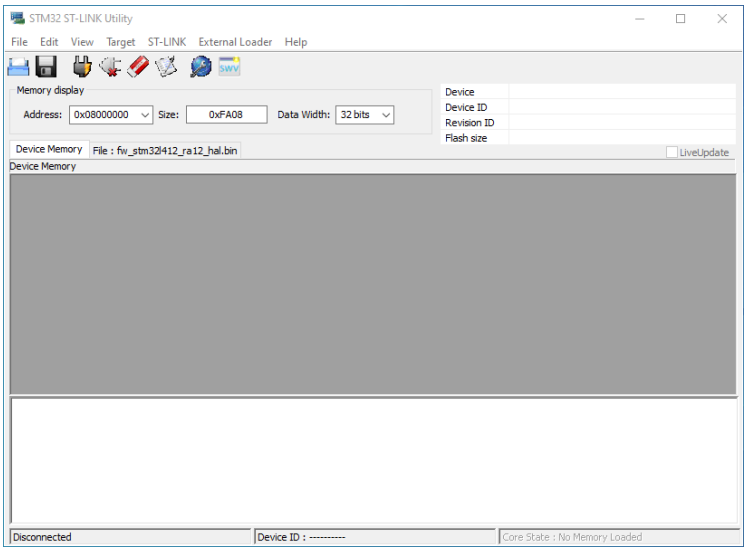


Figure 5-1 STM32 ST-LINK Utility software

5.2. Instruction

1. Open STM32 ST-LINK Utility software
2. Connect RE31/RE41 Development kit to PC
3. Click “Target” and then select “Connect”
4. Click “Target” and then select “Program and Verify”
5. Select target file (.bin, .hex, s19)
6. Click “Start” to update the new firmware to target MCU.

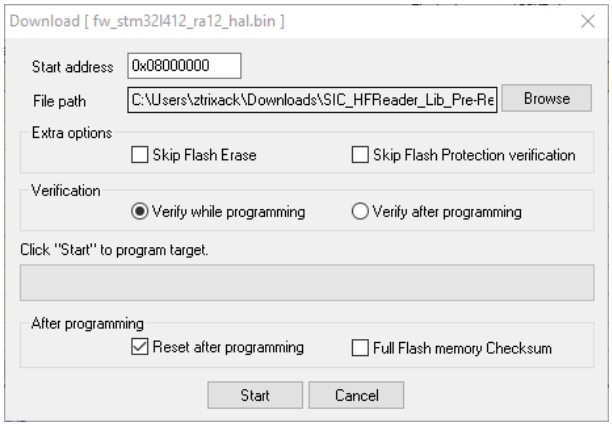
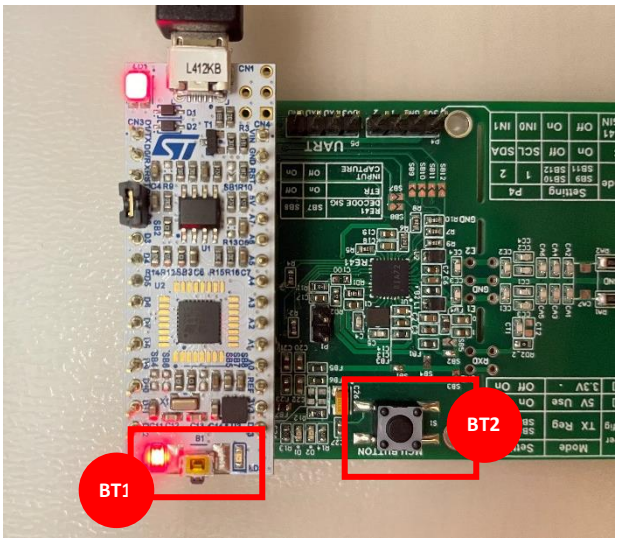


Figure 5-2 Window for update the firmware

6. Test Mode

To enter test mode, the user must activate user button (BT2) while RE31/RE41 Development Kit are in initial process or after push reset button (BT1) within 5 seconds.



There are 3 steps to check RE31/RE41 Development functional per below:

1. Board Information:

RE31/RE41 Development Kit Information will be shown after user button is pushed and successful entering to test mode refer to **Figure 6-1.**

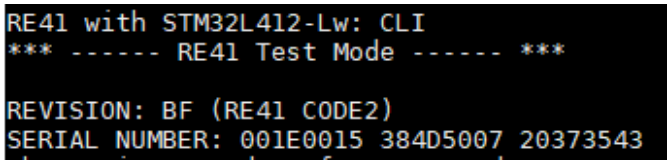


Figure 6-1 RE31/RE41 Development Kit Information

2. Testing RF Field:

RE31/RE41 Development Kit will turn on RF for 5 seconds.

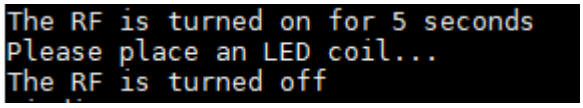


Figure 6-2 RE31/RE41 turn on RF for 5 seconds

3. Reading Standard Tag:

All standard tag should be placed and read UID out with this sequence: ISO14443A, ISO14443B, ISO15693 and Felica.

7. Product and Documentation Support

For more information of the SIC products, tools, and support that are available to help your development, please visit www.sic.co.th

7.1. Notation

The register definition is shown in **Figure 7-1**.

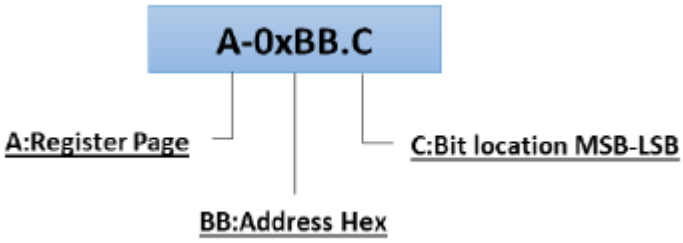


Figure 7-1 Register Definition

Styles and Fonts for key words

This part defines styles and fonts used for the key words throughout this document. The key words are names of signal, register and pin. The styles, fonts and their indications are shown in **Table 7-1**.

Table 7-1 Styles and Fonts for keywords

Symbol	Indication
Signal	Signal name
Register	Register name or Bit name
pin **RX**	Pin name
"State of Operation"	State of operation
Command	Command name in register 0x01 sector 0

To refer to a register address, a hexadecimal number proceeding with "0x" is used, for example 0x05 refer to a register address 0x05.

To refer to a bit located in a register address, a symbol "." following by a number reflecting the bit location starting from 0 to 7 is used. For example, 0x05.2 refers to bit 7, MSB, in the register address 0x05.

To refer to a set of consecutive bits located in a register address, a format ".[MSB:LSB]" is used after a register address . For example, a value of 0x05.[3:0] refers to bit 3, 2, 1 and 0 in the register 0x05.

To refer to a binary value in some registers, the letter "b" is placed at the end of binary number. For an example "0101b".

To refer to logic level, the number in single quote '1' and '0' are used to refer to binary logic level.

7.2. Tools and Software

- Development Kit and Reference Design

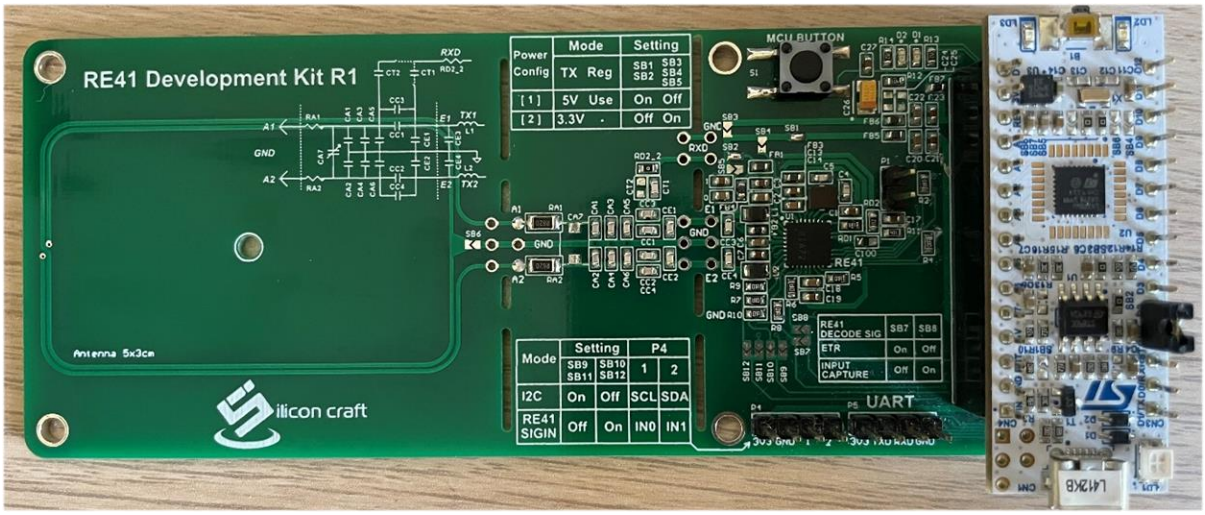


Figure 7-2 RE31/RE41 Development Kit and reference design

7.3. Documentation Support

Datasheet and Factsheet

- RE31/RE41 Data Sheet

- RE31/RE41 Fact Sheet

7.4. Contact Information

Tel: +66 2 589 9991

Fax: +66 2 589 8881

Email: info@sic.co.th

8. Legal Information

8.1. Disclaimer

- The information described herein is subject to change without notice.

- Although the IC contains a static electricity protection circuit, static electricity or voltage that exceeds the limit of the protection circuit should not be applied.

- SIC assumes no responsibility for how this IC is used in products created using this IC or for the specifications of that product, nor does SIC. Assume any responsibility for any infringement of patents or copyrights by-products that include this IC either in Thailand or in other countries.

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