WM_W60X_SDK User Manual
V1.1

Document History

Version	Completion Date	Revision Record	Author	Auditor
V1.0	2018-10-30	Innitial Release	Cuiych	Ray
V1.1	2018-12-15	Modify W600 to W60X	Cuiych	Ray

Content

1 Introduction

1.1 Overview

This user guide describes the functions and usage method of W60X software development kit (SDK). Such SDK has integrated W60X hardware driver (BSP), RTOS, TCP/IP protocol, Wi-Fi Protocol and other public function modules. The W60X's SDK should meet most needs of software applications.

## 1.2 Chipset Introduction
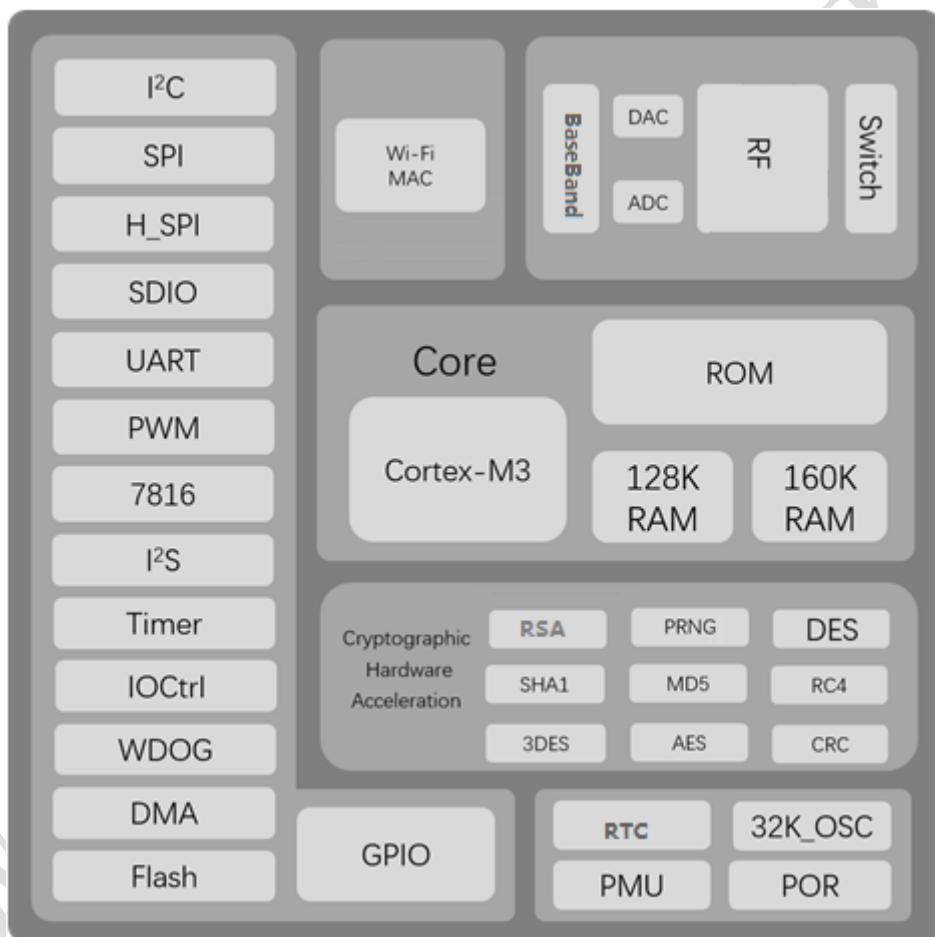
Figure 1 W600 architecture

- Chip Packaging
  - Package QFN32 5mm x 5mm
- Chip Integration
  - Integrated 32bit Embedded Cortex-M3 CPU, operating frequency 80MHz
  - Integrated 288KB RAM

- ➢ Integrated 1MB FLASH
- ➢ Integrated 8 channel DMA controller. The hardware and software can use any free channel. DMA controller has 16 hardware requests, support software chain table
- ➢ Integrated 2.4G RF transceiver, support IEEE802.11 protocol
- ➢ Integrated PA/LNA/TR-Switch
- ➢ Integrated 32.768KHz oscillator
- ➢ Integrated voltage detection circuit
- ➢ Integrated LDO
- ➢ Integrated power supply control circuit
- ➢ Integrated power on reset circuit

- Chip Interface
  - ➢ Integrated one SDIO2.0 Device controller, support SDIO 1-/4-bit and SPI operating mode; operating frequency 0~50MHz;
  - ➢ Integrated 2 UART interface, support RTS/CTS, baud rate: 1200bps~2Mbps;
  - ➢ Integrated one high speed SPI controller, operating frequency: 0~50MHz
  - ➢ Integrated one I²C controller, support data transmission rate 100/400Kbps
  - ➢ Integrated GPIO controller;
  - ➢ Integrated PWM controller, support 5 channel PWM output or 2 channels PWM input capture. Max output frequency is 20MHz and max input frequency is 20MHz;
  - ➢ Integrated I²S controller, support full duplex and codec from 32KHz to 192KHz;
  - ➢ Integrated 7816 interface, support ISO-7816-3 T=0/1, EVM2000 protocol and UART protocol
  - ➢ Integrated encrypted hardware accelerator, such as RSA/ AES/ DES/ 3DES/ RC4/ SHA1/ MD5/ CRC8/ CRC16
  - ➢ CRC32/PRNG
  - ➢ Support up to 17 GPIO ports, each IO port has rich reuse functions. The GPIO ports have input and output configuration method, and some GPIO ports' drive capability achieved to 24mA.

- Wi-Fi Protocol and Functions
  - ➢ Support GB15629.11-2006, IEEE802.11b/g/n
  - ➢ Support WAPI2.0
  - ➢ Support WiFi WMM/WMM-PS/WPA/WPA2/WPS
  - ➢ Support EDCA channel access

- Support 20/40M bandwidth

- Support STBC, GreenField, Short-GI and reverse transmission

- Support RIFS interframe space

- Support AMPDU, AMSDU

- Support IEEE802.11n MCS 0~7, MCS32, transmission rate is up to 150Mbps;

- Support Short Preamble in 2/5.5/11Mbps

- Support HT-immediate Compressed Block Ack, Normal Ack, No Ack;

- Support CTS to self;

- Support AP function;

- Support used as AP and STA at the same time;

- Support up to 32 multicast networks with different encryption methods in BSS;

- As AP in BSS, the sum of sites and groups is up to 32

- Reception sensitivity:

  - 20MHz MCS7@-71dBm@10%PER

  - 40MHz MCS7@-67dBm@10%PER

  - 54Mbps@-73dBm@10%PER

  - 11Mbps@-86dBm@8%PER

  - 1Mbps@-94dBm@8%PER

- Support STA with different encryption modes

- Support multiple filter options in reception frame

- Support listen mode

- Power Supply

  - 3.3V power supply

  - Support PS-Poll low power management

  - W600 SoC Standby power consumption less than 10μA

1.3   SDK Basic Feature

W60X SDK is an embedded Wi-Fi development platform which integrates RTOS, hardware driver, Wi-Fi protocol, TCP/IP protocol, network application protocol, AT+command, multiple application layer protocol and corresponding demo codes.

Function list:

Wireless

- Support IEEE802.11b/g/n standard

- Support frequency range: 2.4~2.4835GHz

- Support basic network (Infra)

  ➢ Support multiple encryption and authentication: OPEN/ WEP64/ WEP128/ TKIP/ CCMP/ WPA-PSK/ WPA2-PSK

  ➢ Support fast networking joined mode (appoint channel and BSSID)

  ➢ Support wireless roaming

  ➢ Support PS-PLL power saved mode

  ➢ Support WPS

- Support SoftAP

  ➢ Support OPEN, WEP, TKIP, AES

  ➢ Support max 8 station

  ➢ Support STA PS-POLL mode

- Support APSTA

  ➢ Support 2 level cascade connection

  ➢ Support max 8 station to connect

Hardware Driver

- Support SPI, UART port driver

  ➢ Support high speed SPI slave port with the max rate 20Mbps

  ➢ Support UART port with the max rate 2Mpbs

- Support programmable GPIO controller

- Support I²S interface driver

- Support I²C interface driver with the max rate 400Kbps

- Support 7816 interface driver

- Support multiple hardware encryption

- Support external SPI-Flash

- Support built-in Flash

Networking

- Support multiple smart config mode

  - ONESHOT

  - WPS

  - Website mode

  - AIRKISS

- Support API for networking (For developers with secondary development)

- Suppport AT command for networking (For developers with AT command)

TCP/IP Protocol

- Support multiple networking protocol: TCP/UDP/ICMP/DHCP/DNS

- Support DHCP Server, DNS Server

- Support HTTP Client, HTTP Server

- Support IPERF

Others

- Support AT+ command instruction

- Support standard socket

- Support m-DNS

- Support web socket

- Support SSLServer, SSL Client

- Support OS replacement

- Support cloud transplantation

- Support Wi-Fi module production and testing based on UART interface

2 SDK Instructions

2.1 Software Framework
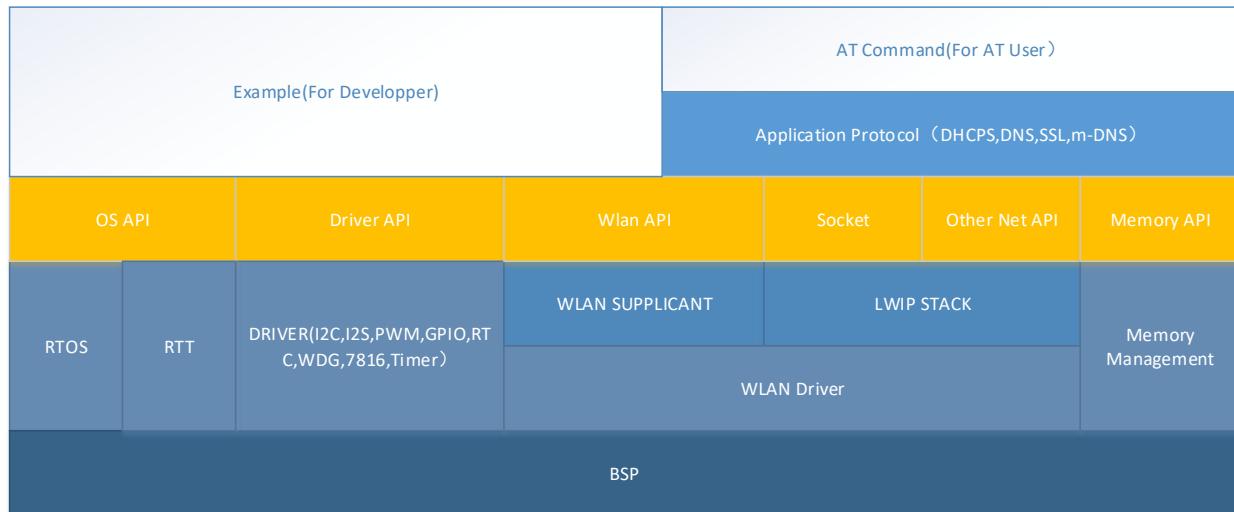
Figure 2 Software framework

2.2 Directory Structure

WM_SDK

├──App   User program entry

├──Bin   Executable files

├──Demo   Basic functions' demo code

├──Doc   Release Note/SDK documents

├──Include   API header files

├──Lib   Wi-Fi Lib

├──Platform   Public source code related with platform

├──Src   Application code, network protocol stack, OS and 3rd party's open source code

└──Tools   GCC makefile, MDK project and IMAGE file maker tools

2.3 Compile

2.3.1 KEIL project complie

In the Tools/Keil/Project directory, click WM_W600.uvproj to open the project. Click red circle below to

compile. The new created files are placed in directory named Bin.
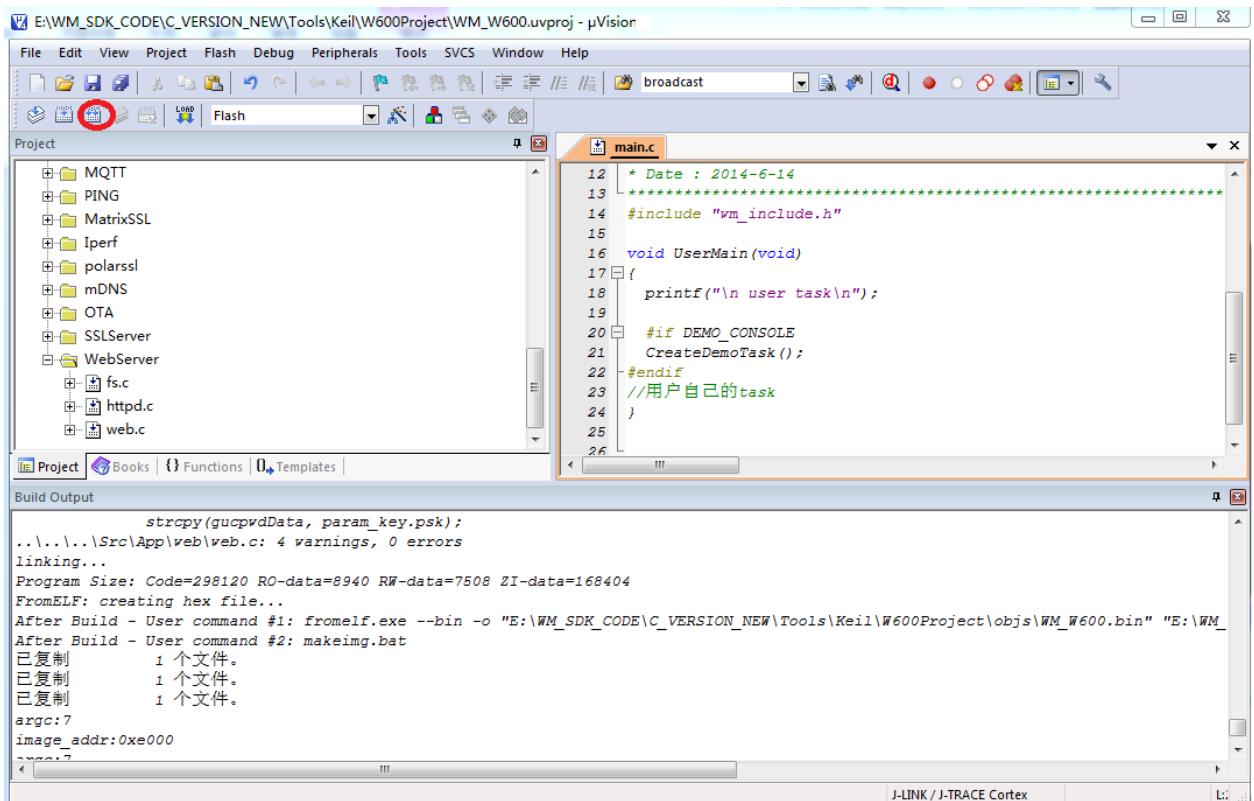
2.3.2　GCC Compile

According to the compiler tools settings, after installation and decompressing the SDK, enter the Tools\GNU

directory and execute "make".

2.3.3　Compilation Results

WM_W600.bin　　　　　Original bin file

WM_W600_GZ.img　　　Xmodem download image file

WM_W600.FLS　　　　Burnt image file for production

WM_W600.map　　　　MAP file

Reference document: <WM_W60X_Firmware Generation Guide>

2.4   Update Firmware

2.4.1   Update Firmware by ROM

If W60X has not burned firmware, it will enter the ROM (Only UART0) code when power on. Below is the

 print information:

If the BOOTMODE pin of W60X is pulled low level last for more than 30ms when power on, It will jump to

ROM (Only UART0) code. Below is the print information:

Based on different stages of XMODEM, the results of command exection and abnormal status in different

stages of start-up, ROM code will print out different chars to express error information through UART0.

Reference document: <WM_W60X_ROM Function Guide>, <WM_W60X_Firmware Update Guide>

2.4.2   Update Firmware through SecBoot

W60X SecBoot code is a program responsible for user's firmware update, moving IMAGE, firmware start-up

verification and other functions. It supports firmeware updated through the Xmodem protocol of UART0 or

UART1.

Press "ESC" of PC's keyboard when the W60X powers on or resets, can enter SecBoot running. Below is the

print out information of UART0 or UART1:

Based on start-up verification information, upgrade information and abnormal status during different stages of

XMODEM, the SecBoot code will print out different chars to express error information through UART0 or

UART1.

Reference document: <WM_W60X_ROM Function Guide>, <WM_W60X_SECBOOT Function Guide>

2.5   Program Debugging

2.5.1   Firmware debug information

SDK supports printf debugging functions of standard C and output through UART0. Developers can add their

own printf information according to their requirement.

The log information can be setup through the macro definitions in wm_debug.h:

/** Define the debugging level: info */

#define TLS_DBG_LEVEL_INFO   TLS_DBG_OFF

/** Define the debugging level: warning */

#define TLS_DBG_LEVEL_WARNING   TLS_DBG_OFF

/** Define the debugging level: error */

#define TLS_DBG_LEVEL_ERR   TLS_DBG_OFF

/** Define the debugging level: dump */

#define TLS_DBG_LEVEL_DUMP   TLS_DBG_OFF

/** general debug info switch, default: off */

#define TLS_GENERAL_DBG   TLS_DBG_OFF

Wi-Fi debugging information should be supported with separate Wi-Fi Lib. The developers should implement

two APIs named wm_printf and wm_vprintf.

2.5.2   JTAG/SWD Debugging

W60X supports SWD/JTAG debugging mode

Reference document: <WM_W60X_SWD Debugging Guide>

2.5.3   AT command

W60X supports AT commands.

Reference document: < WM_W60X_SDK_AT Command>

3   Development Tools
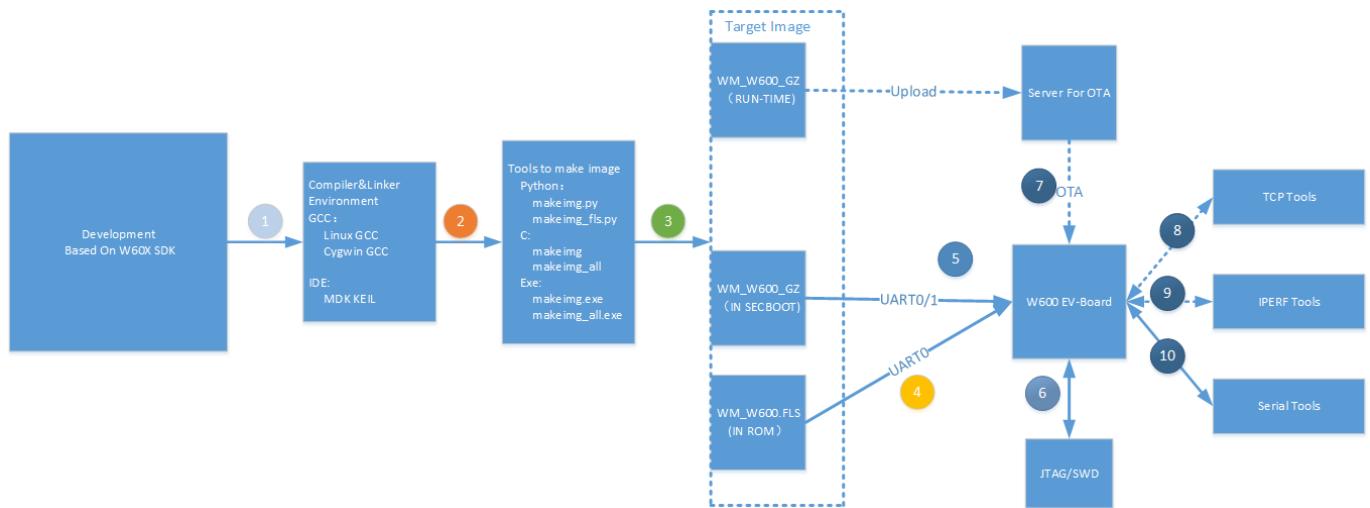
Figure 3 W60X SDK Using Flow

3.1   Compiling Tools

3.1.1   KEIL

W60X SDK supports KEIL development and compiling.

3.1.2   GCC

W60X SDK supports GCC development and compiling.

Reference document: <WM_W60X_SDK_GCC Compiling Guide>

3.2   IMG Generation Tools

After W60X SDK is compiled, the update files should be generated with tools which the SDK provides.

Reference document: <WM_W60X_Firmware Generation Guide>

3.3   Update Tools

W60X supports firmeware updated through the Xmodem protocol. SecureCRT is suggested.

Reference document: <WM_W60X_Firmware Generation Guide>

3.4   Debug Tools

TCP debugging assistant: test socket

Iperf: test performance of networking

4 Development Guide

4.1 WM_SDK startup mode

WM_SDK is running in QFLASH with XIP mode which is based on 32KB Cache integrated in W60X.

W60X SDK starts from ROM and then jump to SECBOOT, and from SECBOOT jumping to user's code.

ROM is responsible for the initialization of the basic functions of the chip and solidified inside W60X.

SECBOOT is responsible for user code verification and update which is placed in FLASH.

The CACHE size of W60X is 32KB. When the running code size is less than 32KB, CPU will not need to read instructions from FLASH.

4.2 User's Program Entry
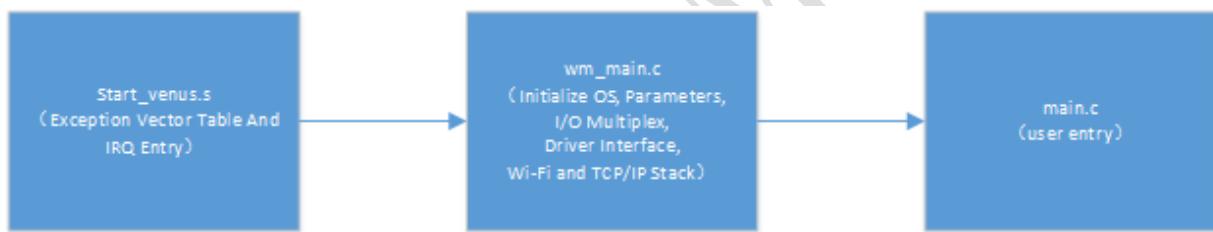
Afer W60X SDK starts up and running through ROM and SECBOOT, the function named start_venus.s will be executed. And then the program will jump to wm_main.c to do some initial work. Finally jump to main.c and print "user task".

W60X SDK's user program (Main.c) entry is: UserMain(void), user can create own Task based on CreateDemoTask to realize application program. There is a CreateDemoTask provided by DEMO CODE to test SDK APIs, and users can modify it according to their actual needs.

```
void UserMain(void)
{
    printf("\n user task\n");
#if WM_DEMO
    CreateDemoTask();
```

#endif

}

4.3 Memory Usage

W60X has 288KByte SRAM with address space 0x20000000~0x2048000. Used for system stack and transceriver BD of Wi-Fi.

Users can define the system stack size in start_venus.s (MDK KEIL) or startup_ARMCM3.s (GCC) :

Heap_Size   EQU   0x001A000

Current default value is 104K Bytes.

Note: The former 160KByte space can be used as task stack area. The latter 128KByte space can be used for data storage only and can not be used for task stack.

4.4 FLASH Address Management

W60X integrate 1Mbyte QFlash. Following is the address layout:
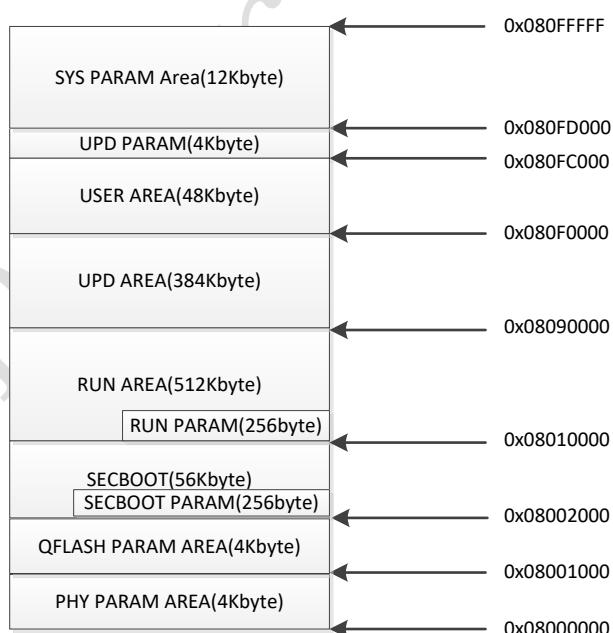
User area is 48KByte, this area can be adjusted according to the IMAGE size of running area and update area.

Reference document: <WM_W60X_QFLASH Management Guide>

4.5　User Data Management

If W60X user wants to save their own data, parameters or log information, a 48KByte area in QFLASH has been defined for users. The address is from 0x80F0000 to 0x80FBFFF.

If the user's code size is smaller than default definition size, the user can ajust the address of code area and parameter area in QFLASH to increase user's data area.

Reference document: <WM_W60X_Parameter Area Guide>

4.6　System Parameter Management

Following is system parameters information:

1) Wi-Fi (SSID, BSSID, KEY, channel list, power saved flag, rate set up, networking mode, area code)

2) IP (static IP，DHCP enable information, NTP server, DNS server)

3) Interface configuration (UART, SDIO, High-speed SPI working mode configuration)

4) Other parameters (WEB)

System parameters management area is from 0x80FD000 to 0x80FFFFF. **This area can not be used for other purposes by user.**

Reference document: <WM_W60X_Parameter Area Guide>