Connected power save profile Application

User guide

Version 0.2

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About this Document

This document describes the process of bringing up the RS9113 based module as a power save enabled station.

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1 Introduction

This project is applicable to all the WiSeConnect variants like WiSeConnect Plus, WiSeMCU and WyzBee. The term WiSeConnect refers to its appropriate variant.

1.1 Application Overview

1.1.1 Overview

The application demonstrates how to configure device in power save profile mode 2 after successful connection with Access point in station mode and how to send UDP data from WiSeConnect device to remote peer in configured power save mode.

In this application, WiSeConnect device connects to Access Point and configures to Power save profile mode2 and do UDP data transfer.

1.1.2 Sequence of Events

This Application explains user how to:

- Create device as a station
- Connect WiSeConnect device to Access point
- Configure device in Power Save profile mode 2
- Open UDP client socket in device
- Send UDP data from WiSeConnect device to remote peer
- Analyze power save profile while it is in Associated state and while data transfer

1.2 Application Setup

The WiSeConnect in its many variants supports SPI and UART interfaces. Depending on the interface used, the required set up is as below:

1.2.1 SPI based Setup Requirements

- Windows PC with CooCox IDE
- Spansion (MB9BF568NBGL) micro controller

Note: If user does not have Spansion (MB9BF568NBGL) host platform, please go through the SPI-Porting guide **\sapis\docs\RS9113-WiSeConnect-SAPI-Porting-Guide-vx.x.pdf** for SAPIs porting to that particular platform.

- WiSeConnect device
- WiFi Access point
- Windows PC2 with UDP server application (iperf)
- Agilent power analyzer

1.2.2 UART/USB-CDC based Setup Requirements

- Windows PC with Dev-C++ IDE
- WiSeConnect device
- WiFi Access point
- Windows PC2 with UDP server application (iperf)
- Agilent power analyzer

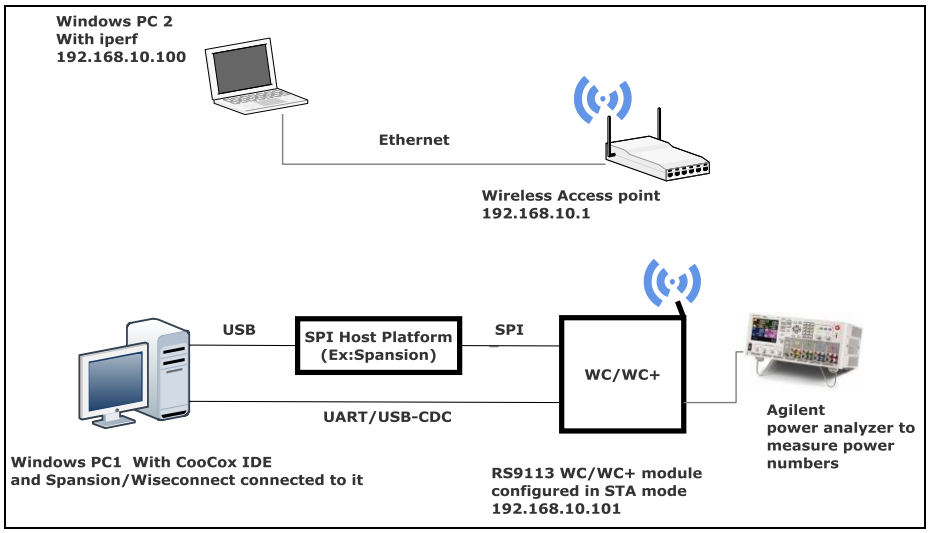


Figure 1: Setup Diagram

2 Configuration and Execution of the Application

The example application is available in the Release at **{Release $}/host/sapis/examples.** These examples will have to be initialized, configured and executed to test the application. The initialization varies based on the interface but configuration and execution are the common.

2.1 Initializing the Application

2.1.1 SPI Interface

If User using SPI interface, Please refer the document ***sapis/platforms/spansion_MB9BF568NBGL/RS9113-WiSeConnect_SAPIS_Spansion_Project_User_guide.pdf*** for opening the ***connected_sleep*** example in CooCox IDE.

2.1.2 UART/USB-CDC Interface

If User using UART interface, Please refer the document ***sapis/platforms/windows_uart/RS9113-WiSeConnect_SAPIS_Windows_Project_UserGuide.pdf*** for opening the ***connected_sleep*** example in Dev-C++ IDE

2.2 Configuring the Application

1. Open ***sapis/examples/wlan/connected_sleep/rsi_wlan_connected_sleep_app.c*** file and update/modify following macros :

SSID refers to the name of the Access point.

```
#define SSID                    "<ap name>"
```

SECURITY_TYPE refers to the type of security. In this application STA supports Open, WPA-PSK, WPA2-PSK securities.

Valid configuration is:

RSI_OPEN - For OPEN security mode

RSI_WPA - For WPA security mode

RSI_WPA2 - For WPA2 security mode

```
#define SECURITY_TYPE           RSI_OPEN
```

PSK refers to the secret key if the Access point configured in WPA-PSK/WPA2-PSK security modes.

```
#define PSK                     "<psk>"
```

SERVER_PORT port refers remote UDP server port number which is opened in Windows PC2.

```
#define SERVER_PORT             <remote port>
```

SERVER_IP_ADDRESS refers remote peer IP address to connect with UDP server socket.

IP address should be in long format and in little endian byte order.

Example: To configure "192.168.10.100" as IP address, update the macro **DEVICE_IP** as **0x640AA8C0**.

```
#define SERVER_IP_ADDRESS       0x640AA8C0
```

NUMEBR_OF_PACKETS refers how many packets to send from device to remote UDP server.

```
#define NUMBER_OF_PACKETS      <no of packets>
```

Application memory length which is required by the driver.

```
#define  GLOBAL_BUFF_LEN        8000
```

To configure IP address

DHCP_MODE refers whether IP address configured through DHCP or STATIC

```
#define DHCP_MODE    1
```

Note:
If user wants to configure STA IP address through DHCP then set DHCP_MODE to 1 and skip configuring the following DEVICE_IP, GATEWAY and NETMASK macros.
(Or)
If user wants to configure STA IP address through STATIC then set DHCP_MODE macro to "0" and configure following DEVICE_IP, GATEWAY and NETMASK macros

IP address which is to be configured to the device in STA mode should be in long format and in little endian byte order.

Example: To configure "192.168.10.10" as IP address, update the macro **DEVICE_IP** as **0x0A0AA8C0**.

```
#define  DEVICE_IP          0X0A0AA8C0
```

IP address of the gateway should also be in long format and in little endian byte order

Example: To configure "192.168.10.1" as Gateway, update the macro GATEWAY as **0x010AA8C0**

```
#define  GATEWAY            0x010AA8C0
```

IP address of the network mask should also be in long format and in little endian byte order

Example: To configure "255.255.255.0" as network mask, update the macro **NETMASK** as **0x00FFFFFF**

```
#define   NETMASK           0x00FFFFFF
```

In this application, default power save mode configuration is set to low power mode 2 `(RSI_SLEEP_MODE_2)` with maximum power save `(RSI_MAX_PSP)` with message based hand shake.

```
#define PSP_MODE              RSI_SLEEP_MODE_2
#define PSP_TYPE              RSI_MAX_PSP
```

2. Open ***sapis/include/rsi_wlan_config.h*** file and update/modify following macros :

```
#define  CONCURRENT_MODE          RSI_DISABLE
#define  RSI_FEATURE_BIT_MAP      FEAT_SECURITY_OPEN
```

```
#define  RSI_TCP_IP_BYPASS          RSI_DISABLE
#define  RSI_TCP_IP_FEATURE_BIT_MAP TCP_IP_FEAT_DHCPV4_CLIENT
#define  RSI_CUSTOM_FEATURE_BIT_MAP  0
#define  RSI_BAND                   RSI_BAND_2P4GHZ
```

Default configuration of low power save mode 2

```
#define  RSI_HAND_SHAKE_TYPE            MSG_BASED
#define  RSI_SELECT_LP_OR_ULP_MODE      RSI_LP_MODE
#define  RSI_DTIM_ALIGNED_TYPE          0
#define  RSI_MONITOR_INTERVAL           50
#define  RSI_WMM_PS_ENABLE              RSI_DISABLE
#define  RSI_WMM_PS_TYPE                0
#define  RSI_WMM_PS_WAKE_INTERVAL       20
#define  RSI_WMM_PS_UAPSD_BITMAP        15
```

3. **If user wants to select different power save mode profiles, please go through the step #4 and #5 other wise skip step #4 and #4.**
4. Open ***sapis/examples/wlan/connected_sleep/rsi_wlan_connected_sleep_app.c*** file and update/modify following macros,

PSP_MODE refers power save profile mode. WiSeConnect device supports following power modes,

RSI_ACTIVE (0): In this mode, module is active and power save is disabled.

RSI_SLEEP_MODE_1 (1): In this power mode, module goes to power save after association with the Access Point. In this sleep mode, SoC will never turn off, therefore no handshake is required before sending data to the module.

RSI_SLEEP_MODE_2 (1): In this power mode, module goes to power save after association with the Access Point. In this sleep mode, SoC will go to sleep based on GPIO hand shake or Message exchange, therefore handshake is required before sending data to the module.

RSI_SLEEP_MODE_8 (8): In this power mode, module goes to power save when it is in unassociated state with the Access Point. In this sleep mode, SoC will go to sleep based on GPIO hand shake or Message exchange, therefore handshake is required before sending the command to the module.

```
#define PSP_MODE                RSI_SLEEP_MODE_2
```

Note1: For RSI_SLEEP_MODE_2 and RSI_SLEEP_MODE_8 modes, GPIO or Message based hand shake can be selected using RSI_HAND_SHAKE_TYPE macro which is define in sapis/include/rsi_wlan_config.h

Note2: In this example user can verify RSI_SLEEP_MODE_2 with Message based hand shake. If user wants to verify other power modes, user has to change the application as well as GPIO hand shake signals.

PSP_TYPE refers power save profile type. WiSeConnect device supports following power save profile types,

RSI_MAX_PSP (0): In this mode, WiSeConnect device will be in Maximum power save mode. i.e Device will wake up for every DTIM beacon and do data Tx and Rx.

RSI_FAST_PSP (1): In this mode, WiSeConnect device will disable power save for any Tx/Rx packet for monitor interval of time (monitor interval can be set through macro in ***sapis/include/rsi_wlan_config.h*** file, default value is 50 ms). If there is no data for monitor interval of time then module will again enable power save.

RSI_UAPSD (2): This **PSP_TYPE** is used to enable WMM power save.

```
#define PSP_TYPE                RSI_MAX_PSP
```

Note1:
PSP_TYPE is valid only when PSP_MODE set to RSI_SLEEP_MODE_1 or RSI_SLEEP_MODE_2 mode.

Note2:
RSI_UAPSD power profile type in PSP_TYPE is valid only when RSI_WMM_PS_ENABLE is enabled in sapis/include/rsi_wlan_config.h file.

5. Open ***sapis/include/rsi_wlan_config.h*** file and update/modify following macros,

RSI_HAND_SHAKE_TYPE is used to select **GPIO or** Message based hand shakein **RSI_SLEEP_MODE_2** and **RSI_SLEEP_MODE_8** modes.

```
#define RSI_HAND_SHAKE_TYPE     MSG_BASED
```

RSI_SELECT_LP_OR_ULP_MODE is used to select low power mode or ultra low power mode. Valid configurations are, **RSI_LP_MODE** or **RSI_ULP_WITH_RAM_RET** or **RSI_ULP_WITHOUT_RAM_RET**

RSI_LP_MODE: In this module will be in Low power mode.

RSI_ULP_WITH_RAM_RET: In this module will be in Ultra low power mode and it will remember the previous state after issuing power save mode command.
RSI_ULP_WITHOUT_RAM_RET: In this module will be in Ultra low power mode and it will not remember the previous state after issuing power save mode command. After wakeup, module will give CARD READY indication and user has to issue commands from wireless initialization.

```
#define RSI_SELECT_LP_OR_ULP_MODE    RSI_LP_MODE
```

RSI_DTIM_ALIGNED_TYPE refers whether module has to wake up at normal beacon or DTIM beacon which is just before listen interval.

If RSI_DTIM_ALIGNED_TYPE is set to 0(Zero) i.e module will wake up at normal beacon which is just before listen interval.

If **RSI_DTIM_ALIGNED_TYPE** is set to 1(Zero) i.e module will wake up at DTIM beacon which is just before listen interval.

```
#define RSI_DTIM_ALIGNED_TYPE        0
```

RSI_MONITOR_INTERVAL refers amount of time (in ms) to wait for Tx or Rx before giving power save indication to connected Access Point.

```
#define RSI_MONITOR_INTERVAL         50
```

Note:
RSI_MONITOR_INTERVAL is applicable only when PSP_TYPE selected as RSI_FAST_PSP

RSI_WMM_PS_ENABLE is used to enable or disable WMM power save.

```
#define RSI_WMM_PS_ENABLE      0
```

RSI_WMM_PS_TYPE is used to set Tx based or Periodic based WMM power save.

Update RSI_WMM_PS_TYPE macro with 0 for Tx Based or 1 for periodic based WMM power save.

```
#define RSI_WMM_PS_TYPE        0
```

RSI_WMM_PS_WAKE_INTERVAL refers at periodic time (in ms) module has to wake up module when RSI_WMM_PS_TYPE selected as Periodic.

```
#define RSI_WMM_PS_WAKE_INTERVAL     20
```

RSI_WMM_PS_UAPSD_BITMAP refers UAPSD bitmap

```
#define RSI_WMM_PS_UAPSD_BITMAP      15
```

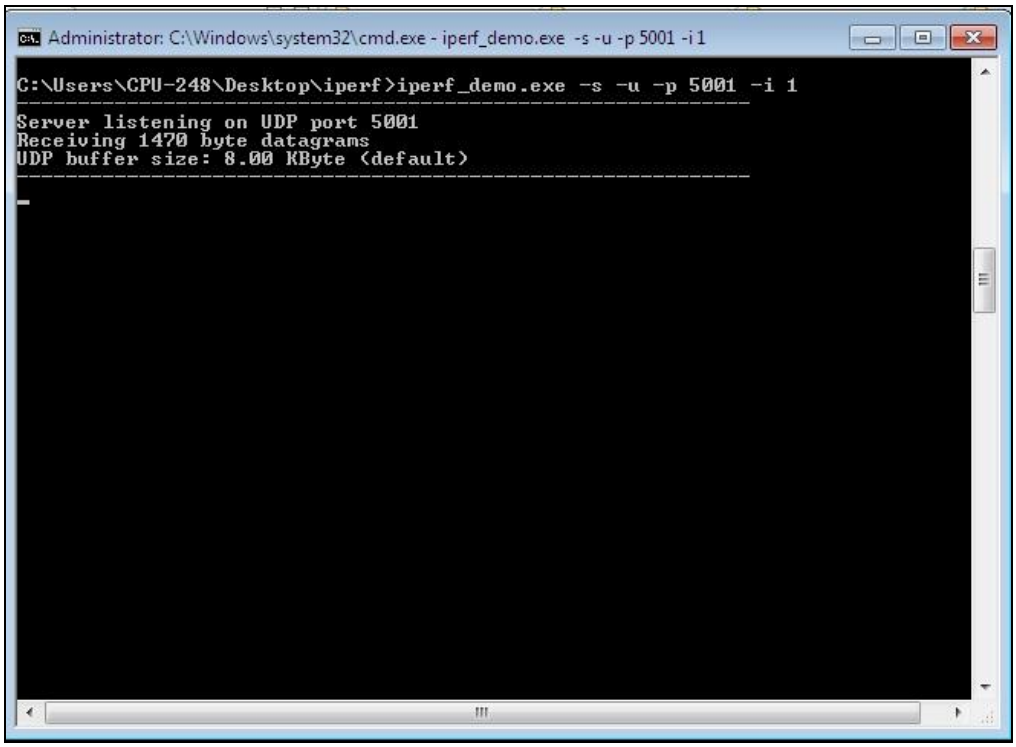
Note:

If RSI_WMM_PS_ENABLE is enabled then user has to set PSP_TYPE to RSI_UAPSD in order to work WMM power save.

2.3 Executing the Application

1. Configure the Access point in OPEN/WPA-PSK/WPA2-PSK mode to connect WiSeConnect device in STA mode.
2. Open UDP server application using iperf application in Windows PC2 which is connected to Access point through LAN.

```
iperf_demo.exe –s -u -p <SERVER_PORT> -i 1
```



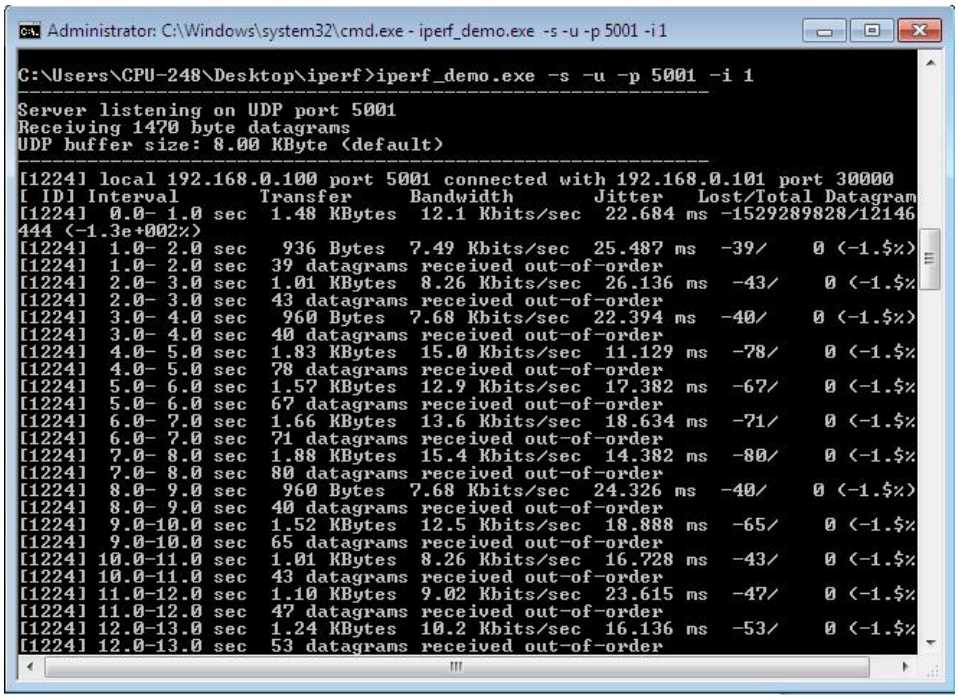
3. **SPI Interface**

   If User using SPI interface, Please refer the document ***sapis/platforms/spansion_MB9BF568NBGL/RS9113-WiSeConnect_SAPIS_Spansion_Project_User_guide.pdf*** for executing the ***connected_sleep*** example in CooCox IDE.

4. **UART/USB-CDC Interface**

   If User using UART interface, Please refer the document ***sapis/platforms/windows_uart/RS9113-WiSeConnect_SAPIS_Windows_Project_UserGuide.pdf*** for executing the ***connected_sleep*** example in Dev-C++ IDE

5. After program gets executed, WiSeConnect Device will scan and connect to Access point and get IP.
6. After successful connection, WiSeConnect device goes into configured power save and sends configured number of (**NUMBER_OF_PACKETS)** UDP packets to remote peer which is connected to Access point through LAN. Please refer the given below image for reception of UDP data on UDP server.



7. Please refer the given below images of power save profile for data transfer in low Power save mode 2 with message based hand shake.

Figure 2: Power Save profile while data transfer for 1 cycle

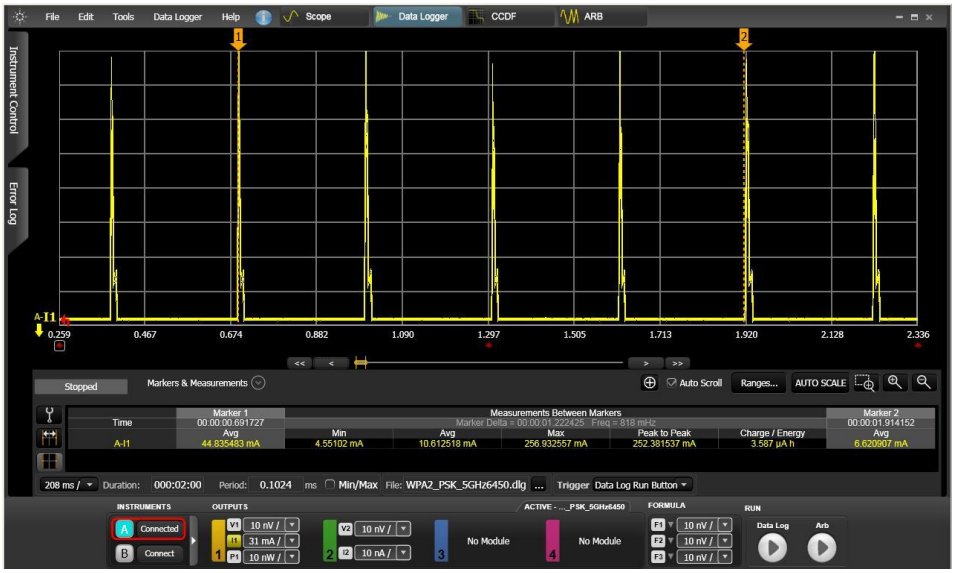


Figure 3: Power Save profile with data transfer

Note1: Beacon interval and DTIM are configured to 100 and 3 for above power save profile. Module wakes up for every DTIM and sends the UDP data to remote peer.

Note2: Above power save image was captured with ~10Kbps UDP traffic from module. So, user does not get same power profile image as shown above while running. It will vary based on the data traffic.

8. Please find below power save profile image when WiSeConnect device is in idle state after connection with Access point in low Power save mode 2 with message based hand shake.

Figure 4: Power save profile in idle state after association for 1 cycle

Figure 5: Power save profile in idle state after association

Note: Beacon interval and DTIM are configured to 100 and 3 for above power save profile. Module wakes up for every DTIM and goes back to sleep immediately.