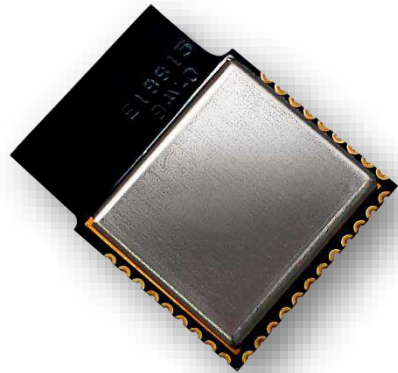


RYWB116

Embedded WLAN Software Programming Reference Manual (PRM)



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About this Document

This document explains the commands to operate RYWB116 for Wi-Fi.

1 Architecture Overview

This document describes the commands to operate RYWB116 in Wi-Fi. The parameters in the commands and their valid values with the expected responses from the modules are also described. The document should be used by the developer to write software on the Host MCU to control and operate the module. Section AT Command Mode describes commands to operate the module using the UART/USB- CDC interfaces. Section Binary Command Mode describes Binary commands to operate the module using the SPI/ USB/UART/USB-CDC/CORTEX-M4 interfaces.

1.1 Architecture

RYWB116 APIs are designed in layers, where each Layer is independent and uses the service of underlying layers.

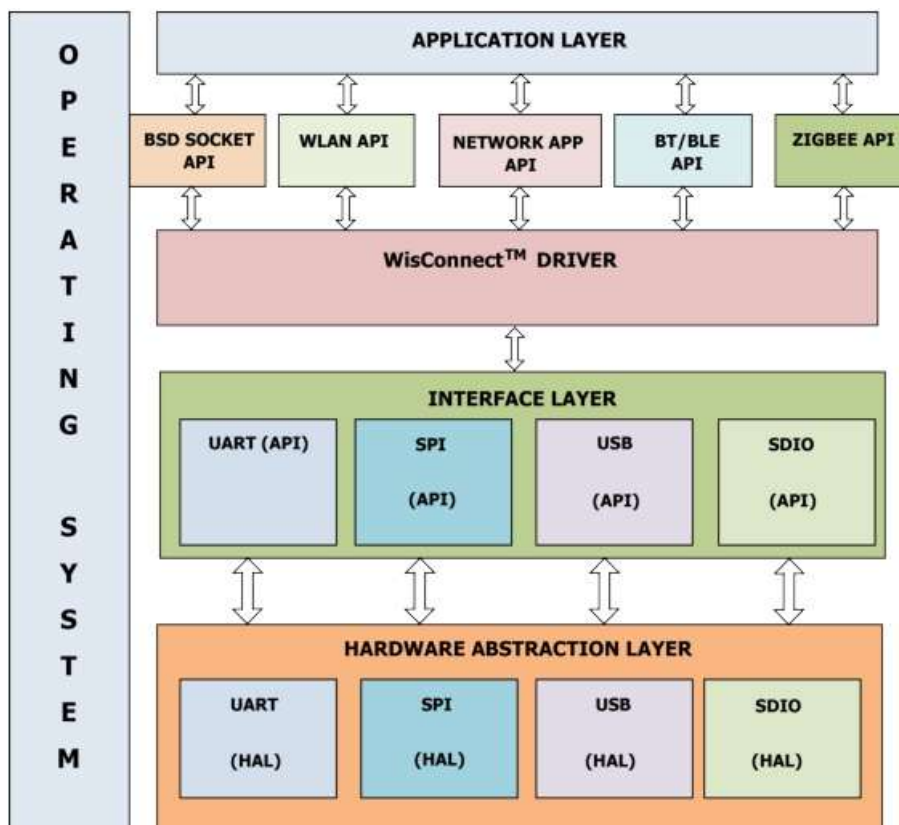


Figure 1-1: Architecture Overview

This document is primarily concerned with the host-module interface. The host can interface with RYWB116 using following list of interfaces to configure and send/receive data.

- SPI
- UART
- USB

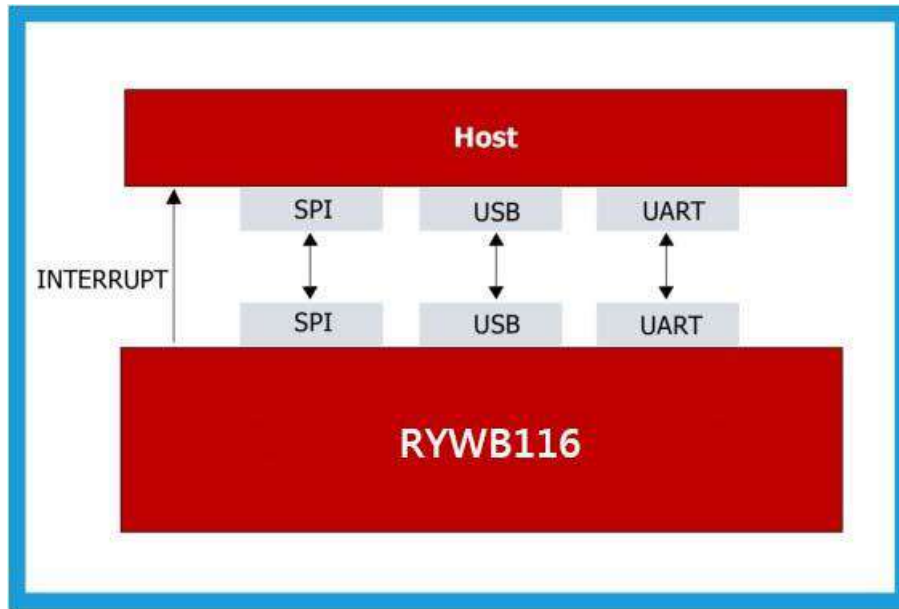


Figure 1-2: Host Interface Block Diagram

Note:

USB-CDC/ UART/ USB/ SPI are the host interfaces for RYWB116.

2 Wi-Fi Software Programming

2.1 Architecture

The following figure depicts the software architecture of the RYWB116.

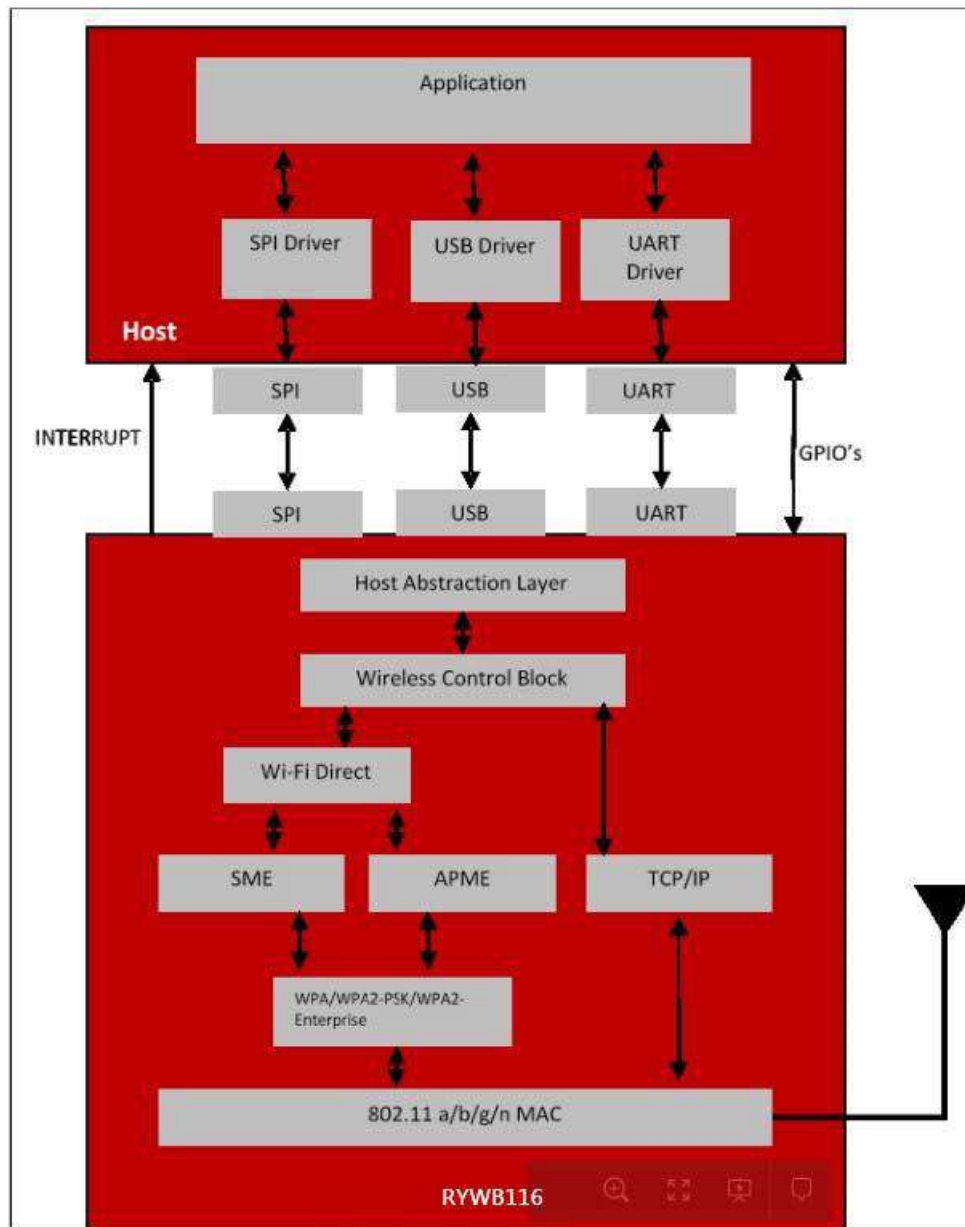


Figure 2-1: Wi-Fi Software Architecture

2.2 Application

The application layer invokes wireless APIs provided by SPI / UART driver. The Application developer can use these APIs to build wireless applications.

2.3 SPI

The SPI interface on the RYWB116 works in slave mode. It is a 4-wire interface. In addition to the SPI interface, the module provides additional interrupt pin to signal events to the host. The interrupt is raised by the module in SPI mode for the following condition.

- When the module has data in its output buffer, it indicates host by raising active high signal on the interrupt pin.

The interrupt from module is active high and host has to configure the interrupt in level trigger mode.

2.4 USB

The USB interface on the RYWB116 transmits / receives data to / from the Host in USB mode.

2.5 UART

The UART interface on the RYWB116 transmits / receives data to / from the Host in UART mode.

2.6 Hardware Abstraction Layer (HAL)

The HAL abstracts the lower layers in the Host interface with which the RYWB116 is connected. The HAL interacts with the Wireless Control Block layer for the processing of the frames obtained from or destined to the Host.

2.7 Wireless Control Block (WCB)

The data from / to the Host is classified as Wi-Fi specific frames or TCP / IP specific frames. The functionality of the WCB module depends on the type and direction of the frames.

2.7.1 Wi-Fi Control Frames

The WCB interprets the Wi-Fi control information from the Host and interacts with the SME (Station Management Entity) or APME (Access Point Management Entity) based on operating mode of RYWB116. Configuration of the RYWB116 from the Host for Wi-Fi access is through AT commands or Binary commands.

2.7.2 TCP / IP Control Frames

TCP / IP networking protocol provides end-to-end connectivity specifying how data should be formatted, addressed, transmitted, routed and received at the destination.

If the packets received from the Host by WCB during transmit are interpreted as TCP / IP frames then WCB interacts with TCP / IP stack for further processing before passing the packets to MAC layer. Similarly if the packets are received from TCP / IP stack by WCB during reception then WCB processes these packets passing to host.

2.8 Wi-Fi Direct

The Wi-Fi Direct is the core layer to operate the module in P2P mode. Wi-Fi Direct use the SME & APME blocks for p2p operations. After Wi-Fi direct exchanges module will become either Wi-Fi Direct Group owner or Wi-Fi Direct client.

2.9 Station Management Entity (SME)

The SME is the core layer which manages the Wi-Fi connectivity in Station mode or P2P client mode. The SME maintains the state machine to detect the activity on the Wi-Fi network and indicates to the user accordingly. It interacts with the WPA supplicant if Security is enabled in the Wi-Fi network.

2.10 Access point Management Entity (APME)

The APME is the core layer which manages the connectivity in Access Point and Wi-Fi direct group owner modes. The APME maintains the state machine to handle multiple clients connected to the module. It interacts with WPA supplicant if Security is enabled in the Wi-Fi network.

2.11 WPA Supplicant

The main functionality of WPA supplicant is, support for key negotiation between Wi-Fi devices in secure mode. This functionality depends on the mode in which RYWB116 operates in Station mode, Access point mode, Wi-Fi Direct mode. The WPA supplicant is used to initiate the 802.1x/E Access Point authentication if WPA/WPA2- PSK is used as the security parameter. It also plays a major part in performing the 4-way handshake to derive the PTK in WPA/WPA2-PSK modes.

Note:

Power save implementation required GPIO pins.

4 Bootloader

4.1 Features

This document contains Features that are supported by the Network and Security Processor (NWP) bootloader.

Basic Features

- Load Default Firmware
- Load Selected Firmware
- Upgrade Firmware from the host
- Selecting Default images
- Enable / Disable Host interaction Bypass
- Supports for multiple host interfaces (SDIO / SPI / UART / USB / USB-CDC)
- Firmware Integrity Check
- Upgrading Keys
- JTAG Selection

The RYWB116 supports two Boot loading modes. They are:

1. Host interaction (Non-bypass) mode: In this mode, the host can interact with the bootloader and can give boot up options (commands) to configure different bootup operations. The host tells the module what operations it has to perform based on the selections made by the user.
2. Bypass mode: In this mode bootloader interactions are completely bypassed and use the stored bootup configurations (which are selected in host interaction mode) & load default firmware image in the module. This mode is recommended for final production software to minimize the bootup time.

4.2 Host Interaction Mode

In Host Interaction mode, host interaction varies based on host interface. Host interaction in SPI / USB and UART / USB-CDC are different. In UART & USB-CDC boot up options are menu based and in SPI / USB, it is using command exchanges. The details are explained in the below section.

4.2.1 Host Interaction Mode in UART / USB-CDC

This section explains the host interaction mode in the UART / USB CDC mode.

4.2.1.1 Startup Operation

After powering up, Host is required to carry out ABRD (Auto baud rate detection) operation and after successful ABRD, the module will display the menu of bootup options to host. The host needs to select the appropriate option.

Note:

On powerup, bootloader checks the integrity of the bootup options. If the integrity fails, it computes the integrity from backup. If integrity passes, it copies the backup to the actual location. If the integrity of the backup options also fails, the bootup options are reset/cleared. In either of the cases, bootloader bypass is disabled and corresponding error messages are given. In the case of integrity failure, "LAST CONFIGURATION NOT SAVED" is displayed when the backup integrity passes and "BOOTUP OPTIONS CHECKSUM FAILED" is displayed when the backup integrity also fails before displaying the bootup options.

Hyper Terminal Configuration

RYWB116 uses the following UART interface configuration for communication:

Baud Rate: The following baud rates are supported by the module: 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps, 230400 bps, 460800 bps, 921600 bps.

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

Before the module is powered up, follow the sequence of steps as given below:

- Open HyperTerminal and enter any name in the "Name" field. After this, click "OK" button. Here, "WiSeConnect" is entered as shown in the figure below.

Note:

Default baud rate of the module is 115200.

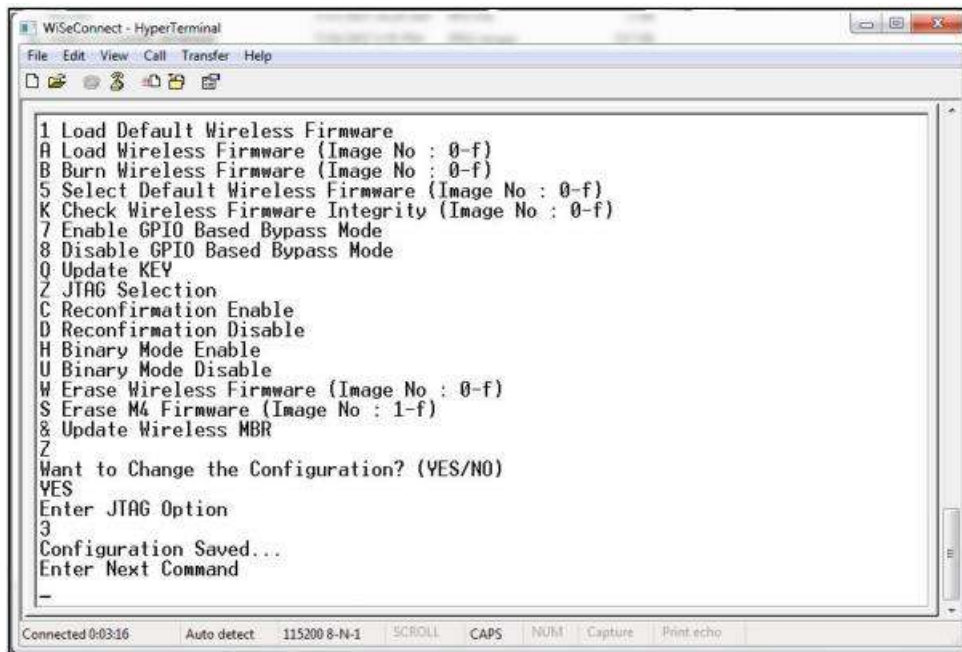


Figure 4-1: HyperTerminal Name field Configuration

- After clicking "OK", the following dialog box is displayed as shown in the figure below.

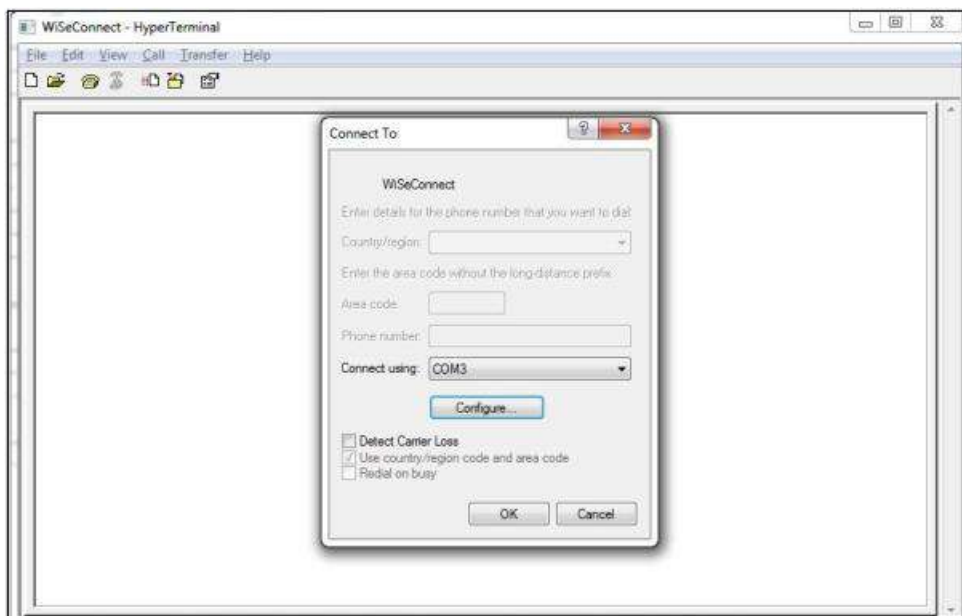


Figure 4-2: HyperTerminal COM port field Configuration

- In the "Connect using" field, select appropriate com port. In the figure above COM3 is selected. Click "OK" button.
- After clicking the "OK" button the following dialog box is displayed as shown in the figure below.

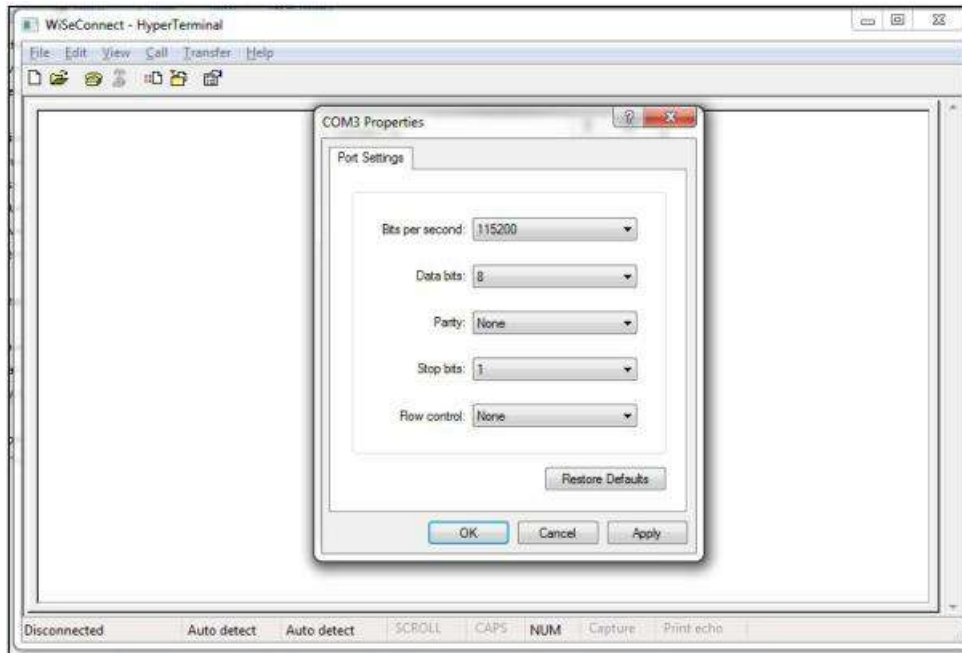


Figure 4-3: HyperTerminal Baud rate field Configuration

Set the following values for different fields in figure 5 as given below.

- Set baud rate to 115200 in "Bits per second" field.
- Set Data bits to 8 in "Data bits" field.
- Set Parity to none in "Parity" field.
- Set stop bits to 1 in "Stop bits" field.
- Set flow control to none in "Flow control" field.
- Click "OK" button after entering the data in all the fields.

Auto Baud Rate Detection (ABRD)

The RYWB116 automatically detects the baud rate of the Host's UART interface by exchanging some bytes. The Host should configure the UART interface for the following parameters for ABRD detection.

RYWB116 uses the following UART interface configuration for communication:

Baud Rate: The following baud rates are supported: 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps, 230400 bps, 460800 bps, 921600 bps.

Data bits: 8

Stop bits: 1

Parity: None

Flow control: None

To perform ABRD on the RYWB116, the host must follow the procedure outlined below.

1. Configure the UART interface of the Host at the desired baud rate.
2. Power on the RYWB116.
3. The Host, after releasing the module from reset, should wait for 20 ms for initial boot-up of the module to complete and then transmit 0x1C at the baud rate with which its UART interface is configured. After transmitting '0x1C' to the module, the Host should wait for the module to transmit 0x55 at the same baud rate.

4. If the '0x55' response is not received from the module, the host has to re-transmit 0x1C, after a delay of 200ms.
5. After finally receiving '0x55', the host should transmit '0x55' to the module. The module is now configured with the intended baud rate.

Note:

Performing ABRD in host interaction mode is must for USB CDC mode.

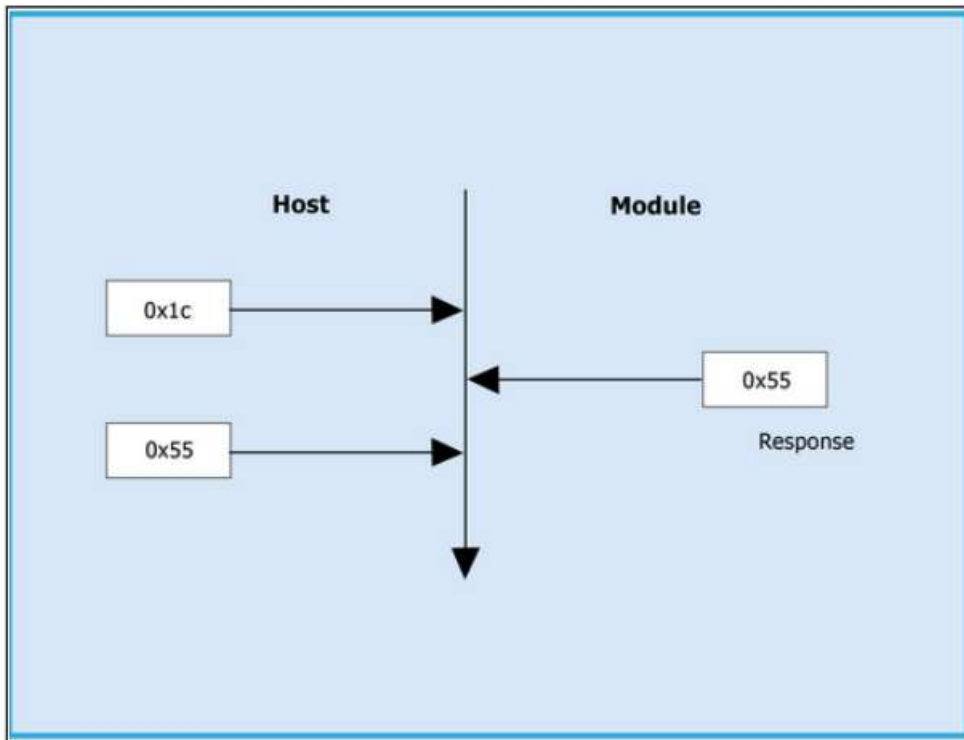


Figure 4-4: ABRD exchange between Host and module

Below are the bootup options, Firmware upgrade and Firmware loading procedure for RYWB116.

4.2.1.2 Start-Up Messages on Power-Up

After powering up the module and performing ABRD you will see a welcome message on the host, followed by boot up options:

Note:

Windows Hyper Terminal is used to demonstrate the boot up /up-gradation procedure.



Figure 4-5: RYWB116 Module UART / USB-CDC Welcome Message

4.2.1.3 Loading the Default Wireless Firmware in the Module

To load the default firmware flashed onto the module, choose Option 1: "Load Default Wireless Firmware " .

4.2.1.4 Load Default Wireless Firmware

- After the welcome message is displayed as shown in the above figure, select option 1 "Load Default Wireless Firmware " for loading Image.

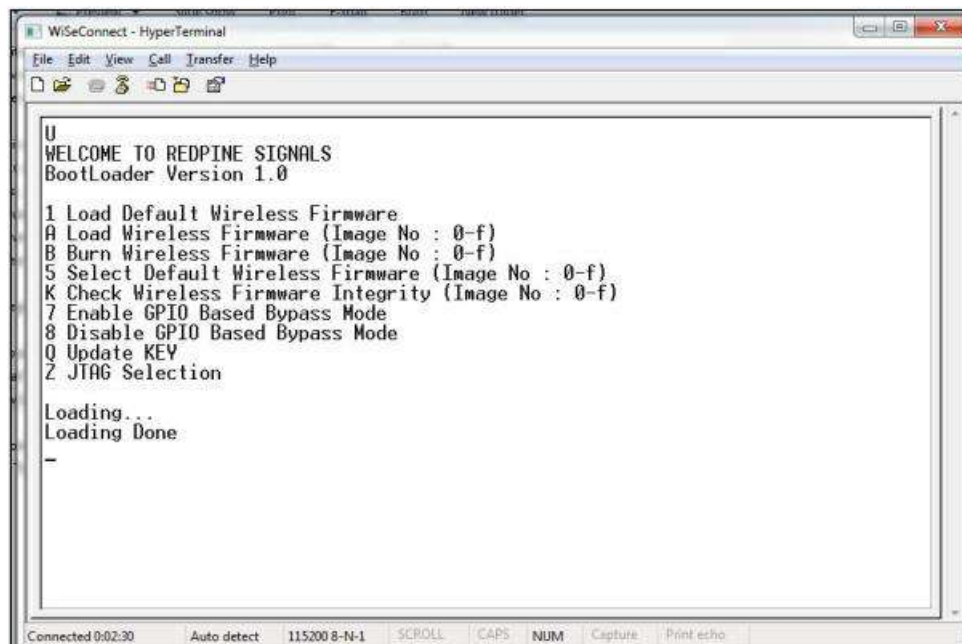


Figure 4-6: RYWB116 Module UART / USB-CDC Default Firmware Loaded

Note:

By default, the module will be configured in AT mode. If mode switch from AT plus command mode to binary mode is required, the user must give 'H' in the bootloader options.

The module lasts in the binary mode unless it changed to AT plus command mode and vice-versa.

To change from binary mode to AT mode, the user must give 'U' in the bootloader options.

4.2.2 Loading selected Wireless Firmware in the Module

To load the selected firmware (from flash) onto the module, choose Option A: "Load Wireless Firmware (Image No: 0-f)".

4.2.2.1 Load Wireless Firmware

- After the welcome message is displayed as shown in the above figure, select option A "Load Wireless Firmware (Image No: 0-f)" for loading Image.
- In response to the option A, Module asks to Enter Image No.
- Select the image number to be loaded from flash.
- After successfully loading the default firmware, "Loading Done" message is displayed.
- After firmware loading is completed, the module is ready to accept commands

Note:

1. In order to use host bypass mode, the user has to select one of the images as default image by selecting options 5 (Select Default Wireless Firmware).
2. In Host interaction mode if there is no option selected after bootup menu for 20 seconds then the bootloader will load selected Wireless default image.
3. If the valid firmware is not present, then a message prompting "Valid firmware not present".

4.2.2.2 Firmware Upgradation

After powering up the module, a welcome message is displayed.

Upgrade NWP firmware Image

- After the welcome message is displayed, select option B "Burn Wireless Firmware (Image No: 0-f)" to upgrade Wireless Image.
- The message "Enter Wireless Image No (0-f)" will be displayed.
- Then select the Image no to be upgraded.
- The message "Send RS9116.NBZ.WC.GENR.x.x.x.rps" should appear as shown in the figure below.

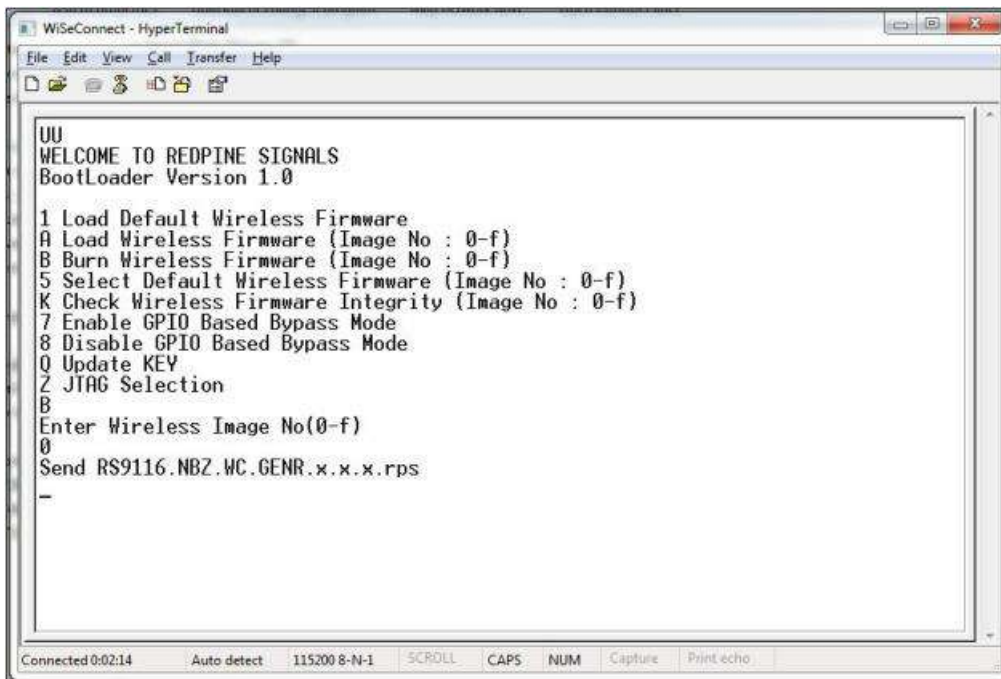


Figure 4-7: RYWB116 Module Firmware Upgrade File Prompt Message

- In the "File" menu of HyperTerminal, select the "send file" option. A dialog box will appear as shown in the figure below. Browse to the path where "RS9116.NBZ.WC.GENR.X.X.X.rps" is located and select Kermit as the protocol option. After this, click the "Send" button to transfer the file.

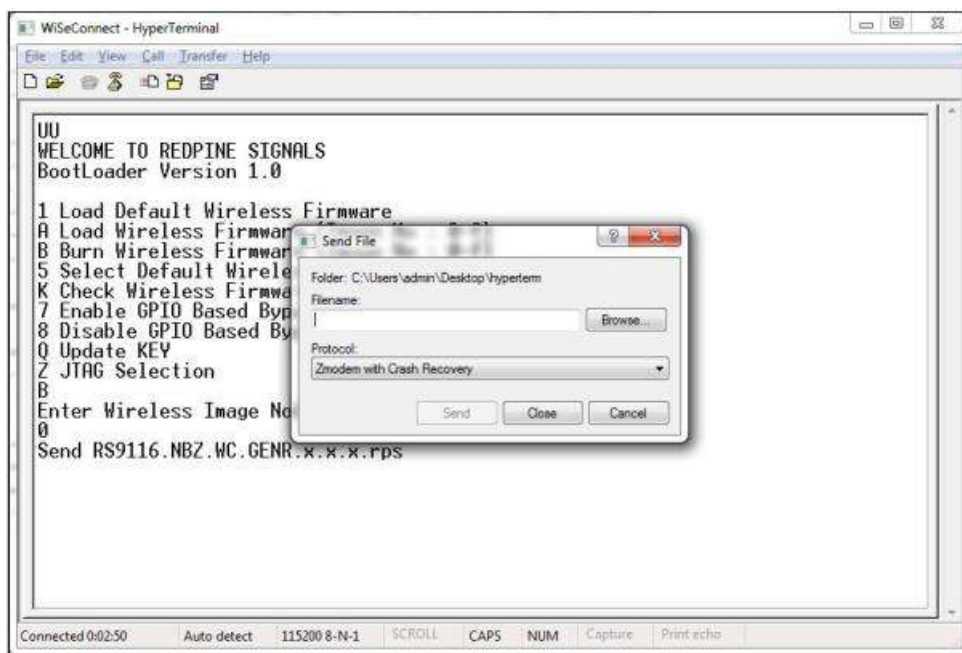


Figure 4-8: RYWB116 Module Firmware Upgrade File Selection Message

The dialog box message is displayed while file transfer is in progress as shown in the figure below.

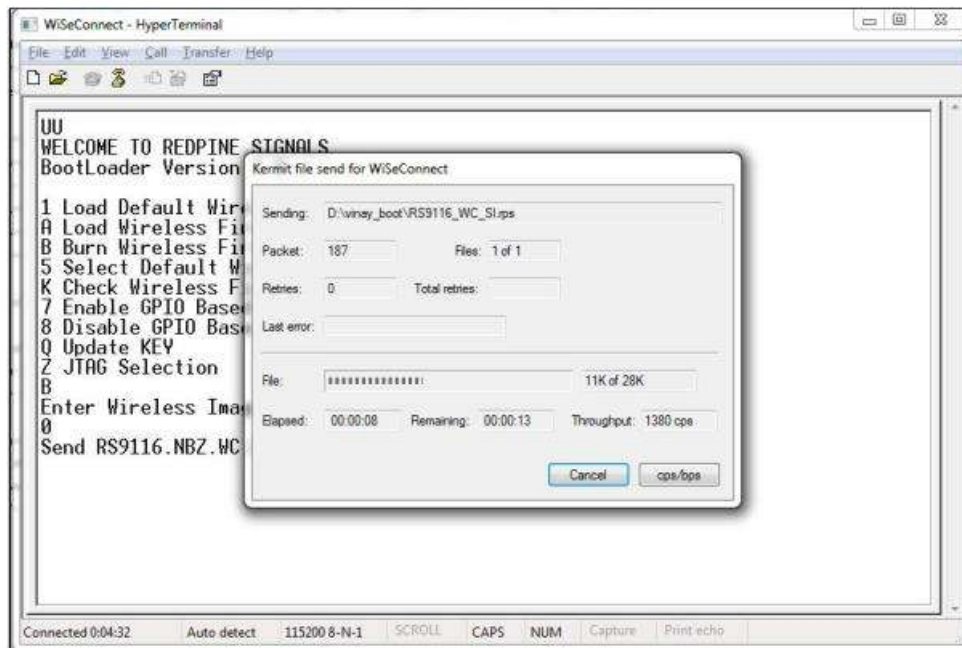


Figure 4-9: RYWB116 Module Firmware Upgrade File transfer Message

- After successfully completing the file transfer, module computes the integrity of the image and displays "@@@@Upgradation Failed, re-burn the image@@@@@@" in the case of failure and "@@Upgradation Failed and default image invalid, Bypass disabled @@" in the case of both failure and corruption of the default image.
- In the case of success, module checks if the bootloader bypass is enabled and computes the integrity of the default image selected. If the integrity fails, it sends "Upgradation successful, Default image invalid, gpio bypass disabled." If integrity passes or gpio bypass not enabled, it sends "Upgradation Successful" message on the terminal as shown in the figure below.

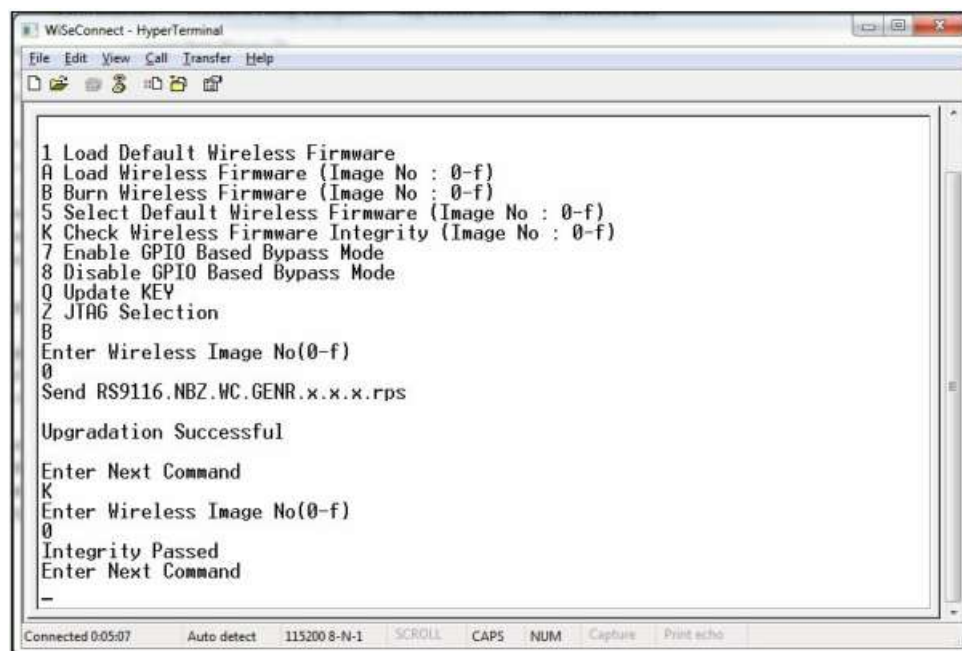


Figure 4-10: RYWB116 Module Firmware Upgrade Completion Message

- At this point, the upgraded firmware Image is successfully flashed to the module.
- The user can again cross check the integrity of the Image by selecting the Option K " Check Wireless Firmware Integrity (Image No: 0-f)" for Wireless Image.
- Follow the steps mentioned in Loading the Default Wireless Firmware in the Module to load the firmware from flash, select Option 1 from the above the Figure.
- The module is ready to accept commands from the Host.

4.3 Host Interaction Mode in SPI / USB

This section explains the exchange between host and module in host interaction mode (while bootloading) to select different boot options through SPI / USB interfaces.

4.3.1 SPI Startup Operations

If the selected host interface is SPI or USB, the Bootloader uses two of the module hardware registers to interact with the host. In the case of SPI host, these registers can be read or written using SPI memory read/write operations. In case of USB host vendor, specific reads and writes on control endpoint is used to access these registers. Bootloader indicates its current state through HOST_INTF_REG_OUT and host can give the corresponding commands by writing onto HOST_INTF_REG_IN.

The significance of 4 bytes of the value written into HOST_INTF_REG_IN register is as follows:

Nibble	Significance
Nibble[1:0]	Message code
Nibble[2]	Represents the Image number based on the command type
Nibble[3]	Represents the validity of the value in HOST_INTF_REG_IN register. Bootloader expects this value to be 0xA(HOST_INTERACT_REG_VALID). Bootloader validates the value written into this register if and only if this value is 0xA
Nibble[7:4]	Represents Mode for JTAG selection

Table 4-1: HOST_INTF_REG_IN Register values

Register Name	Memory Read/Write Address
HOST_INTF_REG_OUT	0x4105003C
HOST_INTF_REG_IN	0x41050034
PING Buffer	PING Buffer 0x18000
PONG Buffer	0x19000

Table 4-2: Bootloader message exchange registers

Bootloader Interaction Messages	Message Codes	Message Codes in Hex
HOST_INTERACT_REG_IN_VALID		0xA000
HOST_INTERACT_REG_OUT_VALID		0xAB00
LOAD_DEFAULT_NWP_FW	'1'	0x31
LOAD_NWP_FW	'A'	0x41
BURN_NWP_FW	'B'	0x42
SELECT_DEFAULT_NWP_FW	'5'	0x35
ENABLE_GPIO_BASED_BYPASS	'7'	0x37
DISABLE_GPIO_BASED_BYPASS	'8'	0x38
CHECK_NWP_INTEGRITY	'K'	0x4B

Bootloader Interaction Messages	Message Codes	Message Codes in Hex
KEY_UPDATE	'Q'	0x51
JTAG_SELECTION	'Z'	0x5A
LOAD_DEFAULT_NWP_FW_ACTIVE_LOW		0x71
LOAD_NWP_FW_ACTIVE_LOW		0x72
SELECT_DEFAULT_NWP_FW_ACTIVE_LOW		0x75
EOF_REACHED	'E'	0x45
PING_BUFFER_VALID	'I'	0x49
JUMP_TO_ZERO_PC	'J'	0x4A
INVALID_ADDRESS	'L'	0x4C
PONG_BUFFER_VALID	'O'	0x4F
POLLING_MODE	'P'	0x50
CONFIGURE_AUTO_READ_MODE	'R'	0x52
DISABLE_FWUPGRADE	'T'	0x54
ENABLE_FWUPGRADE	'N'	0x4E
DEBUG_LOG	'G'	0x47

Table 4-3: Bootloader Message Codes

Bootloader Interaction Messages	Response Codes	Response Codes in Hex
LOADING_INITIATED	'1'	0x31
VALID_FIRMWARE_NOT_PRESENT	'#'	0x23
SEND_RPS_FILE	'2'	0x32
UPGRADATION_SUCCESFULL	'S'	0x53
PONG_AVAIL	'O'	0x4F
PING_AVAIL	'I'	0x49
CMD_PASS		0xAA
CMD_FAIL		0xCC
FLASH_MEM_CTRL_CRC_FAIL		0xF1
FLASH_MEM_CTRL_BKP_CRC_FAIL		0xF2
INVALID_CMD		0xF3
UPGRADATION_SUCCESFULL_INVALID_DEFAULT_IMAGE		0xF4
INVALID_DEFAULT_IMAGE		0xF5
UPGRADATION_FAILED_INVALID_DEFAULT_IMAGE		0xF6
IMAGE_STORED_IN_DUMP		0xF7
FLASH_NOT_PRESENT		0xFA
IMAGE_INTEGRITY_FAILED		0xFB
BOOT_FAIL		0xFC
BOARD_READY	(BL_VER_HIGH << 4 BL_VER_LOW)	0x10
LAST_CONFIG_NOT_SAVED		0xF1
BOOTUP_OPTIONS_INTEGRITY_FAILED		0xF2
FWUP_BUFFER_VALID		0x5AA5

Table 4-4: Bootloader Response Codes

4.3.2 SPI Startup Messages on Powerup

Upon power-up, the HOST_INTF_REG_OUT register will hold value 0xABxx. Here 0xAB (HOST_INTERACT_REG_OUT_VALID) signifies that the content of OUT register is valid. Bootloader checks for the integrity of the bootup options by computing CRC. If the integrity fails, it checks the integrity from backup. If integrity passes, it copies the backup to the actual location and writes (HOST_INTERACT_REG_OUT_VALID | LAST_CONFIG_NOT_SAVED) in HOST_INTF_REG_OUT register. If the integrity of backup options also fails, the bootup options are reset and (HOST_INTERACT_REG_OUT_VALID | BOOTUP_OPTIONS_INTEGRITY_FAILED) is written in HOST_INTF_REG_OUT register. In either of the cases, bootloader bypass is disabled. If the bootup options integrity passes, the HOST_INTF_REG_OUT register contains 0xABxx where xx represents the two nibble bootloader version. This message is referred to as BOARD_READY indication throughout the document.

For instance, for bootloader version 1.0, the value of register will be 0xAB10. The host is expected to poll for one of the three values and should give any succeeding command (based on error codes if present) only after reading the correct value in HOST_INTF_REG_OUT reg.

4.4 Loading Default Wireless Firmware in the Module

The host can give options to bootloader to select the firmware load image type that will load the firmware from the flash of the module.

4.4.1 Load Default Wireless Firmware

Upon receiving Board ready, if host wants to load default wireless firmware, it is expected to write value (HOST_INTERACT_REG_IN_VALID | LOAD_DEFAULT_NWP_FW) or (HOST_INTERACT_REG_IN_VALID | LOAD_DEFAULT_NWP_FW_ACTIVE_LOW) in HOST_INTF_REG_IN register. If the host command is (HOST_INTERACT_REG_IN_VALID | LOAD_DEFAULT_NWP_FW) it is assumed that host platform is expecting active high interrupts. If the command is (HOST_INTERACT_REG_IN_VALID | LOAD_DEFAULT_NWP_FW_ACTIVE_LOW) it is assumed that the host is expecting active low interrupts and SPI hardware will be configured accordingly. After sending this command host should wait for an interrupt for card ready message from the loaded firmware.

Note:

For USB host interface mode interrupt configuration is not required, the host should send (HOST_INTERACT_REG_IN_VALID | LOAD_DEFAULT_NWP_FW) to load default wireless Image

4.5 Loading Selected Wireless Firmware in the Module

The host can give options to bootloader to select the firmware load image type that will load the firmware from the flash of the module.

4.5.1 Load Selected Wireless Firmware

1. Upon receiving Boardready, if host wants to load a selected wireless firmware, it is expected to write value (HOST_INTERACT_REG_IN_VALID | LOAD_NWP_FW | (IMAGE_NO << 8)) or (HOST_INTERACT_REG_IN_VALID | LOAD_NWP_FW_ACTIVE_LOW | (IMAGE_NO << 8)) in HOST_INTF_REG_IN register.
2. If host command is (HOST_INTERACT_REG_IN_VALID | LOAD_NWP_FW | (IMAGE_NO << 8)), it is assumed that host platform is expecting active high interrupts.
3. If the command is (HOST_INTERACT_REG_IN_VALID | LOAD_DEFAULT_NWP_FW_ACTIVE_LOW), it is assumed that the host is expecting active low interrupts and SPI hardware will be configured accordingly. After sending this command host should wait for an interrupt for card ready message from the loaded firmware.

Note:

For USB host interface mode interrupt configuration is not required, host should send (HOST_INTERACT_REG_IN_VALID | LOAD_NWP_FW | (IMAGE_NO << 8)) to load selected wireless Image.

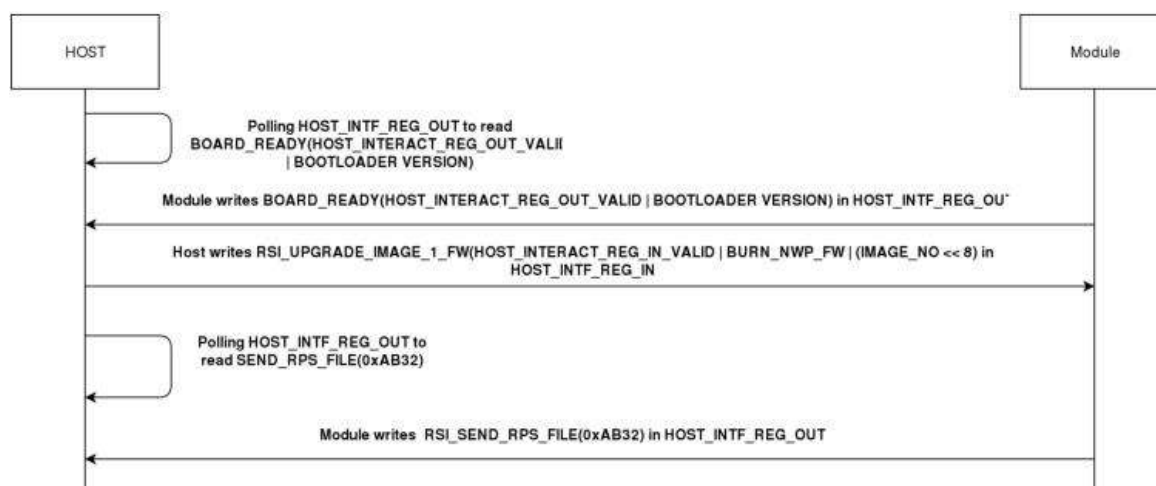
4.6 Upgrading Wireless Firmware in the Module

With this option, host can select to upgrade the firmware in the flash of the module.

4.6.1 Upgrading Wireless Firmware

Steps for firmware upgradation sequence after receiving board ready are as follows.

1. After reading the valid BOARD_READY (i.e. HOST_INTERACT_REG_OUT_VALID | BOOTLOADER VERSION) value in HOST_INTF_REG_OUT, host writes (HOST_INTERACT_REG_IN_VALID | BURN_NWP_FW | (IMAGE_NO << 8)) in HOST_INTF_REG_IN and host starts polling for HOST_INTF_REG_OUT.
2. Module polls for HOST_INTF_REG_IN register. When module reads a valid value (i.e. HOST_INTERACT_REG_IN_VALID | BURN_NWP_FW | (IMAGE_NO << 8)) in HOST_INTF_REG_IN, module writes (HOST_INTERACT_REG_OUT_VALID | SEND_RPS_FILE) in HOST_INTF_REG_OUT.
3. When host reads valid value (i.e. HOST_INTERACT_REG_OUT_VALID | SEND_RPS_FILE) in HOST_INTF_REG_OUT, host will write first 4Kbytes of firmware image in PING Buffer and writes (HOST_INTERACT_REG_IN_VALID | PING_VALID) in HOST_INTF_REG_IN register. Upon receiving PING_VALID command module starts burning this 4 Kbytes chunk onto the flash. When the module is ready to receive data in PONG Buffer it sets value PONG_AVAIL (HOST_INTERACT_REG_OUT_VALID | PONG_AVAIL) in HOST_INTF_REG_OUT. The host is required to wait for this value to be set before writing next 4Kbytes chunk onto the module.
4. On reading valid value (i.e. HOST_INTERACT_REG_OUT_VALID | PONG_AVAIL) in HOST_INTF_REG_OUT, host starts memory write on PONG location and start polling for HOST_INTF_REG_OUT to read valid value (i.e. HOST_INTERACT_REG_OUT_VALID | PING_AVAIL). Module reads (HOST_INTERACT_REG_OUT_VALID | PONG_VALID) 0xAB4F value in HOST_INTF_REG_OUT and begin to write the data from PONG location into the flash.
5. This write process continues until the host has written all the data into the PING-PONG buffers and there is no more data left to write.
6. Host writes a (HOST_INTERACT_REG_IN_VALID | EOF_REACHED) into HOST_INTF_REG_IN register and starts polling for HOST_INTF_REG_OUT.
7. On the other side module polls for HOST_INTF_REG_IN register. When module reads (HOST_INTERACT_REG_IN_VALID | EOF_REACHED) in HOST_INTF_REG_IN, it computes integrity for entire received firmware image. Then it checks if the bypass is enabled. If enabled, it checks for the validity of the default image. If integrity is correct and default image is valid/GPIO bypass not enabled, module writes (HOST_INTERACT_REG_OUT_VALID | FWUP_SUCCESSFUL) in HOST_INTF_REG_OUT register. If integrity is correct and default image is invalid (bypass enabled), module writes (HOST_INTERACT_REG_OUT_VALID | UPGRADATION_SUCCESFULL_INVALID_DEFAULT_IMAGE) in HOST_INTF_REG_OUT register and the bypass is disabled. If the integrity is failed and default image is valid / GPIO bypass is not enabled, then the module writes (HOST_INTERACT_REG_OUT_VALID | CMD_FAIL) in HOST_INTF_REG_OUT register. If the integrity is failed and default image is invalid (bypass enabled), then the module writes (HOST_INTERACT_REG_OUT_VALID | UPGRADATION_FAILED_INVALID_DEFAULT_IMAGE) in HOST_INTF_REG_OUT register and the bypass is disabled.



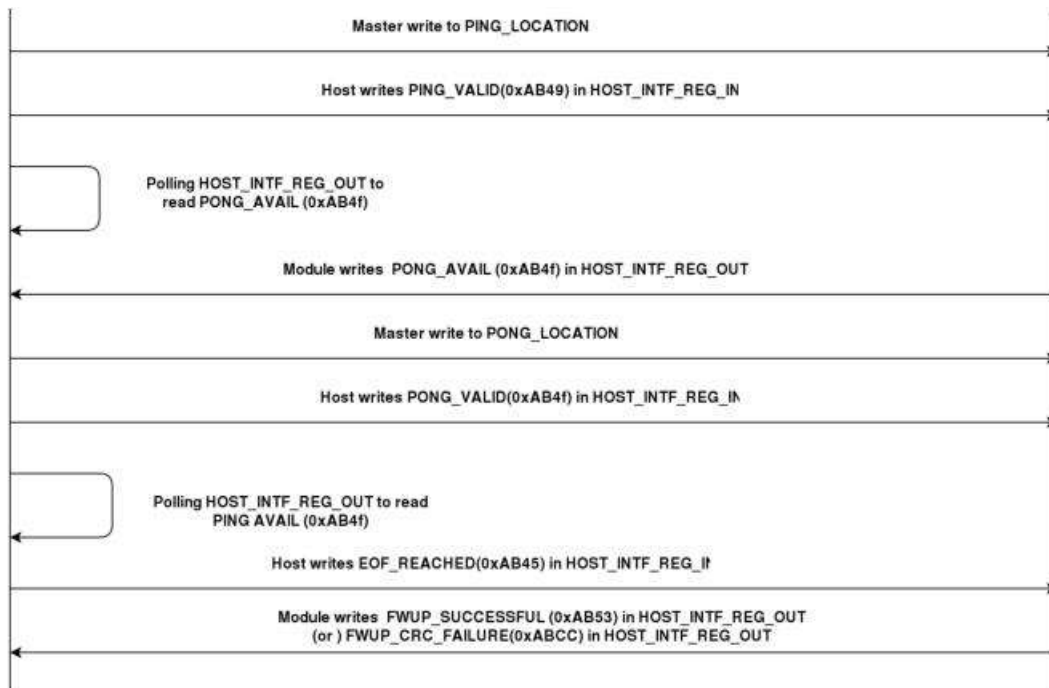


Figure 4-11: Wireless Firmware upgradation through SPI/USB

4.7 GPIO Based Bootloader Bypass Mode for RYWB116

In GPIO based bootloader bypass mode host interactions with bootloader can be bypassed. There are two steps to enable GPIO based Bootloader bypass mode:

1. The host needs to select default wireless image to load in bypass mode.
2. Enable Bootloader bypass mode.
3. Assert UULP_GPIO_2 to Bypass Bootloader on powerup.

To enable Bootloader Bypass mode host first has to give default image that has to be loaded in bypass mode and select the bypass mode(enable). After rebooting the module, it goes to bypass mode and directly loads the default firmware image.

4.8 Bypass Mode in UART / USB-CDC

4.8.1 Making Default Wireless Firmware Selection

With this option, host can select the default firmware image to be loaded.

4.8.1.1 Selecting a valid Image as the Default Image

- After the welcome message is displayed, we can select option 5 "Select Default Wireless Firmware (Image No: 0-f)".
- The message "Enter Wireless Image No (0-f)" is displayed.
- Then select the Image no.
- It is better to check the Integrity of Image before selecting it as Default Image.
- When default image is selected, module checks for the validity of the image selected and displays "Configuration saved".



Figure 4-12: Making Image no - 0 as the default image

4.8.2 Enable/Disable GPIO Based Bypass Option

This option is for enabling or disabling the GPIO bootloader bypass mode.

4.8.2.1 Enabling the GPIO Based Bypass Mode

If you select option 7, GPIO based Bootload bypass gets enabled. When this option is selected, module checks for the validity of the image selected and displays "Configuration saved" if valid and "Default image invalid" if valid default image is not present. Once enabled, from next bootup, Bootloader will latch the value of UULP_GPIO_2. If asserted, it will bypass the whole boot loading process and will load the default firmware image selected.

- After the welcome message is displayed, we can select option 5 "Select Default Wireless Firmware (Image No: 0-f)".
- The message "Enter Wireless Image No (0-f)"
- Then select the Image no
- It is better to check the Integrity of Image before selecting it as Default Image.
- When default image is selected, module checks for the validity of the image selected and displays "Configuration saved".
- Then select option 7 "Enable GPIO Based Bypass Mode"
- Module responds to select the host interface in Bypass mode (0 - UART, 1 - SDIO, 2 - SPI, 4 - USB, 5 - USB-CDC)
- Select the required interface.

If the default image is valid, then it enables GPIO Bypass mode, otherwise it will not enable the GPIO Bypass mode.

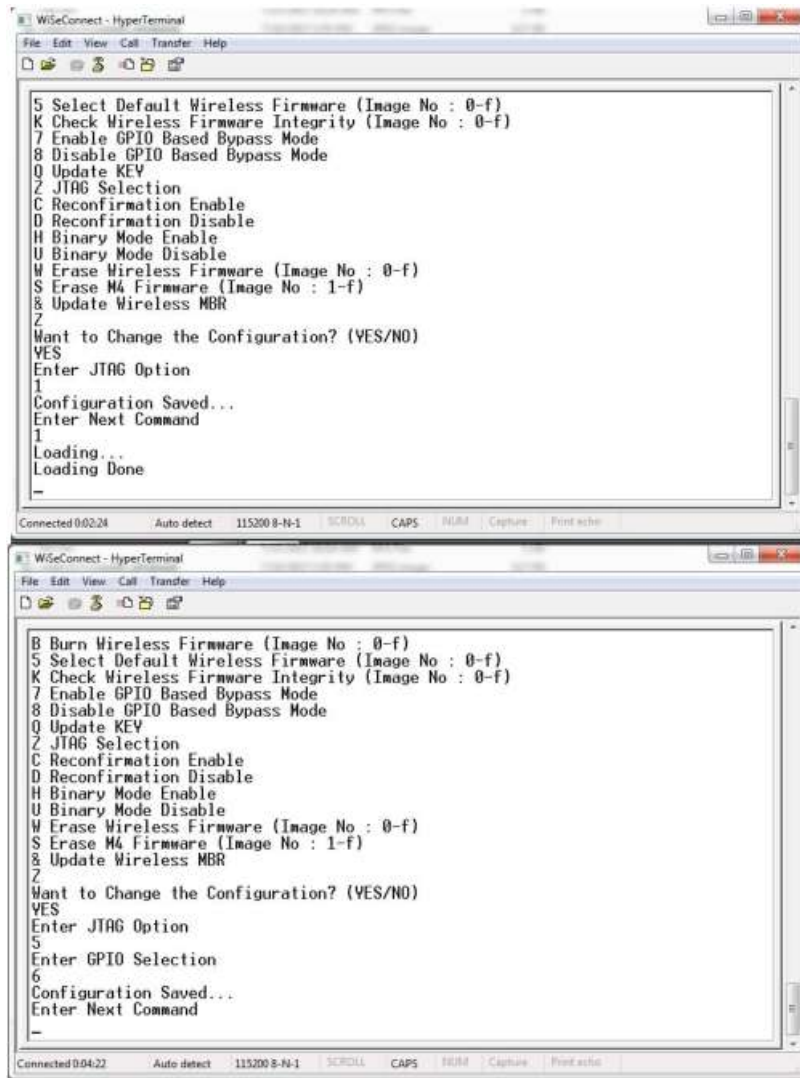


Figure 4-13: Enabling the GPIO based bypass mode a) Valid Default Firmware b) Invalid Firmware

4.8.2.2 Disabling the GPIO Based Bypass Mode

- If the host selects option 8, GPIO based bypass gets disabled.

UULP_GPIO_2 need to be deasserted on power up to move to host interaction mode, to select bootup options like disable Bypass mode or to change the default image

4.8.3 Check Integrity of the Selected Image

This option enables the user to check whether the given image is valid or not. When this command is given, bootloader asks for the image for which integrity has to be verified as shown in the figure below.

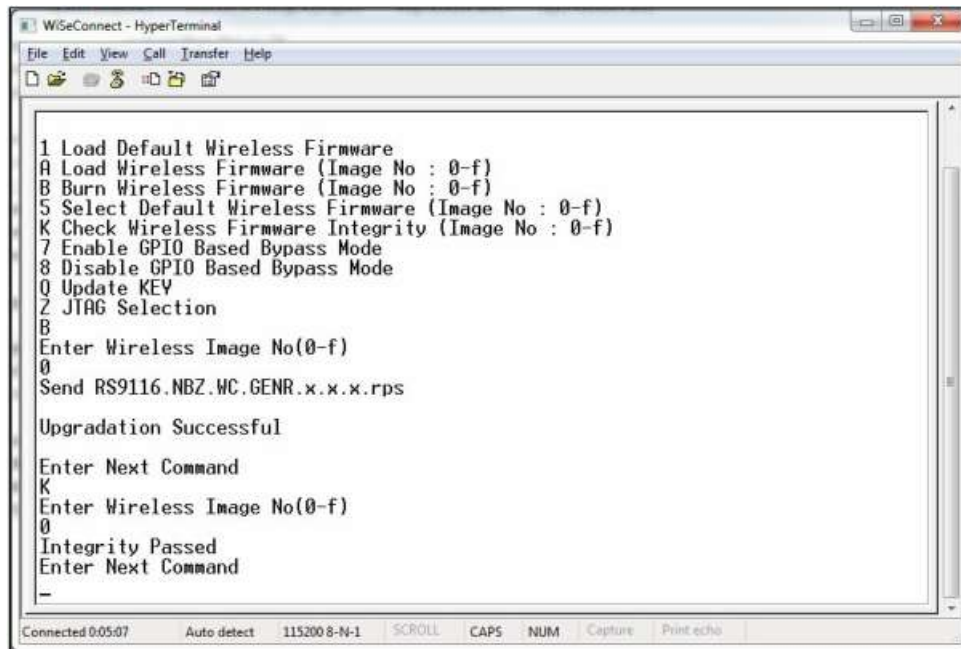


Figure 4-14: Integrity Check passed

4.9 Bypass Mode in SPI / USB

4.9.1 Selecting the Default Image

1. Upon receiving Boardready, if host wants to select default functional image, it is expected to write value (HOST_INTERACT_REG_IN_VALID | SELECT_DEFAULT_NWP_FW | (IMAGE_NO << 8)) in HOST_INTF_REG_IN register.
2. Host is expected to receive confirmation (HOST_INTERACT_REG_OUT_VALID | CMD_PASS) in HOST_INTF_REG_OUT register if default image is valid. If default image is invalid, (HOST_INTERACT_REG_OUT_VALID | CMD_FAIL) is written in HOST_INTF_REG_OUT register.

4.9.2 Enable/Disable GPIO Based Bootloader Bypass Mode

1. Upon receiving Boardready, if host wants to enable or disable GPIO based bypass mode, it is expected to write value (HOST_INTERACT_REG_IN_VALID | ENABLE_GPIO_BASED_BYPASS) or (HOST_INTERACT_REG_IN_VALID | DISABLE_GPIO_BASED_BYPASS) in HOST_INTF_REG_IN register.
2. Host expected to receive (HOST_INTERACT_REG_IN_VALID | ENABLE_GPIO_BASED_BYPASS) or (HOST_INTERACT_REG_IN_VALID | DISABLE_GPIO_BASED_BYPASS) in HOST_INTF_REG_OUT register if command is successful. If default image is invalid, (HOST_INTERACT_REG_OUT_VALID | INVALID_DEFAULT_IMAGE) is written in HOST_INTF_REG_OUT register.
3. The host is expected to reboot the board after receiving confirmation (HOST_INTERACT_REG_IN_VALID | ENABLE_GPIO_BASED_BYPASS) or (HOST_INTERACT_REG_IN_VALID | DISABLE_GPIO_BASED_BYPASS) or (HOST_INTERACT_REG_OUT_VALID | INVALID_DEFAULT_IMAGE) in HOST_INTF_REG_OUT register.
4. If GPIO based bypass is enabled, from next bootup onwards, the bootloader will latch the state of UULP_GPIO_2.
5. If UULP_GPIO_2 is asserted, the bootloader will not give board ready and it will directly load the default functional image selected.

UULP_GPIO_2 need to be deasserted on power up to move to host interaction mode, to select bootup options like disable Bypass mode or to change the default image

4.10 Other Operations

This section contains additional, less frequently used bootloader options.

4.11 Update KEY

Note:

This feature is not enabled in the current release.

4.12 JTAG Selection

Note:

This feature is not enabled in the current release.

5 SPI Interface

This section describes RYWB116 SPI interface, including the commands and processes to operate the module via SPI.

5.1 Features

The features are as follows:

- Supports 8-bit and 32-bit data mode
- Supports flow control

5.2 Hardware Interface

The SPI interface on the RYWB116 works in slave mode. It is a 4-wire interface. In addition to the SPI interface, the module provides an additional interrupt pin to signal events to the host.

The interrupt is raised by the module in SPI mode for the following condition.

- When the module has data in its output buffer, it indicates host by raising the active high signal on the interrupt pin.

The interrupt from the module is active high and the host has to configure the interrupt in level trigger mode. The RYWB116 also supports edge-triggered interrupts, provided the host is configured to handle these appropriately (This is generic and does not entail any specific implementations). The host must check for pending interrupts before clearing/acknowledging an interrupt to avoid missing interrupts and data.

Note:

By default, the interrupt from the module is active high but, it can be configured as active low as well (this can be done from the bootloader menu).

5.2.1 SPI Signals

The SPI Interface is a full duplex serial Host interface, which supports 8-bit and 32-bit data mode. The SPI interface of the module consists of the following signals:

SPI_MOSI (Input) - Serial data input for the module.

SPI_MISO (Output) - Serial data output for the module.

SPI_CS (Input) - Active low slave select signal. This should be low when SPI transactions are to be carried out.

SPI_CLK (Input) - SPI clock. The maximum value allowed is 80 MHz

INTR (Output) - Active high (Default), Active low, level interrupt output from the module.

The module acts as an SPI slave only, while the Host is the SPI master.

Following parameters should be in the host SPI interface.

CPOL (clock polarity) = 0,

CPHA (clock phase) = 0.

5.2.2 Interrupt

The module's INTERRUPT output signal should be connected to the interrupt input of the Host MCU. The INTERRUPT signal is an active high and level triggered signal. It is raised by the module in the following cases:

1. When the module needs to indicate to the Host that it has received data from the remote terminal and the data needs to be read by the Host.
2. When the module needs to indicate to the Host that a response to a command sent by the Host is ready to be read from the module.
3. To indicate to the Host that it should read a CARD READY message from the module. This operation is described in the subsequent sections.
4. An interrupt will be raised for asynchronous RX packets also.

5.2.3 SPI Interface Initialization

This section explains the initialization of the SPI slave interface in the module. Following is the series of steps for SPI initialization:

1. A host sends 0x00124A5C to the module.
2. On successful initialization, the module sends 0x58 (SPI success) to the host or else, the module sends 0x54 (SPI busy) or 0x52 (SPI failure).

5.2.3.1 Operations through SPI

The RYWB116 can be configured and operated from the Host by sending commands through the SPI interface.

The SPI interface is programmed to perform a certain transfer using commands C1, C2, C3 and C4 and an optional 32-bit address. For all the Commands and Addresses, the Host is configured to transmit data with the 8-bit mode. At the end of all the Commands and Addresses, the Host is reconfigured to transmit data with 8-bit or 32-bit mode depending on the commands issued. The Module responds to all the commands with a certain response pattern. The four commands i.e. C1, C2, C3, and C4 indicate to the SPI interface for all the aspects of the transfer.

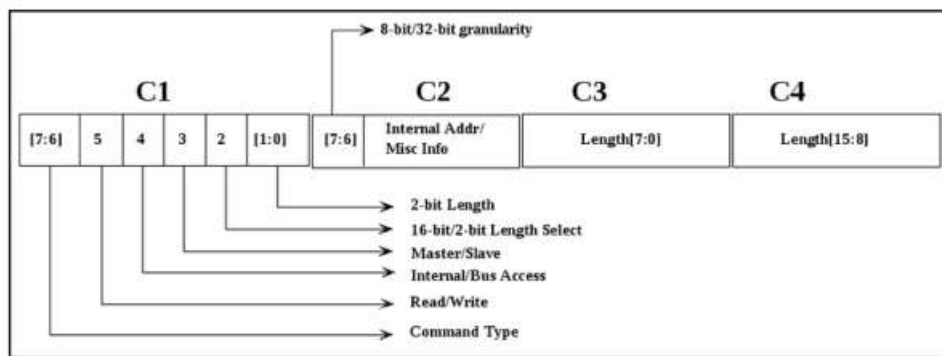


Figure 5-1: SPI Command Description

The command descriptions are as follows:

To all these commands, the SPI interface responds with a set of unique responses.

5.2.3.2 Module Response

The RYWB116 gives responses to the host SPI command requests through the SPI interface. These are as follows:

- A success/failure response at the end of receiving the command. This response is driven with 8-bit mode during the Command and Address phase and is then switched to 8-bit or 32-bit mode during the Data phase as per the command issued.
 - Success: 0x58 or 0x00000058
 - Failure: 0x52 or 0x00000052
- An 8-bit or 32-bit start token is transmitted once the four commands (C1, C2, C3, C4) indicating a read request are received and the Module is ready to transmit data. The start token is immediately followed by the read data.
 - Start Token: 0x55 or 0x00000055
- An 8-bit or 32-bit busy response in case a new transaction is initiated while the previous transaction is still pending from the slave side.
 - Busy Response: 0x54 or 0x00000054

5.2.3.3 Module Bit Ordering of SPI Transmission / Reception

8-bit Mode:

If a sequence of bytes <B3 [7:0]> <B2 [7:0]> <B1[7:0]> <B0[7:0]> is to be sent, where B3 is interpreted as the most significant byte, then the sequence of transmission is as follows :

B0 [7] ..B0 [6] .. B0 [0] -> B1 [7] ..B1 [6] ..B1 [0] -> B2 [7] ..B2[6] .. B2[0] -> B3[7] ..B3[6] .. B3[0]

where, B0 is sent first, then B1, then B2 and so on.

In each of the bytes, the MSB is sent first. For example, when B0 is sent, B0 [7] is sent first, then B0 [6], then B0[5] and so on. Same is the case while receiving data. In this example, B0 [7] is expected first by the receiver, then B0 [6] and so on. Also, as can be seen, the data changes value at the falling edge and is latched at the rising edge.

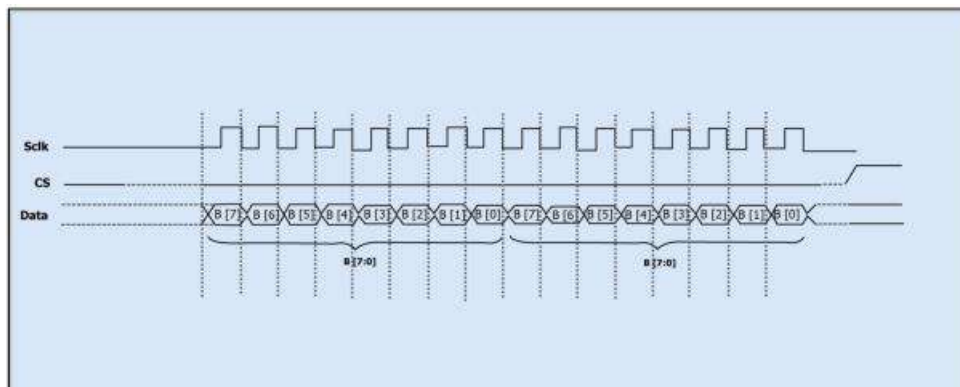


Figure 5-2: 8-bit Mode

32-bit Mode:

If a sequence of 32-bit words is $\langle W3[31:0] \rangle \langle W2[31:0] \rangle \langle W1[31:0] \rangle \langle W0[31:0] \rangle$ is to be sent, where W3 is interpreted as the most significant word, then the sequence of transmission is as follows :

W0[31] ..W0[30] ..W0[0] -> W1[31] ..W1[30] ..W1[0] -> W2[31] ..W2[30] ..W2[0] -> W3[31] ..W3[30] ..W3[0]

where, W0 is sent first, then W1, then W2 and so on.

In each of the 32-bit words, the MSB is sent first. For example, when W0 is sent, W0[31] is sent first, then W0[30], then W0[29] and so on. Same is the case when receiving data. In this example, W0 [31] is expected first by the receiver, then W0[30] and so on. Also, as can be seen, the data change value at the falling edge and is latched at the rising edge.

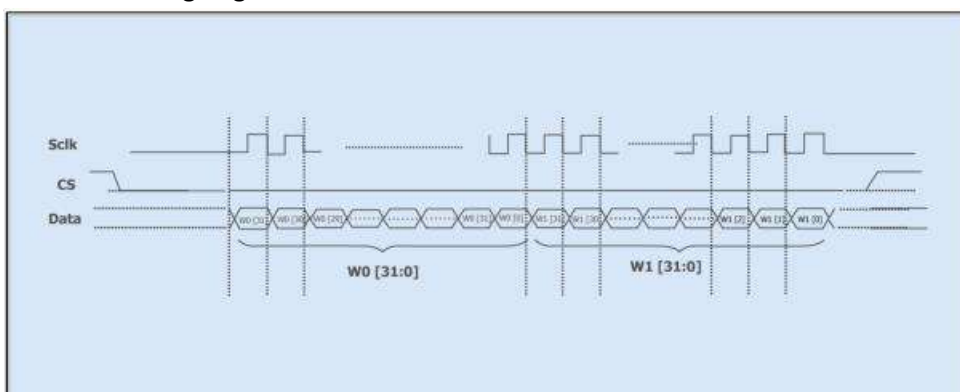


Figure 5-3: 32-bit Mode

Bit Ordering of Module Response

The bit ordering is same as explained in Module bit Ordering of SPI Transmission/Reception. For example, a 0x58 response for 8-bit success is sent as

0->1->0-> 1->1-> 0 -> 0 -> 0 . That is 0 is sent first, then 1, then 0, then 1, and so on.

5.2.4 Module SPI Interface Initialization

The Initialization command is given to the module to initialize the SPI interface. The SPI interface remains non- functional to all the commands before initialization and responds only after successful initialization. Initialization should be done only once after the power is on. The module treats the subsequent initialization of any command before it is reset as errors. SPI initialization is 24-bit command (0x124A5C) followed by an 8-bit dummy data. 24-bit

SPI Initialization command should be sent in a sequence of 0x12, 0x4A, 0x5C bytes. Status response from the SPI Interface is driven during the transmission of the dummy data i.e. after the transfer of 8-bits of command C1.

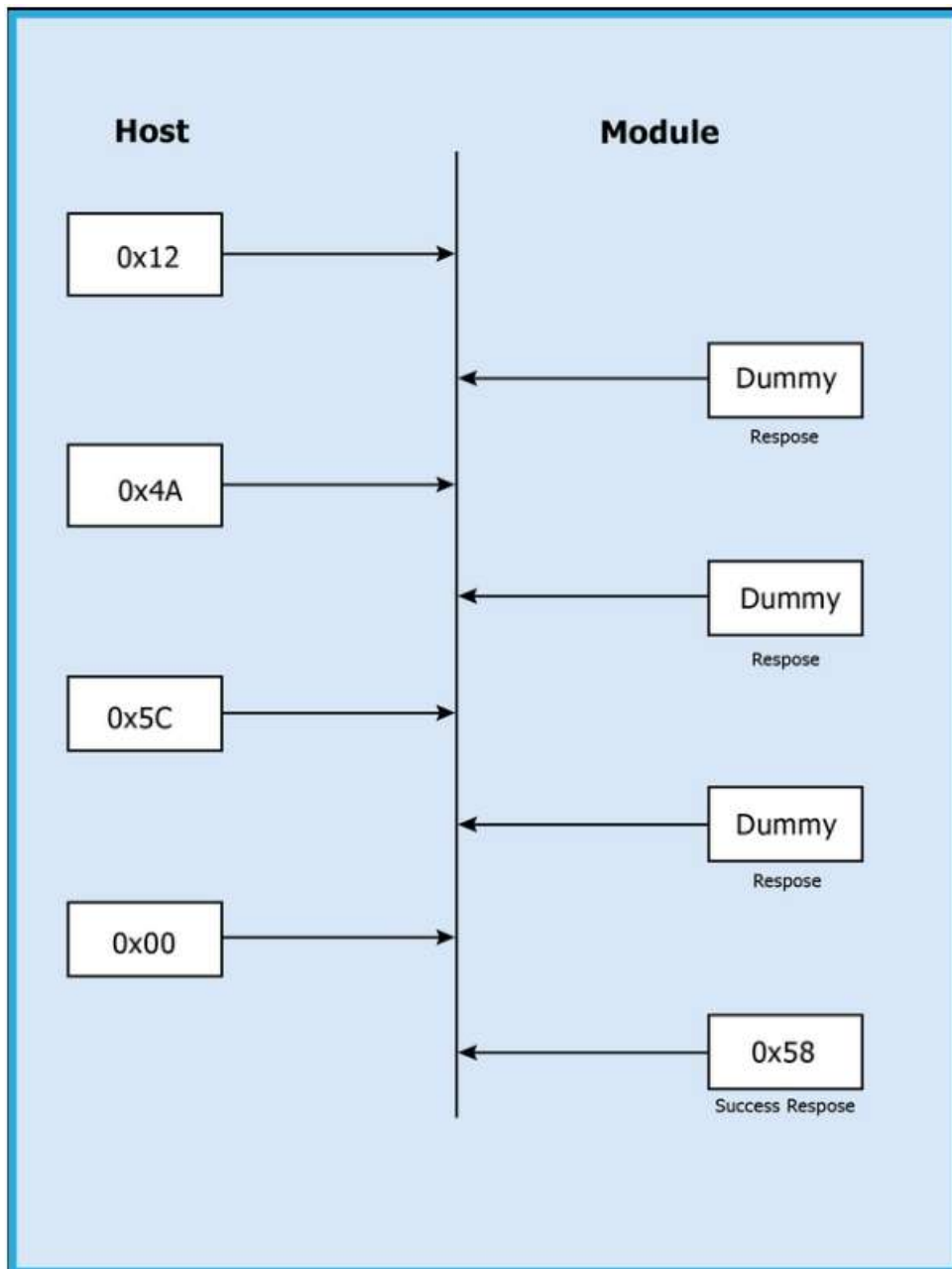


Figure 5-4: SPI Initialization exchanges between Host and Module

Host Interactions Using SPI Command

This section describes the procedures to be followed by the Host to interact with the RYWB116 using SPI commands.

The Host interactions to the module can be categorized as below.

Command	Bit Number	Description
C1	[7:6]	Command Type "00"- Initialization Command "01"- Read/Write Command "10", "11"- Reserved for future use
	5	Read/Write '0'- Read Command '1'- Write Command
	4	Register/(Memory & Frame) read/write Access '0'- register read/write '1'- Memory read/write or Frame read/write
	3	Memory/Frame Access '0'- Memory read/write '1'- Frame read/write
	2	2-bit or 16-bit length for the transfer '0'- 2-bit length for the transfer '1'- 16-bit length for the transfer
	1:0	2-bit length (in terms of bytes) for the transfer (valid only if bit 2 is cleared) "00"- 4 Bytes length "01"- 1 Byte length "10"- 2 Bytes length "11"- 3 Bytes length
C2	7:6	8-bit or 32-bit mode. Indicates the granularity of the write/read data. Note: The SPI (C1, C2, C3, C4) commands and addresses (A1, A2, A3, A4) will always be 8-bit irrespective of this value. "00"- 8-bit mode "01"- 32-bit mode "10", "11"- Reserved for future use
	5:0	This carries Register address, if bit 4 for Command C1 is cleared (i.e. register read/ write selected). Otherwise, reserved for future use.
C3	7:0	Length (7:0) LSB of the transfer's length (which is in terms of bytes) in case bit 2 of C1 is set. This command is skipped if bit 2 of C1 is cleared.
C4	7:0	MSB of the transfer Length (15:8) (Which is in terms of bytes) in case of bit 2 of C1 is set. This command is skipped if bit 2 of C1 is cleared i.e. if a 2-bit length is selected.

Table 5-1: SPI Command Description

5.2.4.1 Memory Type

The host needs to access the memory/registers of the RYWB116 for configuration and operation. To write data into a memory/register address, the memory write command has to be framed as described in the figure below. If a "busy" or "failure" response is sent from the module, the host should either resend the command or reset the module.

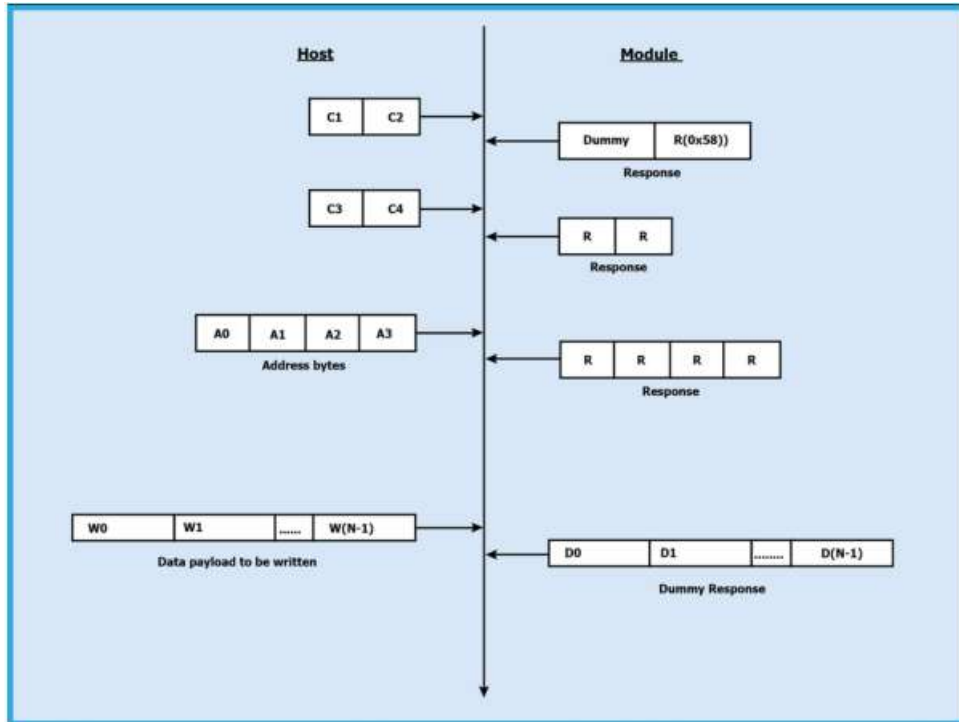


Figure 5-5: Memory Write

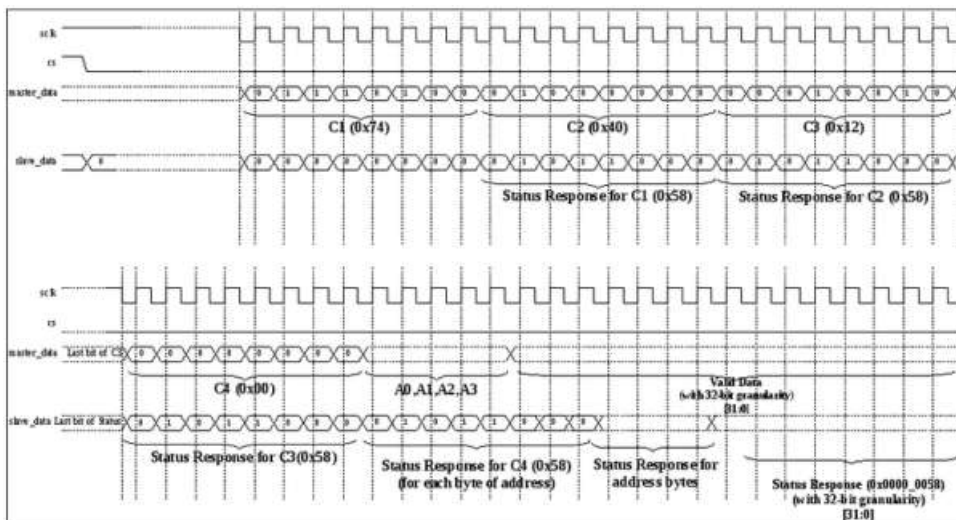


Figure 5-6: Interactions in the physical interface

Note:

This structure is similar for all following read/write operations.

The following procedure is to be followed by the Host.

1. Send the commands C1, C2.
2. Read the response (R) from the Module. The response will appear as described in [RYWB116 module Module Response](#). Status 0x58 indicates that the module is ready.
3. The host should send the commands C3 and C4, followed by the 4-byte address (corresponding to the memory/register address) and data. Status 0x54 indicates that the device is busy. The host has to retry. Status 0x52 indicates a failure response.

The commands C1, C2, C3 and C4 are sent in the following sequence (explained in Module bit Ordering of SPI Transmission / Reception) i.e. C1 first, then C2, C3 and finally C4.

The bit ordering is

C1[7] -> C1[6] ... C1[0] -> C2[7] -> C2[6] ... C2[0] -> C3[7] -> C3[6] ... C3[0] -> C4[7] -> C4[6] ... C4[0].

That is, C1[7] bit is sent first, then C1[6] and so on.

Total data payload size should be 1 byte, or 2 bytes or multiples of 4 bytes in this operation. For example, if 5 bytes need to be sent, then it should be padded with 3 more dummy bytes to make it 8 bytes (multiple of 4) before sending.

Original data <W0[7:0]> <W1[7:0]> <W2[7:0]> <W3[7:0]> <W4[7:0]>

Padded data <W0[7:0]> <W1[7:0]> <W2[7:0]> <W3[7:0]> <W4[7:0]> <D5[7:0]><D6[7:0]><D7[7:0]> ,

where D[7:0] is the dummy data.

The first byte sent is W0, the second byte sent is W1 and so on (refer [Module bit Ordering of SPI Transmission/ Reception](#)).

5.2.4.2 Frame Write

The sequence of command transactions (with no failure from the Module) for a Frame Write is as described in the figure below. The operations are similar to the memory write – except that bit 3 of C1 is set and the Address phase (A0, A1, A2, A3) is skipped.

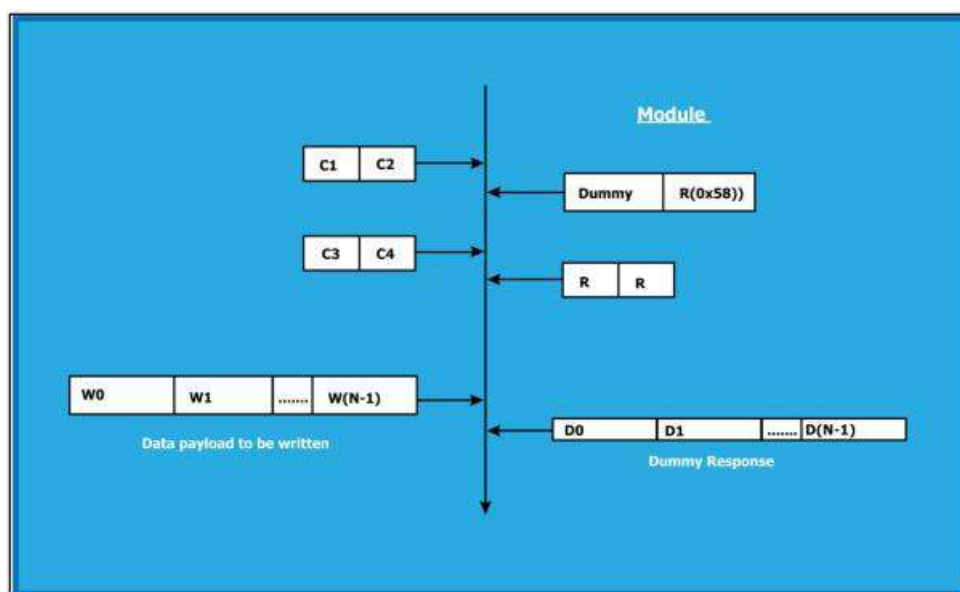


Figure 5-7: Frame Write

The following is the procedure to be followed by the Host.

1. Prepare and send the commands C1, C2 together as described for Frame write.
2. Read the response (R) from the Module (RYWB116).
3. Status 0x58 indicates that the Module is ready. The Host can then send the commands C3 and C4, followed by the data. Status 0x54 indicates that the device is busy. The host has to retry. Status 0x52 indicates a failure response.

Data payload size should be in multiples of 4 bytes in this operation. For example, if 5 bytes of data is to be written, it should be padded with 3 more dummy bytes to make it 8 bytes (multiple of 4) before sending.

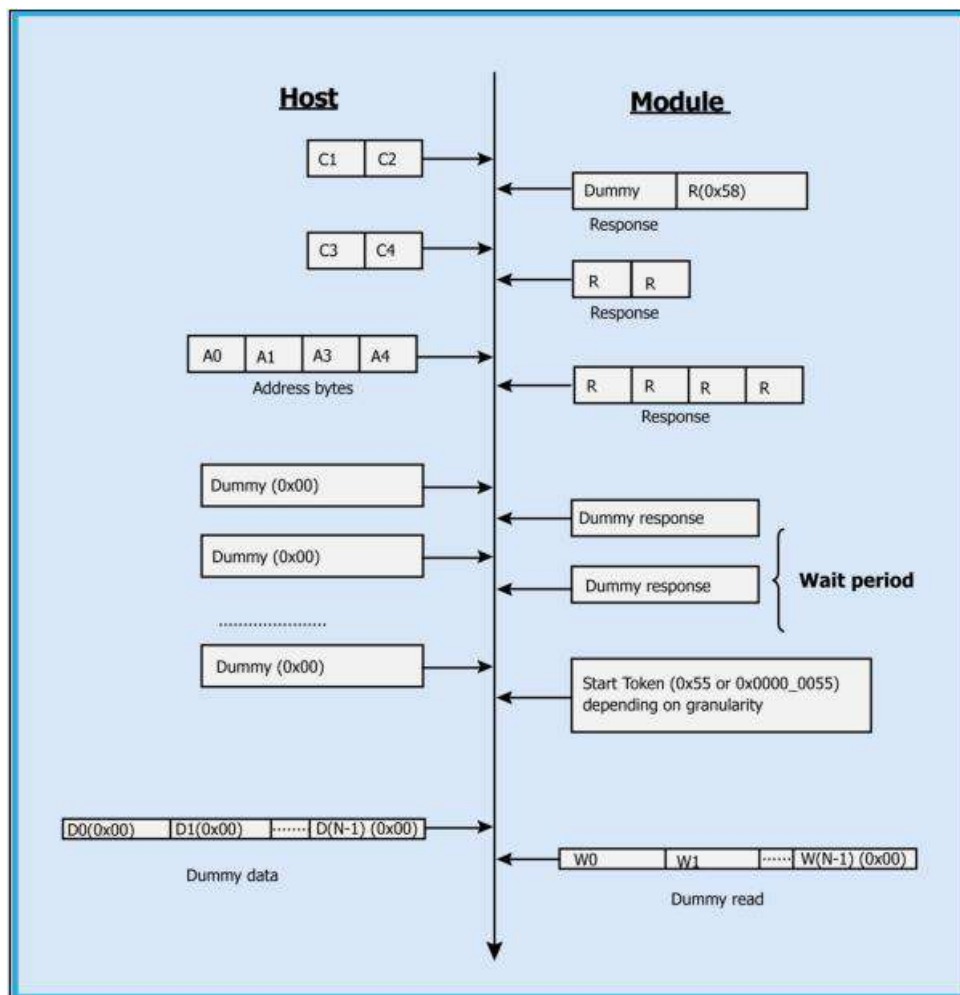
Original data <W4[7:0]> <W3[7:0]> <W2[7:0]> <W1[7:0]> <W0[7:0]>

Padded data <D7[7:0]> <D6[7:0]> <D5[7:0]> <W4[7:0]> <W3[7:0]> <W2[7:0]> <W1[7:0]> <W0[7:0]> , where D[7:0] is the dummy data.

The first byte sent is W0, the second byte sent is W1 and so on (refer [Module bit Ordering of SPI Transmission/ Reception](#)).

5.2.4.3 Memory Read

To read data from a memory/register address, the host must form and send a Memory Read command. The following figure gives the flow for memory reads between the Host and the Module.



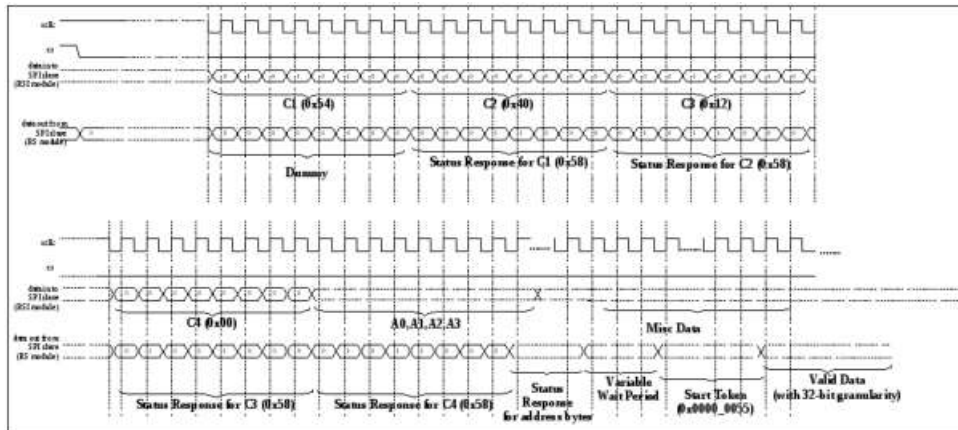


Figure 5-9: Memory Read at Physical Interface

To perform a memory read, the host must follow the procedure below.

1. Prepare and send the commands C1, C2 as described for Memory read.
2. Read the response from the RYWB116.
3. Status 0x58 indicates that the slave is ready. The host should next send the commands C3, C4, which indicate the length of the data to be read, followed by the address of the memory location to be read.
4. After sending/receiving C3, C4 commands/response and the addresses, the host should wait for a start token (0x55). The host writes a stream of dummy bytes to read the data from the module each time. The Host should read this data until the start token is received. The data following the start token should be interpreted as the frame of a specified length that is read from the Module.
5. Status 0x54, after C1 and C2 bytes, indicates that the device is busy. The host has to retry.
6. Status 0x52, after C1 and C2 bytes, indicates a failure response from the Module.

There is a variable wait period, during which dummy data is sent. After this period, a start token is transmitted from the Module to the Host. The start token is followed by valid data. The start token indicates the beginning of valid data to the Host. To read out the valid data, the host must send dummy data i.e. [D0, D1, D2, D (N-1)]. Where, N is the number of 8bit or 32-bit dummy words (based on the mode selected) need to send in order to receive a specified length of valid data from the module.

The commands C1, C2, C3 and C4 are sent in the following sequence (explained in Module bit Ordering of SPI Transmission/Reception) : C1 first, then C2, C3 and finally C4.

The bit ordering is

C1[7] -> C1[6] ... C1[0] -> C2[7] -> C2[6] ... C2[0] -> C3[7] -> C3[6] ... C3[0] -> C4[7] -> C4[6] ... C4[0]. That is, C1[7] bit is sent first, then C1[6] and so on.

If <D3[7:0]> <D2[7:0]> <D1[7:0]> <D0[7:0]> is the data read, then D0 is sent from module first, then D1 and so on.

D0[7] -> D0[6] ... D0[0] -> D1[7] -> D1[6] ... D1[0] -> D2[7] -> D2[6] ... D2[0] -> D3[7] -> D3[6] ... D3[0]

5.2.4.4 Frame Read

This is same as Memory read, except that bit 3 of C1 is set and the Address phase is skipped. The sequence of command transactions (with no failure from the Module) for a Frame Read is as described in the figure below.

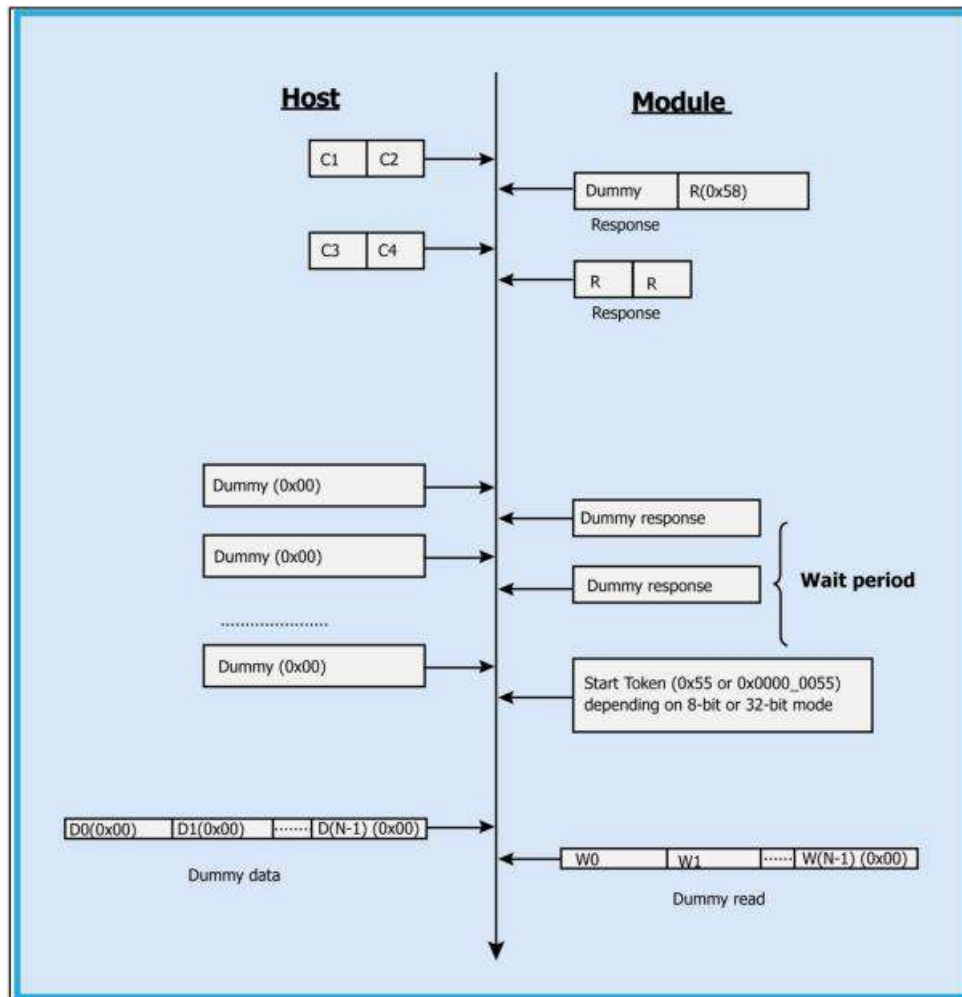


Figure 5-10: Frame Read

To perform a Frame Read, the host must follow the procedure below.

1. Prepare and send the commands C1, C2 as described for Frame Read.
2. Read the response from the RYWB116.
3. Status 0x58 indicates that the Module is ready. The host should send the commands C3, C4 which indicate the length of the data to be read.
4. After sending/receiving C3, C4 commands/response, the host should wait for a start token (0x55). The data then follows after the start token. The host writes a dummy byte to read the data from the module each time. The Host should read this data until the start token is received. The data following the start token should be interpreted as the frame of a specified length that is read from the Module. Status 0x54, after C1 and C2 bytes, indicates that the device is busy. The host has to retry. Status 0x52, after C1 and C2 bytes, indicates a failure response from the Module.

The commands C1, C2, C3 and C4 are sent in the following sequence (explained in Module bit Ordering of SPI Transmission/Reception) : C1 first, then C2, C3 and finally C4.

The bit ordering is

C1[7] -> C1[6] ... C1[0] -> C2[7] -> C2[6] ... C2[0] -> C3[7] -> C3[6] ... C3[0] -> C4[7] -> C4[6] ... C4[0]. That is, C1[7] bit is sent first, then C1[6] and so on.

If <D3 [7:0]> <D2[7:0]> <D1[7:0]> <D0[7:0]> is the data read, then D0 is sent from module first, then D1 and so on. D0[7] -> D0[6] ... D0[0] -> D1[7] -> D1[6] ... D1[0] -> D2[7] -> D2[6] ... D2[0] -> D3[7] -> D3[6] ... D3[0]

5.2.4.5 Register Read

Register Read commands are used to read the registers in the module using internal register address. Register read commands like C1 and C2 are only need to send to the module (i.e., C3, C4, and address phases are skipped). The C2 command bits [5:0] should be the SPI internal address of the register. For Register Reads following sequence needs to be followed:

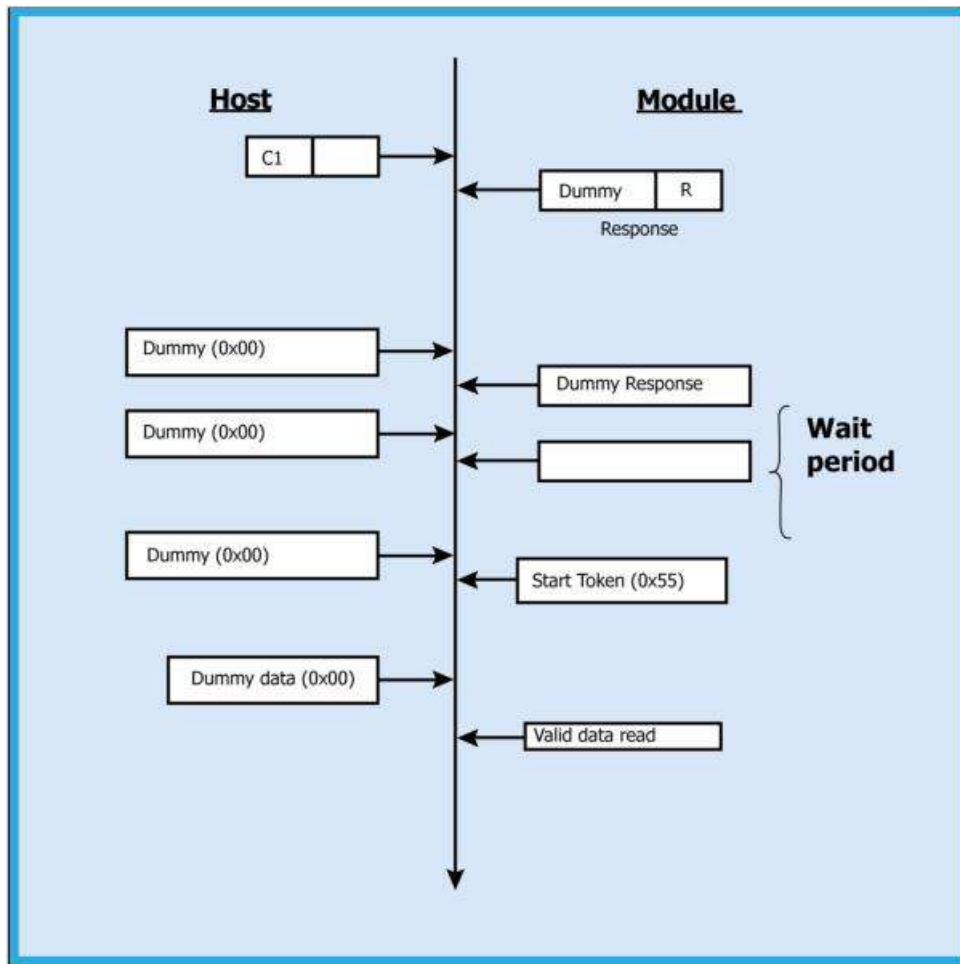


Figure 5-11: Register Read

5.2.4.6 Register Writes

Register write commands are used to write the data to the registers in the module by using internal register address. To Register write, the host needs to send C1 and C2 followed by the data to the module (i.e., C3, C4, and address phases are skipped). The C2 command bits [5:0] should be the SPI internal address of the register.

For Register writes, follow the below sequence as shown below:

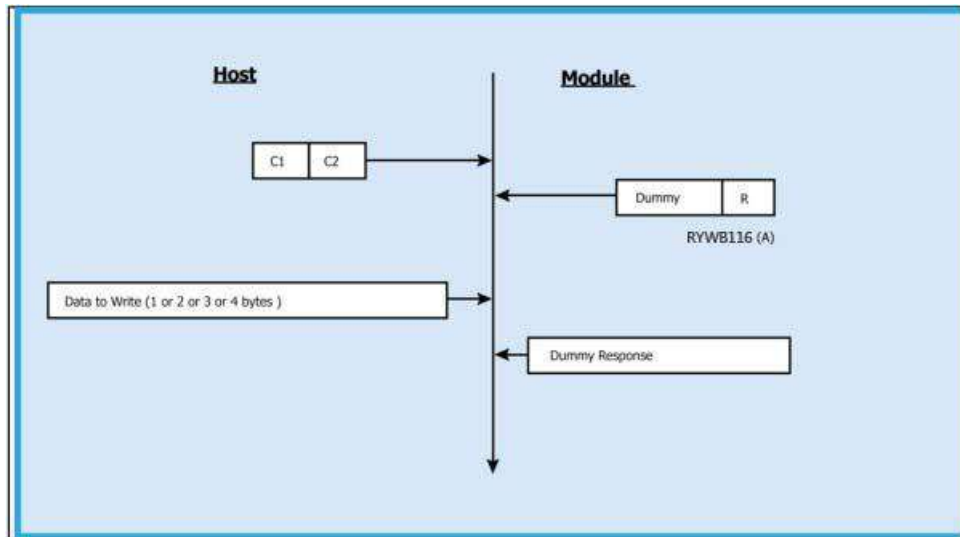


Figure 5-12: Register Write

5.2.5 Register Summary

Register	Address
SPI_HOST_INT	0x00

Table 5-2: RYWB116 Module Register Description

Module registers can be accessed from the host by using register read / writes commands.

SPI_HOST_INTR				
Register Address: 0x00				
Bit	Access	Function	Default Value	Description
[7:0]	Read only	SPI_HO ST_INTR	0x00	<p>These bits indicate the interrupt status value</p> <p>Bit 0: If '1', Buffer Full condition reached. When this bit is set to host shouldn't send data packets.</p> <p>This bit has to be polled before sending each packet.</p> <p>Bit 1: Reserved Bit 2: Reserved</p> <p>Bit 3: If '1', indicates data packet or response to Management frames are pending. This is a self-clearing bit and is cleared after the packet is read by host.</p> <p>Bit 4: Reserved Bit 5: Reserved Bit 6: Reserved</p>

Table 5-3: SPI Host Interrupt Register

5.3 Software Protocol

This section explains the procedure that the host needs to follow in order to send Wi-Fi commands frames to the module and to receive responses from the module.

Tx Operation

The Host uses Tx operations:

1. To send management commands to the module from the Host
2. To send actual data to the module which is to be transmitted onto the air

The host should follow the steps below to send the command frames to the Module:

1. Host should check buffer full condition by reading interrupt status register using register read.
2. If buffer full bit is not set in interrupt status register, the host needs to send Command frame in two parts:
 First, it is required to send 16 byte Frame descriptor using Frame write.
 Second, it is required to send optional Frame body using Frame write.

Note:

Frame write is an API provided to the host which is present in the release package.

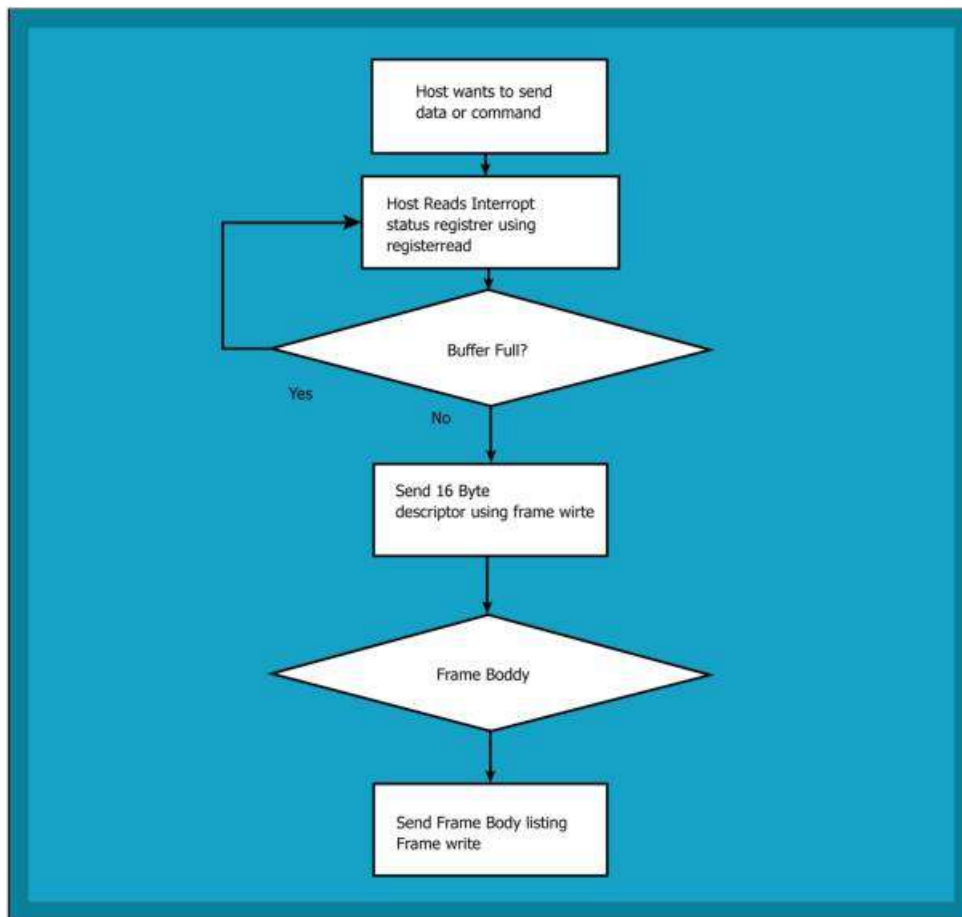


Figure 5-13: Tx From Host to Module

Management / Data Frame Descriptor and Frame body of command frames are sent to the module by using two separate frame write as shown below:

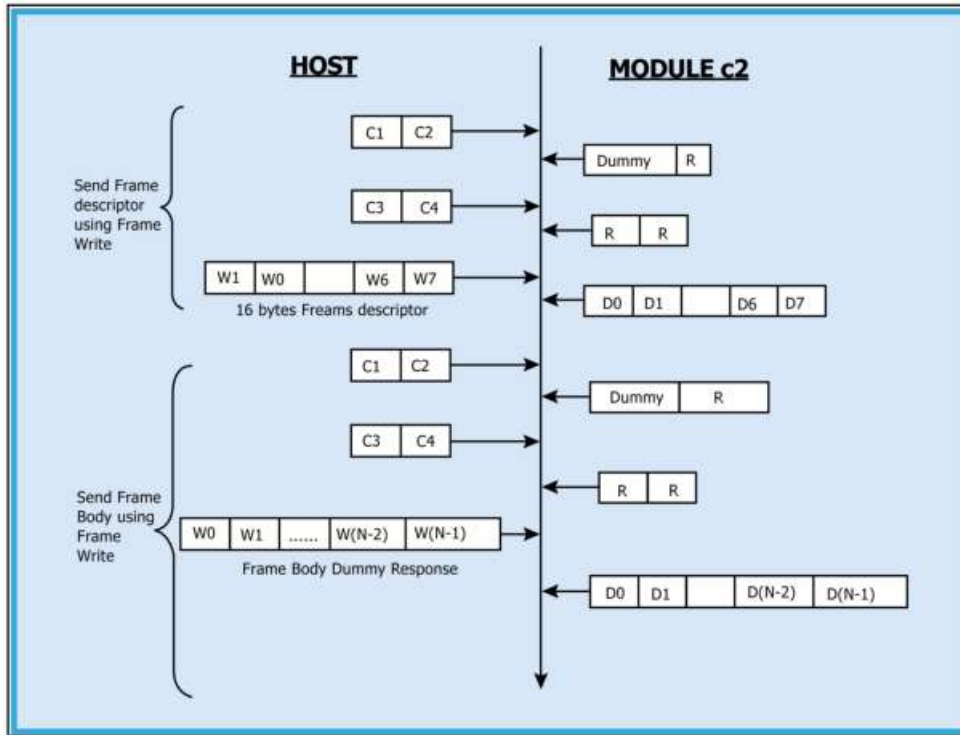


Figure 5-14: Exchanges between Host and Module for Tx operation

Rx Operation

The Host uses this operation:

- module's responses, for the commands
- To read data received by the module from the remote peer.

The module sends the response/received data to Host in a format as shown below:

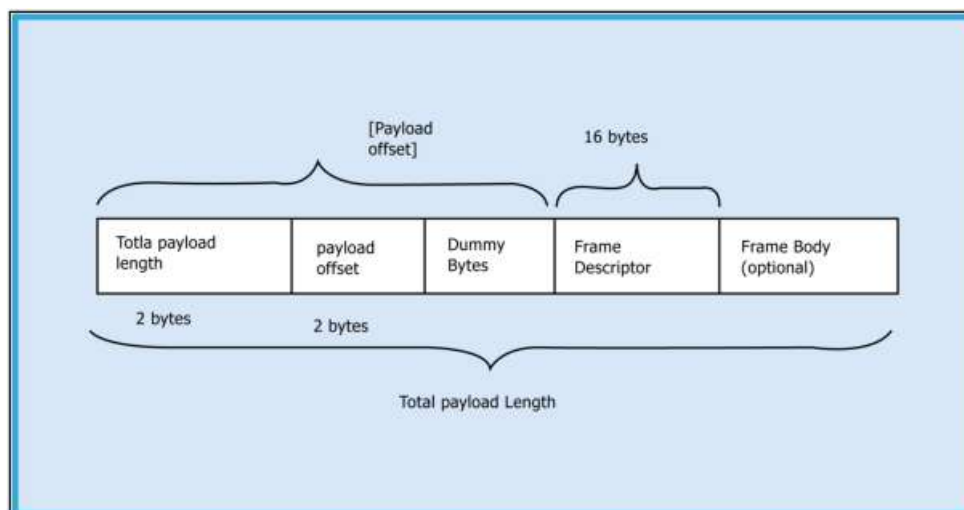


Figure 5-15: RX Frame Format

Note:

If Payload offset is 'x', 'x-4' dummy bytes will be added before Frame Descriptor.

The host should follow the steps below to read the frame from the Module:

1. If any Data / Management packet is pending from the module, module raises an interrupt to HOST.
2. The host needs to check the reason for interrupt by reading interrupt status register using register read.
3. If data pending bit is set in interrupt status register, follow the steps below:
 - a. Read 4 bytes using Frame read.
 - b. Decode Total payload length and payload offset.

Read remaining payload by sending Frame to read with (total payload length – 4 bytes), discard Dummy bytes and then decode Frame descriptor and Frame Body.

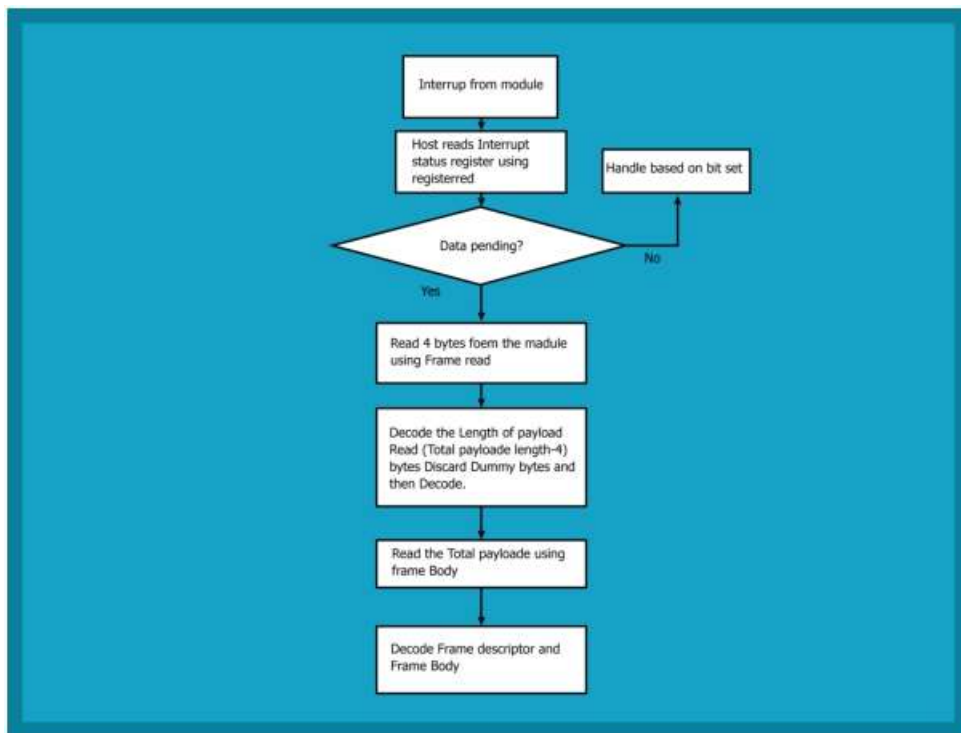


Figure 5-16: RX Operation from Module to Host

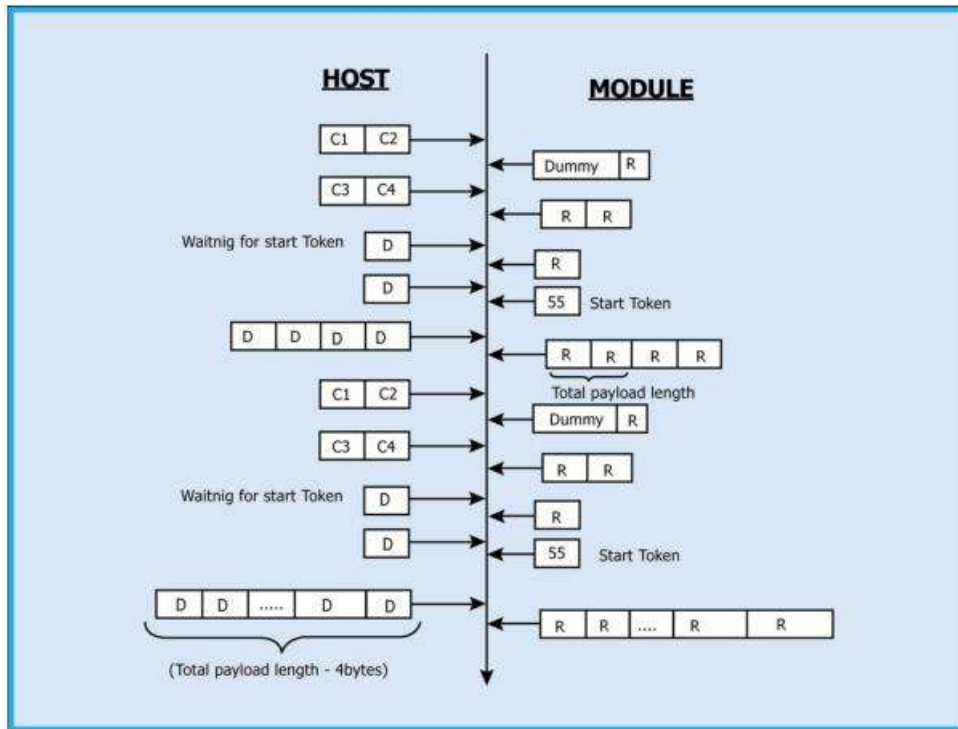


Figure 5-17: Message exchanges between Host and Module for Rx operation

5.4 Commands

The SPI Interface supports binary commands only. To learn more about binary commands, consult the section [Binary Command Mode](#).

6 UART Interface

The UART on the RYWB116 is used as a host interface to configure the module to send data and also to receive data.

6.1 Features

- Supports hardware (RTS/CTS) flow control.
- Supports following list of baud rates
 - 9600 bps
 - 19200 bps
 - 38400 bps
 - 57600 bps
 - 115200 bps
 - 230400 bps
 - 460800 bps
 - 921600 bps

Note:

921600 bps is supported only if hardware flow control is enabled.

6.2 Hardware Interface

The UART interface on the RYWB116 transmits/receives data to/from the Host in UART mode. The RYWB116 uses TTL serial UART at an operating voltage of 3.3V.

The Host UART device must be configured with the following settings:

- Data bits - 8
- Stop bits - 1
- Parity - None
- Flow control - None

6.3 Software Protocol

6.3.1 AT+ command mode

This section explains the procedure that the host needs to follow in order to send Wi-Fi commands frames to the module and to receive responses from the module in AT+ command mode.

TX Operation

The Host uses TX operations:

1. To send management commands to the module from the Host
2. To send actual data to the module which is to be transmitted onto the air
3. If the host receives error code indicating packet dropped, the host has to wait for a while and send the next command /data
4. The host should send next data packet only if it receives "OK<number of bytes sent>" response for the previous one

Rx Operation

RYWB116 responds with either an 'OK' or 'ERROR' string, for Management or Data frames along with a result or error code.

6.3.2 Binary command mode

This section explains the procedure that the host needs to follow in order to send Wi-Fi commands frames to the module and to receive responses from the module.

TX Operation

The Host uses TX operations:

1. To send management commands to the module from the Host
2. To send actual data to the module which is to be transmitted onto the air
3. If the host receives error code indicating packet dropped, the host has to wait for a while and send the next command /data
4. The host should send next data packet only if it receives ACK frame for the previous one

The host should follow the steps below to send the command frames to the Module:

1. First, it is required to send 16 byte Frame descriptor using Frame write.
Second, it is required to send optional Frame body using Frame write.

RX Operation

RYWB116 responds with the frame of same frame type with or with an error code in the error code field.

The Host uses this operation:

- module's responses, for the commands
- To read data received by the module from the remote peer.
- Receives asynchronous information from the RYWB116

The module sends the response/received data to Host in a format as shown below:

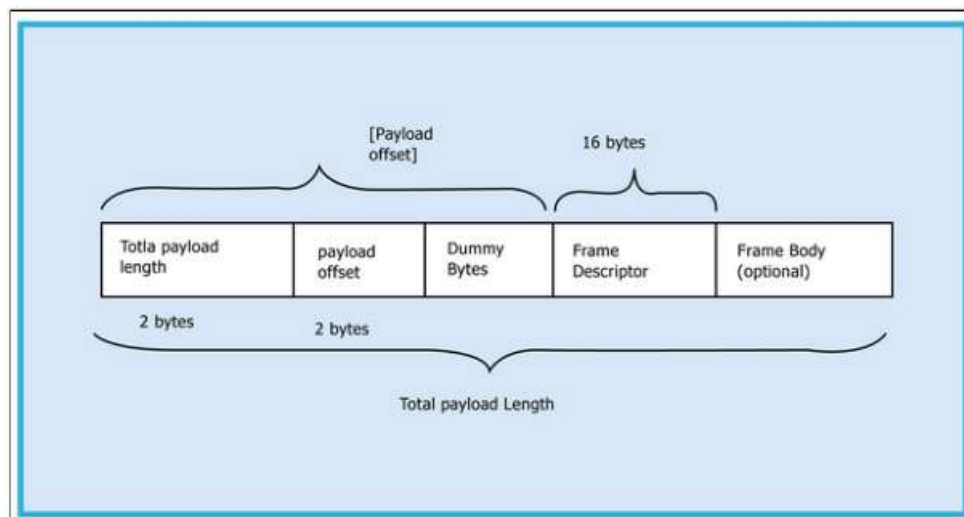


Figure 6-1: RX Frame format

Note:

If Payload offset is 'x', 'x-4' dummy bytes will be added before Frame Descriptor.

The host should follow the steps below to read the frame from the Module:

Read 4 bytes using Frame read.

1. Decode Total payload length and payload offset.

2. Read remaining payload by sending Frame to read with (total payload length – 4 bytes), discard Dummy bytes and then decode Frame descriptor and Frame Body.

6.4 Commands

UART mode supports both AT and binary commands. To learn about AT Commands, see [AT Command Mode](#). To learn about Binary Commands, see [Binary Command Mode](#). For concrete examples of AT commands over UART, consult, [Appendix A](#).

7 USB Interface

RYWB116 supports USB interface which allows the host to configure and send/receive data through the module via USB.

7.1 Features

- USB 2.0 (USB-HS core)
 - a. USB 2.0 offers the user a longer bandwidth with increasing data throughput.
 - b. USB 2.0 supports additional data rate of 480 Mbits/Sec in addition to 1.5Mbits/Sec and 12 Mbits/Sec.
- Supports USB-CDC

7.2 Hardware Interface

USB mode uses the standard USB 2.0 interface.

7.3 Software Protocol

This section explains the procedure of how to configure and send the Wi-Fi commands to the module and receive a response from the module using USB.

RYWB116 supports two modes by using the USB interface.

- USB mode
- USB CDC mode

7.3.1 USB Mode

In USB mode all Wi-Fi command frame formats (Frame Descriptor), Command ID's / response ID's and Error codes are exactly the same as Wi-Fi SPI commands.

RYWB116 USB interface support 2 endpoints:

- Control endpoint: control endpoint used during enumeration process.
- Bulk endpoint: Bulk endpoint used to send/receive data between host and module through USB interface.

In USB mode the transfer of command/data packets from the host to the module (Tx packet) required headroom as shown in the figure below:

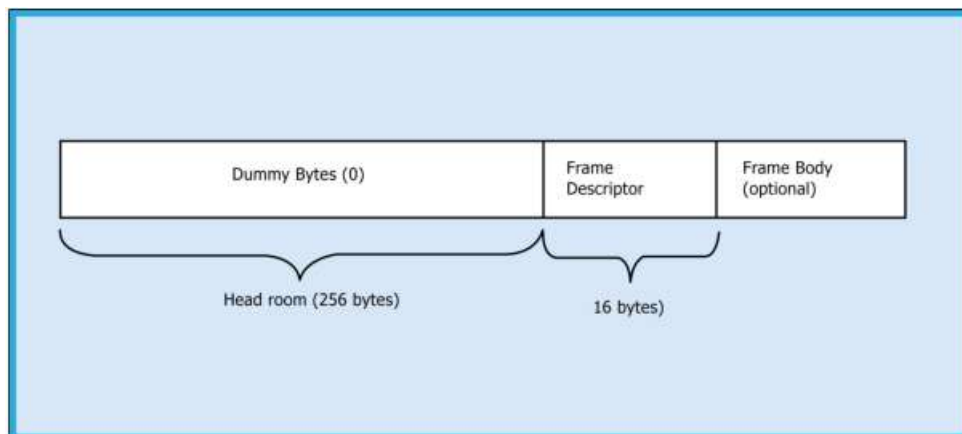


Figure 7-1: Command/Data Packet format from host to the module in USB mode

Note:

Head room size 256 bytes.

In receive path first 4 bytes contain total packet length and descriptor offset. Frame Descriptor starts at descriptor offset location from packet start.

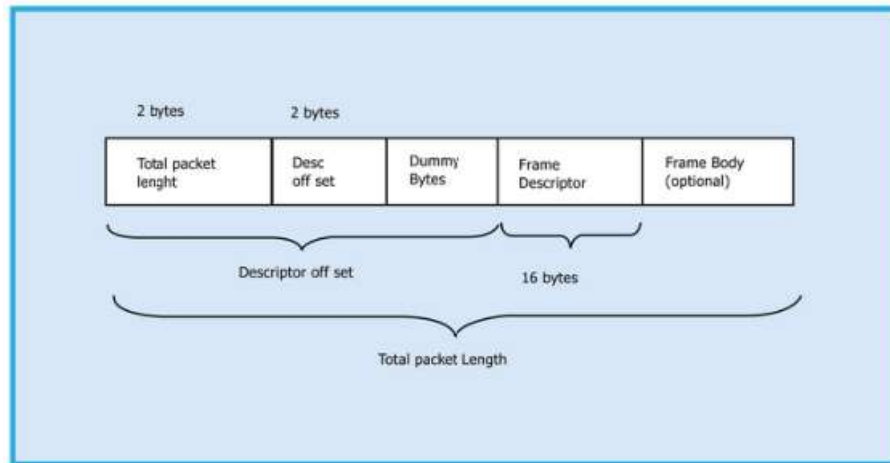


Figure 7-2: Command/Data Packet format from module to host in USB mode

Operations through USB interface:

This section explains the procedure to be followed by the host to send Wi-Fi command frame to the module and to receive a response from the module.

A. TX operation

Following are the sequence of steps to be followed to send command frame to the module through USB interface.

- Prepare command frame with headroom as shown in figure 54: Command/Data Packet format from host to the module in USB mode.
- Forward packet to the module.

B. RX operation

Following are the sequence of steps to be followed in order to receive a response from the module. Send an empty buffer from the host.

After receiving the packet from the module, extract the frame by ignoring the process of the Frame Descriptor and Frame Body accordingly.

7.3.2 USB CDC-ACM Mode

The USB interface in the mode corresponds to the CDC-ACM class and presents itself as a USB Device to the Host USB. In order to communicate with the module, the user should install a driver file (provided with the software package) in the Host.USB-CDC follows the same command structure as UART Software Protocol

USB CDC-ACM mode usage:

A sample flow is provided below to use the module with a PC's USB interface.

1. Connect the module's USB CDC port to USB interface of the PC. The PC prompts for installing the USB-CDC driver. Install the driver file from RS9116.WC.GENR.x.x.x\utils\usb_cdc\rsi_usbcdc.inf. The file needs to be installed only once.
2. Power cycle the module. Check the list in "Ports" in the Device Manager Settings of the PC. It should show the device as "RSI WSC Virtual Com Port" on Windows 8 and below.
3. On Windows 10 and above there is default serial driver and it comes up as "USB Serial Device (COMxx)".

7.4 Commands

USB mode supports binary commands only. USB-CDC mode supports both AT and binary commands. To learn about AT Commands, see [AT Command Mode](#). To learn about Binary Commands, see [Binary Command Mode](#).

8 Command Mode Selection

This section describes the AT command mode or Binary mode selection in UART and USB-CDC.

The command mode type is selected by the user either AT command mode or Binary mode through bootloader options.

The module reads the command type from the Flash Memory Controller and parses the commands respectively.

Once the mode is selected, it will remain in the same mode until it is switched to the other mode. By default, the module remains in AT command mode.

9 AT Command Mode

The Wi-Fi AT command set represents the frames that are sent from the Host to operate RYWB116. The command set resembles the standard AT command interface used for modems.

- All AT commands start with "at" and are terminated with a carriage return('\r') and a new line('\n') character.
- The AT command set for the RYWB116 starts with "at+rsi_" followed by the name of the command and any relevant parameters.
- In some commands, a '?' character is used after the command to query data from the module.

[Appendix A: Sample Flow of Commands for Wi-Fi over UART](#) captures the sample flow of commands to configure the module in various functional modes.

Syntax of AT command:

```
at+rsi_<command_name>[=][parameters][?]\r\n
```

Example:

```
at+rsi_command=< parameter1 >,< parameter2 >,< parameter3 >\r\n
```

Each parameter should be separated by comma (.).

Note:

1. All commands are issued from Host to module as a sequence of ASCII characters. All return messages from module to Host consist of OK or ERROR strings, along with some return parameters. The return parameters may be ASCII or Hex on a case by case basis. ERROR is accompanied by <Error code>.
2. A command should NOT be issued by the Host before receiving the response of a previously issued command from the module.

RYWB116 support following host interface in AT Command mode:

- UART
- USB-CDC

The following protocols are supporting AT Command mode

- WLAN
- BT/BLE

10 Binary Command Mode

This section explains the Wi-Fi commands that are used to configure RYWB116 in Binary Mode. Following are list of host interfaces supported in Binary Mode:

- UART
- SPI
- USB
- USB-CDC
- SDIO

The Wi-Fi configuration and operation commands are sent to the module and the responses are read from the module by using frame write/frame read (as mentioned in the preceding sections) so these configuration and operation commands are called as command frames.

The command frame is categorized as management or data frames. The management frames are used to configure the Wi-Fi module to access Wi-Fi connectivity, TCP/IP stack and operate the module. Data frames are used to send the data.

Management and data frames are exchanged between the host and module. Management frame is sent from Host to the module to configure the module, and also is sent from module to host to send responses to these commands.

The format of the command frames are divided into two parts:

1. Management/Data Frame descriptor
2. Management/Data Frame Body

Management/Data Frame Descriptor (16 bytes)	Management/Data Frame Body
---	----------------------------

Note:

Management/Data Frame Body (variable length) should be the multiples of 4 bytes in the case of SPI interface.

The following is the frame format for management and data frames in Binary Command Mode. The command frame format is shown below. This description is for a Little Endian System.

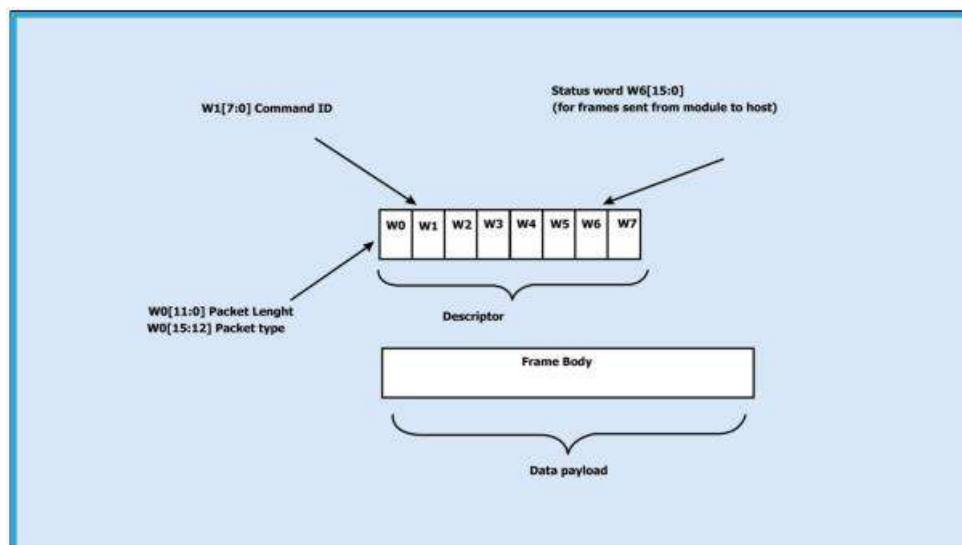


Figure 10-1: Command Frame Format

The following table provides the general description of the frame descriptor for management and data frames.

Word	Management Frame Descriptor	Management Frame Descriptor Data Frame Descriptor
Word0 W0[15:0]	Bits [11:0] – Length of the frame Bits [15:12] – 4 (indicate management packet).	Bits [11:0] – Length of the frame Bits [15:12] – 5 (indicate data packet)
Word1 W1[15:0]	Bits [7:0] - Command ID. Bits[15:8]-Reserved	Bits [7:0] – 0x0 Datatype. Note: Anything other than 0x0 is a management packet. Bits[15:8]-Reserved
Word2 W2[15:0]	Reserved	Reserved
Word3 W3[15:0]	Reserved	Reserved
Word4 W4[15:0]	Reserved	Reserved
Word5 W5[15:0]	Reserved	Reserved
Word6 W6[15:0]	1. (0x0000) when sent from the host to module. 2. When sent from module to host (as response frame), it contains the status.	Reserved
Word7 W7[15:0]	Reserved	Reserved

Table 10-1: Frame Descriptor for Management/Data Frames in Binary Mode

The management frames represent the command frames that are sent from the Host to the RYWB116 to configure for Wi-Fi access. These are frame write commands. The following are the types of management requests and responses and the corresponding codes. The first table below is applicable when the Host sends the frames to the module; the second table below is applicable when the module sends the frames to the host. The corresponding code is to be filled in W1 [7:0] mentioned in the table above.

Command	Command ID
Send Data	0x00
Set Operating Mode	0x10
Band	0x11
Init	0x12
Scan	0x13
Join	0x14
Power save mode	0x15
Sleep Timer	0x16
Set Mac address	0x17
Query Network Parameters	0x18
Disconnect	0x19

Command	Command ID
Antenna Select	0x1B
Soft Reset	0x1C
Set region	0x1D
Config Save	0x20
Config Enable	0x21
Config Get	0x22
User Store configuration	0x23
AP config	0x24
Set WEP Keys	0x25
Ping command	0x29
RSSI Query	0x3A
Multicast Address Filter	0x40
Set IP Parameters	0x41
Socket Create	0x42
Socket Close	0x43
DNS Resolution	0x44
Query LTCP Connection Status	0x46
Query WLAN Connection Status	0x48
Query Firmware Version	0x49
Get MAC Address	0x4A
Configure P2P	0x4B
Configure EAP	0x4C
Set Certificate	0x4D
Query GO Param	0x4E
Load Web pages	0x50
HTTP GET	0x51
HTTP POST	0x52
HTTP CLIENT PUT	0x53
DNS Server	0x55
URL response	0x56
FWUP REQ OK	0x5A
BG scan	0x6A
HT Caps REQ	0x6D
Rejoin params	0x6F
WPS method REQ	0x72
Roam Params REQ	0x7B
PER MODE REQ	0x7C
Webpage Clear REQ	0x7F
SNMP Get response	0x83
SNMP Get next response	0x84
SNMP ENABLE	0x85
SNMP TRAP	0x86
SNMP_GET_STATS	0x88
IPv6 Config	0x90
Trigger Autoconfiguration	0x91
WMM PS REQ	0x97
Firmware upgradation from host	0x99

Command	Command ID
Webpage Erase REQ	0x9A
JSON erase REQ	0x9B
JSON create REQ	0x9C
PER Stats REQ	0xA2
Transparent Mode REQ	0xA3
UART flow control	0xA4
Set PSK/PMK REQ	0xA5
Socket Configuration REQ	0xA7
RF current mode configuration	0xAD
Multicast request	0xB1
Sent Bytes on Socket	0xB2
HTTP Abort	0xB3
HTTP Credentials Request	0xB4
Load MFI ie in the beacon	0xB5
Read Authentication certificate	0xB6
IAP coprocessor init	0xB7
Generate MFI authentication signature	0xB8
certificate valid	0xBC
Set Region of Access point	0xBD
FEATURE FRAME	0xC8
PUF Intrinsic key	0xCE
PUF Enroll	0xD0
PUF disable enroll	0xD1
PUF start	0xD2
PUF set key	0xD3
PUF disable set key	0xD4
PUF get key	0xD5
PUF disable get key	0xD6
PUF load key	0xD7
AES Encrypt	0xD8
AES Decrypt	0xD9
AES MAC	0xDA
MDNSD START REQ	0xDB
Power save ACK	0xDE
FTP REQ	0xE2
FTP FILE WRITE REQ	0xE3
SNTP REQ	0xE4
SMTP REQ	0xE6
POP3 Client REQ	0xE7
Set RTC time	0xE9
DHCP USER CLASS REQ	0xEC

Table 10-2: Command IDs for Tx Data Operation

Command	Response ID
Set Operating Mode	0x10

Command	Response ID
Band	0x11
Init	0x12
Scan	0x13
Join	0x14
Power save mode	0x15
Sleep Timer	0x16
Set Mac address	0x17
Query Network Parameters	0x18
Disconnect	0x19
Antenna select	0x1B
Soft Reset	0x1C
Set region	0x1D
Config save	0x20
Config Enable	0x21
Config Get	0x22
User store configuration	0x23
AP Config	0x24
Set WEP Keys	0x25
Ping command	0x29
Async connection accept the request from remote wfd device	0x30
RSSI Query	0x3A
Multicast Address filter	0x40
IP Parameters Configure	0x41
Socket Create	0x42
Socket Close	0x43
DNS Resolution	0x44
Query LTCP Connection Status	0x46
Query WLAN Connection Status	0x48
Query Firmware Version	0x49
Get MAC Address	0x4A
Configure P2P	0x4B
Configure EAP	0x4C
Set Certificate	0x4D
Query GO Params	0x4E
Load webpage	0x50
HTTP GET	0x51
HTTP POST	0x52
HTTP PUT	0x53
Async WFD	0x54
DNS Server	0x55
URL response	0x56
FWUP RSP	0x59
Async TCP Socket Connection Established	0x61
Async Socket Remote Terminate	0x62
URL request	0x64
BG scan	0x6A
HT Caps RSP	0x6D

Command	Response ID
Rejoin params	0x6F
Module state	0x70
WPS method RSP	0x72
Roam Params RSP	0x7B
PER MODE RSP	0x7C
Webpage Clear RSP	0x7F
SNMP GET	0x80
SNMP GET NEXT	0x81
SNMP SET	0x82
SNMP GET RESPONSE RSP	0x83
SNMP GET NEXT RESPONSE RSP	0x84
SNMP ENABLE RSP	0x85
SNMP TRAP RSP	0x86
SNMP_GET_STATS	0x88
Card Ready	0x89
WMM PS RSP	0x97
Webpage Erase RSP	0x9A
JSON erase RSP	0x9B
JSON create RSP	0x9C
JSON Update	0x9D
Config IPv6	0xA1
PER Stats	0xA2
Transparent Mode RSP	0xA3
UART flow control RSP	0xA4
Set PSK/PMK RSP	0xA5
Socket Configuration RSP	0xA7
IP Change notify	0xAA
TCP ACK indication to host	0xAB
Delayed ACK for UART	0xAC
binary mode	
RF current mode configuration	0xAD
Multicast response	0xB1
HTTP Abort	0xB3
HTTP Credentials	0xB4
Load MFI ie in beacon	0xB5
Read Authentication certificate	0xB6
IAP coprocessor init	0xB7
Generate MFI authentication signature	0xB8
certificate valid	0xBC
Set Region of Access point	0xBD
Station connected Indication	0xC2
Station Disconnected Indication	0xC3
Feature Frame	0xC8
PUF intrinsic key	0xCE
PUF Enroll	0xD0
PUF disable enroll	0xD1
PUF start	0xD2

Command	Response ID
PUF set key	0xD3
PUF disable set key	0xD4
PUF get key	0xD5
PUF disable set key	0xD6
PUF load key	0xD7
AES Encrypt	0xD8
AES Decrypt	0xD9
AES MAC	0xD4
Wakeup indication	0xDD
Sleep indication	0xDE
Receive data	Ignore the response ID field while receiving data from a remote terminal
MDNSD START RSP	0xDB
FTP RSP	0xE2
FTP FILE WRITE RSP	0xE3
SNTP RSP	0xE4
SNTP SERVER RSP	0xE5
POP3 Client RSP	0xE7
POP3 Client terminate RSP	0xE8
RTC time response	0xE9
HTTP POST DATA	0xEB
DHCP USER CLASS RSP	0xEC
DNS Update	0xED
OTAF	0xEF

Table 10-3: Response IDs for Rx Operation

11 WLAN Commands

The following sections will explain RYWB116 commands, their structures, their responses and relevance in AT mode and Binary mode.

11.1 Set Operating Mode

Description:

This is the first command that needs to be sent from the Host after receiving card ready frame from the module. This command configures the module in different functional modes.

Command Format:

AT Mode:

```
at+rsi_opermode= <oper_mode >,<feature_bit_map>,<tcp_ip_feature_bit_map>,<custom_feature_bit_map>,<ext_custom_feat
ure_bit_map>,<
bt_feature_bit_map>,<ext_tcp_ip_feature_bit_map>,<ble_feature_bit_map>\r\n
```

0 - Wi-Fi Client Mode.

Note:

ext_custom_feature_bit_map gets enabled when BIT(31) is set to '1' in custom_feature_bitmap

```
at+rsi_opermode=<oper_mode>,<feature_bit_map>,<tcp_ip_feature_bit_map>,<custom_feature_bitmap>,<ext_cus
tom_feature_bit_map>\r\n
```

ext_tcp_ip_feature_bit_map gets enabled when BIT(31) is set to '1' in tcp_ip_feature_bit_map

```
at+rsi_opermode=<oper_mode>,<feature_bit_map>,<tcp_ip_feature_bit_map>,<custom_feature_bitmap>,<ext_tcp
_ip_feature_bit_map>\r\n
```

bt_feature_bit_map gets enabled when BIT(31) is set to '1' in both custom_feature_bit_map and ext_custom_feature_bit_map

```
at+rsi_opermode=<oper_mode>,<feature_bit_map>,<tcp_ip_feature_bit_map>,<custom_feature_bitmap>,<ext_cus
tom_feature_bit_map>,<bt_feature_bit_map>\r\n
```

ble_feature_bit_map gets enabled when BIT(31) is set to 1 in custom_feature_bitmap, ext_custom_feature_bit_map and bt_feature_bit_map

```
at+rsi_opermode=<oper_mode>,<feature_bit_map>,<tcp_ip_feature_bit_map>,<custom_feature_bitmap>,<ext_cus
tom_feature_bit_map>,<bt_feature_bit_map>,<ext_tcp_ip_feature_bit_map>,<ble_feature_bit_map>\r\n
```

Binary Mode:

The structure of the payload is outlined below:

```
typedef struct
{
uint32 oper_mode;
uint32 feature_bit_map;
uint32 tcp_ip_feature_bit_map;
uint32 custom_feature_bit_map;
uint32 ext_custom_feature_bit_map;
uint32 bt_feature_bit_map;
uint32 ext_tcp_ip_feature_bit_map;
uint32 ble_feature_bit_map;
} operModeFrameSnd;
```

Command Parameters:

Oper_mode:

Sets the mode of operation. oper_mode contains two parts <wifi_oper_mode, coex_mode>. Lower two bytes represent wifi_oper_mode and higher two bytes represent coex_modes.

```
oper_mode = ((wifi_oper_mode) | (coex_mode << 16))
```

Wi-Fi_oper_mode values:

- 0 - Wi-Fi Client Mode.
The module works as a normal client that can connect to an Access Point with different security modes other than enterprise security.
- 1 – Wi-Fi Direct™ or Autonomous GO.
In this mode, the module either acts as a Wi-Fi Direct node or as an Autonomous GO (with intent value 16), depending on the inputs supplied for the command "[Configure Wi-Fi Direct Peer-to-Peer Mode](#)". In Autonomous GO and in Wi-Fi Direct GO mode, a maximum of 4 client devices are supported.
- 2 – Enterprise Security Client Mode.
The module works as a client that can connect to an Access Point with WPA/WPA2-Enterprise security.
- 6 – Access Point mode.
In this mode, the module acts as an Access Point, depending on the inputs supplied for the command "[Configure AP Mode](#)". In Access Point mode, a Maximum of 16 clients can connect based on the bits set in custom feature bit map selection in opermode.
- 8 - PER Mode.
This mode is used for calculating packet error rate and mostly used during RF certification tests.
- 9 – Concurrent mode.
This mode is used to run module in concurrent mode. In concurrent mode, host can connect to a AP and can create AP simultaneously.

Note:

In concurrent mode

4. AP MAC address's last byte will differ and it will be one plus the station mode MAC last byte.
5. In TCP/IP non bypass mode, Broadcast / Multicast packet will go to first created interface (e.g. if Station mode connects first the broadcast / multicast packet will go to the network belonging to station mode).
6. IPV6 support is not present in the current release.
7. In Concurrent mode, aggregation is not supported.

Following table represents the possible coex modes supported:

Coex_mode	Description
1	WLAN
2	ZigBee
3	WLAN + ZigBee
4	Bluetooth
5	WLAN + Bluetooth
6	Bluetooth + Zigbee co-existence*
7	WLAN + Bluetooth + ZigBee co-existence*
8	Dual Mode (Bluetooth and BLE)
9	WLAN + Dual Mode
10	Dual Mode + ZigBee co-existence*
11	WLAN + Dual Mode + ZigBee co-existence*
12	BLE mode
13	WLAN + BLE
14	BLE and ZigBee co-existence*
15	WLAN + BLE + ZigBee co-existence*

* Will be supported in future releases

Table 11-1: Coex Modes Supported

Note:

Coex modes are supported only in 256K memory configuration

To select proper Coex mode, please refer to RYWB116_TCP_IP_Feature_Selection_vx.x.x.xlsx given in "Docs" folder if the release package

Note:

If coex mode is enabled in opermode command, then BT / BLE or ZigBee protocol will start and give corresponding card ready in parallel with opermode command response (which will be handled by corresponding application).
BT card ready frame is described in Embedded-BT-Classic-Software-PRM-vx.x.x.pdf, BLE card ready frame is described in Embedded-BLE-Software-PRM-vx.x.x.pdf and ZigBee card ready frame is described in Embedded-WiseConnect-ZigBee-Software-PRM-vx.x.x.pdf.

feature_bit_map: This bitmap is used to enable following WLAN features:

feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
feature_bit_map[0]	Open mode feature	Disable	Enable	Supported in client mode
feature_bit_map[1]	PSK security	Disable	Enable	Supported in client mode
feature_bit_map[2]	Aggregation	Disable	Enable	
feature_bit_map[3]	LP GPIO hand shake	Disable	Enable	
feature_bit_map[4]	ULP GPIO hand shake	Disable	Enable	
feature_bit_map[5]	Reserved	Reserved	Reserved	
feature_bit_map[6]	Reserved	Reserved	Reserved	

feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
feature_bit_map[7]	WPS support	Enable	Disable	
feature_bit_map[8]	To support EAP-LEAP in WiFi + BT Coex mode	Disable	Enable	
feature_bit_map[9:31]	Reserved. Should set to be '0'			

Note

feature_bit_map[0], feature_bit_map[1] are valid only in Wi-Fi client mode.

tcp_ip_feature_bit_map: To enable TCP/IP related features.

tcp_ip_feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
tcp_ip_feature_bit_map[0]	TCP/IP bypass	Disable	Enable	
tcp_ip_feature_bit_map[1]	HTTP server	Disable	Enable	
tcp_ip_feature_bit_map[2]	DHCPv4 client	Disable	Enable	
tcp_ip_feature_bit_map[3]	DHCPv6 client	Disable	Enable	
tcp_ip_feature_bit_map[4]	DHCPv4 server	Disable	Enable	
tcp_ip_feature_bit_map[5]	DHCPv6 server	Disable	Enable	
tcp_ip_feature_bit_map[6]	Dynamic update of web pages (JSON objects)	Disable	Enable	
tcp_ip_feature_bit_map[7]	HTTP client	Disable	Enable	
tcp_ip_feature_bit_map[8]	DNS client	Disable	Enable	
tcp_ip_feature_bit_map[9]	SNMP agent	Disable	Enable	
tcp_ip_feature_bit_map[10]	SSL	Disable	Enable	
tcp_ip_feature_bit_map[11]	PING from module (ICMP)	Disable	Enable	
tcp_ip_feature_bit_map[12]	HTTPS Server	Disable	Enable	Only supported in opermode 0
tcp_ip_feature_bit_map[13]	Set to 0.			
tcp_ip_feature_bit_map[14]	To send configuration details to host on submitting configurations on wireless configuration page	Disable	Enable	

tcp_ip_feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
tcp_ip_feature_bit_map[15]	FTP client	Disable	Enable	
tcp_ip_feature_bit_map[16]	SNTP client	Disable	Enable	
tcp_ip_feature_bit_map[17]	IPv6 mode	Disable	Enable	IPv6 will also get enabled if DHCP v6 client/DHCP v6 server is enabled irrespective of tcp_ip_feature_bit_map[17]
tcp_ip_feature_bit_map[18]	RAW Socket feature	Disable	Enable	This feature is supported only in AP mode. TCP_BYPASS feature should be disabled for this feature to be supported, If any packet from host with frame type 0x1 is received by firmware, the packet will be sent on air without TCP/ IP stack processing. ARP and broadcast packets (other than DHCP packets) which are coming on air will be sent to host
tcp_ip_feature_bit_map[19]	To MDNS and DNS-SD	Disable	Enable	
tcp_ip_feature_bit_map[20]	SMTP client	Disable	Enable	
tcp_ip_feature_bit_map[21:24]	To select no of sockets			
tcp_ip_feature_bit_map[25]	Single SSL socket	Disable	Enable	
tcp_ip_feature_bit_map[26]	Private & Public certificate	Disable	Enable	If Secure handshake is with CA – certificate alone, then disable loading private and public keys and erase these certificates from the flash using load_cert API. Or if Secure handshake is needed for verification of Private and Public keys, then enable loading of private and public keys.
tcp_ip_feature_bit_map[27]	SSL certificate on to the RAM	Disable	Enable	

tcp_ip_feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
tcp_ip_feature_bit_map[29]	POP3 client	Disable	Enable	
tcp_ip_feature_bit_map[30]	To enable OTAF(On The Air Firmware) up gradation.	Disable	Enable	
tcp_ip_feature_bit_map[31]	tcp_ip_ext_feature_bitmap validity	Disable	Enable	

Note:

Feature selection utility is provided in the package. RYWB116 supports the selected features combination only if it is feasible according to the [RYWB116_TCPIP_Feature_Selection_vx.x.x.xlsx](#)

custom_feature_bit_map:This bitmap is used to enable following custom features

custom_feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
custom_feature_bit_map[2]	If this bit is set to '1', the DHCP server behavior, when the module is in AP mode, changes. The DHCP server, when it assigns IP addresses to the client nodes, does not send out a Gateway address, and sends only the assigned IP and Subnet values to the client. It is highly recommended to keep this value at '0' as the changed behavior is required in only very specialised use cases and not in normal AP functionality. The default value of this bit is '0'.			
custom_feature_bit_map[5]	Hidden SSID in AP mode	Disable	Enable	
custom_feature_bit_map[6]	DNS server IP address in DHCP offer response in AP mode.	Disable	Enable	
custom_feature_bit_map[8]	DFS channel passive scan support	Disable	Enable	

custom_feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
custom_feature_bit_map[10]	Asynchronous messages to host to indicate the module state.	Disable	Enable	
custom_feature_bit_map[11]	Packet pending (Wake on Wireless) indication in UART mode	Disable	Enable	
custom_feature_bit_map[12]	AP blacklist feature in client mode during roaming or rejoin. By default module maintains AP blacklist internally to avoid some access points.	Disable	Enable	
custom_feature_bit_map[13:16]	Used to set the maximum number of stations or client to support in AP or Wi-Fi Direct mode. The possible values are 1 to 16 in AP mode and 1 to 4 in Wi-Fi Direct mode.			If these bits are not set, default maximum clients supported is set to 4.
custom_feature_bit_map[17]	To select between de-authentication or null data (with power management bit set) based roaming. Depending on selected method station, it will send death or Null data to the connected AP when roaming from connected AP to the newly selected AP.	Disable	Enable	
custom_feature_bit_map[18]	Reserved			
custom_feature_bit_map[19]	Reserved			
custom_feature_bit_map[20]	Trigger Auto Configuration	Disable	Enable	
custom_feature_bit_map[22]	Used to enable per station power save packet buffer limit in AP mode. When enabled, only two packets per station will be buffered when station is in power save	Disable	Enable	
custom_feature_bit_map[23]	HTTP/HTTPs authentication	Disable	Disable	

custom_feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
custom_feature_bit_map[24]	Higher clock frequency	Disable	Disable	
custom_feature_bit_map[25]	HTTP server credentials to host in get configuration command	Disable	Enable	
custom_feature_bit_map[26]	To accept or reject new connection request when maximum clients are connected in case of LTCP.	Disable	Enable	<p>By default this bit value is zero.</p> <p>When BIT[26] is zero: For a LTCP socket when maximum clients are connected if a new connection request is received, then this connection request will not be rejected. Instead module will maintain this connection request in LTCP pending list.</p> <p>This request will be served when any of the connected client is disconnected.</p> <p>When BIT[26] is set: For a LTCP socket when maximum clients are connected if a new connection request is received, then this connection request will be rejected immediately. Module will not maintain this connection request in LTCP pending list.</p>
custom_feature_bit_map[27]	Dual band roaming and vcsafd feature	Disable	Enable	
custom_feature_bit_map[28]	Real time clock from host	Disable	Enable	
custom_feature_bit_map[29]	IAP support in BT mode	Disable	Enable	
custom_feature_bit_map[31]	ext_custom_feat_bitmap validity	Disable	Enable	

Info:

BIT[0:1],BIT[3:4],BIT[7],BIT[21], BIT[30]: Reserved, should be set to all '0'.

Note:

For UART / USB-CDC in AT mode:

When user does not give any tcp_ip_feature_bit_map value then default settings for client mode, Enterprise client mode, WiFi-Direct mode are as follows:

HTTP server, DHCPv4 client, DHCPv6 client and JSON objects are enabled.

When user does not give any tcp_ip_feature_bit_map value then default settings for Access point mode are:

HTTP server, DHCPv4 server, DHCPv6 server and JSON objects are enabled.

Parameters- feature_bit_map, tcp_ip_feature_bit_map and custom_feature_bit_map are optional in opermode command in UART mode for AT mode.

If user does not give these parameters then default configuration gets selected, as explained above, based upon the operating mode configured.

If opermode is 8 (PER mode is selected) - feature_bit_map, tcp_ip_feature_bit_map and custom_feature_bit_map can be ignored or not valid. Set to zero.

ext_custom_feature_bit_map:

This feature bitmap is an extension of custom feature bitmap and is valid only if BIT[31] of custom feature bitmap is set. This enables the following feature.

ext_custom_feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
ext_custom_feature_bit_map[0]	Antenna diversity feature.	Disable	Disable	
ext_custom_feature_bit_map[1]	4096 bit RSA key support	Disable	Disable	This bit is required to set for 4096 bit RSA key support. If key size is 4096 bit, module will use software routine for exponentiation, so connection time will increase.
ext_custom_feature_bit_map[3]	SSL certificate with 4096 bit key support	Disable	Enable	
ext_custom_feature_bit_map[4]	This bit is applicable only in AP and concurrent AP mode. If this bit is set, the module will send broadcast data (if any) immediately without waiting for DTIM.	Disable (AP sends broadcast packet at DTIM only.)	Enable (Enable sending broadcast without waiting for DTIM)	If this bit is enable then connected client who is in power save may miss the packet.
ext_custom_feature_bit_map[5]	Pre authentication Support.	Disable	Enable	
ext_custom_feature_bit_map[6]	40MHZ Support	Disable	Enable	
ext_custom_feature_bit_map[9]	EXT_HTTP_SKIP_DEFAULT_LEADING_CHARACTER To skip default leading character ("\\") in resource name			

ext_custom_feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info															
ext_custom_feature_bit_map[11]	802.11R Over the Air Roaming Support	Disable	Enable	1.Resource Request Support is not Present. 2 If both BIT[11] and BIT[16] are not enabled then it will select as Legacy Roaming.															
ext_custom_feature_bit_map[12]	802.11J support.	Disable	Enable	If this bit is enable, set region command is mandatory with setting it to Japan region and band value must be 1 (5GHz).															
ext_custom_feature_bit_map[13]	802.11W support.	Disable	Enable																
ext_custom_feature_bit_map[14]	TLS Multiple versions Support in SSL.	Disable	Enable																
ext_custom_feature_bit_map[15]	Support 16 Stations in AP Mode.			If this bit is enable then 16 stations can connect in AP mode otherwise Maximum of 8 stations can connect.															
ext_custom_feature_bit_map[16]	802.11R Over the Distributed System Roaming Support			1. Resource Request Support is not Present. 2. If both BIT[11] and BIT[16] are not enabled then it will select as Legacy Roaming.															
ext_custom_feature_bit_map[19]	Low power mode in GPIO based or M4 based ULP power save																		
ext_custom_feature_bit_map[20:21]	Default memory configuration (RAM) is 192KB. User can set these bits to change the memory configuration as below:																		
	<table border="1"> <thead> <tr> <th>MODE(KB)</th> <th>BIT[20]</th> <th>BIT[21]</th> </tr> </thead> <tbody> <tr> <td>192</td> <td>0</td> <td>0</td> </tr> <tr> <td>256</td> <td>0</td> <td>1</td> </tr> <tr> <td>320</td> <td>1</td> <td>0</td> </tr> <tr> <td>384*</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	MODE(KB)	BIT[20]	BIT[21]	192	0	0	256	0	1	320	1	0	384*	1	1			
MODE(KB)	BIT[20]	BIT[21]																	
192	0	0																	
256	0	1																	
320	1	0																	
384*	1	1																	
	* 384k memory configuration is applicable only in RYWB116 product mode.																		
ext_custom_feature_bit_map[22:26]	Reserved																		

ext_custom_feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
ext_custom_feature_bit_map[27]	To select UART port for NWP (Networking Processor) debug prints	Disable	Enable (Enable debug prints on UART 1 and is applicable only if Host Interface is not UART)	<p>UART 1 pins are mapped to the following pins w.r.t to NWP. User needs to ensure that these pins are not used in MCU applications to avoid conflicts of pins usage based on the requirement. This bit is valid only if BIT[28] in ext_custom_feature_bit_map is set to 0.</p> <p>UART 1 - TX: GPIO_9 RX: GPIO_8</p> <p>There is no functionality on rx pins for debug prints.</p>
ext_custom_feature_bit_map[28]	UART debug prints from NWP	Disable (Enable debug prints)	Enable (Disable debug prints on UART1)	<p>By default this bit value is zero.</p> <p>When BIT[26] is zero: For a LTCP socket when maximum clients are connected if a new connection request is received, then this connection request will not be rejected. Instead module will maintain this connection request in LTCP pending list.</p> <p>This request will be served when any of the connected client is disconnected.</p> <p>When BIT[26] is set: For a LTCP socket when maximum clients are connected if a new connection request is received, then this connection request will be rejected immediately. Module will not maintain this connection request in LTCP pending list.</p>

ext_tcp_ip_feature_bit_map

ext_tcp_ip_feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
ext_tcp_ip_feature_bit_map[1]	DHCP USER CLASS	Disable	Disable	
ext_tcp_ip_feature_bit_map[2]	HTTP server root path bypass	Disable	Disable	
ext_tcp_ip_feature_bit_map[3]	Correcting the ACK sequence number in the TCP packet retransmission path	Disable	Enable	
ext_tcp_ip_feature_bit_map[4]	To enable TCP ACK division factor feature	Disable	Enable	
ext_tcp_ip_feature_bit_map[5]	To enable SSL server certificate validation by host.	Disable	Enable	
ext_tcp_ip_feature_bit_map[7]	To enable DNS_CLIENT_BYPASS by host	Disable	Enable	

bt_feature_bit_map

This bitmap is valid only if BIT[31] of extended custom feature bit map is set.

bt_feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
bt_feature_bit_map[0-14]	Reserved			
bt_feature_bit_map[15]	HFP profile bit enable	Disable	Disable	
bt_feature_bit_map[16:19]	Reserved for future use			
bt_feature_bit_map[20:22]	number of slaves supported by BT			Maximum no of bt slaves: 1
bt_feature_bit_map[23]	A2DP profile bit enable	Disable	Enable	
bt_feature_bit_map[24]	A2DP profile role selection	Disable	Enable	
bt_feature_bit_map[25]	A2DP accelerated mode selection	Disable	Enable	
bt_feature_bit_map[26]	A2DP i2s mode selection	Disable	Enable	
bt_feature_bit_map[27:29]	Reserved			
bt_feature_bit_map[30]	RF Type selection	Disable	Enable	
bt_feature_bit_map[31]	Validate ble feature bit map	Disable	Enable	

ble_feature_bit_map

This bitmap is valid only if BIT[31] of bt custom feature bit map is set.

ble_feature_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
ble_feature_bit_map[0:7]	BLE nbr of attributes,			Maximum No of Ble attributes = 80, Please refer NOTE given below for more info
ble_feature_bit_map[8:11]	BLE Nbr of GATT services			maximum no services - 10 Please refer NOTE given below for more info
ble_feature_bit_map[12:15]	BLE Nbr of slaves			Maximum No of Ble slaves = 8 Please refer NOTE given below for more info
ble_feature_bit_map[16:23]	BLE tx power index			Give 31 as ble tx power index (eg: 31<<16) This variable is used to select the ble tx power index value.The following are the possible values. Default Value for BLE Tx Power Index is 31 Range for the BLE Tx Power Index is 1 to 75 (0, 32 index is invalid) 1 - 31 BLE -0DBM Mode 33 - 63 BLE- 10DBM Mode 64-75 BLE - HP Mode.
ble_feature_bit_map[24:26]	BLE powersave options BLE_DUTY_CYCLING BIT(24) BLR_DUTY_CYCLING BIT(25) BLE_4X_PWR_SAVE_MODE BIT(26)			
ble_feature_bit_map[27:29]	Reserved			
ble_feature_bit_map[30]	RYWB116 compatible features	Disable	Enable	
ble_feature_bit_map[31]	Reserved			

Note:

If bit `bt_custom_feature_bit_map[31]` is set:

1. User can enter maximum of 8 BLE slaves.
2. Maximum of 10 services in total can exist out of which two services namely GAP and GATT are added by default. So if this bitmap has value 10 user can add upto 8 services.
3. Maximum of 80 attributes in total can exist out of which ten attributes of GAP and GATT are added by default. So if this bitmap has value 80 user can add upto 70 attributes.

If bit `bt_custom_feature_bit_map` is not set:

1. Default number of BLE slaves supported is 3.
2. Maximum of 5 services in total can exist out of which two services namely GAP and GATT are added by default. So user can add upto 3 services.
3. Maximum of 20 attributes in total can exist out of which ten attributes of GAP and GATT are added by default. So user can add upto 10 attributes.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

There is no response payload for this command.

Possible error codes:

Possible error codes are 0x0021,0x0025,0xFF73,0x002C,0xFF6E,0xFF6F,0xFF70,0xFFC5.

Example:

AT Mode:

When only `oper_mode` is given in command:

```
at+rsi_opermode=1\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6F 0x70 0x65 0x72 0x6D 0x6F 0x64 0x65 0x3D 0x31 0x0D 0x0A
```

Response:

```
OK\r\n
0x4F 0x4B 0x0D 0x0A
```

When other parameters along with `mode_val` is given in `opermode` command:

```
at+rsi_opermode=1,1,2,0\r\n
```

```
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6F 0x70 0x65 0x72 0x6D 0x6F 0x64 0x65 0x3D 0x31 0x2C 0x31 0x2C 0x32 0x2C 0x30
0x0D 0x0A
```

By giving above command module is configured in WFD mode with HTTP server enabled in open mode.

Response:

```
OK\r\n
0x4F 0x4B 0x0D 0x0A
```

11.2 Band

Description:

This command configures the band in which the module has to be configured. This command has to be issued after `opermode` command.

Command Format:

AT Mode:

at+rsi_band=< bandVal >\r\n

Binary Mode:

```
typedef struct {
    uint8 bandVal;
} bandFrameSnd;
```

Command Parameters:

The valid values for the parameter for this command are as follows:

bandVal:

Mode	Functionality
0	2.4 GHz
1	5 GHz
2	Dual band (2.4 Ghz and 5 Ghz)

Note:
Dual band is supported in station mode and WiFi Direct mode

Note:
802.11J support only 5 GHz bandVal

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

There is no response payload for this command.

Possible error codes:

Possible error codes are 0x0005, 0x0021, 0x0025, 0x002C, 0x003c.

Relevance:

This command is relevant in all operating modes.

Example:

AT Mode:

```
at+rsi_ban
d=0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x62 0x61 0x6E 0x64 0x3D 0x30 0x0D 0x0A
```

Response:

```
OK\r\n
0x4F 0x4B 0x0D 0x0A
```

11.3 Set MAC Address

Description:

This command sets the module's MAC address. This command has to be issued before band command.

Command:

AT Mode:

at+rsi_setmac=< macAddr >\r\n

Binary Mode:

```
typedef struct {
    uint8 macAddr[6];
}setMacAddrFrameSnd;
```

Command Parameters:

macAddr – Mac address to be set for module.

Note:

In concurrent mode, given MAC is applied to station mode and AP mode MAC address last byte will differ from station mode MAC. AP mode MAC address last byte will be one plus the station mode MAC address last byte given by host.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

There is no response payload for this command.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C.

Relevance:

This command is relevant in all operating modes.

Example:

AT Mode: at+rsi_setmac=001122334455\r\n

0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x73 0x65 0x74 0x6D 0x61 0x63 0x3D 0x30 0x30 0x31 0x31 0x32 0x32 0x33 0x33
0x34 0x34 0x35 0x35 0x0D 0x0A

Response:

OK\r\n

0x4F 0x4B 0x0D 0x0A

11.4 Init

Description:

This command programs the module's Baseband and RF components and returns the MAC address of the module to the host. This command has to be issued after band command.

Command:

AT Mode:

at+rsi_init\r\n

Binary Mode:

No Payload required.

Command Parameters:

No parameters

Response:

AT Mode:

Result Code	Description
OK<macAddress>	macAddress (6 bytes, Hex)
ERROR<Error code>	Failure

Binary Mode:

```
typedef struct {
    uint8 macAddress[6];
}rsi_initResponse;
```

Response Parameters:

macAddress: The MAC address of the module.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C,0x0002.

Relevance:

This command is relevant in all operating modes

Example:

AT Mode:

```
at+rsi_init\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x69 0x6E 0x69 0x74 0x0D 0x0A
```

Response:

FOR NON CONCURRENT MODE:

```
OK<MAC_Address>\r\n
OK 0x00 0x23 0xA7 0x13 0x14 0x15\r\n
0x4F 0x4B 0x00 0x23 0xA7 0x13 0x14 0x15 0x0D 0x0A
```

FOR CONCURRENT MODE:

Response:

AT Mode:

Result Code	Description
OK <macAddress1> <macAddress2>	macAddress(6 bytes Hex) macAddress(6 bytes Hex)
ERROR<Error code>	Failure

Binary Mode:

```
typedef struct {
    uint8 macAddress1[6];
    uint8 macAddress2[6];
}rsi_initResponse;
```

Response Parameters:

macAddress: The MAC address for two interfaces of the module.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C,0x0002.

Relevance:

This command is relevant in all operating modes

Example:

AT Mode:

```
at+rsi_init\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x69 0x6E 0x69 0x74 0x0D 0x0A
```

Response:

```
OK<MAC_Address1><MAC_Address2>\r\n
OK 0x00 0x23 0xA7 0x13 0x14 0x15 0x00 0x23 0xA7 0x13 0x14 0x16\r\n
0x4F 0x4B 0x00 0x23 0xA7 0x13 0x14 0x15 0x00 0x23 0xA7 0x13 0x14 0x16 0x0D 0x0A
```

11.5 PER Mode

Description:

This command configures the PER (Packet Error Rate) Mode in RYWB116. This command should be issued after Initcommand.

Command Format:

AT Mode:

```
at+rsi_per=<per_mode_enable>,<power>,<rate>,<length>,<mode>,<channel>,<rate_flags>,<aggr_enable>,<no_of_pkts>,<delay>\r\n
```

Binary Mode:

```
typedef struct {
uint8per_mode_enable[2];
uint8power[2];
uint8rate[4];
uint8length[2];
uint8mode[2];
uint8channel[2];
uint8rate_flags[2];
uint8reserved1[2];
uint8aggr_enable[2];
uint8reserved2[2];
uint8no_of_pkts[2];
uint8delay[4];
} perModeFrameSnd;
```

Command Parameters:

per_mode_enable: To enable or disable PER Mode.

0 – disable

1 – enable

power: To set Tx power in dbm.

rate: To set transmit data rate.

Data Rate (Mbps)	Value of rate
1	0
2	2
5.5	4
11	6

Data Rate (Mbps)	Value of rate
6	139
9	143
12	138
18	142
24	137
36	141
48	136
54	140
MCS0	256
MCS1	257
MCS2	258
MCS3	259
MCS4	260
MCS5	261
MCS6	262
MCS7	263

Table 11-2: PER Mode Data Rates

length: To configure length of the tx packet. Valid values are in the range of 24 to 1500 bytes in the burst mode and range of 24 to 260 bytes in the continuous mode

mode: transmit mode

Mode	Functionality
0	Burst Mode
1	Continuous Mode
2	Continuous wave Mode (non modulation) in DC mode
3	Continuous wave Mode (non modulation) in single tone mode (center frequency -2.5MHz)
4	Continuous wave Mode (non modulation) in single tone mode (center frequency +5MHz)

Note:

Before starting Continuous Wave mode, it is required to start Burst mode with power and channel values which is intended to be used in Continuous Wave mode 1.e.

1. Start Burst mode with intended power value and channel values - Pass any valid values for rate and length
2. Stop Burst mode
3. Start Continuous Wave mode.

channel: For setting the channel number in 2.4 GHz/5GHz .

The following tables map the channel number to the actual radio frequency in the 2.4 GHz spectrum.

Channel Numbers (2.4GHz)	Center frequencies for 20MHz channel width(MHz)
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437

Channel Numbers (2.4GHz)	Center frequencies for 20MHz channel width(MHz)
7	2442
8	2447
9	2452
10	2457
11	2462
12	2467
13	2472
14	2484

Table 11-3: Channel Number and Frequencies for 20MHz Channel Width in 2.4GHz

Note:

To support PER mode in 12,13,14 channels, set region command has to be given by the host before PER command.

Channel numbers in 5 GHz range from 36 to 165. The following table map the channel number to the actual radio frequency in the 5 GHz spectrum for 20MHz channel bandwidth.

Channel Numbers (5GHz)	Center Frequencies for 20MHz channel width (MHz)
36	5180
40	5200
44	5220
48	5240
52	5260
56	5280
60	5300
64	5320
100	5500
104	5520
108	5540
112	5560
116	5580
120	5600
124	5620
128	5640
132	5660
136	5680
140	5700
144	5720
149	5745
153	5765
157	5785
161	5805
165	5825

Table 11-4: Channel Number and Frequencies for 20MHz Channel Width in 5GHz

The following tables map the channel number to the actual radio frequency in the 4.9 GHz spectrum for 802.11J.

Channel Numbers (4.9GHz)	Center frequencies for 20MHz channel width(MHz)
184	4920
188	4940
192	4960
196	4980
8	5040
12	5060
16	5080

Note:

802.11J features are valid only when Japan region is set. For other regions even if 802.11J is enabled it has no effect.

rate_flags: Rate flags contain short GI, Greenfield and channel width values. Various fields in rate flags are divided as specified below:

Fields	Short GI	Greenfield	Channel Width	Reserved
Bits:	0	1	2-4	5-15

Table 11-5: Rate Flags

To enable short GI – set rate flags value as '1'

To enable Greenfield – set rate flags value as '2'

Channel width should be set to zero to set 20MHz channel width.

Reserved1: reserved bytes. This field can be ignored. Set '0'

aggr_enable:This flag is for enabling or disabling aggregation support .

Note:

Aggregation feature is supported only in burst mode. This field will be ignored in case of continuous mode.

Reserved2: reserved bytes. This field can be ignored. Set '0'

no_of_pkts: This field is used to set the number of packets to be sent in burst mode. If the value given is 'n' then 'n' number of packets will be sent on air, after that transmission will be stopped. If this field is given as zero(0) then packets will be sent continuously until user stops the transmission. This field will be ignored in case of continuous mode

delay: This field is used to set the delay between the packets in burst mode. Delay should be given in micro seconds. i.e. if the value is given as 'n' then a delay of 'n' micro seconds will be added for every transmitted packet in the burst mode. If this field is set to zero (0) then packets will be sent continuously without any delay. This field will be ignored in case of continuous mode.

Note:

Reserved1, Reserved2 are available only in Binary mode.

Only per_mode_enable , power, rate, length , mode, channel, rate_flags fields are valid. Remaining fields are not supported.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

There is no response payload for this command.

Possible error codes:

Possible error codes are 0x000A,0x0021, 0x0025, 0x002C.

Relevance:

This command is relevant when the module is configured in operating mode 8.

Example:

AT Mode:

To start transmit:

```
at+rsi_per=1,18,139,30,0,1,0,0,0,0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x70 0x65 0x72 0x3D 0x31 0x2C 0x31 0x38 0x2C 0x31 0x33 0x39 0x2C 0x33 0x30
0x2C 0x30 0x2C 0x31 0x2C 0x30 0x2C 0x30 0x2C 0x30 0x2C 0x30 0x0D 0x0A
```

To stop transmit:

```
at+rsi_per=0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x70 0x65 0x72 0x3D 0x30 0x0D 0x0A
```

Response:

```
OK\r\n
0x4F 0x4B 0x0D 0x0A
```

11.6 Configure Wi-Fi Direct Peer-to-Peer Mode

Description:

This command is used to set the configuration information for Wi-Fi Direct mode. After receiving this command, the module scans for Wi-Fi Direct nodes. If any Wi-Fi Direct node is found, it will send the information to the Host. This command has to be issued after initcommand.

Command Format:

AT Mode:

```
at+rsi_wfd=<GOIntent>,<deviceName>,<operChannel>,<ssidPostFix>,<psk>\r\n
```

Binary Mode:

```
typedef struct {
    uint8 GOIntent[2];
    uint8 deviceName[64];
    uint8 operChannel[2];
    uint8 ssidPostFix[64];
    uint8 psk[64];
}configP2pFrameSnd;
```

Command Parameters:

GOIntent: This determines whether the device is intended to form a GO (group owner) or work as a Wi-Fi Direct Peer node. This value is used in the GO negotiation process, when the module negotiates with another Wi-Fi Direct Node on who would become the Group Owner. The valid range of values for this parameter is: 0 to 16. Higher the number, higher is the willingness of the module to become a GO. After the module becomes a GO in Wi-Fi Direct

mode, it appears as an Access Point to the client devices. If the number is between 0 and 15, a GO negotiation takes place. If the value is 16, the module forms an Autonomous GO without negotiating with any other device.

deviceName: This is the device name for the module. The maximum length of this field is 32 characters and the remaining bytes are filled with 0x00. Another Wi-Fi Direct device would see this name when it scans for Wi-Fi Direct nodes.

operChannel: Operating channel to be used in Group Owner or Autonomous GO mode. The specified channel is used if the device becomes a GO or Autonomous GO. The supported channels can be any valid channel in 2.4GHz or 5GHz. If band_val=0 is used in the Band command, then a channel in 2.4 GHz should be supplied to this parameter. If band_val=1 or 2 is used in the Band command, then a channel in 5GHz should be supplied to this parameter. The valid values for this parameter are listed in the [PER Mode](#) section. '0' is NOT a valid value for this parameter.

ssidPostFix: This parameter is used to add a postfix to the SSID in Wi-Fi Direct GO mode and Autonomous GO mode.

If the module becomes a Wi-Fi Direct Group Owner, it would have an SSID with "DIRECT-xy" prefixed to the ssidPostFix parameter. "xy" is any alpha numeric character randomly generated by the module after the GO negotiation process is over. Legacy Wi-Fi nodes (non Wi-Fi Direct) would see this SSID on scanning the device. After the module becomes a GO in WiFi direct mode, it appears as an Access Point to client devices.

For example if the ssidPostFix is given as "WiSe", the SSID of the module in GO mode or Autonomous GO mode could be DIRECT-89WiSe. All client devices would see this name in their scan results.

Note:

ssidPostFix should be maximum of 23 bytes.

psk: Passphrase of a maximum length of 63 characters (a null character should be supplied to make it 64 bytes in the structure). This PSK is used if the module becomes a GO owner. Remote clients should use this passphrase while connecting to the module when it is in GO mode.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
AT+RSI_WFDDEV=<devState> <devName><macAddress>< devtype>	Asynchronous Message from module to Host, sent when module finds any Wi-Fi Direct node.
AT+RSI_CONNREQ< devName >	Asynchronous message from Module to Host, sent when module receives a connection request from any remote Wi-Fi Direct node.
ERROR<Error code>	Failure

Binary Mode:

There is no response payload for this command.

After the command is received by the module, it scans for Wi-Fi Direct devices. Whenever it finds any devices, it raises an asynchronous interrupt. The Host should perform an Rx Operation on receiving this interrupt. On performing the Rx operation, host receives the code for Async WFD (refer to the [Binary Command mode](#) section for more details) and the below structure explains the Payload.

Response Parameters:

```
typedef struct {
    uint8 devState;
    uint8 devName[32];
    uint8 macAddress[6];
    uint8 devtype[2];
}rsi_wfdDevInfo;
```

After the command is received, the device is scanned by other Wi-Fi Direct devices too. If any of those devices send a connect request to the module, it raises an asynchronous interrupt. The Host should perform an Rx Operation on receiving this interrupt. On performing the Rx operation, host receives the code for Async CONNREQ (refer to the [Binary Command Mode](#) section for more details) for the Response ID and the below structure explains the Payload.

```
typedef struct
{
    uint8 dev_name[32];
    }rsi_ConnAcceptRcv;
```

Command Parameters:

devstate: State of the remote Wi-Fi Direct node.

0– The remote Wi-Fi Direct node was found in previous scan iteration

1– A new remote Wi-Fi Direct node has been found

devName: Device name of the remote Wi-Fi Direct node, returned in ASCII. The length is 32 bytes. If the device name of the remote node is less than 32 bytes, 0x00 is padded to make the length 32 bytes.

macAddress: MAC ID of the remote Wi-Fi Direct node. Returned in Hex

devType: Type of the device, returned in two Hex bytes. The first byte returned is the primary ID and the second byte is the sub-category ID. Refer to the [Configure Wi-Fi Direct Peer-to-Peer Mode](#) section for more details.

When scanned WFD devices are moved out of range or powered off, the device's lost indication will be given to the host using the asynchronous (Async WFD) message from module to host.

device_state: 0 – The remote Wi-Fi Direct node was found in the previous scan iteration

device_name: All are 0x00's

device_mac: MAC ID of the remote Wi-Fi Direct node which is moved out of range.

device_type: All are 0x00's

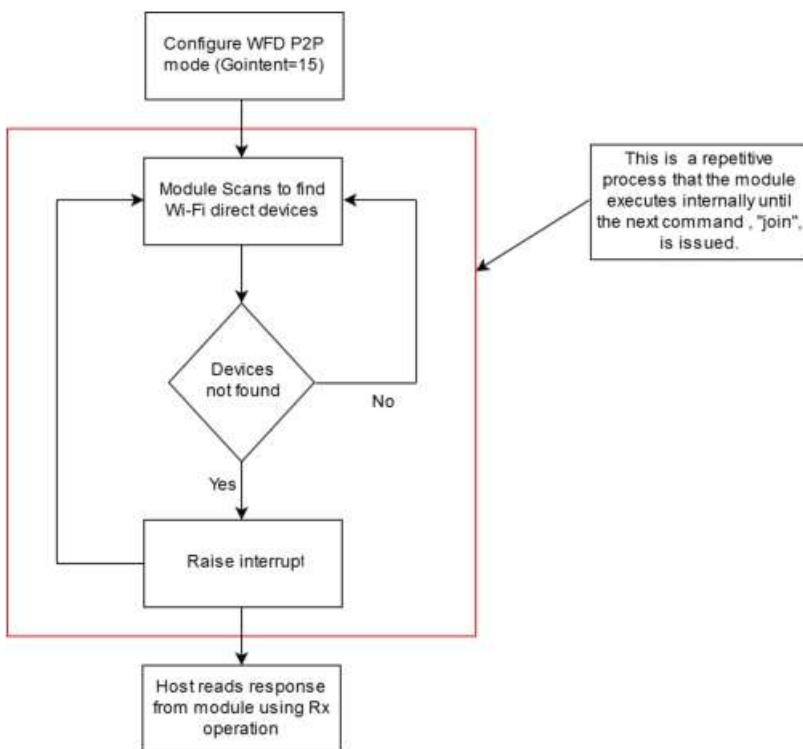


Figure 11-1: Operation after issuing "configure WFD P2P Mode" 2P Mode" command

Possible error codes:

Possible error codes are 0x001D, 0x0021, 0x0025, 0x002C.

Relevance:

This command is relevant when the module is configured in Operating Mode 1.

Note:

After getting the connect request from remote device, host needs to issue the join command with the remote device name from which the connect request is received. Host needs to make sure that the remote device is scanned by module too (Async WFD with remote device name). If the host issues join command before remote device gets scanned by the module, then host will get join response with error code "25".

Example:

AT Mode:

```
at+rsi_wfd =7,re yax,11,test,012345678\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x77 0x66 0x64 0x3D 0x37 0x2C 0x72 0x65 0x79 0x61 0x78 0x2C 0x31 0x31 0x2C
0x74 0x65 0x73 0x74 0x2C 0x30 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0x0D 0x0A
```

Response:

```
OK\r\n
0x4F 0x4B 0x0D 0x0A

AT+RSI_WFDDEV=1 wi_fi_phone 0x00 0x23 0x12 0x13 0x14 0x16 0x0A 0x04 0x0D 0x0A
0x41 0x54 0x2B 0x52 0x53 0x49 0x5F 0x57 0x46 0x44 0x44 0x45 0x56 0x3D 0x31 0x77 0x69 0x5F 0x66 0x69 0x5F 0x70
0x68 0x6F 0x6E 0x65 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x0A 0x04 0x0D 0x0A

When scanned WFD devices are moved out of range or powered off, the device lost indication will be given to host
using the asynchronous message AT+RSI_WFDDEV from module to host.

AT+RSI_WFDDEV=<1byte-NULL> <32 bytes -NULL> 0x00 0x23 0x12 0x13 0x14 0x16 <2bytes-NULL> 0x0D 0x0A
0x41 0x54 0x2B 0x52 0x53 0x49 0x5F 0x57 0x46 0x44 0x44 0x45 0x56 0x3D 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x00 0x00 0x0D 0x0A
```

11.7 Configure AP Mode

Description

This command is used to set the configuration information for AP mode. This command has to be issued after init command.

Payload

AT Mode:

```
at+rsi_apconf = <channel_no>,<ssid>,<security_type>,< encryp_mode>, <psk>,<beacon_interval>,<dtim_period>,<
max_sta_support>,<ap_keeplive_type>,<ap_keeplive_period>\r\n
```

Binary Mode:

```
#define RSI_SSID_LEN 34
#define RSI_PSK_LEN 64
struct {
uint8 channel_no[2];
uint8 ssid[RSI_SSID_LEN];

uint8 security_type;
uint8 encryp_mode;
uint8 psk[RSI_PSK_LEN];

uint8 beacon_interval[2];
uint8 dtim_period[2];
uint8 ap_keepalive_type;
uint8 ap_keepalive_period;
uint8 max_sta_support[2];
}rsi_apconfig;
```

Parameters

channel_no: The channel in which the AP would operate. Refer the [PER Mode](#) section .

A value of zero enables the Auto channel selection feature.

0 - Auto channel selection.

Auto Channel Selection is used to enable interfaces to automatically figure out which channel configuration to use. It sets the channel which has low traffic.

Note:

DFS channels are not supported in ap mode.

ssid: SSID of the AP to be created

security_type: Security type.

Mode	Functionality
0	Open
1	WPA
2	WPA2

encryp_mode: Encryption type.

Mode	Functionality
0	Open
1	TKIP
2	CCMP

psk: PSK of the AP in security mode. If the AP is in Open mode, this parameter can be set to '0'.

Note:

Minimum and maximum length of PSK is 8 bytes and 63 bytes respectively.

beacon_interval: Beacon interval of the AP in milliseconds. Allowed values are integers from 100 to 1000 which are multiples of 100.

dtim_period: DTIM period. Allowed values are from 1 to 255

ap_keepalive_type: This is the bitmap to enable AP keep alive functionality and to select the keep alive type.

BIT[0]: To enable/disable keep alive functionality.

1 - To enable keep alive functionality.

0 - To disable keep alive functionality.

BIT[1]: To select AP keep alive method.

1 - To enable null data based keep alive functionality.

0 - default keep alive functionality (i.e disconnect the station if there is no wireless exchanges from station with in ap_keepalive_period).

ap_keepalive_period: This is the period after which AP will disconnect the station if there are no wireless exchanges from station to AP.Keep alive period is calculated in terms of 32 multiples of beacon interval(i.e if there are no wireless transfers from station to AP with in (32*beacon_interval*keep_alive_period) milli seconds time period,station will be disconnected).If null data based method is selected,AP checks the connectivity of station by sending null data packet. If station does not ack the packet ,that station will be disconnected after 4 retries.

max_sta_support: Number of clients supported. This value should be less than or equal to the value given in custom feature select bit map[BIT[13:16]] of the [Set Operating Mode command](#). If value is not set in custom feature select bit map[BIT[13:16]] of the [Set Operating Mode command](#) then maximum supported stations are 4.

Note:

In RYWB116 there is Support of connecting 16 clients to the created AP by setting custom feature bitmap [Bit[13-16]] and also extended custom feature bitmap [Bit[15]] by using the equation mentioned below: Number of stations = (Stations Obtained by setting Bit[13-16] + 1) * 2

For example if host want 16 clients support in AP then need to set following bits BIT[13], BIT[14] and BIT[15] (leave BIT[16] as 0) in custom feature bitmap and also BIT[15] in extended custom feature bitmap then number of stations will become (7+1) * 2 = 16. If you are configuring more than 16 stations then it will throw an error.

If you are not setting extended custom feature bitmap then it can configure maximum of 8 stations.This is Backward Caompatibility,In this case also if you are configuring more than 8 stations then it will throw an error.

Response

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

There is no response payload for this command.

Possible error codes

Possible error codes are 0x0021,0x0025,0x002C,0x0026,0x004C,0x0028,0x001A,0x000A,0x001D

Relevance

This command is relevant when the module is configured in Operating Mode 6.

Example:

AT Mode:

Configured AP with channel num =11, ssid = reyx, open mode, beacon interval = 100, DTIM count =3 and max stations support =3.

```
at+rsi_apconf=11,reyx,0,0,0,100,3,3\r\n
```

```
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x61 0x70 0x63 0x6F 0x6E 0x66 0x3D 0x31 0x31 0x2C 0x72 0x65 0x79 0x61 0x78
```

```
0x2C 0x30 0x2C 0x30 0x2C 0x30 0x2C 0x31 0x30 0x30 0x2C 0x33 0x2C 0x33 0x0D 0x0A
```

Response:

```
OK\r\n
```

```
0x4F 0x4B 0x0D 0x0A
```


11.8 WPS PIN Method

Description:

This command configures the WPS PIN method to be used in RYWB116. This command should be issued before join command.

Command Format:

AT Mode:

```
at+rsi_wps_method=<wps_method>,<generate_pin>,<wps_pin>\r\n
```

Binary Mode:

```
#define RSI_WPS_PIN_LEN 8
typedef struct {
    uint8 wps_method[2];
    uint8 generate_pin[2];
    uint8 wps_pin[RSI_WPS_PIN_LEN];
}wpsMethodFrameSnd;
```

Command Parameters:

wps_method: WPS method type Should set to '1' for PIN method.

generate_pin: This parameter specifies whether to validate entered pin or generate pin .This parameter is valid only if wps_method is 1.

0-Use entered pin in wps_pin field.

1-pin generation

If generate_pin is 0, module will validate the given 8 digit wps_pin. If pin given is less than 8 digit or if pin is wrong then module will give error.

wps_pin: wps_pin is of 8 digits pin. Module validates and uses this pin only in case of when wps_method is pin method and generate_pin is 0.

Response:

Note:

Response contains following payload only if PIN method is selected. In case of PUSH methd response does not contains any payload.

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

```
typedef struct {
    uint8 wps_pin[RSI_WPS_PIN_LEN];
}rsi_wpsMethodFrameRecv;
```

Response Parameters:

wps_pin: The WPS PIN will be used by the module to connect with WPS AP.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C, 0x0037, 0x0038.

Relevance:

This command is relevant when the module is configured in Operating Mode 0 and 6.

Example:

AT Mode:

When PIN of length 8 is given

```
at+rsi_wps_method=1,0,12345678\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x77 0x70 0x73 0x5F 0x6D 0x65 0x74 0x68 0x6F 0x64 0x3D 0x31 0x2C 0x30 0x2C
0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0x0D 0x0A
```

Response:

```
OK 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08\r\n
0x4F 0x4B 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08 0x0D 0x0A
```

When PIN of length less than 8 is given

```
at+rsi_wps_method=1,1,1234\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x77 0x70 0x73 0x5F 0x6D 0x65 0x74 0x68 0x6F 0x64 0x3D 0x31 0x2C 0x30 0x2C
0x31 0x32 0x33 0x34 0x0D 0x0A
```

11.9 Scan

Description:

This command scans for Access Points and gives the scan results to the host. The scan results are sorted in decreasing order of signal strength (RSSI value). The scanned access point with highest signal strength will be the first in the list. This command has to be issued after initcommand and before Joincommand .

Command Format:

AT Mode:

```
at+rsi_scan=<channel>,<ssid>,<channel_bit_map_2_4>,<channel_bit_map_5>\r\n
or
at+rsi_scan=<channel>,<ssid>,<scan_feature_bitmap>\r\n
```

Binary Mode:

```
#define RSI_SSID_LEN 34
typedef struct {
uint8channel[4];
uint8ssid[RSI_SSID_LEN];
uint8 reserved[5];
uint8 scan_feature_bitmap;
uint8 channel_bit_map_2_4[2];
uint8 channel_bit_map_5[4];
} scanFrameSnd;
```

Command Parameters:

Channel: Channel Number on which scan has to be done. If this value is 0, the module scans in all the channels in the band that is selected through the band command. The values of this parameter are listed in table below To select DFS channels user need to set custom feature bit in opermode command.

Note:

1. If chan_num is 0 and channel bit maps (selective scan) are provided then module will scan only the channels specified in bitmaps instead of scanning all channels.
2. In case of 5GHz, module performs passive scan in DFS channels only when BIT[8] is set in custom feature bit map in [Set Operating Mode](#) command.
3. scan feature bitmap is valid only if channel number and ssid is given.
4. If channel bitmap is specified, Module will scan only channels which are valid in selected region

Channel Number	chan_num parameter
All channels	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14

Table 11-6: Channel in 2.4 GHz Mode

Note:

Scanning in 12,13,14 channels is allowed based on the region selected in **Set Region** command.

Channel Number	chan_num parameter
All channels	0
36	36
40	40
44	44
48	48
52	52
56	56
60	60
64	64
100	100
104	104
108	108
112	112
116	116
132	132
136	136
140	140

Channel Number	chan_num parameter
149	149
153	153
157	157
161	161
165	165

Table 11-7: Channel in 5GHz Mode

Channel Number(4.9GHz)	chan_num parameter
All channels	0
184	184
188	188
192	192
196	196
8	8
12	12
16	16

ssid: Optional Input. For scanning a hidden Access Point, its SSID can be provided as part of the SCAN command. The maximum number of scanned networks reported to the host is 11. If not used, null characters should be supplied to fill the structure.

Reserved: Set to '0's. Only present in Binary mode.

scan_feature_bitmap: Scan feature bitmap

BIT[0]: To enable/disable quick scan feature.

1 - To enable quick scan feature.

0 - To disable quick scan feature.

BIT[1]-BIT[7]: Reserved.

channel_bit_map_2_4: channel bitmap for scanning in set of selective channels in 2.4Ghz.

Channel_bit_map_5: channel bitmap for scanning a set of selective channels in 5Ghz.

Note:
For 11J channel bit map need to give in Channel_bit_map_5.

Channel Number	Channel bit position in bitmap
1	0
2	1
3	2
4	3
5	4
6	5
7	6
8	7

Channel Number	Channel bit position in bitmap
9	8
10	9
11	10
12	11
13	12
14	13

Table 11-8: Channel Number to Bitmap Mapping in 2.4GHz

Channel Number	chan_num parameter
36	0
40	1
44	2
48	3
52	4
56	5
60	6
64	7
100	8
104	9
108	10
112	11
116	12
120	13
124	14
128	15
132	16
136	17
140	18
149	19
153	20
157	21
161	22
165	23

Table 11-9: Channel number to bitmap mapping in 5GHz

Channel Number(4.9GHz)	Channel bit position in bitmap
8	0
12	1
16	2
184	3
188	4

Channel Number(4.9GHz)	Channel bit position in bitmap
192	5
196	6

Note:
Channel bit maps , e.g. channel_bit_map_2_4 and channel_bit_map_5 used for background scan.

Response:

AT Mode:

Result Code	Description
OK< scanCount >< padding > < rfChannel >< securityMode >< rssiVal >< uNetworkType >< ssid >< bssid >< reserved >up to the number of scanned nodes	Successful execution of the command.
ERROR<Error code>	Failure

Binary Mode:

```
#define RSI_SSID_LEN 34
#define RSI_BSSID_LEN 6
struct{
uint8 rfChannel;
uint8 securityMode;
uint8 rssiVal;
uint8 uNetworkType;
uint8 ssid[RSI_SSID_LEN];
uint8 bssid[RSI_BSSID_LEN];
uint8 reserved[2];
}rsi_scanInfo;
#define RSI_AP_SCANNED_MAX 11
typedef struct {
uint8 scanCount[4];
uint8 padding[4];
rsi_scanInfostrScanInfo[RSI_AP_SCANNED_MAX];
} rsi_scanResponse;
```

Response Parameters:

scancount(4 bytes): Number of Access Points scanned

padding(4 bytes): padding bytes which can be ignored.

rfChannel(1 byte): Channel Number of the scanned Access Point

security Mode(1 byte):

Mode	Functionality
0	Open
1	WPA
2	WPA2

Mode	Functionality
3	WEP
4	WPA Enterprise
5	WPA2 Enterprise

rssival(1 byte): RSSI of the scanned Access Point

uNetworkType(1 byte): Network type of the scanned Access Point 1– Infrastructure mode

ssid(34 bytes): SSID of the scanned Access Point

bssid(6 bytes): MAC address of the scanned Access Point.

Reserved(2 bytes): Reserved bytes.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C, 0x0014, 0x0002, 0x0003, 0x0024, 0x001A, 0x0015, 0x000A, 0x0026.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 2, 6.

Example:

AT Mode:

To scan all the networks in all channels

```
at+rsi_scan=0\r\n
```

```
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x73 0x63 0x61 0x6E 0x3D 0x30 0x0D 0x0A
```

To scan a specific network "Test_AP" in a specific channel 6

```
at+rsi_scan=6,Test_AP\r\n
```

```
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x73 0x63 0x61 0x3D 0x36 0x2C 0x54 0x65 0x73 0x74 0x5F 0x41 0x50 0x0D 0x0A
```

Response:

If two networks are found with the SSID "Reyax_net1" and "Reyax_net2", in channels 6 and 10, with measured RSSI of -20dBm and -14dBm respectively, the return value is

```
O K < scanCount =2> < padding > < rfChannel =0x0A> < securityMode =0x02> < rssiVal =14> < uNetworkType =0x01> < ssid = Reyax_net2> < bssid =0x00 0x23 0xA7 0x1F 0x1F 0x15> < reserved > < rfChannel =0x06> < securityMode =0x00> < rssiVal =20> < uNetworkType =0x01> < ssid = Reyax_net1> < bssid =0x00 0x23 0xA7 0x1F 0x1F 0x14> < reserved > \r\n
0x4F 0x4B 0x02 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x0A 0x02 0x0D 0x01 0x52 0x65 0x79 0x61 0x78 0x5F 0x6E 0x74 0x32 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x23 0xA7 0x1F 0x1F 0x15 0x00 0x00 0x06 0x00 0x14 0x01 0x52 0x65 0x79 0x61 0x78 0x5F 0x6E 0x74 0x31 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x23 0xA7 0x1F 0x1F 0x14 0x00 0x00 0x0D 0x0A
```

11.10 Join

Description:

This command is used for following:

1. Associate to an access point (operating mode = 0 or 2)
2. Associate to a remote device in Wi-Fi Direct mode or to create autonomous GO(operating mode 1)
3. Create an Access Point (operating mode 6)
4. Allow a third party to associate to a Wi-Fi Direct group created by the module (operating mode 1)
5. To enable WPS PUSH method in Access point mode

Command Format:

AT Mode:

```
at+rsi_join=<ssid>,<dataRate>,<powerLevel>,<Security_mode>,<join_feature_bitmap>,<listen_interval>,<vap_id >,<join_bssid>\r\n
```

Binary Mode:

```
#define RSI_PSK_LEN 64
#define RSI_SSID_LEN 34
struct {
uint8 reserved1;
uint8 SecurityType;
uint8 dataRate;
uint8 powerLevel;
uint8 psk[RSI_PSK_LEN];
uint8 ssid[RSI_SSID_LEN];
uint8 join_feature_bitmap;
uint8 reserved2[2];
uint8 ssid_len;
uint8 listen_interval[4];
uint8 vap_id;
uint8 join_bssid[6];
} joinFrameSnd;
```

Command Parameters:

reserved1: Reserved. Set to '0'

SecurityType: This variable is used to define the security mode of the Access point to which module is supposed to connect.

Possible values:

Mode	Functionality
0	Connect only to AP in open mode
1	Connect to AP in WPA mode
2	Connect to AP in WPA2 mode
3	Connect to AP in WEP open mode
4	Connect to AP in EAP WPA mode
5	Connect to AP in EAP WPA2 mode
6	Connect to AP either in WPA/WPA2 mode (Mixed mode → It gives priority to WPA2)

Note:

1. Security_mode parameter is valid only if opermode is 0 or 2.
2. psk is required for security mode 1,2,6. Otherwise module returns Join failure with error 0x16.
3. In Enterprise mode(Security_mode 4,5), module will derive the PSK using EAP exchanges with Authentication server.
4. Module strictly obey security mode specified in Join command, not depends on psk.
5. In opermode 6, Once Access point is created host can enable WPS PUSH method by giving JOIN command (with same parameters which were used to create Access point) again.
6. psk, reserved2, ssid_len fields are present only in Binary mode.
7. WPS method is not supported in Coex mode .

dataRate: Transmission data rate. Physical rate at which data has to be transmitted.

Data Rate (Mbps)	Value of dataRate
Auto-rate	0
1	1
2	2

Data Rate (Mbps)	Value of dataRate
5.5	3
11	4
6	5
9	6
12	7
18	8
24	9
36	10
48	11
54	12
MCS0	13
MCS1	14
MCS2	15
MCS3	16
MCS4	17
MCS5	18
MCS6	19
MCS7	20

Table 11-10: Transmission Data Rates

powerLevel: This fixes the Transmit Power level of the module. This value can be set as follows:

At 2.4GHz

Mode	Functionality
0	Low power (7+/-1) dBm
1	Medium power (10 +/-1) dBm
2	High power (18 + /- 2) dBm

At 5 GHz

Mode	Functionality
0	Low power (5+/-1) dBm
1	Medium power (7 +/-1) dBm
2	High power (12 + /- 2) dBm

psk: Passphrase used in WPA/WPA2-PSK security mode.

In open mode, WEP mode, Enterprise Security and Wi-Fi Direct modes, this should be filled with NULL characters.

Ssid: When the module is in Operating modes 0 or 2, this parameter is the SSID of the Access Point (assuming WPS is not enabled in the Access Point).

When the module is in operating modes 0 or 2, and wants to connect to an access point in WPS mode then the value of this parameter is NULL .

In Wi-Fi Direct mode, this parameter is the device name of the remote P2P node to which the module wants to associate.

When an Access Point needs to be created, this parameter should be the same as the parameter ssid in the command "Configure AP mode".

In Wi-Fi Direct mode, when the module is a Group Owner and already connected to a Wi-Fi Direct node; and another Wi-Fi node wants to join, then this parameter is module's device name.

Note:

Comma(",") is not supported in the SSID name in the AT commands. Other than comma, you can use any special characters.

Reserved2: Reserved, set to '0'

ssid_len: Actual length of the SSID

join_feature_bitmap:

join_feature_bitmap	Functionality	Bit set to 0	Bit set to 1	Note and Info
join_feature_bitmap[0]	b/g only mode in station mode	Disable	Disable	
join_feature_bitmap[1]	listen interval from join command	Disable	Disable	
join_feature_bitmap[2]	quick join feature	Disable	Enable	
join_feature_bitmap[3]	CCXV2	Disable	Enable	
join_feature_bitmap[4]	AP based on BSSID	Disable	Enable	
join_feature_bitmap[5]	Management Frame Protection Capable only(802.11W)	Disable	Enable	
join_feature_bitmap[6]	Management Frame Protection required(802.11W)			BIT[5] and BIT[6] valid when 11W(BIT[13] in ext custom feature bitmap) enabled, if both bits are not set it will disable PMF.
join_feature_bitmap[7]	Reserved			

listen_interval: This is valid only if BIT(1) in join_feature_bit_map is set. This value is given in Time units(1024 microsecond). This parameter is used to configure maximum sleep duration in power save.

Vap_id: Possible values are 0 and 1.

When 0 – Module will try to connect to scanned AP.

When 1 – Module will create AP.

join_bssid: This contains BSSID of selected AP. This is valid only if

join_feature_bitmap BIT[4] is set otherwise module will ignore the value.

Note:

1. vap_id will be considered only in concurrent mode.
2. In concurrent mode, if connected station network is same as default dhcp server network then dhcp server will not start but join command for AP creation will give success message to host.

Response:

AT Mode:

Result Code	Description
OK<GO status>	Successful execution of the command. GO_Status (1 byte, hex): 0x47 (ASCII "G") – If the module becomes a Group Owner (GO) after the GO negotiation stage, or becomes an Access Point. 0x43 (ASCII "C") – If the module does not become a GO after the GO negotiation stage, or becomes a client (or station). Note: The module gets a default IP of 192.168.100.76 if it becomes a Group Owner or Access Point in case of IPv4. and gets a default IP of 2001:db8:0:1:0:0:0:120 in case of IPv6.
ERROR<Error code>	Failure

Binary Mode:

Response Payload:

```
struct {
    uint8 operState ;
}rsi_joinResponse ;
```

Response Parameters:

operState:

State	Funtionality
0x47	if the module becomes a Group Owner (GO) after the GO negotiation stage.
0x43	if the module does not become a GO after the GO negotiation stage.

This parameter should be used by the Host when the module is configured as a Wi-Fi Direct node within Operating mode 1 (refer Configure Wi-Fi Direct Peer-to-Peer Mode (Configure P2P)). Note: The module gets a default IP of 192.168.100.76 if it becomes a Group Owner or Access Point in case of IPv4 and gets default IP of 2001:db8:0:1:0:0:0:120 in case of IPv6.

Possible error codes:

Possible error codes are 0x0002,0x0004, 0x0006,0x0008, 0x0009, 0x000E,0x0015, 0x0016, 0x0018, 0x0019, 0x001E, 0x0020, 0x0021, 0x0023, 0x0025, 0x0026, 0x0027,0x0028,0x002A, 0x002B, 0x002C, 0xFFFF,0x0033,0x0040,0x0042,0x0043,0x0044, 0x0045,0x0046,0x0047, 0x0048, 0x0049, 0x004B

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2, 6. When the module is in Operating Mode 1, this command initiates a GO negotiation and subsequent association to a Wi-Fi Direct node. In Operating mode 0, it initiates a security authentication and association process with an Access Point.

11.11 Request timeout

Description:

This command is used to set various timeouts. Currently we can use this command to set the authentication and association request timeouts.

Command Format:

AT Mode:

at+rsi_timeout=<timeout_bitmap>,<timeout_value>\r\n

Binary Mode:

```
struct request_timeout{ uint32 timeout_bitmap; uint16 timeout_value };
```

Command Parameters:

timeout_bitmap:

timeout_bitmap	Functionality
timeout_bitmap[0]	sets timeout for association and authentication request. timeout_value : timeout value in ms(default 300ms).
timeout_bitmap[1]	Sets the each channel active scan time in ms (default 100ms)
timeout_bitmap[2]	Sets the WLAN keep alive time in seconds (default value is 90s)

Note:

For Setting WLAN Keep alive timeout need to give time out command before init.If timeout is given as '0'(zero).Keep alive functionality will be disabled

Example:

AT Mode:

To set authentication and association request timeout of 1.5 seconds
at+rsi_timeout=1,1500\r\n

11.12 Re-Join

Description:

The module automatically tries to re-join if it loses connection to the network it was associated with. If the re-join is successful, then the WLAN link is re-established. During the time the module is trying to re-join, if the Host sends

any command, the module does not accept it and throws an error code 37 in status code. The module aborts the re-join after a fixed number of re-tries (maximum number of retries for rejoin is 20 by default). If this happens, an asynchronous message is sent to the Host with an error code 25. User can configure the rejoin parameters using rejoin command.

Note:

When Re-join fails module will close all prior opened TCP/IP sockets.

Command Format:

AT Mode:

at+rsi_rejoin_params=< rsi_max_try >,< rsi_scan_interval >,
< rsi_beacon_missed_count >,< rsi_first_time_retry_enabled >\r\n

Binary Mode:

```
typedef struct rsi_rejoin_params_s{
uint8 rsi_max_try[4];
uint8 rsi_scan_interval[4];
uint8 rsi_beacon_missed_count[4];
uint8 rsi_first_time_retry_enable[4];
} rsi_rejoin_params_t;
```

Command Parameters:

rsi_max_try: This represents the number of attempt for join before giving up the error.

Note:

If number of rejoin attempts is 0 then module will try infinitely for rejoin.

rsi_scan_interval: This is the time interval in seconds for the subsequent retry.

rsi_beacon_missed_count: This is the beacon missed count that module used to declare module connection status. If module found continuous beacon missed is greater than or equal to this value then it will declare connection as disconnected and will start rejoin process again.

rsi_first_time_retry_enable: If this is set to 1 then module will retry to connect if first join attempt fails. Number of attempts and scan interval may be configured by rsi_max_try and rsi_scan_interval respectively.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

No response payload

Possible error codes:

Possible error codes are 0x0025, 0x002C.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 2.

Example:

AT Mode:

N/A

Response:

Asynchronous responses from module:

Following message to indicate that module is in process of rejoin, so unable to process requested command.

ERROR<Error code=37>\r\n

0x45 0x52 0x52 0x4F 0x52 0x25 0x00 0x0D 0x0A

Following message to indicate rejoin failure to host.

ERROR<Error code=25>\r\n

0x45 0x52 0x52 0x4F 0x52 0x19 0x00 0x0D 0x0A

11.13 WMM PS

Description:

This command is used to enable WMM PS configurations. This command should be issued before join command and before power save command.

Command Format:

AT Mode:

at+rsi_wmm_config=< wmm_ps_enable >< wmm_ps_type >< wmm_ps_wakeup_interval >< wmm_ps_uapsd_bitmap >\r\n

Binary Mode:

```
struct {
    uint8 wmm_ps_enable[2];
    uint8 wmm_ps_type[2];
    uint8 wmm_ps_wakeup_interval[4];
    uint8 wmm_ps_uapsd_bitmap;
}wmmPsFrameSnd;
```

Command Parameters:

wmm_ps_enable: To enable or disable WMM PS

0 - disable
1 - enable

wmm_ps_type: WMM PS type

0 - Tx Based
1 - Periodic

wakeup_interval: Wakeup interval in milli seconds.

wmm_ps_uapsd_bitmap: Bitmap , 0 to 15 possible values.

wmm_ps_uapsd_bitmap	Funtionality
wmm_ps_uapsd_bitmap[0]	Access category: voice
wmm_ps_uapsd_bitmap[1]	Access category: video
wmm_ps_uapsd_bitmap[2]	Access category: Back ground
wmm_ps_uapsd_bitmap[3]	Access category: Best effort U-APSD
wmm_ps_uapsd_bitmap[4:7]	All set to '0'. Don't care bits.

Parameters wmm_ps_type, wakeup_interval, wmm_ps_uapsd_bitmap will be used for WMM-PS if Power save is enabled and psp_type given as UAPSD.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

There is no response payload for this command.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

Example:

AT Mode:

```
at+rsi_wmm_config=1,1,0,10\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x77 0x6D 0x6D 0x5F 0x70 0x73 0x3D 0x31 0x2C 0x31 0x2C 0x30 0x2C 0x31
0x30 0x0D 0x0A
```

Response:

```
OK\r\n
.....
0x4F 0x4B 0x0D 0x0A
```

11.14 Set Sleep Timer

Description:

This command configures the sleep timer mode of the module to go into sleep during power save operation. The command can be issued any time in case of power save mode 9. If this command is not issued, then by default module takes 3 seconds as sleep timer.

Command Format:

AT Mode:

```
at+rsi_sleeptimer=< TimeVal >\r\n
```

Binary Mode:

```
struct {
    uint8 TimeVal[2];
} SleepTimerFrameSnd;
```

Command Parameters:

TimeVal: Sleep Timer value in seconds.
Minimum value is 1, and maximum value is 2100.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the
ERROR<Error code>	Failure

Binary Mode:

There is no response payload for this command.

Possible error codes:

Possible error codes are 0x0025, 0x002C.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 2.

11.15 Power Mode

Description:

This command configures the power save mode of the module. Power save is disabled by default. The command can be issued any time after the Join command in case of power save mode 1, 2 and 3.

And after Init command before join command in case of power save mode 8 and 9.

Note:

1. RYWB116 doesn't support power save modes while operating in AP or group owner mode.
2. Power save modes 2 and 8 are not supported in USB interface.
3. In SPI interface when ULP mode is enabled, after wakeup from sleep, host has to initialize SPI interface of the module.
4. To use number of dtim skip feature, listen interval should be disable from join command, listen_interval_dtim param in at+rsi_pwmode command should be 1(dtim aligned).

Command Format:

AT Mode:

at+rsi_pwmode=< powerVal >,< ulp_mode_enable >,
<listen_interval_dtim>,<PSP_type>,<monitor_interval><num_of_dtim_skip>\r\n

Binary Mode:

```
typedef union{
    struct {
        uint8 powerVal;
        uint8 ulp_mode_enable;
        uint8 listen_interval_dtim;
        uint8 rsi_psp_type;
        uint16 monitor_interval;
        uint8 num_of_dtim_skip;
    } powerFrameSnd;
    uint8 uPowerFrameBuf[6];
    }rsi_uPower;
```

Command Parameters:

powerVal:

Mode	Functionality
0	Mode 0: Disable power save mode
1	Power save Mode 1
2	Power save Mode 2
3	Power save Mode 3
8	Power save Mode 8
9	Power save Mode 9

ulp_mode_enable:

Mode	Functionality
0	Mode 0: Disable power save mode
1	Ultra low power mode with RAM retention. Valid for powerVal modes 2,3,8 and 9.
2	Ultra low power mode without RAM retention. Valid for powerVal modes 8 and 9.

listen_interval_dtim:

According to set or reset of this param, the module computes the desired sleep duration based on listen interval (from join command) and its wakeup align with Beacon or DTIM Beacon (based on this parameter).

0 - module wakes up before nearest Beacon that does not exceed the specified listen interval time.

1 - module wakes up before nearest DTIM Beacon that does not exceed the specified listen interval time.

rsi_psp_type: This parameter shows Power Save Procedure type used. Following is the values for the PSP_type.

0 – Max Power save procedure.

1 – Fast power save procedure.

2 – UAPSD power save

Note:

1. When fast psp is enabled, module will disable power save for monitor interval of time for each data packet received or sent.
2. UAPSD power save is valid only if wmm is enabled through wmm ps command

Monitor_interval: This is time in ms to keep module in wakeup state for each Tx or Rx traffic sent or received respectively. Default value for this is 50 ms.

num_of_dtim_skip:

This parameter is to skip the number of dtim. if its value is n then our module will wakeup at (n+1)th dtim at each wakeup cycle.

To use this feature, ensure following condition,
 BIT(1) is reset in the join_feature_bitmap in join command

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

There is no response payload for this command.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C, 0xFFF8,0x0015,0x0026,0x0052

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 2.

11.15.1 Power save Operation

The behavior of the module differs according to the power save mode it is configured.

The following terminology can be used in the below section in order to describe the functionality.

Protocol	Non Connected State	Connected State
WLAN	This mode is significant when module is not connected with any AP	This mode is significant when module is in associated state with AP
BT Classic	This mode is significant when module is in Idle (standby) state.	This mode is significant when module is in Connected sniff mode, Discoverable mode (ISCAN) and Connectable mode (PSCAN)
BLE	This mode is significant when module is in Idle (standby) state.	This mode is significant when module is in Advertising state, Scan state or Connected state.

Note:

1. In case of WLAN, wake up period will be calculated based on DTIM interval.
2. In case of BT-Classic, wake up period will be calculated based on inquiry scan interval in discoverable mode, page scan interval in connectable mode and sniff interval in connected mode.
3. In case of BLE, wake up period will be calculated based on advertise interval in advertising state, scan interval in scanning state and connection interval in connected state.
4. If incase BT/BLE wakeup period is lesserthen the WLAN wakeup period, the module will wakeup and servs BT/BLE and go back to the sleep again.

11.15.2 Power save Mode 1

Once the module is configured to power save mode 1, it wakes itself up periodically based upon the DTIM interval configured in connected AP. In power mode 1, only the RF of the module is in power save while SOC continues to work normally. After successful execution of command, confirmation is received in response. This command has to be given only when module is in connected state (with the AP).

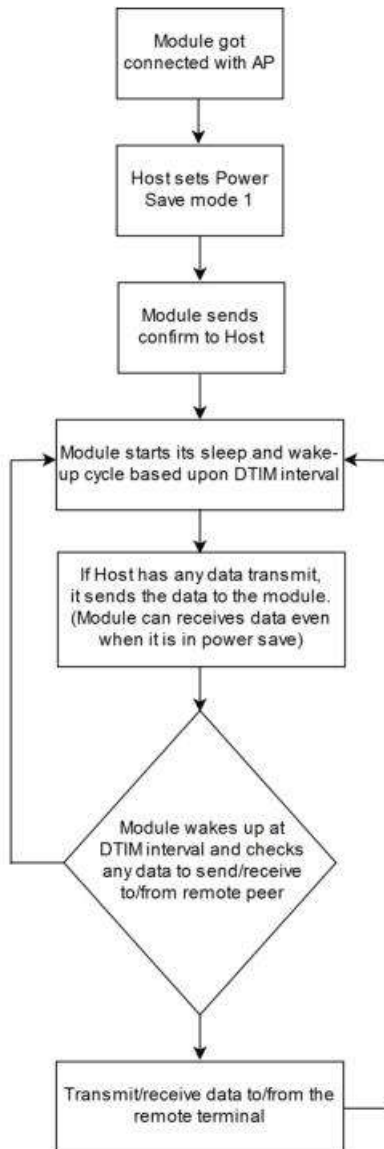


Figure 11-2: Setting Power save Mode 1

After having configured the module to power save mode, the Host can issue subsequent commands. In power save mode 1 the module can receive data from host at any point of time but it can send/receive the data to/from remote terminal only when it is awake at DTIM intervals.

11.15.3 Power save Mode 2

Once the module is configured to power save mode 2, it can be woken up either by the Host or periodically during its sleep-wakeup cycle based upon the DTIM interval.

Power mode 2 is GPIO based. In ULP mode , feature_bit_map[4] has to be set in opermode command. In this mode, When ever host want to send data to module, gives wakeup indication to module by setting ULP_GPIO_5 high in case of LP or UULP_GPIO_2 in case of ULP(which make module to wakeup from power save). After wakeup, if the module is ready for data transfer, it sends wakeup indication to host (by setting UULP_GPIO_3 high). Host required to wait until module give wakeup indication before sending any data to module.

After completion of data transfer host can give sleep permission to module by resetting ULP_GPIO_5 in case of LP or UULP_GPIO_2 in case of ULP. After recognizing sleep permission from host, module give confirmation to host by resetting UULP_GPIO_3 and again gets back to its sleep-wakeup cycle.

Module can send received packets or responses to host at any instant of time. No handshake is required on Rx path.

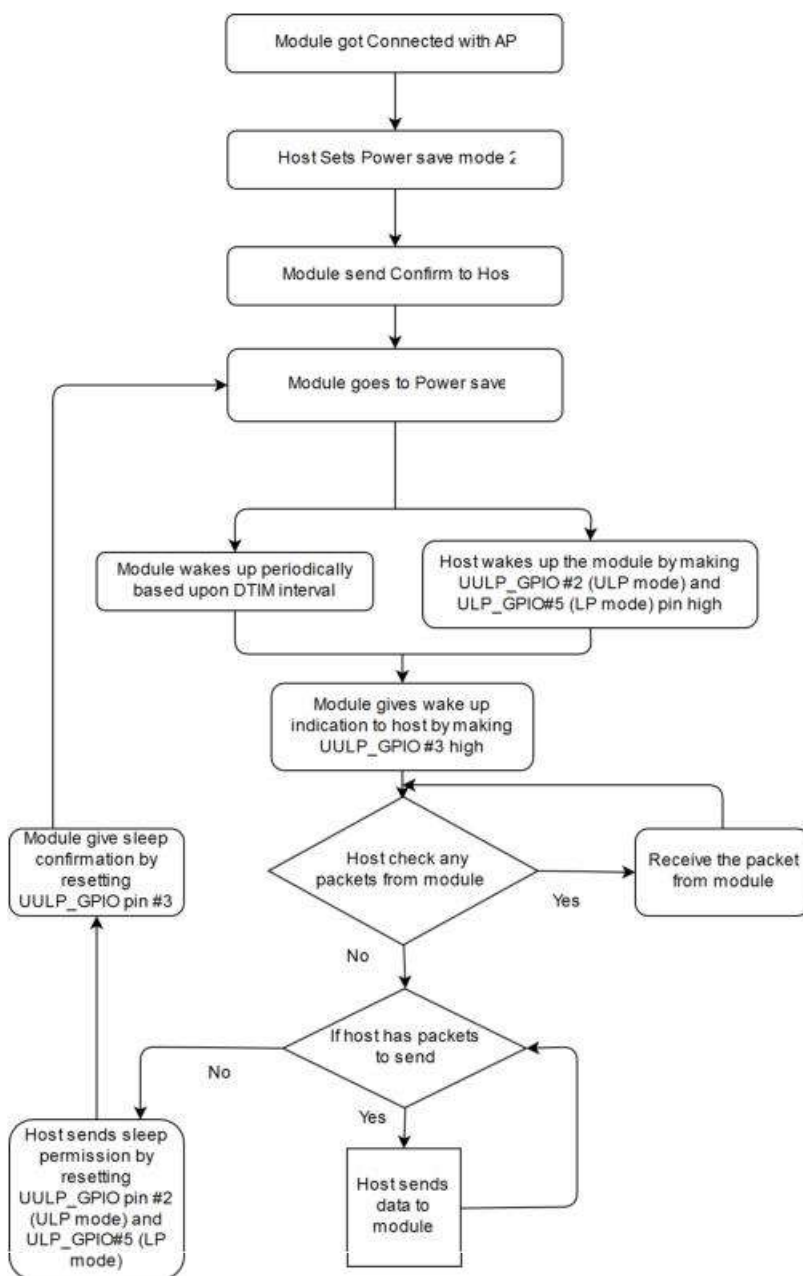


Figure 11-3: Power save Mode 2

11.15.4 Power Save mode 3

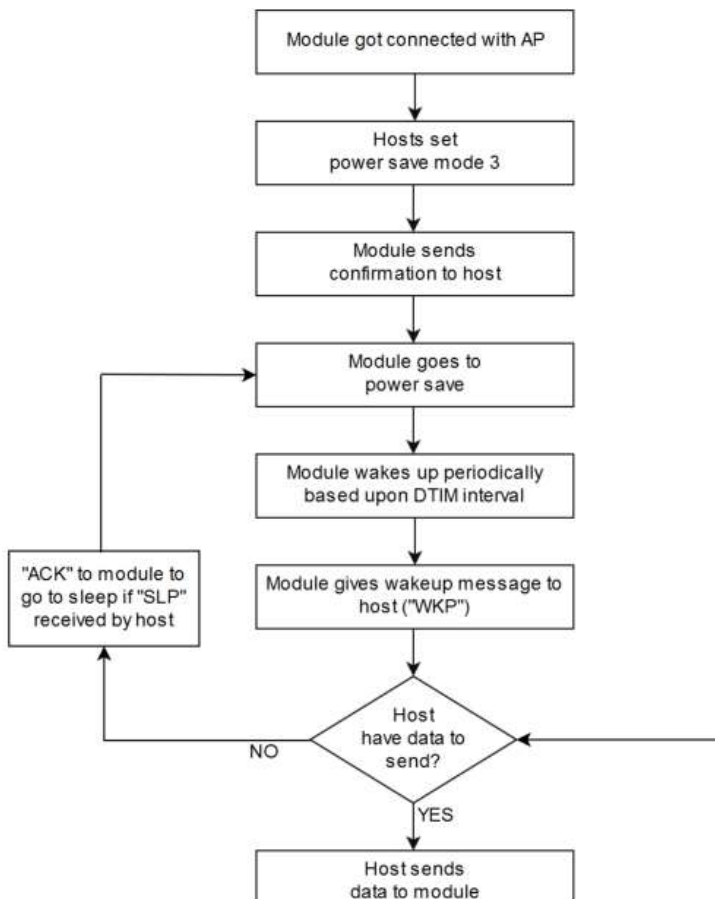
Power Mode 3 is message based power save. In Power Mode 3 like Power mode 2 both radio and SOC of RYWB116 are in power save mode. This mode is significant when module is in associated state with AP. Module wakes up periodically upon every DTIM and gives wakeup message ("WKP") to host. Module can not be woken up asynchronously. Every time module intends to go to sleep it sends a sleep request message ("SLP") to the host and expects host to send the ack message. Host either send ack ("ACK") or any other pending message. But once ack is sent, Host should not send any other message unless next wakeup message from module is received. Module shall not go into complete power-save state if ack is not received from host for given sleep message. Module can send received packets or responses to host at any instant of time. No handshake is required on Rx path.

AT Mode	Binary Mode
"WKP"	0xDD
"SLP"	0xDE

Table 11-11: Message From Module in Power save Mode

AT Mode	Binary Mode
"ACK"	0xDE

Table 11-12: Message from host in Power save Mode



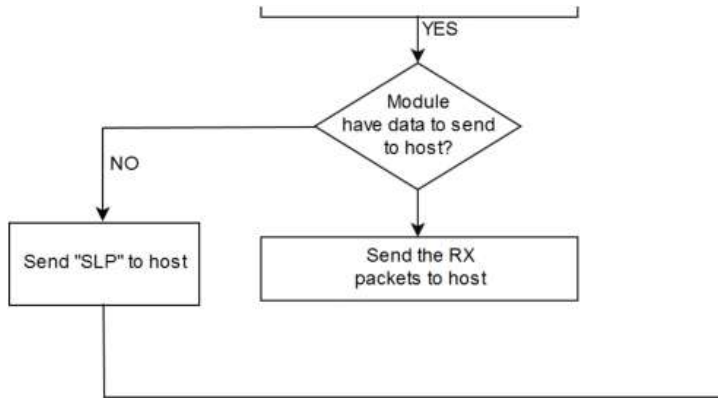


Figure 11-4: Power save Mode 3

11.15.5 Power save mode 8

This command has to be issued after Init command.

In Power Mode 8 both RF and SOC of RYWB116 are in complete power save mode. This mode is significant when module is not connected with any AP. Power mode 8 is GPIO based. In ULP mode , feature_bit_map[4] has to be set in opermode command.

In case of LP (when ulp_mode_enable is '0') host can wakeup the module from power save by making ULP_GPIO_5 high.

In case of ULP (when ulp_mode_enable is '1' or '2') host can wakeup the module from power save by making UULP_GPIO_2 high.

When ulp_mode_enable is set to '0' or '1', once the module gets wakeup it continues to be in wakeup state until it gets power mode 8 commands from host.

When ulp_mode_enable is set to '2', after waking up from sleep module sends following message to host when RAM retention is not enabled. After receiving this message host needs to start giving commands from beginning (opemode) as module's state is not retained.

AT Mode	Binary Mode
"WKP FRM SLEEP"	0xCD

Table 11: 13: Message From Module in ULP Mode 2

11.15.6 Power save mode 9

In Power Mode 9 both Radio and SOC of RYWB116 are in complete power save mode. This mode is significant when module is not connected with any AP. Once power mode 9 command is given, the module goes to sleep immediately and wakes up after sleep duration configurable by host by set sleep timer command. If host does not sets any default time, then the module wakes up in 3sec by default. Upon wakeup module sends a wakeup message to the host and expects host to give ack before it goes into next sleep cycle. Host either send ack or any other messages but once ACK is sent no other packet should be sent before receiving next wakeup message.

When ulp_mode_enable is set to '2', after waking up from sleep, the module sends following message to host when RAM retention is not enabled. After receiving this message, host needs to start giving commands from beginning (opemode) as module's state is not retained.

AT Mode	Binary Mode
"WKP FRM SLEEP"	0xCD

Table 11-14: Message From Module in ULP Mode 2

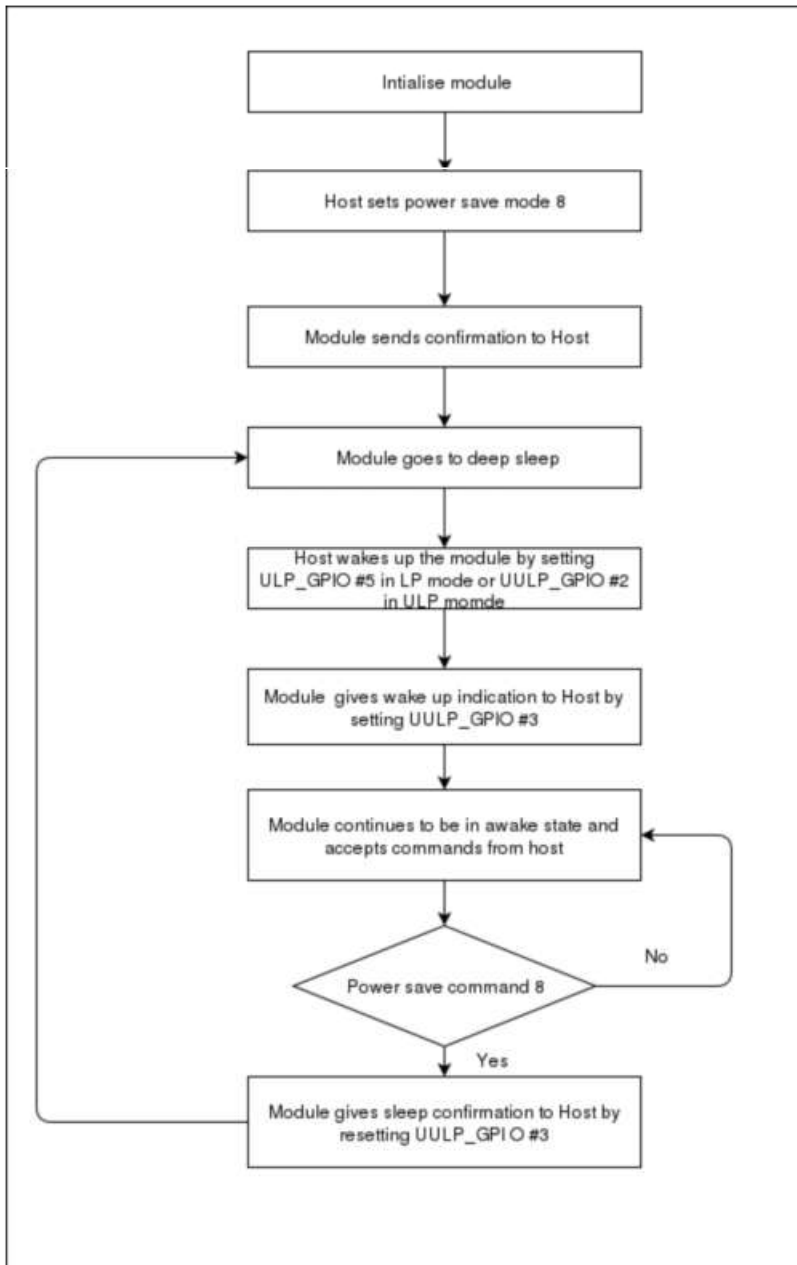


Figure 11-5: Power save Mode 8

11.16 PSK/PMK

Description:

The command is used to set the PSK (Pre shared key) to join to WPA/WPA2-PSK enabled APs. Using this command user can also pass the PMK (PAIRWISE MASTER KEY) as a parameter and can also generate PMK by providing PSK and SSID of connecting AP.

User can directly give PMK from host to reduce the connection time. This command should be issued after init and before join command if module needs to connect to a secure Access point. This command can be ignored if the AP is in Open mode.

Command Format:

AT Mode:

at+rsi_psk=<TYPE>,<psk_or_pmk >,<ap_ssid >\r\n

Binary Mode:

```
#define RSI_SSID_LEN 34
#define RSI_PSK_LEN 64
struct {
    uint8 TYPE;
    uint8 psk_or_pmk [RSI_PSK_LEN];
    uint8 ap_ssid [RSI_SSID_LEN];
}PskFrameSnd;
```

Command Parameters:

TYPE: possible values of this field are 1, 2, 3.

- 1 - indicate pre_shared_key is provided in psk_or_pmk field,
- 2 - indicate pairwise_master_key is provided in psk_or_pmk field,
- 3 - indicate generate pairwise master key from given pre shared key and SSID to which module wants to connect.

Note:

AT command mode TYPE 4 and 5 is added to support ‘,’ in PSK.
 TYPE 4 – indicate length based PSK
 TYPE 5 – indicate generation of PMK from length based PSK and SSID

To support above type new parameter introduced in the command and command format

for the same is

at+rsi_psk=<TYPE>,<length_of_psk>,<psk_or_pmk >,<ap_ssid >\r\n

where,

length_of_psk (1 byte) : gives the length of psk which can includes ‘,’ for example at+rsi_psk=4,10,123,456789

Where,

“123,456789” is psk with 10 bytes length

psk_or_pmk: In this field expected parameters are pre shared key of the access point to which module wants to associate or pair wise master key. Length of this field is 64 Bytes. In case of PMK only 32 bytes are valid, In case of PSK length can vary (8 to 63).

Note:

PMK Is of 32 Bytes .In ATplus command mode, 32 bytes of PMK is given in hex format (64 characters) in the command.

For Example: If PMK is of array, PMK[32] = {0x71, 0x72, 0x01, 0x0A, 0x16, 0x17, 0x07,0x90, 0x71, 0x72, 0x01, 0x0A, 0x16, 0x17, 0x07,0x90, 0x71, 0x72, 0x01, 0x0A, 0x16, 0x17, 0x07,0x90, 0x71, 0x72, 0x01, 0x0A, 0x16, 0x17, 0x07,0x90};, then the command should be given as

at+rsi_psk=2,7172010A161707907172010A161707907172010A161707907172010A16170790\r\n

SSID: This field contains the SSID of the access point, this field will be valid only if TYPE value is 3.

Note:

If user generates PMK using TYPE 3 (i.e. by providing psk and ssid) then module will use generated PMK for connection establishment and there is no need to give pre shared key or pair wise master key again.

Response:

Response contains following payload only if TYPE value is 3. In case of TYPE 1 & 2 response does not contains any payload.

AT Mode:

Result Code	Description
OK	Successful execution of the command. If TYPE value is '1'or '2'.

Result Code	Description
OK< pmk >	Successful execution of the command. If TYPE value is '3'.
ERROR<Error code>	Failure

Binary Mode:

```
typedef struct {
    uint8 pmk[32];
} rsi_PmkResponse;
```

Response Parameters:

Pair wise master key of 32 bytes is given to host if TYPE is 3.

Relevance:

This command is relevant in operating mode 0.

Possible Error Codes:

Possible error codes for this command are 0x0021, 0x0025,0x0026,0x0028,0x002C,0x0039, 0x003a, 0x003b .

Note:
If this command is given by the user then there is no need to give pre_shared_key in join command in Binary Mode.

Example:

AT Mode:

To join a WPA2-PSK security enabled network with key "12345ABCDE", the command is

```
at+rsi_psk=1,12345ABCDE\r\n
0x61 0x740x2B0x720x730x690x5F 0x70 0x73 0x6B 0x3D 0x31 0x2c 0x31 0x32 0x33 0x34 0x35 0x41 0x42 0x43
0x44 0x45 0x0D 0x0A
```

Response:

```
OK\r\n
0x4F 0x4B 0x0D 0x0A
```

To join a WPA2-PSK security enable network with pairwise_master_key "ABCDEFABCDEFABCDEF12345678901234ABCDEFABCDEF12345678901234" ,the command is
at+rsi_psk=2, ABCDEFABCDEFABCDEF12345678901234ABCDEFABCDEF12345678901234,\r\n

Response:

```
OK\r\n
0x4F 0x4B 0x0D 0x0A
```

To generate pairwise_master_key for the pre_shared_key "12345678" and SSID "wise_ap", the command is
at+rsi_psk=3,12345678,wise_ap\r\n

Response:

```
OK<pairwise_master_key>\r\n
0x4F 0x4B <32bytes of pairwise_master_key> 0x0D 0x0A
```

11.17 Set WEP Keys

Description:

This command configures the WEP key in the module to connect to an AP with WEP security. This command should be issued before join.

Command Format:

AT Mode:

```
at+rsi_wepkey=< index >,< key1 >,< key2 >,< key3 >,< key4 >\r\n
```

Binary Mode:


```

struct
{
  uint8 index[2];
  uint8 key[4][32];
}rsi_wepkey;
    
```

Command Parameters:

index: used to select key index configured in AP

0-Key 1 will be used.

1-Key 2 will be used.

2-Key 3 will be used.

3-Key 4 will be used.

Key/Key1/Key2/Key3/Key4: Actual keys. The module supports WEP hex mode only.

The key to be supplied to the AP should be of 10 characters (for 64 bit WEP mode) or 26 characters (for 128 bit WEP mode), and only the following characters are allowed for the key: A,B,C,D,E,F,a,b,c,d,e,f,0,1,2,3,4,5,6,7,8,9

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

No response payload for this command.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C,0x002D

Relevance:

This command is relevant when the module is configured in Operating Mode 0.

Example:

AT Mode:

Give write up for the below key entry

at+rsi_wepkey=0,ABCDE12345,ABCDE12346,ABCDE12347, ABCDE12348\r\n

If the user wants to enter only one valid key

at+rsi_wepkey=0,ABCDE12345,0,0,0\r\n

If the user wants to enter only one valid key

at+rsi_wepkey=2,0,0,ABCDE12345,0\r\n

Response:

OK\r\n

0x4F 0x4B 0x0D 0x0A

11.18 Set WEP Authentication Mode

Description:

This command configures the authentication mode for WEP in the module, if the AP is in WEP security mode. This command supported only in AT Mode.

Command Format:

at+rsi_authmode=[auth_mode](#)\r\n

Command Parameters:

auth_mode: set to '0' for open WEP authentication

Note:
WEP shared mode is not supported in RYWB116_WC_GENR_0_x_x release.

Response:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure, Possible error codes are 0x0021, 0x0025, 0x002C, 0xFF8,0x002D

Relevance:

This command is relevant when the module is configured in Operating Mode 0

Example:

```
at+rsi_authmode=0\r\n
0x61 0x74 0x2B0x72 0x73 0x69 0x5F 0x61 0x75 0x74 0x68 0x6D 0x6F 0x64 0x65 0x3D 0x30 0x0D 0x0A
```

Response:

```
OK\r\n
0x4F 0x4B 0x0D 0x0A
```

11.19 Set EAP Configuration

Description:

This command is used to configure the EAP parameters for connecting to an Enterprise Security enabled Access Point. The supported EAP types are EAP-TLS, EAP-TTLS, EAP-PEAP, EAP-FAST and EAP-LEAP.

Note:
EAP-GTC is not supported for EAP-FAST.
This command can be sent any time after at+rsi_init and before at+rsi_join in enterprise security mode.

Command Format:

AT Mode:

```
at+rsi_eap =< eapMethod >,< innerMethod >,< userIdentity >,< password >,< okc >,<private_key_password>\r\n
```

Binary Mode:

```
typedef struct {
uint8 eapMethod[32];
uint8 innerMethod[32];
uint8 userIdentity[64];
uint8 password[128];
int8 okc_enabled[4];
uint8 private_key_password[82];
}setEapFrameSnd ;
```

Command Parameters:

eapMethod: Should be one of among TLS, TTLS, FAST, PEAP or LEAP. It should be ASCII character string.

innerMethod: This field is valid only in TTLS/PEAP. In case of TTLS/PEAP supported inner methods are MSCHAP/MSCHAPV2. In case of TLS/FAST/LEAP this field is not valid and it should be fixed to MSCHAPV2.

Here MSCHAP/MSCHAPV2 are ASCII character strings.

userIdentity: User ID which is configured in the user configuration file of the radius sever.

Password: Password which is configured in the user configuration file of the Radius Server for that User Identity.

Okc_enabled: To enable or disable opportunistic key caching(OKC)

0 – disable

1 – enable

When this is enabled, module will use cached PMKID to get MSK(Master Session Key) which is need for generating PMK which is needed for 4-way handshake.

private_key_password: This is password for encrypted private key given to the module. Module will use this password during decryption of encrypted private key.

Password length should not be more than 80 bytes

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the
ERROR<Error code>	Failure,

Binary Mode:

There is no response payload for this command.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C.

Relevance:

This command is relevant when the module is configured in Operating Mode 2.

11.20 Set Certificate

Description:

This command is used to load/erase SSL (certificate and private keys) and enterprise security (EAP-TLS or EAP-FAST) certificates. Certificates should be loaded before using SSL/EAP. This command should be sent before join command for enterprise security mode and before socket creation for SSL sockets. Certificates will be loaded in non-volatile memory of the module so certificate load is required to be done only once.

Note:

This command should be sent only after opermode command.

Command Format:

AT Mode:

at+rsi_cert =< CertType >,< total_len >,< KeyPwd >,< Certificate >\r\n

Binary Mode:

```
#define MAX_CERT_SEND_SIZE 1400
struct cert_info_s
{
uint8 total_len[2];
uint8 CertType;
uint8 more_chunks;
uint8 CertLen[2];
uint8 KeyPwd[128];
};
#define MAX_DATA_SIZE (MAX_CERT_SEND_SIZE - sizeof(struct cert_info_s))
struct SET_CHUNK_S
{
struct cert_info_s cert_info;
uint8 Certificate[MAX_DATA_SIZE];
};
```

Command Parameters:

total_len: Certificate's total length in bytes.

Note:

1. For Enterprise security, maximum cert_len should be less than 12280 bytes. For SSL Certificates, the max length is 12280 bytes and for the Private Keys, it is 4088 bytes.
2. Module shares same SSL certificates for all supported SSL sockets.
3. For enterprise, user can load certificates in two ways
 - User can provide wifiuser.pem which contains 4 certificates in a given fixed order of private key, client certificate 1,client certificate 2,CA certificate with CertType as 1.
 - User can load individual EAP certificates private key, public key, and CA certificates with CertType as 17,33 and 49 respectively. Maximum certificate length for each individual certificates is 4088 bytes
4. more_chunks, CertLen fields are available only in Binary Mode.
5. Certificate Loading into Flash is only allowed upto init state. After init state e.g. scan/join etc certificate loading into flash is not allowed.
6. Certificate Loading into RAM is allowed in connected state also provided same type of socket already does not exist. For example, loading client cert is only allowed if there does not exist any client socket. Same is for server certificates too

Note:

Recommended to use loading of single certificate method (wifiuser.pem)

Note:

Set BIT(27) in tcp_ip_feature_bit_map to load SSL certificate onto RAM. By default SSL certificates will be loaded onto flash.

cert_type	Type of certificate
1	EAP client certificate
2	FAST PAC file
3	SSL Client Certificate
4	SSL Client Private Key
5	SSL CA Certificate

cert_type	Type of certificate
6	SSL Server Certificate
7	SSL Server Private Key
17	EAP private key
33	EAP public key
49	EAP CA certificate

more_chunks: A maximum of "MAX_DATA_SIZE" bytes of the certificate can be sent to the module from the Host. If the certificate length is more than "MAX_DATA_SIZE" bytes, then the certificate need to be sent over multiple segments in case of Binary mode. If more_chunks is 0x01, then it indicates to the module that another segment is coming after the current segment. If it is 0x00, it indicates to the module that it is the last segment. Set this parameter to all '0' if total_length is '0'.

In case of AT mode Host need to send whole certificate at a time.

CertLen: Length of the current segment. This parameter is available only in Binary

mode. keyPwd(128 bytes): Reserved.

certificate: This is the data of the actual certificate.

Certificate erase:

For erasing certificate,

more_chunks, cert_length, keypwd, certificate fields should be set to '0' in Binary Mode. total_len, KeyPwd , Certificate fields should be set to '0' in AT Mode.

cert_type should be set to type of the certificate to erase as mentioned above

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

There is no response payload for this command.

Possible error codes:

Possible error codes are 0x0015,0x0021, 0x0025,0x0026, 0x002C.

Relevance:

This command is relevant when the module is configured in Operating Mode 0,2

Example:

AT Mode:

It may not be possible to issue this command in Hyper-terminal because the content of a certificate file needs to be supplied as one of the inputs of the command. This can be done by other means, such as using a Python script. A sample Python excerpt is shown below, where wifuser.pem is the names of the certificate file:

```
def set_cert():
    print "Set certificate\n"
    f3 = open('e:\\certificates\\wifuser.pem', 'r+')
    str = f3.read()
    num =len (str)
    print 'Certificate len', num
    out='at+rsi_cert=1,6522,password,'str'\r\n'
```

print 'Given command'

sp.write(out)

For loading certificate:

at+rsi_cert=1,10,12345678,@\$cd5%ghij\r\n

0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x63 0x65 0x72 0x74 0x3D 0x31 0x2C 0x31 0x30 0x2C 0x31 0x32 0x33 0x34
0x35 0x36 0x37 0x38 0x2C 0x40 0x24 0x63 0x64 0x35 0x25 0x67 0x68 0x69 0x6A 0x0D 0x0A

Response:

OK\r\n

0x4F 0x4B 0x0D 0x0A

For erasing certificate:

at+rsi_cert=1,0,0,0\r\n

0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x63 0x65 0x72 0x74 0x3D 0x31 0x2C 0x30 0x2C 0x30 0x2C 0x30 0x0D 0x0A

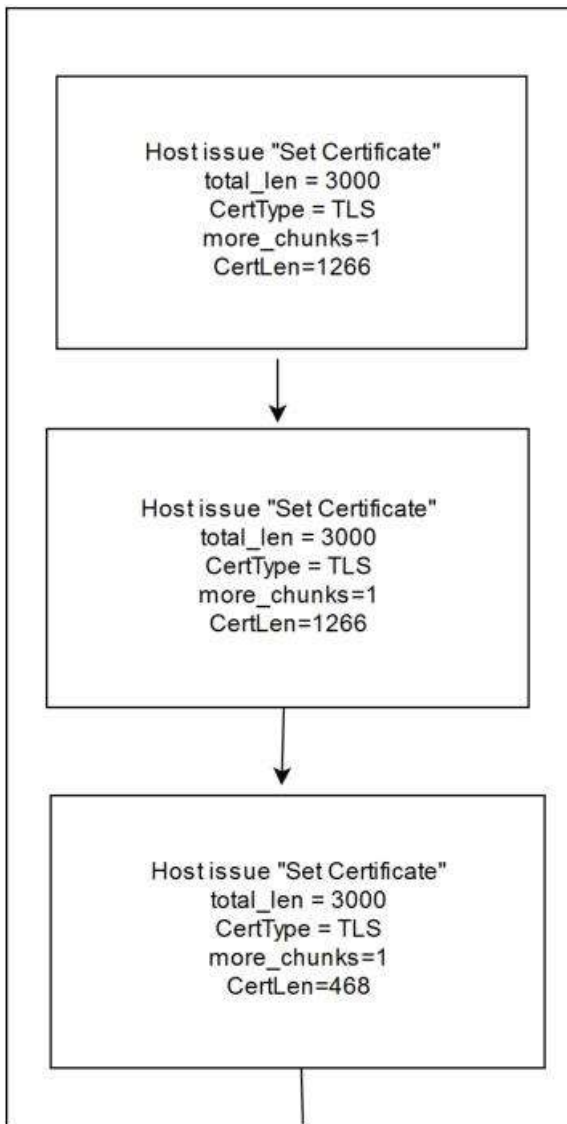
Response:

OK\r\n

0x4F 0x4B 0x0D 0x0A

Binary Mode:

For example, to send a certificate of total length of 3000 bytes, the following flow should be used:



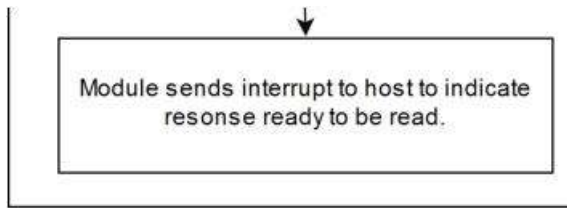


Figure 11-6: Loading Certificate in Binary Mode

11.21 Set Certificate with Indices

Description:

This command is used to load/erase SSL (certificate and private keys) and enterprise security (EAP-TLS or EAP-FAST) certificates. Certificates should be loaded before using SSL/EAP. This command should be sent before join command for enterprise security mode and before socket creation for SSL sockets. Certificates will be loaded in non-volatile memory of the module so certificate load is required to be done only once.

Note:

This command should be sent only after opermode command.

Command Format:

AT Mode:

at+rsi_cert =< CertType >,< total_len >,< CertIdx >,< KeyPwd >,< Certificate >\r\n

Binary Mode:

```
#define MAX_CERT_SEND_SIZE 1400
struct cert_info_s
{
    uint8 total_len[2];
    uint8 CertType;
    uint8 more_chunks;
    uint8 CertLen[2];

    uint8 CertIdx;
    uint8 KeyPwd[127];
};
#define MAX_DATA_SIZE (MAX_CERT_SEND_SIZE - sizeof(struct cert_info_s))
struct SET_CHUNK_S
{
    struct cert_info_s cert_info;
    uint8 Certificate[MAX_DATA_SIZE];
};
```

Command Parameters:

total_len: Certificate's total length in bytes.

Note:

1. For Enterprise security, maximum cert_len should be less than 12280 bytes. For SSL Certificates, the max length is 12280 bytes and for the Private Keys, it is 4088 bytes.
2. Module shares same SSL certificates for all supported SSL sockets.
3. For enterprise, user can load certificates in two ways
 - User can provide wifuser.pem which contains 4 certificates in a given fixed order of private key, client certificate 1,client certificate 2,CA certificate with CertType as 1.
 - User can load individual EAP certificates private key, public key, and CA certificates with CertType as 17,33 and 49 respectively. Maximum certificate length for each individual certificates is 4088 bytes.
4. more_chunks, CertLen fields are available only in Binary Mode.
5. Certificate Loading into Flash is only allowed upto init state. After init state e.g. scan/join etc certificate loading into flash is not allowed.
6. Certificate Loading into RAM is allowed in connected state also provided same type of socket already does not exist. For example, loading client cert is only allowed if there does not exist any client socket. Same is for server certificates too.

Note:

Recommended to use loading of single certificate method (wifuser.pem)

Note:

Set BIT(27) in tcp_ip_feature_bit_map to load SSL certificate onto RAM. By default SSL certificates will be loaded onto flash.

cert_type	Type of certificate
1	EAP client certificate
2	FAST PAC file
3	SSL Client Certificate
4	SSL Client Private Key
5	SSL CA Certificate
6	SSL Server Certificate
7	SSL Server Private Key
17	EAP private key
33	EAP public key
49	EAP CA certificate

more_chunks: A maximum of "MAX_DATA_SIZE" bytes of the certificate can be sent to the module from the Host. If the certificate length is more than "MAX_DATA_SIZE" bytes, then the certificate need to be sent over multiple segments in case of Binary mode. If more_chunks is 0x01, then it indicates to the module that another segment is coming after the current segment. If it is 0x00, it indicates to the module that it is the last segment. Set this parameter to all '0' if total_length is '0'.

In case of AT mode Host need to send whole certificate at a time.

CertLen: Length of the current segment. This parameter is available only in Binary mode.

CertInx (1 bytes): Currently module can hold two sets of SSL certificate into RAM. To field is used to provide the index of the certificates and possible values are 0 and 1.

keyPwd(127 bytes): Reserved.

certificate: This is the data of the actual certificate.

Certificate erase:

For erasing certificate,

more_chunks,cert_length,keypwd,certificate fields should be set to '0' in Binary Mode. total_len, KeyPwd , Certificate fields should be set to '0' in AT Mode.

cert_type should be set to type of the certificate to erase as mentioned above

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

There is no response payload for this command.

Possible error codes:

Possible error codes are 0x0015,0x0021, 0x0025,0x0026, 0x002C, 0x005D, 0x005E, 0x005F.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 2.

Example:

AT Mode:

It may not be possible to issue this command in Hyper-terminal because the content of a certificate file needs to be supplied as one of the inputs of the command. This can be done by other means, such as using a Python script. A sample Python excerpt is shown below, where wifiuser.pem is the names of the certificate file to load certificate with index 0:

```
def set_cert():
print "Set certificate\n"
f3 = open('e:\certificates\wifiuser.pem', 'r+')
str = f3.read()
num =len (str)
print 'Certificate len', num
out='at+rsi_cert_inx=1,6522,0,password,'str'\r\n'
print 'Given command'
sp.write(out)
```

For loading certificate with index 0:

```
at+rsi_cert_inx=1,10,0,12345678,@$cd5%ghij\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x63 0x65 0x72 0x74 0x5F 0x69 0x6E 0x78 0x3D 0x31 0x2C 0x31 0x30 0x2C
0x30 0x2C 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0x2C 0x40 0x24 0x63 0x64 0x35 0x25 0x67 0x68 0x69 0x6A
0x0D 0x0A
```

Response:

```
OK\r\n
0x4F 0x4B 0x0D 0x0A
```

For erasing certificate with index 0:

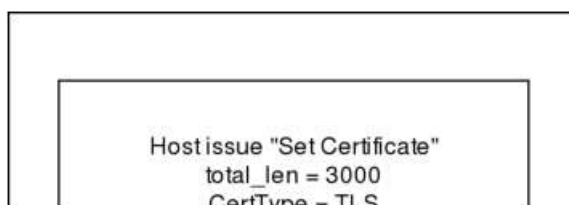
```
at+rsi_cert_inx=1,0,0,0,0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x63 0x65 0x72 0x74 x5F 0x69 0x6E 0x78 0x3D 0x31 0x2C 0x30 0x2C
0x30 0x2C 0x30 0x2C 0x30 0x0D 0x0A
```

Response:

```
OK\r\n
0x4F 0x4B 0x0D 0x0A
```

Binary Mode:

For example, to send a certificate of total length of 3000 bytes with cert index 0, the following flow should be used.



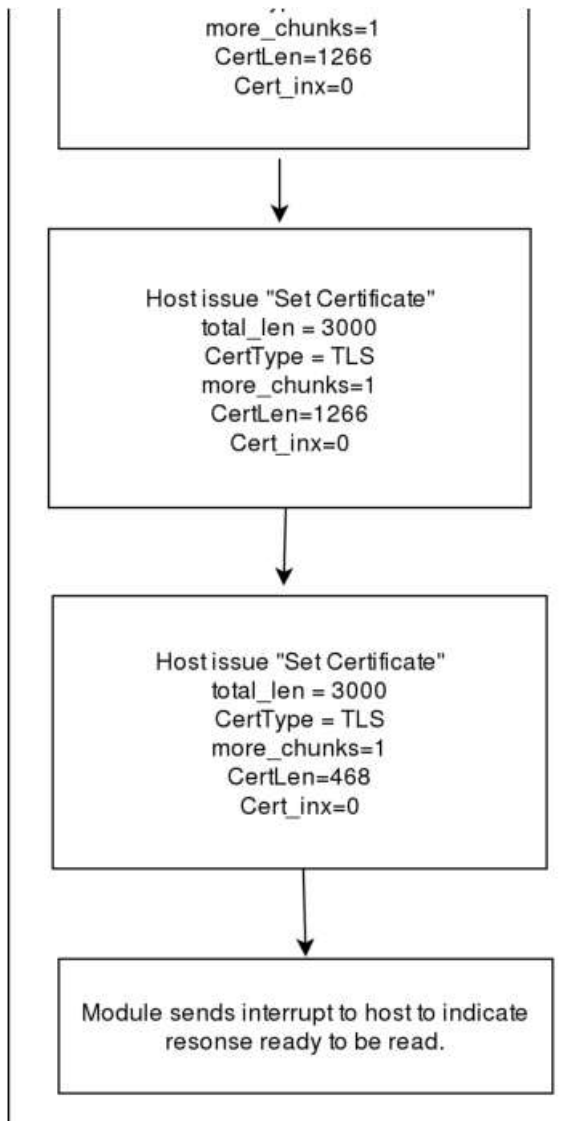


Figure 11-7: Loading Certificate in Binary Mode using indexes

11.22 Disassociate

Description:

This command is issued to request the module to disassociate (disconnect) from an Access Point. The Host can then issue a fresh set of Init, Scan and Join commands to connect to a different Access Point or the same Access Point with a different set of connection parameters. This command can also be used to stop the module from continuing an on-going rejoin operation. Additionally, this command is used when the module is in AP mode, to remove clients from its list of connected nodes.

Command Format:

AT Mode:

at+rsi_disassoc=< mode_flag >,< client_mac_addr >\r\n

Binary Mode:

```
struct{
uint8 mode_flag[2];
uint8 client_mac_addr[6];
}rsi_disassoc_t;
```

Command Parameters:

mode_flag:

Mode	Functionality
0	Module is in client mode. The second parameter mac_addr is ignored when mode is 0.
1	Module is in AP mode.

mac_addr: MAC address of the client to disconnect. Used when the module is in AP mode

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

There is no response payload for this command.

Possible error codes:

Possible error codes are 0x0006, 0x0013, 0x0021, 0x002C, 0x0015.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

Note:

If user issues disconnect command in P2P mode, then there is no way for user to continue further. Module needs a soft reset in that case.

After issuing disconnect command, if there is any power save enabled by that time will be disabled. User can reissue the power save command after initializing the module again.

Example:

AT Mode:

Module is in client mode and is connected to an AP. It wants to formally disconnect from the AP.

```
at+rsi_disassoc=0\r\n
```

```
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x64 0x69 0x73 0x61 0x73 0x73 0x6F 0x63 0x3D 0x30 0x0D 0x0A
```

Module is in AP mode and 3 clients are connected to it. One of the clients, with MAC 0x01 0x02 0x03 0x04 0x05 0x06 , needs to be disconnected by the AP.

```
at+rsi_disassoc=1,010203040506\r\n
```

```
0x61 0x740x2B0x720x730x690x5F 0x64 0x69 0x73 0x61 0x73 0x73 0x6F 0x63 0x3D 0x31 0x2C 0x30 0x31 0x30 0x32 0x30 0x33 0x30 0x34 0x30 0x35 0x30 0x36 0x0D 0x0A
```

Response:

```
OK\r\n
```

```
0x4F 0x4B 0x0D 0x0A
```

11.23 Set IP Parameters

Description:

This command configures the IP address, subnet mask and default gateway for the module.

Command Format:

AT Mode:

at+rsi_ipconf=< dhcpMode >, < ipaddr >,< netmask >,< gateway >, < hostname >, <vap id>,< fqdnFlag>\r\n

Binary Mode:

```
struct {
uint8 dhcpMode;
uint8 ipaddr[4];
uint8 netmask[4];
uint8 gateway[4];
uint8 hostname[31];
uint8 vap_id;

uint8 fqdnFlag[4];
} ipparamFrameSnd;
```

Command Parameters:

dhcpMode: Used to configure TCP/IP stack in manual or DHCP modes.

- 0– Manual
- 1– DHCP enabled
- 3 - To enable DHCP and to send host name in DHCP discover

Note:
 In AP mode only DHCP manual mode (static IP) is valid. sending host name is valid only in DHCP enable mode.
 4 -To enable FQDN Option with static ip (Option 81 with static IP)
 7 -To enable DHCP, hostname, DHCP client FQDN option (Option 81 with Dynamic IP)
 9 - To support DHCP unicast Offer from server

ipAddr: IP address in 4 bytes hex format. This can be 0's in the case of DHCP.

netmask: Subnet mask in 4 bytes hex format. This can be 0's in the case of DHCP.

Gateway: Gateway in 4 bytes hex format. This can be 0's in the case of DHCP.

hostname: Host name for DHCP Client. This can be null, when DHCP mode is not enabled. This field is valid only when dhcpMode value is 3. Maximum Hostname length is valid up to 31 bytes including NULL.

Vap_id: Possible values are 0 and 1.

When 1 - Used start DHCP server in concurrent AP mode (should be given before AP creation i.e. join).

When 0 – Used to assign static IP for client mode.

Note:
 vap_id will be considered only in concurrent mode and when dhcp mode is manual.

fqdnFlag:

0 - DNS Client should update TYPE_A(host name) record and TYPE_PTR records.

1 - DHCP Server will update both TYPE_A and TYPE_PTR records

Response:

AT Mode:

Result Code	Description
OK< macAddr >< ipaddr >< netmask >< gateway >	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

```
typedef struct {
    uint8 macAddr[6];
    uint8 ipaddr[4];
    uint8 netmask[4];
    uint8 gateway[4];
} rsi_ipparamFrameRcv;
```

Response Parameters:

macAddr(6 bytes): MAC Address
 ipAddr(4 bytes) : Assigned IP address
 netmask(4 bytes): Assigned subnet address
 gateway(4 bytes): Assigned gateway address

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C, 0xFFFC,0xFF74, 0xFF9C, 0xFF9D.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

Example:

AT Mode:

To configure in manual mode, with 192.168.1.3, 255.255.255.0 and 192.168.1.1 as the IP address, subnet mask and gateway the command is

```
at+rsi_ipconf=0,192.168.1.3,255.255.255.0,192.168.1.1\r\n
0x610x740x2B0x720x730x690x5F0x690x700x63
0x6F0x6E0x660x3D 0x300x2C0x310x390x320x2E
0x310x360x380x2E0x310x2E0x330x2C 0x320x35
0x350x2E0x320x350x350x2E0x320x350x350x2E
0x300x2C 0x310x390x320x2E0x310x360x380x2E
0x310x2E0x310x0D 0x0A
```

Response:

```
OK<MAC_Address><IP_Address><Subnet_Mask><Gateway>\r\n
0x4F 0x4B 0x01 0x02 0x03 0x04 0x05 0x06 0xC0 0xA8 0x01 0x03 0xFF 0xFF 0xFF 0x00 0xC0 0xA8 0x01 0x01 0x0D0x0A
```

To configure the IP in DHCP enabled mode, the command is

```
at+rsi_ipconf=1,0,0,0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x69 0x70 0x63 0x6F 0x6E 0x66 0x3D 0x31 0x2C 0x30 0x2C 0x30 0x2C 0x30 0x0D
0x0A
```

Response:

```
OK<MAC_Address><IP_Address><Subnet_Mask><Gateway>\r\n
0x4F 0x4B 0x01 0x02 0x03 0x04 0x05 0x06 0xC0 0xA8 0x01 0x03 0xFF0xFF0xFF0x000xC00xA80x01 0x01 0x0D 0x0A
```

To configure the IP in DHCP enabled mode with hostname, the command is

```
at+rsi_ipconf=3,dhcp_client\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x69 0x70 0x63 0x6F 0x6E 0x66 0x3D 0x31 0x2C 0x30 0x2C 0x30 0x2C 0x30 0x0D
0x0A
```

Response:

```
OK<MAC_Address><IP_Address><Subnet_Mask><Gateway>\r\n
0x4F 0x4B 0x01 0x02 0x03 0x04 0x05 0x06 0xC0 0xA8 0x01 0x03 0xFF0xFF0xFF0x000xC00xA80x01 0x01 0x0D 0x0A
```

11.24 IP Change Notification

Description:

This notification is received when module gets a different IP as compared to modules old IP address, after DHCP renewal. Module indicates this IP change to host by an asynchronous frame.

Command Format:

N/A

Command Parameters:

N/A

Response:

AT Mode:

Result Code	Description
AT+RSI_IPCONF< macAddr >< ipaddr >< netmask >< gateway >	

Binary Mode:

```
typedef struct {
    uint8 macAddr[6];
    uint8 ipaddr[4];
    uint8 netmask[4];
    uint8 gateway[4];
} rsi_recvipChange;
```

Response Parameters:

- macAddr(6 bytes): MAC Address
- ipAddr(4 bytes): Assigned IP address
- netmask(4 bytes): Assigned subnet address
- gateway(4 bytes): Assigned gateway address

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

Example:

AT Mode:

```
AT+RSI_IPCONF< macAddr >< ipaddr >< netmask >< gateway >\r\n
0x41 0x54 0x2B 0x52 0x53 0x49 0x5F 0x49 0x50 0x43 0x4F 0x4E 0x46 0x3D 0x01 0x02 0x03 0x04 0x05 0x06 0xC0
0xA8 0x01 0x03 0xFF0xFF0xFF0x000xC00xA8
0x01 0x01 0x0D 0x0A
```

11.25 Set IPv6 Parameters

Description:

This command configures the IPv6 address, prefix length and default router for the module.

Command Format:

AT Mode:

```
at+rsi_ipconf6=< mode >,< prefixLength >,< ipaddr6 >,< gateway6 >\r\n
```

Binary Mode:

```
struct {
    uint8 mode[2];
    uint8 prefixLength[2];
    uint8 ipaddr6[16];
    uint8 gateway6[16];
} ipconf6FrameSnd;
```

Command Parameters:

mode:

Used to configure TCP/IP stack in manual or DHCPv6 modes.

0–Manual
1–DHCPv6

prefixLength: Prefix length of the IPv6 address.

ipaddr6: IPv6 address. This can be 0's in the case of DHCPv6.

gateway6: Default router's IPv6 address. This should be Null in the case of DHCPv6.

IPv6 address is generally of the form - octet of four hexadecimal digits separated by "colons".

e.g. 2001:0db8:1:0:0:0:0:123 (supported format)

2001:db8:1::123 (not supported format)

Double colons are used in place of continuous zeroes in IPV6 address, to minimize the IPV6 address, but in RYWB116 double colons are not supported. In ipconf6 command you have to supply all the eight groups of four hexadecimal digits.

Response:

AT Mode:

Result Code	Description
OK< prefixLength >< ipaddr6>< defaultgw6>	Successful execution of the command.
ERROR<Error code>	Failure

Binary Mode:

```
typedef struct {
    uint8 prefixLength[2];
    uint8 ipaddr6[16];
    uint8 defaultgw6[16];
} rsi_ipconf6FrameRcv;
```

Response Parameters:

prefixLength(2 bytes): Prefix length of IPv6 address

ipaddr6(16 bytes): Assigned IPv6 address

gateway6(16 bytes): Assigned default_router address

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C, 0xFFFC, 0xFF9C, 0xFF74, 0xFF9D.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

Example:

AT Mode:

To configure in manual mode, with 2001:db8:1:0:0:0:0:123 as the IPV6 address and with 2001:db8:1:0:0:0:0:100 as router IPV6 address, the command is :

```
at+rsi_ipconf6=0,64,2001:DB8:1:0:0:0:0:123,2001:DB8:1:0:0:0:0:100\r\n
0x610x740x2B0x720x730x690x5F0x690x700x63 0x6F0x6E0x660x36 0x3D 0x300x2C0x360x340x32 0x300x30 0x31
0x3A0x440x420x380x3A0x310x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x31 0x32 0x330x2C0x32
0x300x30 0x31 0x3A0x440x420x38 0x3A0x310x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x31 0x00
0x000x0D 0x0A
```

Response:

```
OK< prefixLength >< ipaddr6 >< gateway6>\r\n
0x4F 0x4B 0x40 0x00 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x23 0x01 0x00 0x00 0xB8
0x0D 0x01 0x20 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x01 0x00 0x00 0x0D 0x0A
```

To configure the IPV6 in DHCPV6 enabled mode, the command is

```
at+rsi_ipconf6=1\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x69 0x70 0x63 0x6F 0x6E 0x66 0x36 0x3D 0x31 0x0D 0x0A
```

Response:

OK< prefixLength >< ipaddr6 >< gateway6>\r\n
 0x4F 0x4B 0x40 0x00 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x36 0x01 0x00 0x00 0xB8
 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x01 0x00 0x00 0x0D 0x0A
 The IPv6 address assigned to module by DHCPv6 server is 2001:DB8:1:0:0:0:136, default prefix 64 is used and
 router ipv6 address is 2001:DB8:1:0:0:0:100.

11.26 SNMP

Description:

This command configures the SNMP agent in the module. This command can be issued only after set IP parameters or set IPv6 parameters command. This is the very first command for using SNMP feature

Command Format:

AT Mode:

at+rsi_snmp_enable=< snmpEnable >\r\n

Binary Mode:

```
struct {
    uint8 snmpEnable;
} snmpEnableFrameSnd;
```

Command Parameters:

snmpEnable:

To enable SNMP agent in module
 0 - SNMP disable
 1 - SNMP enable

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command.
ERROR<Error code>	Failure

Binary Mode:

N/A

Response Parameters:

N/A

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C,0xFF74,0x0015,0x100,0xFF82.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

Example:

AT Mode:

To enable SNMP in module the command is
 at+rsi_snmp_enable=1\r\n

.....
 0x610x740x2B0x720x730x690x5F0x73 0x6E 0x6D 0x70 0x5F 0x65 0x6E 0x61 0x62 0x6C 0x65 0x3D 0x31 0x0D
 0x0A

Response:

OK\r\n
 0x4F 0x4B 0x0D 0x0A

11.27 SNMP Set

Description:

This is an asynchronous message which module gives to host whenever it receives snmp set message from the remote SNMP server to set the value corresponding to the object id. This message can only be received when module is configured as an SNMP agent.

Command Format:

AT Mode:

N/A

Binary Mode:

N/A

Command Parameters:

N/A

Response:

AT Mode:

Result Code	Description
AT_RSI_SNMP_SET=<object_id >,< length >,< value >	Asynchronous message sent by remote snmp server and received by the module.

Binary Mode:

```
struct{
    uint8 object_id[128];
    uint8 length[4];
    uint8 value[200];
}rsi_snmp_set;
```

Response Parameters:

object_id (128 bytes): object id for which the snmp server wants to set.

length (4bytes):length of value of object id.

LSB is returned first.

value (200bytes): value of object id to be set. Out of these 200 bytes user has to consider only length number of bytes.

Note:

Value contains maximum of 144 bytes in case of IPV6.

Possible error codes:

N/A

Relevance:

This message is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

Example:

AT Mode:

```
AT+RSI_SNMP_SET=1.3.6.1.2.1.1.1.0,4,home\r\n
0x41 0x54 0x2B 0x52 0x53 0x49 0x5F 0x53 0x4E 0x4D 0x50 0x5F 0x53 0x45 0x54 0x3D 0x31 0x2E 0x33 0x2E 0x36 0x2E
0x31 0x2E 0x32 0x2E 0x31 0x2E 0x31 0x2E 0x31 0x2E 0x30 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00
0X00 0X00 0X00 0X00 0x2C 0x00 0x00 0x00 0x04 0x2C 0X68 0X6F 0X6D 0X65 0X00 0X00 0X00 0X00 0X00 0X00 0X00
0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00
0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00
```

0X00
 0X00
 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X00 0X0D 0X0A

11.28 SNMP Get Response

Description:

This command is given in response to the get request received by the SNMP agent (module) and issued by the SNMP server. Whenever snmp server sends a snmp get request ,module indicates this to host by an asynchronous message. Then module has to issue this command for sending response to corresponding received snmp get request.

Command Format:

AT Mode:

at+rsi_snmp_get_rsp=< type >,< value >,< OID >|\r\n

Binary Mode:

```
#define MAX_SNMP_VALUE 200
#define MAX_OID_LENGTH 128

struct{
uint8 type;
uint8 value[MAX_SNMP_VALUE];

uint8 objid[MAX_OID_LENGTH];
}snmpFrameSnd;
```

Command Parameters:

type: type of object requested.

SNMP Object Type	Object code
SNMP_ANS1_COUNTER	0x41
SNMP_ANS1_COUNTER64	0x46
SNMP_ANS1_END_OF_MIB_VIEW	0x82
SNMP_ANS1_GAUGE	0x42
SNMP_ANS1_OBJECT_ID	0x6
SNMP_ANS1_INTEGER	0x2
SNMP_ANS1_IP_ADDRESS	0x40
SNMP_ANS1_IPV6_ADDRESS	0x44
SNMP_ANS1_NO_SUCH_INSTANCE	0x81
SNMP_ANS1_NO_SUCH_OBJECT	0x80
SNMP_ANS1_OCTET_STRING	0x4
SNMP_ANS1_TIME_TICS	0x43

Figure 10- 17: SNMP Object Types and Codes

value: value passed in response corresponding to the type of object requested.

Note:

1. Size of the value should be 200 bytes. For example, if the value is “reyax” (length of the value is 5 bytes) then remaining 195 bytes should be filled with NULL.
2. OID should be given followed by value, without having any comma(,) separator between value and OID.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command.
ERROR<Error code>	Failure

Binary Mode:

N/A

Response Parameters:

N/A

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

The list of example OIDs are:

OID	Description
1.3.6.1.2.1.4.3.0	The total number of input datagrams received from interfaces, including those received in error
1.3.6.1.2.1.4.4.0	The number of input datagrams discarded due to errors in their IP headers, including bad checksums, version number mismatch, other format errors, time-to-live exceeded, errors discovered in processing their IP options, etc.
1.3.6.1.2.1.4.5.0	The number of input datagrams discarded because the IP address in their IP header's destination field was not a valid address to be received at this entity. This count includes invalid addresses (e.g., 0.0.0.0) and addresses of unsupported Classes (e.g., Class E). For entities which are not IP routers and therefore do not forward datagrams, this counter includes datagrams discarded because the destination address was not a local address
1.3.6.1.2.1.4.6.0	The number of input datagrams for which this entity was not their final IP destination, as a result of which an attempt was made to find a route to forward them to that final destination. In entities which do not act as IP routers, this counter will include only those packets which were Source- Routed via this entity. and the Source-Route option processing was successful
1.3.6.1.2.1.4.7.0	The number of locally-addressed datagrams received successfully but discarded because of an unknown or unsupported protocol."ecause of an unknown or unsupported protocol
1.3.6.1.2.1.4.9.0	The total number of input datagrams successfully delivered to IP user-protocols (including ICMP)
1.3.6.1.2.1.4.10.0	The total number of IP datagrams which local IP user- protocols (including ICMP) supplied to IP in requests for transmission. Note that this counter does not include any datagrams counted in ipForwDatagrams
1.3.6.1.2.1.4.11.0	The number of output IP datagrams for which no problem was encountered to prevent their transmission to their destination, but which were discarded (e.g., for lack of buffer space). Note that this counter would include datagrams counted in ipForwDatagrams if any such packets met this (discretionary) discard criterion

OID	Description
1.3.6.1.2.1.4.12.0	The number of IP datagrams discarded because no route could be found to transmit them to their destination. Note that this counter includes any packets counted in ipForwDatagrams which meet this 'no-route' criterion. Note that this includes any datagrams which a host cannot route because all of its default routers are down
1.3.6.1.2.1.4.14.0	Number of Internet Protocol (IP) fragments received which needed to be reassembled at this entity
1.3.6.1.2.1.4.15.0	Number of Internet Protocol (IP) datagrams successfully re- assembled
1.3.6.1.2.1.4.16.0	Number of failures detected by the IP reassembly algorithm (for whatever reason: timed out, errors, etc). Note that this is not necessarily a count of discarded IP fragments since some algorithms (notably the algorithm in RFC 815) can lose track of the number of fragments by combining them as they are received.
1.3.6.1. 2.1.4.17.0	Number of Internet Protocol (IP) datagrams that have been successfully fragmented at this entity
1.3.6.1.2.1.4.18.0	The number of Internet Protocol (IP) datagrams that have been discarded because they needed to be fragmented at this entity but could not be, e.g. because their Don't Fragment flag was set
1.3.6.1.2.1.4.19.0	Number of Internet Protocol (IP) datagram fragments that have been generated as a result of fragmentation at this entity
1.3.6.1.2.1.5.1.0	The total number of ICMP messages which the entity received. Note that this counter includes all those counted by icmpInErrors
1.3.6.1.2.1.5.2.0	The number of ICMP messages which the entity received but determined as having ICMP-specific errors (bad ICMP checksums, bad length, etc.)
1.3.6.1.2.1.5.8.0	The number of ICMP Echo (request) messages received
1.3.6.1.2.1.5.9.0	The number of ICMP Echo Reply messages received
1.3.6.1.2.1.5.14.0	The total number of ICMP messages which this entity attempted to send. Note that this counter includes all those counted by icmpOutErrors
1.3.6.1.2.1.5.15.0	Number of ICMP messages which this entity did not send due to problems discovered within ICMP such as a lack of buffers. This value should not include errors discovered outside the ICMP layer such as the inability of IP to route the resultant datagram. In some implementations there may be no types of error which contribute to this counter's value
1.3.6.1.2.1.5.21.0	The number of ICMP Echo (request) messages sent.
1.3.6.1.2.1.5.22.0	The number of ICMP Echo Reply messages sent
1.3.6.1.2.1.6.5.0	The number of times TCP connections have made a direct transition to the SYN-SENT state from the CLOSED state
1.3.6.1.2.1.6.6.0	The number of times TCP connections have made a direct transition to the SYN-RCVD state from the LISTEN state
1.3.6.1.2.1.6.7.0	The number of times TCP connections have made a direct transition to the CLOSED state from either the SYN-SENT state or the SYN-RCVD state, plus the number of times TCP connections have made a direct transition to the LISTEN state from the SYN-RCVD state
1.3.6.1.2.1.6.8.0	The number of times TCP connections have made a direct transition to the CLOSED state from either the ESTABLISHED state or the CLOSE-WAIT state
1.3.6.1.2.1.6.10.0	The total number of segments received, including those received in error. This count includes segments received on currently established connections
1.3.6.1.2.1.6.11.0	The total number of segments sent, including those on current connections but excluding those containing only retransmitted octets
1.3.6.1. 2.1.6.12.0	The total number of segments retransmitted - that is, the number of TCP segments transmitted containing one or more previously transmitted octets
1.3.6.1.2.1.6.14.0	The total number of segments received in error (e.g., bad TCP checksums)

OID	Description
1.3.6.1.2.1.6.15.0	The number of TCP segments sent containing the RST flag
1.3.6.1.2.1.7.1.0	The total number of UDP datagrams delivered to UDP users
1.3.6.1.2.1.7.4.0	The total number of UDP datagrams sent from this entity
1.3.6.1.2.1.7.3.0	The number of received UDP datagrams that could not be delivered for reasons other than the lack of an application at the destination port

Example:

AT Mode:

To respond for string type of SNMP object requested by the remote SNMP server

"AT+RSI_SNMP_GET=1.3.6.1.2.1.1.1.0" the command is :

at+rsi_snmp_get_rsp=4,abcd\r\n

0x61 0x74 0x2B 0x72 0x730x69 0x5F 0x73 0x6E 0x6D 0x70 0x5F 0x67 0x65 0x74 0x5F 0x72 0x73 0x70 0x3D 0x34 0x2C 0x61 0x62 0x63 0x64 0x0D 0x0A

Response:

OK\r\n

0x4F 0x4B 0x0D 0x0A

For, OID of type INTEGER, COUNTER, COUNTER64, GAUGE, TIMER_TICKS input shall be given in hexa-equivalent form.

To respond for INTEGER type of SNMP object requested by the remote SNMP server

"AT+RSI_SNMP_GET=1.3.6.1.2.1.1.3.0" the command is :

for Integer value 6:-

HEX EQUIVALENT:

61 74 2B 72 73 69 5F 73 6E 6D 70 5F 67 65 74 5F 72 73 70 3D 32 2C 06 0D 0A

For Integer value 10:-

HEX EQUIVALENT:

61 74 2B 72 73 69 5F 73 6E 6D 70 5F 67 65 74 5F 72 73 70 3D 32 2C 0A 0D 0A

For Integer value 276:-

HEX EQUIVALENT:

61 74 2B 72 73 69 5F 73 6E 6D 70 5F 67 65 74 5F 72 73 70 3D 32 2C 14 01 0D 0A

For, OID of type IP_ADDRESS, if the response ip-address want to give is 192.168.10.163 the command shall be given in hexa form as shown below:

0x61 0x74 0x2b 0x72 0x73 0x69 0x5f 0x73 0x6e 0x6d 0x70 0x5f

0x67 0x65 0x74 0x5f 0x72 0x73 0x70 0x3d 0x36 0x34 0x2c 0xa3

0x0a 0xa8 0xc0 0x0d 0x0a

For, OID of type IPV6_ADDRESS, if the response ipv6-address want to give is 2001:db8:0:1:0:0:0:123

11.29 SNMP Get Next Response

Description:

This command is given in response to the get request received by the SNMP agent (module) and issued by the SNMP server. Whenever snmp server sends a snmp get_next request ,module indicates this to host by an asynchronous message. Then module has to issue this command for sending response to corresponding received snmp get next request.

Command Format:

AT Mode:

at+rsi_snmp_getnext_rsp=< type >,< value >,<next objid in MIB table>\r\n

Binary Mode:

```
#define MAX_SNMP_VALUE 200

#define MAX_OID_LENGTH 128
struct{
uint8 type;
uint8 value[MAX_SNMP_VALUE];

uint8 objid[MAX_OID_LENGTH];
}snmpFrameSnd;
```

Command Parameters:

type : type of object requested.

SNMP Object Type	Object code
SNMP_ANS1_COUNTER	0x41
SNMP_ANS1_COUNTER64	0x46
SNMP_ANS1_END_OF_MIB_VIEW	0x82
SNMP_ANS1_GAUGE	0x42
SNMP_ANS1_OBJECT_ID	0x6
SNMP_ANS1_INTEGER	0x2
SNMP_ANS1_IP_ADDRESS	0x40
SNMP_ANS1_IPV6_ADDRESS	0x44
SNMP_ANS1_NO_SUCH_INSTANCE	0x81
SNMP_ANS1_NO_SUCH_OBJECT	SNMP_ANS1_NO_SUCH_OBJECT 0x80
SNMP_ANS1_OCTET_STRING	0x4
SNMP_ANS1_TIME_TICS	0x43

Table 11-15: SNMP Object Types and Codes

value: value passed in response corresponding to the type of object requested.

Note:

1. Size of the value should be 200 bytes. For example, if the value is “reyax” (length of the value is 5 bytes) then remaining 195 bytes should be filled with NULL.
2. OID should be given followed by value, without having any comma(,) separator between value and OID.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command.
ERROR<Error code>	Failure

Binary Mode:

N/A

Response Parameters:

N/A

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C.


```
#define RSI_SNMP_TAP_BUFFER_LENGTH 1024
struct{
uint8 snmp_version[4];
uint8 ip_version[4];
union{
uint8 ipv4_address[4];
uint8 ipv6_address[16];
}destIPAddr;
uint8 community[32];
uint8 trap_type;
uint8 elapsed_time[4];
uint8 trap_oid[51];
uint8 obj_list_count;
uint8 snmp_buf[RSI_SNMP_TAP_BUFFER_LENGTH]
}snmptrapFrameSnd;
```

Format of snmp object list variable:

```
typedef struct SNMP_OBJECT_DATA_STRUCT
{
uint8 snmp_object_data_type[4];
uint8 snmp_object_data_msw[4];
uint8 snmp_object_data_lsw[4];
uint8 snmp_ip_version[4];
union{
uint8 ipv4_address[4];
uint8 ipv6_address[16];
}snmp_nxd_address;
uint8 snmp_object_octet_string_size[4];
} SNMP_OBJECT_DATA;
typedef struct SNMP_TRAP_OBJECT_STRUCT
{
uint8 snmp_object_string_ptr[40];
SNMP_OBJECT_DATA snmp_object_data;
} SNMP_TRAP_OBJECT;
```

Command Parameters:

snmp_version: snmp version (1/2/3). Currently only version 2 is supported for SNMP trap.

ip_version: IP version (4 or 6)

destIPAddr.ipv4_address: ipv4 address based upon the ip_version 4 selected. Module ignores remaining 12 bytes in case of ip version 4.

destIPAddr.ipv6_address: ipv6 address based upon the ip_version 6 selected.

community: community name

trap_type: type of trap

trap_type	type of trap
0	(coldStart)
1	(warmStart)
2	(linkDown)

trap_type	type of trap
3	(linkUp)
4	(authenticationFailure)
5	(egpNeighborLoss)
6	(User specific trap type)

0 - (coldStart)
 1 - (warmStart)
 2 - (linkDown)
 3 - (linkUp)
 4 - (authenticationFailure)
 5 - (egpNeighborLoss)
 6 - (User specific trap type)

trap_oid: trap oid of the user specific trap.elapsed time: Total device time elapsed .

obj_list_count: Obeject variables list count

snmp_buf: snmp buf contains the array of snmp trap object variablestructures(SNMP_TRAP_OBJECT).

- User has to fill snmp_buf with number of SNMP_TRAP_OBJECT(obj_list_count) structure.
- Based on snmp_object_data_type, User need to fill SNMP_TRAP_OBJECT structure.
- To use Octet string object data type, user needs to fill length of the string in snmp_object_octet_string_size parameter.

Based on string size user has to fill octect string. If string length is zero, Octet string has to be filled with NULL .

Note:

1. Maximum supported length for snmp Buffer is 1024.
2. Maximum supported object list count is 10.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command.
ERROR<Error code>	Failure

Binary Mode:

N/A

Response Parameters:

N/A

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C, 0xFF82,0x0100,0x0104,.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

Note:

For trap_type value 0 – 5 trap_oid parameter has to be NULL character.

Example:

AT Mode:

For ipv4:

11.31 Open Socket

Description:

This command opens a TCP/UDP/SSL/Websocket client socket, a Listening TCP/UDP/SSL socket.

Note:

1. A maximum of 10 sockets can be opened. Range of socket handles are between 1 to 10.
2. Module supports maximum of 2 SSL sockets. These can be either client or server sockets. When HTTPS server is enabled then user can open only 1 SSL socket.
3. Module supports maximum of 8 non SSL Web sockets and 2 SSL Web sockets.
4. Each SSL/Web socket will occupy one TCP socket. SSL is supported only in Wi-Fi client mode.
5. If SSL is enabled module will use same SSL version until module reboots.
6. If SSL is enabled module will use same CA certificate for both SSL server socket and SSL client socket until module reboots.

Note:

Above case is valid only when BIT(27) is not set in tcp_ip_feature_bit_map (module will use SSL certificates from FLASH).

1. If BIT(27) (SSL certificate on to the RAM feature) is set in tcp_ip_feature_bit_map, module will only support either SSL server socket or SSL client socket.

Command Format:

AT Mode:

To open TCP/SSL/Web socket over IPv4:

```
at+rsi_tcp=< destIPAddr >, < destSocket >, < moduleSocket >, < tos >, < ssl_ws_enable >, < ssl_ciphers >, < webs_resource_name >, < webs_host_name >, <tcp_retry_count>, < socket_bitmap >, <rx_window_size>, <tcp_keepalive_timeout>, < vap_id >, <cert_inx>\r\n
```

To open TCP/SSL/Web socket over IPv6:

```
at+rsi_tcp6=< destIPAddr >, < destSocket >, < moduleSocket >, < tos >, < ssl_ws_enable >, <ssl_ciphers >, < webs_resource_name >, < webs_host_name >, <tcp_retry_count>, < socket_bitmap >, <rx_window_size>, <tcp_keepalive_timeout>, < vap_id >\r\n
```

To open TCP/SSL server socket over IPv4:

```
at+rsi_ltcp=< moduleSocket >, < max_count >, < tos >, < ssl_ws_enable >, <ssl_ciphers >, <tcp_retry_count>, < socket_bitmap >, <rx_window_size>, <tcp_keepalive_timeout>, < vap_id >, <cert_inx>\r\n
```

To open TCP/SSL server socket over IPv6:

```
at+rsi_ltcp6=< moduleSocket >, < max_count >, < tos >, < ssl_ws_enable >, < ssl_ciphers >, <tcp_retry_count>, < socket_bitmap ><rx_window_size>, <tcp_keepalive_timeout>, < vap_id >\r\n
```

To open LUDP socket over IPv4:

```
at+rsi_ludp=< moduleSocket >,< tos >,< socket_bitmap >,< vap_id >\r\n
```

To open LUDP socket over IPv6:

```
at+rsi_ludp6=< moduleSocket >, < tos >, < socket_bitmap >, < vap_id >\r\n
```

Binary Mode:

```
#define WEBS_MAX_URL_LEN 51
#define WEBS_MAX_HOST_LEN 51
struct {
    uint8 ip_version[2];
    uint8 socketType[2];
    uint8 moduleSocket[2];
    uint8 destSocket[2];
    union{
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    }destIPAddr;
    uint8 max_count[2];
    uint8 tos[4];
    uint8 ssl_bitmap;
    uint8 ssl_ciphers;
    uint8 webs_resource_name[WEBS_MAX_URL_LEN];
    uint8 webs_host_name[WEBS_MAX_HOST_LEN];
    uint8 tcp_retry_count;
    uint8 socket_bitmap;
    uint8 rx_window_size;
    uint8 tcp_keepalive_initial_time[2];
    uint8 vap_id;
    uint8 cert_inx;
} socketFrameSnd;
```

Command Parameters:

Note:

ip_version, socketType fields are available only in Binary Mode.

ip_version: IP version used, either 4 or 6.

socketType: Type of the socket

0– TCP/SSL Client

2– TCP/SSL Server (Listening TCP)

4– Listening UDP

moduleSocket: Port number of the socket in the module. Value ranges from 1024 to 49151.

destSocket: destination port. Value ranges from 1024 to 49151. Ignored when TCP server or Listening UDP sockets are to be opened.

destIPAddr.ipv4_address: IP Address of the target server. Ignored when TCP server or Listening UDP sockets are to be opened. If ip_version is 4 then only first four bytes of the ipv4_address is filled rest twelve bytes will be 0.

destIPAddr.ipv6_address: IPv6 Address of the target server. Ignored when TCP server or Listening UDP sockets are to be opened. All 16 bytes are filled if ip_version is 6.

max_count: Maximum number of clients can be connect in case of LTCP.

Note:

Module support maximum 2 SSL sockets, so max_count should be less than or equal to 2 in case of LTCP. If max_count is 2 then host can create only one SSL based LTCP socket with two clients support.

This field can be ignored if the socket type is other than 2(TCP server).

tos: type of service field. Possible values are 0-7.

TOS Value	Description
0	Best Effort
1	Priority
2	Immediate
3	Flash-mainly used for voice signaling
4	Flash Override
5	Critical-mainly used for voice RTP
6	Internet
7	Network

Table 11:16: TOS Values

ssl_bitmap: This field is used to enable following:

Possible values:

- 0 – To open TCP socket.
- BIT(0) - To open SSL client socket.
- BIT(1) - To open Web socket client.
- BIT(2) - To open SSL socket with TLS 1.0 version.
- BIT(3) - To open SSL socket with TLS 1.2 version.
- BIT(7) – To open High performance TCP RX socket.

Note:
To Support SSL Socket with Multiple TLS Versions need to set extended custom feature bitmap i.e BIT[14].

Examples:

ssl_ws_enable value should be

- '0' to open normal TCP socket
- '1' to open SSL over TCP socket. By default module will open SSL socket which support both TLS 1.0 and TLS 1.2.
- '2' to open web socket client over TCP socket
- '3' to open web socket over SSL TCP socket
- '5' to open SSL over TCP socket with TLS 1.0 version
- '9' to open SSL over TCP socket with TLS 1.2 version
- '7' to open web socket client over SSL TCP socket with TLS 1.0 version
- '11' to open web socket client over SSL TCP socket with TLS 1.2 version
- '128' to open High performance TCP socket
- '129' to open High performance TCP socket over SSL
- '130' to open High performance web socket TCP client socket
- '131' to open High performance web socket TCP client socket over SSL

ssl_bitmap: 1 byte bitmap used to select the various cipher modes. This field is optional and the possible values are listed below:BIT(0): 1: TLS_RSA_WITH_AES_256_CBC_SHA256

BIT(1): 2: TLS_RSA_WITH_AES_128_CBC_SHA256

BIT(2): 4: TLS_RSA_WITH_AES_256_CBC_SHA

BIT(3): 8: TLS_RSA_WITH_AES_128_CBC_SHA

BIT(4): 16: TLS_RSA_WITH_AES_128_CCM_8

BIT(5): 32: TLS_RSA_WITH_AES_256_CCM_8

These values can be OR'd together to select multiple ciphers. To select all the ciphers, either all bits can be set or alternatively, 0 can be passed.

webs_resource_name: Web socket resource name.

A string of 50 characters is the maximum possible input to this variable webs_host_name: Web socket host name. A string of 50 characters is the maximum possible input to this variable

tcp_retry_count: To configure tcp retransmissions count

socket_bitmap: To configure socket bit map

socket_bitmap	Functionality
socket_bitmap[0]	synchronous data read <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Info: Module sends data to host only after receiving data read request from host. </div>
socket_bitmap[1]	TCP socket <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Info: To open a listening TCP socket, on which to accept client connection host need to provide accept command. </div>
socket_bitmap[2]	TCP ACK indication <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Info: When this bit is enabled module gives an TCP ACK indication(Frame type 0xAB) to host, when it receives TCP ACK from remote peer. Host has to send next data packet to module only after receiving this TCP ACK indication </div>
socket_bitmap[3]	If this bit is set module handles small size received packets effectively. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Info: Recommended to set for the sockets which receives small size packets </div>
socket_bitmap[4]	TCP RX window size <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Info: When this bit is enabled module opens socket with RX window size based on the value provided in rx_window_size field </div>

BIT(0) : Set to enable synchronous data read

Module sends data to host only after receiving data read request from host.

BIT(1) : To open a listening TCP socket, on which to accept client connection host need to provide accept command.

BIT(2): Set to enable TCP ACK indication. This bit is valid for TCP/SSL Client, TCP/SSL Server (Listening TCP) and Web Sockets.

When this bit is enabled module gives an TCP ACK indication(Frame type 0xAB) to host, when it receives TCP ACK from remote peer. Host has to send next data packet to module only after receiving this TCP ACK indication.

BIT(3): If this bit is set module handles small size received packets effectively.

Recommended to set for the sockets which receives small size packets .

BIT(4): Set to configure TCP RX window size. This bit is valid for TCP/SSL Client, TCP/SSL Server (Listening TCP).

When this bit is enabled module opens socket with RX window size based on the value provided in rx_window_size field

rx_window_size: This field is used to configure the RX window size for the TCP socket. Possible values are 1 to 15 based on the availability of memory.

cert_inx: This field is used for the Certificate index

Response:

AT Mode:

For TCP/SSL/Web socket over IPv4/IPv6:

Result Code	Description
OK< ip_version >< socketType >< socketDescriptor >< moduleSocket >< ipv4_addr / ipv6_addr > < mss >< window_size >	Successful execution of the command.
ERROR<Error code>	Failure

For TCP/SSL server socket over IPv4 / IPv6:

or

For LUDP socket over IPv4 / IPv6:

Result Code	Description
OK< ip_version >< socketType >< socketDescriptor >< moduleSocket >< ipv4_addr / ipv6_addr >	Successful execution of the command.
ERROR<Error code>	Failure

Binary Mode:

```
typedef struct {
    uint8 ip_version[2];
    uint8 socketType[2];
    uint8 socketDescriptor[2];
    uint8 moduleSocket[2];
    union{
        uint8 ipv4_addr[4];
        uint8 ipv6_addr[16];
    }moduleIPAddr;
    uint8 mss[2];
    uint8 window_size[4];
    } rsi_socketFrameRcv;
```

Response Parameters:

ip_version(2 bytes): IP version used, either 4 or 6.

socketType(2 bytes): Type of the created socket.

0–TCP/SSL Client

2–TCP/SSL Server (Listening TCP)

4–Listening UDP

socketDescriptor(2 bytes): Created socket's descriptor or handle, starts from 1. socketDescriptor ranges from 1 to 10. The first socket opened will have a socket descriptor of 1, the second socket will have 2 and so on.

moduleSocket(2 bytes): Port number of the socket in the module.

moduleIPAddr.ipv4_address(16 bytes): The IPv4 address of the module. Only first four bytes of ipv4_address is filled rest 12 bytes are '0' in case of IPv4.

moduleIPAddr.ipv6_address(16 bytes): The IPv6 address of the module in case of IPv6.

mss(2 bytes): maximum segment size of the remote peer. In case of Ludp/Ltcp this field will not present.
 window_size(4 bytes): Window size of the remote peer. In case of Ludp/Ltcp this field will not present.

Possible error codes:

Possible error codes are 0xBB46, 0xBB22, 0xBB23, 0xBB33, 0xBB34, 0xBB35, 0xBB36, 0xBB45, 0xBB46, 0x0015, 0x0021, 0x0025, 0x002C, 0xFF74, 0xBBD3, 0xBBD2, 0xBBD1, 0xFF80.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

Example:

AT Mode:

To TCP socket over IPv4:

```
at+rsi_tcp=192.168.40.10,8000,1234,0,1,0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x74 0x63 0x70 0x3D 0x31 0x39 0x32 0x2E 0x31 0x36 0x38 0x2E 0x34 0x30 0x2E
0x31 0x30 0x2C 0x38 0x30 0x30 0x30 0x2C 0x31 0x32 0x33 0x34 0x2C 0x30 0x2C 0x31 0x2C 0x30 0x0D 0x0A
```

Response:

```
OK< ip_version =0x04 0x00>< socketType =0x0000 >< socketDescriptor =0x0001>< moduleSocket =0x4d2><
ipv4_addr= 0xC0 0xA8 0x28 0x120x00(12 times)> < mss =0xB4 0x05>< window_size =0x00 0x00 0x01 0x0>\r\n
0x4F 0x4B 0x04 0x00 0x00 0x00 0x01 0x00 0xd2 0x04 0xC0 0xA8 0x28 0x12 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x00 0x00
0xB4 0x05 0x00 0x00 0x01 0x00 0x0D 0x0A
```

To open Web socket over IPv4:

```
at+rsi_tcp=174.129.224.73,80,1234,0,2,0,echo.websocket.org\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x74 0x63 0x70 0x3D 0x31 0x37 0x34 0x2E 0x31 0x32 0x39 0x2E 0x32 0x32 0x34
0x2E 0x37 0x33 0x2C 0x38 0x30 0x2C 0x35 0x30 0x30 0x30 0x2C 0x30 0x2C 0x32 0x2C 0x30 0x2C 0x2C 0x65 0x63 0x68
0x6F 0x2E 0x77 0x65 0x62 0x73 0x6F 0x63 0x6B 0x65 0x74 0x2E 0x6F 0x72 0x67 0x3C 0x43 0x52 0x3E 0x3C 0x4C 0x46
0x3E
```

Response:

```
OK< ip_version =0x04 0x00>< socketType =0x0000 >< socketDescriptor =0x0001>< moduleSocket =0x4d2><
ipv4_addr= 0xC0 0xA8 0x28 0x120x00(12 times)> < mss =0xB4 0x05>< window_size =0x00 0x00 0x01 0x0>\r\n
0x4F 0x4B 0x04 0x00 0x00 0x00 0x01 0x00 0xd2 0x04 0xC0 0xA8 0x28 0x12 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x00 0x00 0xB4 0x05 0x00 0x00 0x01 0x00 0x0D 0x0A
```

To open Web socket over IPv6:

```
at+rsi_tcp6=2001:DB8:1:0:0:0:153,8000,1234,2,1,0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x74 0x63 0x70 0x36 0x3D 0x32 0x30 0x30 0x31 0x3A 0x44 0x42 0x38 0x3A 0x31
0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x31 0x35 0x33 0x2C 0x38 0x30 0x30 0x30 0x2C 0x31 0x32 0x33
0x34 0x2C 0x32 0x2C 0x31 0x2C 0x30 0x0D 0x0A
```

Response:

```
OK< ip_version =0x06 0x00>< socketType =0x0000 >< socketDescriptor =0x0001>< moduleSocket =0x4d2><
ipv6_addr= addr 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x53 0x01 0x00 0x00 > < mss =0xB4
0x05>< window_size =0x00 0x00 0x01 0x00>\r\n
0x4F 0x4B 0x06 0x00 0x00 0x00 0x01 0x00 0xd2 0x04 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x00
0x53 0x01 0x00 0x00 0xB4 0x05 0x00 0x00 0x01 0x00 0x0D 0x0A
```

To open LTCP socket over IPv4 :

```
at+rsi_ltcp=1234,5,7,1,0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6C 0x74 0x63 0x70 0x3D 0x31 0x32 0x33 0x34 0x2C 0x35 0x2C 0x37 0x2C 0x31
0x2C 0x30 0x0D 0x0A
```

Response:

```
OK<ip_version><socket_type><socket_handle><Lport><module_ipv4addr>\r\n
OK< ip_version =0x04 0x00>< socketType =0x0002 >< socketDescriptor =0x0001>< moduleSocket =0x4d2><
ipv4_addr= 0xC0 0xA8 0x12 0xD2 0x00(12 times) > \r\n
0x4F 0x4B 0x02 0x00 0x01 0x00 0xd2 0x04 0xC0 0xA8 0x28 0x12 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x0D 0x0A
```

To open LTCP socket over IPv6:

```
at+rsi_ltcp6=1234,5,7,1,0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6C 0x74 0x63 0x70 0x3D 0x31 0x32 0x33 0x34 0x2C 0x35 0x2C 0x37 0x2C 0x31
0x2C 0x30 0x0D 0x0A
```


Response:

```
OK<ip_version><socket_type> <socket_handle><Lport> <module_ipv6_addr>\r\n
OK< ip_version =0x06 0x00>< socketType =0x0002 >< socketDescriptor =0x0001>< moduleSocket =0x4d2><
ipv6_addr= 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x36 0x01 0x00 0x00 > \r\n
0x4F 0x4B 0x06 0x00 0x02 0x00 0x01 0x00 0xd2 0x04 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00
0x00 0x36 0x01 0x00 0x00 0x0D 0x0A
To open LUDP socket over IPv4:
at+rsi_ludp=1234,7\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6C 0x75 0x64 0x70 0x3D 0x31 0x32 0x33 0x34 0x2C 0x7 0x0D 0x0A
```

Response:

```
OK< ip_version =0x04 0x00>< socketType =0x0004 >< socketDescriptor =0x0001>< moduleSocket =0x4d2><
ipv4_addr= 0xC0 0xA8 0x28 0x12 0x00(12 times) > \r\n
0x4F 0x4B 0x04 0x00 0x04 0x00 0x01 0x00 0xd2 0x04 0xC0 0xA8 0x28 0x12 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x00 0x00 0x0D 0x0A
To open LUDP socket over IPv6:
at+rsi_ludp6=1234,5\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6C 0x75 0x64 0x70 0x36 0x3D 0x31 0x32 0x33 0x34 0x2C 0x35 0x0D 0x0A
```

Response:

```
OK< ip_version =0x06 0x00>< socketType =0x0004 >< socketDescriptor =0x0001>< moduleSocket =0x4d2><
ipv6_addr= 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x36 0x01 0x00 0x00 > \r\n
0x4F 0x4B 0x06 0x00 0x04 0x00 0x01 0x00 0xd2 0x04 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00
0x00 0x36 0x01 0x00 0x00 0x0D 0x0A
```

11.32 TCP Socket Connection Established

Description:

If a server TCP socket is opened in the module, the socket remains in listening state till the time the remote terminal opens and binds a corresponding client TCP socket. Once the socket binding is done, the module sends an asynchronous message to the Host to indicate that its server socket is now connected to a client socket.

Note:

If SSL is enabled module will use same SSL version until module reboots.

Command Format:

AT Mode:

N/A

Binary Mode:

N/A

Command Parameters:

N/A

Response:

AT Mode:

Result Code	Description
AT+RSI_LTCP_CONNECT=< ip_version >< socket >,<fromPortNum >,< ipv4_address / ipv6_address >< mss >< window_size >< SrcPortNum >	Asynchronous message from modue to host on tcp connection establishment .

Binary Mode:

```

struct {
    uint8 ip_version[2];
    uint8 sock_id[2];
    uint8 fromPortNum[2];
    union{
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    }dst_ip_address;
    uint8 mss[2];
    uint8 window_size[4];
    uint8 SrcPortNum[2];
    } rsi_recvLtcpEst;
    
```

Response Parameter:

ip_version(2 bytes): IP version used, either 4 or 6.

Sock_id(2 bytes): Socket descriptor of the server TCP socket.

fromPortNum(2 bytes): Port number of the remote socket

dst_ip_address.ipv4_address(16 bytes): Remote IPv4 address. Only first four bytes of ipv4_address are filled, rest 12 bytes are zero.

dst_ip_address.ipv6_address(16 bytes): Remote IPv6 address

mss(2 bytes): Maximum segment size of remote peer.

window_size(4 bytes): Window size of the remote peer.

SrcPortNum(2 bytes): Source Port Number to which client is connected.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

11.33 Query a Listening Socket's Active Connection Status

Description:

This command is issued when a listening/server TCP/SSL socket has been opened in the module, to know whether the socket got connected to a client socket.

Command Format:

AT Mode:

at+rsi_ctcp=< socketDescriptor >\r\n

Binary Mode:

```

struct{
    uint8socketDescriptor[2];
    } queryLtcpConnStatusFrameSnd;
    
```

Response:

AT Mode:

Result Code	Description
OK< socketDescriptor >< ip_version >< ipv4_address / ipv6_address >< destPort >	Successful Execution of Command.
ERROR <Error>	Failure

Binary Mode:

```

struct {
    uint8 socketDescriptor[2];
    uint8 ip_version[2];
    union{
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    }dest_ip;
    uint8 dPort[2];
    } rsi_LTCPConnStatusFrameRcv;
    
```

Response Parameters:

ip_version(2 bytes): IP version used, either 4 or 6.

socketDescriptor(2 bytes): Socket handle for an already open listening TCP/SSL socket in the module.

destIPAddr(16 bytes): Destination IPv4/IPv6 address of the remote peer whose socket is connected. Last 12 bytes will be filled to '0' in case of IPv6.

dPort (2 bytes): Port number of the remote peer client which is connected

Possible Error codes:

Possible error codes are 0x0021, 0x0025, 0x002C, 0xFF86, 0xFFFA, 0xFF82.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

Example:

AT Mode:

Response:

```

OK< socketDescriptor =7>< ipv4_address =192.168.40.10>
< destPort =8001> \r\n
0x4F 0x4B 0x07 0x00 0xC0 0xA8 0x28 0x0A 0x41 0x1F 0x0D 0x0A
    
```

11.34 Close Socket

Description:

This command closes a TCP/LTCP/UDP/SSL/Web socket in the module.

Command Format:

AT Mode:

```

at+rsi_cls=< socketDescriptor >,< port_number >\r\n
    
```

Binary Mode:

```

struct {
    uint8 socketDescriptor[2];
    uint8 port_number[2];
    } socketCloseFrameSnd;
    
```

Parameters :

socketDescriptor: Socket descriptor of the socket to be closed.

port_number: This field is valid only for LTCP socket.

When this field is mentioned module closes all LTCP connections which are opened with provided port number.

Note:

1. This field will be ignored in case of closing UDP/TCP client sockets.
2. In order to use port based socket close to close all LTCP sockets user has to set socket_handle as zero.
3. For web socket: If close command is given socket will be closed without waiting for server to initiate web socket close.

In order get graceful closure , host has to issue data send command with an opcode of 0x8 and fin bit set and with an dummy data. This dummy data will be ignored by server side web socket(Example: at+rsi_snd=1,0,0,136,\r\n in AT mode).

In this case module sends web socket close frame to server. On receiving this frame server initiates web socket close. After successful socket close exchanges, module gives remote terminate indication to host.

Response:

AT Mode:

Result Code	Description
OK< socketDsc >< bytesSent >	Successful execution of command
ERROR<Error code>	Failure

Note:

In the case of TCP socket, when a remote peer closes the socket connection, the module sends the "AT+RSI_CLOSE<socket_handle><number of bytes sent>\r\n" message to the Host. This is an asynchronous message sent from module to host and not the response of a specific command. Socket_handle is sent in 2 bytes, number of bytes sent is 4 bytes in hex. The least significant byte is returned first. AT+RSI_CLOSE is returned in uppercase and ASCII format.

Binary Mode:

```
typedef struct {
    uint8 socketDsc[2];
    uint8 sentBytesCnt[4];
} rsi_socketCloseFrameRcv;
```

Response Parameters:

socketDsc(2 bytes): Socket descriptor of the socket closed.

sentBytesCnt(4 bytes):Number of bytes sent successfully on that socket.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C, 0xFF86,0xBB35,0xBB27,0xBB42

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

Example:

AT Mode:

To close the socket with handle 1, the command is

at+rsi_cls=1\r\n

0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x63 0x6C 0x73 0x3D 0x31 0x0D 0x0A

Response:

OK<socket_handle><number of bytes sent>\r\n

0x4F 0x4B 0x01 0x00 0x01 0x02 0x03 0x04 0x0D 0x0A

11.35 Send Data

This section explains how to send data from the host to the module.

11.35.1 Send Data in AT mode

Description:

This command is used to send data from the host to the module, to be transmitted over a wireless media in AT mode.

Note:

1. Maximum data can be send over TCP/LTCP socket is 1460 Bytes
2. Maximum data can be send over LUDP socket is 1472 Bytes
3. Maximum data can be send over Web socket is 1452 Bytes
4. Maximum data can be send over TCP-SSL/LTCP-SSL is 1390 Bytes
5. Maximum data can be send over Web socket over SSL is 1382 Bytes

Command Format:

To send data over IPv4:

at+rsi_snd=< socketDescriptor >,< sendBufLen > , < destIPAddr >,< destPort > , < sendDataBuf >\r\n

To send data over IPv6:

at+rsi_snd6=< socketDescriptor >,< sendBufLen > , < destIPAddr >,< destPort > , < sendDataBuf >\r\n

Command Parameters:

socketDescriptor: Socket handle of the socket over which data is to be sent.

sendBufLen: Length of the data that is getting transmitted, wrong parameter may cause module hang in some cases. In case of Web socket correct length is mandatory.

destIPAddr: Destination IPv4/IPv6 Address. Should be '0' in case of data transmitting on a TCP/LTCP/SSL socket.

destPort: Destination Port. Should be '0' in case of data transmitting on a TCP/LTCP/SSL socket.

In case of Web sockets, this field represents web socket information.

In web socket information seventh bit indicates the FIN packet and bit [3:0] indicates the opcode (type of the packet to be included in web socket header).

OPCODE should be as follows(Refer RFC 6455):

Mode	Functionality
0	Continuation frame
1	Text frame
2	Binary frame
[3-7]	Reserved for further non-control frames
8	Connection close frame
9	Ping frame
10	Pong frame
[B-F]	Reserved for further control frames
FIN Bit	0: More web socket frames to be followed. 1: Final frame web socket message.

sendDataBuf: Actual data to be sent to be sent to the specified socket.

Response:

Result Code	Description
OK<length> (or) OK<socket id><length>	2 bytes length(2 bytes hex), length of data sent. 1 byte socket id ,2 bytes length(2 bytes hex), length of data sent.
ERROR<Error code>	Failure On a failure while sending the data on the TCP socket, if the error code indicates "TCP connection closed", then the module closes the socket. Possible error codes are 0x0030,0xFFFFE,0xFF7E,0xFFF8,0x003F,0xFFF7.

When enable the socket BIT(2)(opensocket)

Note:

1. When enable the socket bit map(2)(open socket) the send response gives 3bytes. User need to consider following for "snd" command in case of TCP_ACK(bit[2]) is enabled. User will get an immediate "OK<socket id ><length>\r\n" response for "snd" command. This indicates the "snd" command transaction happened successfully at the host interface level. This doesn't mean that the packet is successfully transmitted to the remote peer. Module responds with "OK<socket id ><length>\r\n" and takes the next "snd" command till it has buffers to buffer those packets.
2. In case of SSL socket the response of send command gives length of data (Includes SSL data)on the TCP socket.

Note:

1. The parameter sendDataBuf cont.
2. The parameter sendDataBuf contains the actual data not the ACII representations of the data. User need to consider following for "snd" command in case of UART mode. User will get an immediate "OK<length>\r\n" response for "snd" command. This indicates the "snd" command transaction happened successfully at the host interface level. This doesn't mean that the packet is successfully transmitted to the remote peer. Module responds with "OK<length>\r\n" and takes the next "snd" command till it has buffers to buffer those packets. User need to take care that the data_len value that is given in "snd" command should be same as the number of bytes that are getting transmitted with "snd" command. In TCP/IP bypass only < sendDataBuf > parameter is valid and remaining parameters are dummy user can send 0.

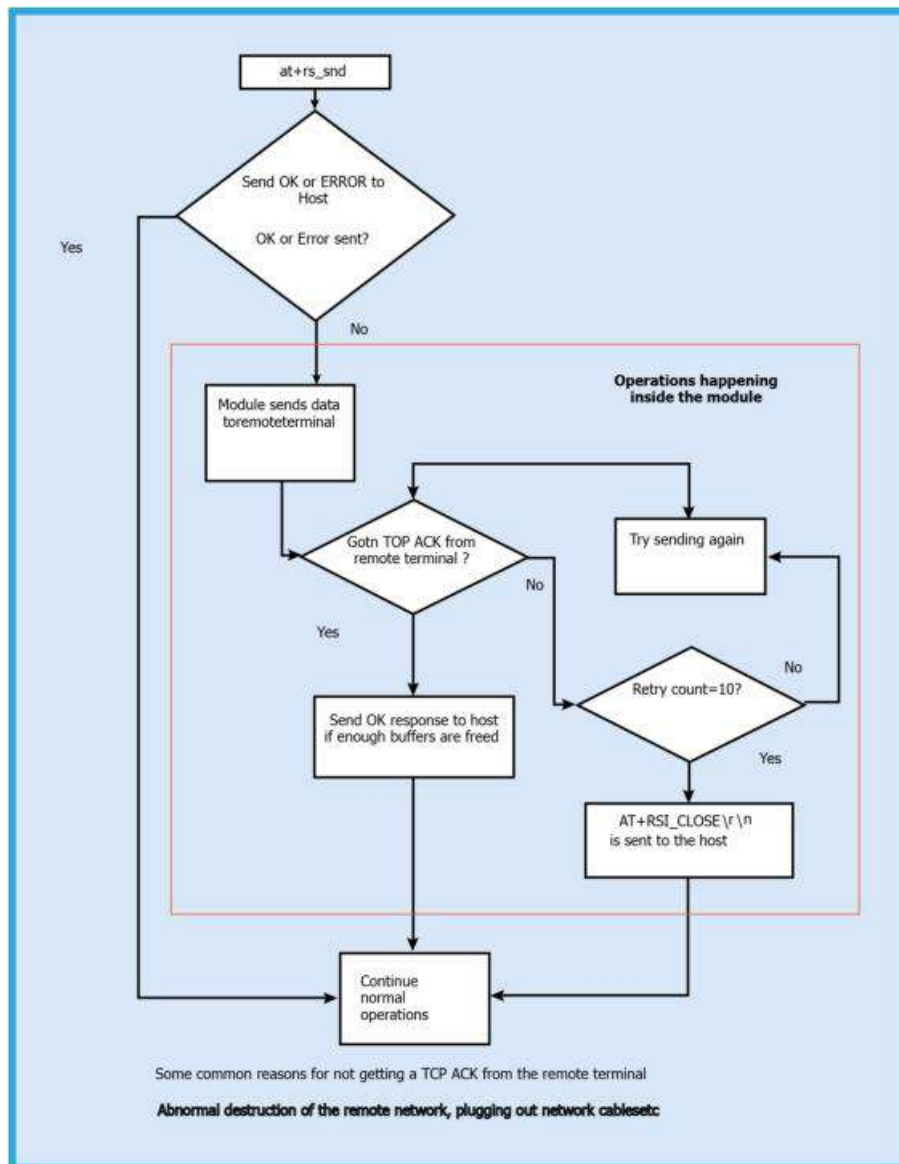


Figure 11-8:

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

NOTE on Byte Stuffing:

The '\r\n' character sequence (0x0D, 0x0A in hex) is used to indicate the termination of an AT command. If the actual data to be sent from Host comprises of \r\n characters in sequence, the host should replace this set of characters with (0xDB) and (0xDC). If (0xDB) itself is part of the data then (0xDB 0xDD) has to be sent. If (0xDB 0xDC) itself is part of the data then (0xDB 0xDD 0xDC) has to be sent. If either 0xDD or 0xDC is not sent after 0xDB, then an error (-9) is sent.

Example 1 : If 0x41 0x42 0x43 0x0D 0x0A is the actual data stream that needs to be sent then the command is
 at+rsi_snd <hn> <sz=5> <Dip> <Dport> < 0x41> <0x42> <0x43> <0xDB> <0xDC> <0x0D> <0x0A>

Example 2 : If 0x41 0x42 0x43 0x0D 0x0A 0x31 0x32 is the actual data stream that needs to be sent then the command is
 at+rsi_snd <hn> <sz=7> <Dip> <Dport> < 0x41> <0x42> <0x43> <0xDB> <0xDC> <0x31> <0x32> <0x0D> <0x0A>

Example 3 : If 0x41 0x42 0x43 0xDB 0x31 0x32 is the actual data stream that needs to be sent then the command is
 at+rsi_snd <hn> <sz=7> <Dip> <Dport> < 0x41> <0x42> <0x43> <0xDB> <0xDD> <0x31> <0x32> <0x0D> <0x0A>

Example 4 : If 0x41 0x42 0x43 0xDB 0xDC 0x31 0x32 is the actual data that needs to be transmitted, then the command is
 at+rsi_snd <hn> <sz=8> <Dip> <Dport> <0x41> <0x42> <0x43> <0xDB><0xDD><0xDC> <0x31><0x32> <0x0D> <0x0A>

Example 5 : If 0x41 0x42 0x43 0x0D 0x0A 0xDB 0x31 0x32 is the actual data that needs to be transmitted, then the command is
 at+rsi_snd <hn> <sz=9> <Dip> <Dport> <0x41> <0x42> <0x43> <0xDB><0xDC> <0xDB> <0xDD> <0x31><0x32> <0x0D> <0x0A>

Example 6 : If 0x41 0x42 0x43 0x0D 0x0A 0xDB 0xDC 0x31 0x32 is the actual data that needs to be transmitted, then the command is
 at+rsi_snd <hn> <sz=10> <Dip> <Dport> <0x41> <0x42> <0x43> <0xDB><0xDC> <0xDB> <0xDD> <0xDC> <0x31><0x32> <0x0D> <0x0A>

at+rsi_snd is the only command that requires byte stuffing to be done by the Host before sending to the module. There are NO other commands (from Host to module) that require byte stuffing. There are NO responses (from module to Host) that are byte stuffed by module before giving to Host.

Data Stuffing

Example:

Command:

To send a data stream 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08 0x09 0x0A over a TCP socket

```
at+rsi_snd=1,10,0,0, 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08 0x09 0x0A\r\n
0x61 0x74 0x2B 0x72 0x73 0x690x5F0x730x6E0x64 0x3D 0x31 0x2C 0x31 0x30 0x2C 0x300x2C0x300x2C 0x01
0x02 0x03 0x04 0x05 0x06 0x07 0x08 0x09 0x0A 0x0D 0x0A
```

To send a data stream 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08 0x09 0x0A over a UDP socket to a destination IP 192.168.1.20 and destination port 8001

```
at+rsi_snd=1,10,192.168.1.20,8001, 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08 0x09 0x0A\r\n
0x61 0x74 0x2B 0x72 0x730x690x5F0x730x6E0x64 0x3D 0x31 0x2C 0x31 0x30 0x2C 0x310x39 0x32 0x2E 0x31
0x36 0x38 0x2E 0x31 0x2E 0x32 0x30 0x2C 0x38 0x30 0x30 0x31 0x2C 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08
0x09 0x0A 0x0D 0x0A
```

To send a stream "abcdefghij" over a Multicast socket

```
at+rsi_snd=1,10,239.0.0.0,1900,abcdefghij\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x73 0x6E 0x64 0x3D 0x31 0x2C 0x31 0x30 0x2C 0x32 0x33 0x39 0x2E 0x30
0x2E 0x30 0x2E 0x30 0x2C 0x31 0x39 0x30 0x30 0x2C0x61 0x62 0x63 0x64 0x65 0x66 0x67 0x68 0x69 0x6A 0x0D
0x0A
```


Response:

For 250 bytes sent, the response is
 OK 250\r\n
 0x4F 0x4B 0xFA 0x00 0x0D 0x0A
 When TCP_ACK(bit[2]) is enabled the send response gives 3bytes,1byte for socket id and 2bytes represents the length.
 at+rsi_snd=1,10,0,0,0123456789\r\n

Response:

OK
 0x02\0x00
 0x4F 0x4B 0x02 0x0A 0x00 0x0D 0x0A
 When enable socket bit map of tcp socket the response of send command over ssl
 at+rsi_snd=1,10,0,0,hellohello\r\n

Response:

0x4F 0x4B 0x01 0x45 0x00 0x0D 0x0A

11.35.2 Send Data in Binary mode

Description:

This command sends data from the host to the module, to be transmitted over a wireless media. This same command can be used to send SSL/web socket data. No additional parameters are required.

Note:

1. Maximum data can be send over TCP/LTCP socket is 1460 Bytes
2. Maximum data can be send over LUDP socket is 1472 Bytes
3. Maximum data can be send over Web socket is 1452 Bytes
4. Maximum data can be send over TCP-SSL/LTCP-SSL is 1390 Bytes
5. Maximum data can be send over Web socket over SSL is 1382 Bytes

Command Format:

```

#define PROTOCOL_OFFSET 46 for TCP
#define WEBSOCKET_HEADER_SIZE 6 for payload size less than 126
#define WEBSOCKET_HEADER_SIZE 8 for payload size more than or equal to 126

#define PROTOCOL_OFFSET 34 for UDP
#define RSI_MAX_PAYLOAD_SIZE 1460 for TCP
#define RSI_MAX_PAYLOAD_SIZE 1472 for UDP
#define RSI_MAX_PAYLOAD_SIZE 1450 for WS
#define RSI_MAX_PAYLOAD_SIZE 1390 for SSL
#define RSI_MAX_PAYLOAD_SIZE 1382 for WSS
#define RSI_TXDATA_OFFSET_TCP 46
#define RSI_TXDATA_OFFSET_LUDP 16
#define RSI_IP_ADD_LEN 4

typedef union {
    struct {
        uint8 ip_version[2];
        uint8 socketDescriptor[2];
        uint8 sendBufLen[4];
        uint8 sendDataOffsetSize[2];
        uint8 padding[RSI_MAX_PAYLOAD_SIZE];
    } sendFrameSnd;
    struct {
        uint8 ip_version[2];
        uint8 socketDescriptor[2];
        uint8 sendBufLen[4];
        uint8 sendDataOffsetSize[2];
        uint8 destPort[2];
    }
    union{
        uint8 ipv4_address[RSI_IP_ADD_LEN];
        uint8 ipv6_address[RSI_IP_ADD_LEN*4];
    }destIPAddr;
        uint8 sendDataOffsetBuf[RSI_TXDATA_OFFSET_LUDP];
        uint8 sendDataBuf[RSI_MAX_PAYLOAD_SIZE];
    } sendFrameLudpSnd;
        uint8 uSendBuf[RSI_MAX_PAYLOAD_SIZE];
    } rsi_uSend;

```

Command Parameters:

ip_version: IP version used, either 4 or 6.

socketDescriptor: Lower byte is used as Socket number over which data is to be sent.

If websocket is enabled, higher byte is used to send the web socket information.

In web socket information seventh bit indicates the FIN packet and bit [3:0] indicates the opcode (type of the packet to be included in web socket header).

OPCODE should be as follows(Refer RFC 6455):

Mode	Functionality
0	Continuation frame
1	Text frame
2	Binary frame
[3-7]	Reserved for further non-control frames
8	Connection close frame
9	Ping frame
10	Pong frame

Mode	Functionality
[B-F]	Reserved for further control frames
FIN Bit	0: More web socket frames to be followed. 1: Final frame web socket message.

sendBufLen:Data payload length to be sent.

sendDataOffsetSize:Offset at which payload present.

padding/sendDataBuf: Actual data to be sent. A maximum of 1460bytes in case of TCP and 1472 bytes in case of UDP, can be sent in a packet.

destPort: Destination port number, of the socket in the remote terminal.

ipv4_address: IPv4 address of the remote terminal.Only first 4 bytes of ipv4 address gets filled, remaining 12 bytes are zero.

ipv6_address: IPv6 address of the remote terminal.

sendDataOffsetBuf:Dummy bytes.

When the TCP/IP stack is bypassed, the Host uses its own TCP/IP stack and sends Ethernet II frames to the module. The maximum size of the payload is 1514 bytes. The user needs to use rsi_send_raw_data.c API to send the data in TCP/IP bypass mode. Refer Set Operating Mode to know how to enable TCP/IP bypass mode.

Response:

There is no response payload for this command.

Note:

In case of USB-CDC and UART Binary Modes(To overcome the flow control),for each and every data packet, ack is received as response. Before sending the next data packet, user must ensure of getting the data packet ack for the previous data packet.

Frame Type of data packet ack is 0xAC

If the error code of 0x3F is received in the data packet ack, this means buffer full condition has occurred and give some delay for the next data packet to send.

Possible error codes:

Possible error codes are -2, 63.

Relevance:

This command is relevant when module is configured in operating mode 0,1,2 or 6.

11.36 Read Data

This section explains how to read socket data from the module to host.

Note:

To use this feature we need to set BIT(0) in the socketbitmap while opening a socket.

Read Data in AT mode

Description:

This command is used to request number of bytes received on given socket. Module will give requested number of bytes received on particular socket (synchronous) only if this command is given from host.If requested numbers of bytes are greater than bytes available on given socket module will return only available number of bytes to host.If no data available on given socket module will wait till data received on given socket to serve this command.

Command Format:

To read data

at+rsi_read=< socketDescriptor >,< no of bytes >,<timeout in ms>\r\n

Command Parameters:

socketDescriptor: Socket handle of the socket over which data is to be received.

no of bytes: Length of the data that has to be read from the module.

time out in ms: Read timeout in milliseconds to configure read data time out.

Response:

Result Code	Description
AT+RSI_READ<ip_version > <recvSocket ><recvBufLen >< ipv4_address / ipv6_address > < src_port ><recvDataBuf >	<p>ip_version (2 bytes, hex): IP version of the data received. 4 – for IPv4 6 – for IPv6</p> <p>recvSocket (2 bytes, hex): socket handle of the socket over which the data is received. The least significant byte is returned first. If Web socket has been enabled, upper byte holds the web socket info. Seventh bit indicates the FIN packet and bit 3:0 gives the opcode information from web socket header.</p> <p>recvBufLen (2 bytes, hex): Number of bytes received. The least significant byte is sent first. For example, 900 bytes (0x0384) would be sent as <0x84> <0x03></p> <p>ipv4_address / ipv6_address (16 bytes, hex): Source IPv4/IPv6 address. i.e IP address from which data is received. This field is not present in the message if the data is received over a TCP socket. Only first 4 bytes are filled rest 12 bytes are zero for IPv4 address.</p> <p>src_port (2 bytes, hex): Source port. i.e port number from which data is received. This field is not present in the message if the data is received over a TCP socket.</p> <p>recvDataBuf: Actual received data stream. A maximum of 1472 bytes can be received in case of UDP and 1460 bytes in case of TCP, in this field. When the module sends data to the Host, byte stuffing is NOT done by the module. The size parameter should be used to know how many bytes of valid data is expected.</p>

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

Example:

Command:

at+rsi_read=1,4,100\r\n

Response:

For IPV4:

If 'abcd' is sent from remote terminal to module, on an UDP socket with handle 1, from source ipv4 address 192.168.1.1 to destination ipv4 address 192.168.1.2(module address) and source port 8001, the module sends the following response to the host.

```
AT+RSI_READ 4 1 4 192 168 1 1 8001 abcd \r\n
0x41 0x54 0x2B 0x52 0x53 0x49 0x5F 0x52 0x45 0x41 0x44 0x04 0x00 0x01 0x00 0x04 0x00 0xC0 0xA8 0x01 0x01
0x41 0x1F 0x61 0x62 0x63 0x64 0x0D 0x0A
```

If 'abcd' is sent from remote terminal to module, on a TCP socket with handle 1, the module sends the following

response to the host.

AT+RSI_READ 4 1 4 abcd \r\n

0x41 0x54 0x2B 0x52 0x53 0x49 0x5F 0x52 0x45 0x41 0x44 0x04 0x00 0x01 0x00 0x04 0x00 0x61 0x62 0x63 0x64 0x0D 0x0A

For IPV6:

If 'abcd' is sent from remote terminal to module, on an UDP socket with handle 1, from source ipv6 address 2001:db8:1:0:0:0:0:153 to destination ipv6 address 2001:db8:1:0:0:0:0:154 (module address) and source port 8001, the module sends the following response to the host.

AT+RSI_READ 6 1 4 2001:db8:1:0:0:0:0:153 8001 abcd \r\n

0x41 0x54 0x2B 0x52 0x53 0x49 0x5F 0x52 0x45 0x41 0x44 0x06 0x00 0x01 0x00 0x04 0x00 0x32 0x30 0x30 0x31 0x3A 0x44 0x42 0x38 0x3A 0x31 0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x31 0x35 0x33 0x41 0x1F 0x61 0x62 0x63 0x64 0x0D 0x0A

Note:
The data delivered to the Host on receiving data on a TCP socket does not include the source IP address and source port (Sip and Sport).

11.36.1 Read Data in Binary mode

Description:

This command is used to request number of bytes received on given socket. Module will give requested number of bytes received on particular socket (synchronous) only if this command is given from host. If requested numbers of bytes are greater than bytes available on given socket module will return only available number of bytes to host. If no data available on given socket module will wait till data received on given socket to serve this command.

Command Format:

```
#define RSI_MAX_PAYLOAD_SIZE 1460 for TCP
#define RSI_MAX_PAYLOAD_SIZE 1472 for UDP
#define RSI_MAX_PAYLOAD_SIZE 1452 for WS
#define RSI_MAX_PAYLOAD_SIZE 1390 for SSL
#define RSI_MAX_PAYLOAD_SIZE 1382 for WSS
typedef struct {
    uint8 socketDescriptor;
    uint8 data_length[4];
    uint8 timeout_in_ms[2];
} socketReadFrameSnd;
```

Command Parameters:

socketDescriptor – Socket handle of the socket over which data is to be received.

no of bytes – Length of the data that has to be read from the module.

timeout_in_ms - Read timeout in milliseconds to configure read data time out.

Response:

```
#define RSI_RXDATA_OFFSET_TCP_V426
#define RSI_RXDATA_OFFSET_TCP_V646
#define RSI_RXDATA_OFFSET_UDP_V414
#define RSI_RXDATA_OFFSET_UDP_V634
#define RSI_MAX_PAYLOAD_SIZE 1460 for TCP
#define RSI_MAX_PAYLOAD_SIZE 1472 for UDP
```

For UDP:

```
typedef struct {
    uint8 ip_version[2];
    uint8 recvSocket[2];
    uint8 recvBufLen[4];
    uint8 recvDataOffsetSize[2];
    uint8 fromPortNum[2];
    union{
        uint8ipv4_address[4];
        uint8 ipv6_address[16];
    }fromIPAddr;
    uint8recvDataOffsetBuf[RSI_RXDATA_OFFSET_UDP_V4];
    uint8recvDataBuf[RSI_MAX_PAYLOAD_SIZE];
} rsi_recvFrameUdp;
```

For UDP on IPv6 address:

```
typedef struct {
    uint8 ip_version[2];
    uint8 recvSocket[2];
    uint8 recvBufLen[4];
    uint8 recvDataOffsetSize[2];
    uint8 fromPortNum[2];
    union{
        uint8ipv4_address[4];
        uint8 ipv6_address[16];
    }fromIPAddr;
    uint8recvDataOffsetBuf[RSI_RXDATA_OFFSET_UDP_V6];
    uint8recvDataBuf[RSI_MAX_PAYLOAD_SIZE];
} rsi_recvFrameUdp6;
```

For TCP:

```
typedef struct {
    uint8 ip_version[2];
    uint8 recvSocket[2];
    uint8 recvBufLen[4];
    uint8 recvDataOffsetSize[2];
    uint8 fromPortNum[2];
    union{
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    }fromIPAddr;
    uint8 recvDataOffsetBuf[RSI_RXDATA_OFFSET_TCP_V4];
    uint8 recvDataBuf[RSI_MAX_PAYLOAD_SIZE];
} rsi_recvFrameTcp;
```

For TCP on ipv6 address:

```
typedef struct {
    uint8 ip_version[2];
    uint8 recvSocket[2];
    uint8 recvBufLen[4];
    uint8 recvDataOffsetSize[2];
    uint8 fromPortNum[2];
    union{
        uint8ipv4_address[4];
        uint8 ipv6_address[16];
    }fromIPAddr;
    uint8recvDataOffsetBuf[RSI_RXDATA_OFFSET_TCP_V6];
    uint8recvDataBuf[RSI_MAX_PAYLOAD_SIZE];
    } rsi_recvFrameTcp6;
```

Response Parameters:

ip_version: IP version used, either 4 or 6.

recvSocket: Out of 2 bytes lower byte represents socket number on which data is received.

If web socket is enabled, higher byte represents the web socket information. In web socket information seventh bit indicates the FIN packet and bit [3:0] indicates the opcode from web socket header.

recvBufLen: The size of the data received

recvDataOffsetSize: This is the offset in the received payload, after which actual data begins.

fromPortNum: Port number of the remote peer

fromIPAddr.ipv4_address: The IPv4 address of the remote peer. Only first four bytes of ipv4 address are filled rest 12 bytes are zero.

fromIPAddr.ipv6_address: The IPv6 address of the remote peer.

recvDataOffsetBuff: Dummy bytes which can be ignored by host.

recvDataBuf: Actual data sent from remote peer.

Possible error codes:

Possible error codes are 0x0021, 0xff74, 0xff80,0xff6a

Relevance:

This command is relevant when module is configured in operating mode 0,1,2 or 6

Note:

1. Maximum data can be send over TCP/LTCP socket is 1460 Bytes
2. Maximum data can be send over LUDP socket is 1472 Bytes

11.37 Receive Data on Socket

This section explains how module sends received data to Host.

Note:

Module support maximum SSL record size is 8K. If it is more than 8K module will close the socket.

11.37.1 Receive Data on Socket in AT mode

Description:

The module delivers the data obtained on a socket to the Host with this message. This is an asynchronous response. It is sent from the module to the host when the module receives data from a remote terminal. SSL data is also received in a similar fashion.

Command Parameters:

N/A

Response:

Result Code	Description
AT+RSI_READ<ip_version > < recvSocket >< recvBufLen >< ipv4_address / ipv6_address > < src_port >< recvDataBuf >	<p>ip_version (2 bytes, hex): IP version of the data received. 4 – for IPv4 6 – for IPv6</p> <p>recvSocket (2 bytes, hex): socket handle of the socket over which the data is received. The least significant byte is returned first. If Web socket has been enabled, upper byte holds the web socket info. Seventh bit indicates the FIN packet and bit 3:0 gives the opcode information from web socket header.</p> <p>recvBufLen (2 bytes, hex): Number of bytes received. The least significant byte is sent first. For example, 900 bytes (0x0384) would be sent as <0x84> <0x03></p> <p>ipv4_address / ipv6_address (16 bytes, hex): Source IPv4/IPv6 address. i.e IP address from which data is received. This field is not present in the message if the data is received over a TCP socket. Only first 4 bytes are filled rest 12 bytes are zero for IPv4 address.</p> <p>src_port (2 bytes, hex): Source port. i.e port number from which data is received. This field is not present in the message if the data is received over a TCP socket.</p> <p>recvDataBuf: Actual received data stream. A maximum of 1472 bytes can be received in case of UDP and 1460 bytes in case of TCP, in this field. When the module sends data to the Host, byte stuffing is NOT done by the module. The size parameter should be used to know how many bytes of valid data is expected.</p>

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

Example:

Command:

N/A

Response:

For IPV4:

If 'abcd' is sent from remote terminal to module, on an UDP socket with handle 1, from source ipv4 address 192.168.1.1 to destination ipv4 address 192.168.1.2(module address) and source port 8001, the module sends the following response to the host.

```
AT+RSI_READ 4 1 4 192 168 1 1 8001 abcd \r\n
0x41 0x54 0x2B 0x52 0x53 0x49 0x5F 0x52 0x45 0x41 0x44 0x04 0x00 0x01 0x00 0x04 0x00 0xC0 0xA8 0x01 0x01
0x41 0x1F 0x61 0x62 0x63 0x64 0x0D 0x0A
```


If 'abcd' is sent from remote terminal to module, on a TCP socket with handle 1, the module sends the following response to the host.

AT+RSI_READ 4 1 4 abcd \r\n

0x41 0x54 0x2B 0x52 0x53 0x49 0x5F 0x52 0x45 0x41 0x44 0x04 0x00 0x01 0x00 0x04 0x00 0x61 0x62 0x63 0x64 0x0D 0x0A

For IPV6:

If 'abcd' is sent from remote terminal to module, on an UDP socket with handle 1, from source ipv6 address 2001:db8:1:0:0:0:0:153 to destination ipv6 address 2001:db8:1:0:0:0:0:154 (module address) and source port 8001, the module sends the following response to the host.

AT+RSI_READ 6 1 4 2001:db8:1:0:0:0:0:153 8001 abcd \r\n

0x41 0x54 0x2B 0x52 0x53 0x49 0x5F 0x52 0x45 0x41 0x44 0x06 0x00 0x01 0x00 0x04 0x00 0x32 0x30 0x30 0x31 0x3A 0x44 0x42 0x38 0x3A 0x31 0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x31 0x35 0x33 0x41 0x1F 0x61 0x62 0x63 0x64 0x0D 0x0A

Note:
The data delivered to the Host on receiving data on a TCP socket does not include the source IP address and source port (Sip and Sport).

11.37.2 Receive Data on Socket in Binary mode

Description:

When the module receives data from a remote client, it raises an asynchronous interrupt to indicate to the Host that new data has arrived and needs to be read.

In case of SSL, the max length of data that can be received is 1390 bytes. Add limits for all cases TCP/UDP/WEBS

Command Format:

N/A

Command Parameters:

N/A

Response:

```
#define RSI_RXDATA_OFFSET_TCP_V426
#define RSI_RXDATA_OFFSET_TCP_V646
#define RSI_RXDATA_OFFSET_UDP_V414
#define RSI_RXDATA_OFFSET_UDP_V634
#define RSI_MAX_PAYLOAD_SIZE 1460 for TCP
#define RSI_MAX_PAYLOAD_SIZE 1472 for UDP
```

For UDP:

```
typedef struct {
    uint8 ip_version[2];
    uint8 recvSocket[2];
    uint8 recvBufLen[4];
    uint8 recvDataOffsetSize[2];
    uint8 fromPortNum[2];
    union{
        uint8ipv4_address[4];
        uint8 ipv6_address[16];
    }fromIPAddr;
    uint8recvDataOffsetBuf[RSI_RXDATA_OFFSET_UDP_V4];
    uint8recvDataBuf[RSI_MAX_PAYLOAD_SIZE];
} rsi_recvFrameUdp;
```

For UDP on IPv6 address:

```
typedef struct {
    uint8 ip_version[2];
    uint8 recvSocket[2];
    uint8 recvBufLen[4];
    uint8 recvDataOffsetSize[2];
    uint8 fromPortNum[2];
    union{
        uint8ipv4_address[4];
        uint8 ipv6_address[16];
    }fromIPAddr;
    uint8recvDataOffsetBuf[RSI_RXDATA_OFFSET_UDP_V6];
    uint8recvDataBuf[RSI_MAX_PAYLOAD_SIZE];
    } rsi_recvFrameUdp6;
```

For TCP:

```
typedef struct {
    uint8 ip_version[2];
    uint8 recvSocket[2];
    uint8 recvBufLen[4];
    uint8 recvDataOffsetSize[2];
    uint8 fromPortNum[2];
    union{
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    }fromIPAddr;
    uint8 recvDataOffsetBuf[RSI_RXDATA_OFFSET_TCP_V4];
    uint8 recvDataBuf[RSI_MAX_PAYLOAD_SIZE];
    } rsi_recvFrameTcp;
```

For TCP on ipv6 address:

```
typedef struct {
    uint8 ip_version[2];
    uint8 recvSocket[2];
    uint8 recvBufLen[4];
    uint8 recvDataOffsetSize[2];
    uint8 fromPortNum[2];
    union{
        uint8ipv4_address[4];
        uint8 ipv6_address[16];
    }fromIPAddr;
    uint8recvDataOffsetBuf[RSI_RXDATA_OFFSET_TCP_V6];
    uint8recvDataBuf[RSI_MAX_PAYLOAD_SIZE];
    } rsi_recvFrameTcp6;
```

Response Parameters:

ip_version: IP version used, either 4 or 6.

recvSocket: Out of 2 bytes lower byte represents socket number on which data is received.

If web socket is enabled, higher byte represents the web socket information. In web socket information seventh bit indicates the FIN packet and bit [3:0] indicates the opcode from web socket header.

recvBufLen: The size of the data received

recvDataOffsetSize: This is the offset in the received payload, after which actual data begins.

fromPortNum: Port number of the remote peer

fromIPAddr.ipv4_address: The IPv4 address of the remote peer. Only first four bytes of ipv4 address are filled rest 12 bytes are zero.

fromIPAddr.ipv6_address: The IPv6 address of the remote peer.

recvDataOffsetBuff: Dummy bytes which can be ignored by host.

recvDataBuf: Actual data sent from remote peer.

When the TCP/IP stack is bypassed, the module receives WLAN frames from the remote terminal and passes on to the Host through an interrupt.

Module forwards receive packet in ETHERNET II format.

Possible error codes:

No possible error code as it is asynchronous message from module to host.

Relevance:

This command is relevant when module is configured in operating mode 0,1,2 or 6

11.38 Wireless Firmware Upgrade

Description:

This command is sent as a response to the wireless firmware upgradation request.

When user clicks on Upgrade button on the wireless up gradation page, module sends an asynchronous message("AT+RSI_FWUPREQ" in AT mode and Frame type 0x59 in Binary mode) to host. Upon receiving this message host has to send wireless firmware upgrade request message if upgrade is required. Host can ignore if upgrade is not required. For more details on wireless firmware upgrade refer [Wireless Firmware Upgrade](#) section.

Command Format:

AT Mode:

at+rsi_fwupok\r\n

Binary Mode:

N/A

Command Parameters:

N/A

Response:

AT Mode:

There is no response for this command.

After successful upgradation,firmware gives a success indication with an asynchronous message as

"AT+RSI_FWUPSUCCESS\r\n". Also "Firmware up gradation successful" pop-up window appears on the browser. On firmware upgrade failure or host not responding for firmware upgrade request , module gives an error message on pop-up window:"module not responding" on the browser.

Binary Mode:

After successful upgradation,firmware gives a success indication with an asynchronous frame type 0x5A. Also

"Firmware up gradation successful" pop-up window appears on the browser.

On firmware upgrade failure or host not responding for firmware upgrade request , module gives an error message on pop-up window:"module not responding" on the browser.

Response Parameters:

N/A

Possible Error Codes:

Possible error codes are 0x0021,0x0025,0x002C, 0x0034.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

Note:

Wireless firmware upgradation is supported only for the latest versions of firefox,google chrome.

11.39 Background scan (BG scan)

Description:

This command is to scan Access Points, when module is in connected state. The scan results are sorted in decreasing order of signal strength (RSSI value). The scanned access point with highest signal strength will be the first in the list. Upon issuing this command, RYWB116 validates the Channel bit map issued through the scan command, to ensure that background scan is performed only on those channels.

Command Format:

AT Mode:

at+rsi_bgscan= < bgscan_enable >,< enable_instant_bgscan >,< bgscan_threshold >,< rssi_tolerance_threshold > , < bgscan_periodicity > , < active_scan_duration >,< passive_scan_duration >,< multi_probe >\r\n

Binary Mode:

```
struct {
uint8 bgscan_enable[2];
uint8 enable_instant_bgscan[2];

uint8 bgscan_threshold[2];
uint8 rssi_tolerance_threshold[2];
uint8 bgscan_periodicity[2];
uint8 active_scan_duration[2];
uint8 passive_scan_duration[2];
uint8 multi_probe;
} bgscanFrameSnd;
```

Command Parameters:

bgscan_enable:

To enable/Disable bgscan

0 – Disable

1 - Enable

enable instant_bgscan:

If this is set to 1 then module will send probe request immediately on air and bgscan results will be given to host.

Note:

If host requires BGScan results then instant_bg_enable has to be set to 1.

bgscan_threshold:

This is the threshold in dBm to trigger the bgscan. After bgscan_periodicity, If connected AP RSSI falls below this value then bgscan will be triggered.

rssi_tolerance_threshold:

This is difference of last RSSI of connected AP and current RSSI of connected AP. Here last RSSI is the RSSI calculated at the last beacon received and current RSSI is the RSSI calculated at current beacon received.

If this difference is more than rssi_tolerance_threshold then bgscan will be triggered irrespective of periodicity.

bgscan_periodicity:

This is time period in seconds to trigger bgscan if RSSI of connected AP is above (assuming RSSI is positive value) the given bgscan_threshold.

active_scan_duration:

This is active scan duration per channel in milli seconds.

passive_scan_duration:

This is passive scan duration per DFS channel in 5GHz in milli seconds.

multi_probe:

If set to one then module will send two probe request one with specific SSID provided during join command and other with NULL ssid (to scan all the access points).

Note:

1. Channel to scan in background scan is taken from Channel bit maps of scan command , e.g. channel_bit_map_2_4 and channel_bit_map_5.
2. active_scan_duration should be less than DTIM period to avoid multicast packet loss.
3. Number of channels supported in bgscan are 24 only.

Response:

AT Mode:

If instant_bg_enable is disabled:

OK\r\n

If instant_bg_enable is enabled:

Result Code	Description
OK< scanCount >< padding > < rfChannel >< securityMode >< rssiVal >< uNetworkType >< ssid >< bssid >< reserved >up to the number of scanned nodes	Successful execution of the command.
ERROR<Error code>	Failure

Binary Mode:

If enable instant_bgscan is enabled:

```

struct{
uint8 rfChannel;
uint8 securityMode;
uint8 rssiVal;
uint8 uNetworkType;
uint8 ssid[34];
uint8 bssid[6];
uint8 reserved2[2];
}rsi_scanInfo;
#define RSI_AP_SCANNED_MAX 11
typedef struct {
uint8 scanCount[4];
uint8 padding[4];
rsi_scanInfo strScanInfo[RSI_AP_SCANNED_MAX];
} rsi_scanResponse;
    
```

Response Parameters:

Scancount(4 byte): Number of Access Points scanned

padding(4 byte): reserved bytes.

rfChannel(1 byte): Channel Number of the scanned Access Point

securityMode(1 byte):

0–Open

1–WPA

2–WPA2

3–WEP

4–WPA Enterprise

5–WPA2 Enterprise


```
struct {
    uint8 roam_enable[4];
    uint8 roam_threshold[4];
    uint8 roam_hysteresis[4];
}roamParamsFrameSnd;
```

Command Parameters:

roam_enable:

To Enable/Disable roaming.

0 – Disable

1 - Enable

roam_threshold:

If connected AP RSSI falls below this then module will search for new AP from background scanned list.

roam_hysteresis:

If module found new AP with same configuration (SSID, Security etc) and if (connected_AP_RSSI – Selected_AP_RSSI) is greater than roam_hysteresis then it will try to roam to the new selected AP.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of command.
ERROR<Error code>	Failure

Binary Mode:

No response payload for this command.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C, 0x0026.

Relevance:

This command is relevant when the module is configured in Operating Mode 0,2.

Example:

AT Mode: at+rsi_roam_params=1,5,2\r\n

0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x72 0x6F 0x61 0x6D 0x5F 0x70 0x61 0x72 0x61 0x6D 0x73 0x3D 0x31 0x2C 0x35 0x2C 0x32 0x0D 0x0A

Response:

OK\r\n

0x4F 0x4B 0x0D 0x0A

11.41 HT Caps

Description:

This command is used to enable HT(high throughput) Caps (capabilities) in module when operating in AP mode.

This command has to be issued after ap configuration parameters command.

Command Format:

AT Mode:

at+rsi_ht_caps=< mode_11n_enable >,< ht_caps_bitmap >\r\n

Binary Mode:

```
struct {
    uint8 mode_11n_enable[2];
    uint8 ht_caps_bitmap[2];
}htCapsFrameSnd;
```

Command Parameters:

mode_11n_enable:

Enable/Disable 11n capabilities in AP Mode.

1 - Enable

0 - Disable

ht_caps_bit_map:

Bit map corresponding to high throughput capabilities.

ht_caps_bit_map	Functionality	Bit set to 0	Bit set to 1	Note and Info
ht_caps_bit_map[10:15]	All set to '0'			
ht_caps_bit_map[8:9]	Rx STBC support	Disable	Disable	
ht_caps_bit_map[6:7]	Set to '0'			
ht_caps_bit_map[5]	short GI for 20Mhz support	Disable (short GI for 20Mhz support disabled)	Enable (short GI for 20Mhz support enabled)	
ht_caps_bit_map[4]	Green field support	Disable (Green field support disabled)	Enable (Green field support enabled)	
ht_caps_bit_map[2:3]	Set to '0'			
ht_caps_bit_map[1]	set to enable 11n mode			
ht_caps_bit_map[0]	Set to '0'			

Response:

AT Mode:

Result Code	Description
OK	Successful execution of command.
ERROR<Error code>	Failure

Binary Mode:

No reponse payload for this command.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C,0x004D.

Relevance:

This command is relevant when the module is configured in Operating Mode 6.

Example:

AT Mode:

at+rsi_ht_caps=1,2\r\n

0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x68 0x74 0x5F 0x63 0x61 0x70 0x73 0x3D 0x31 0x2C 0x32 0x0D 0x0A
Response:
OK\r\n
0x4F 0x4B 0x0D 0x0A

11.42 DNS Server

Description:

This command is used to provide the DNS server's IP address to the module. This command should be issued before the "DNS Resolution" command and after the "Set IP Parameter" command.

Command Format:

AT Mode:

For IPv4:

```
at+rsi_dnsserver=< DNSMode >,< primary_dns_ip.ipv4_address >,< secondary_dns_ip.ipv4_address >\r\n
```

For IPv6:

```
at+rsi_dnsserver6=< DNSMode >,< primary_dns_ip.ipv6_address >,< secondary_dns_ip.ipv6_address >\r\n
```

Binary Mode:

```
typedef struct {
    uint8 ip_version[2];
    uint8 DNSMode[2];
    union{
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    }primary_dns_ip;
    union{
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    }secondary_dns_ip;
    }dnsServerFrameSnd;
```

Command Parameters:

ip_version:IPv4/IPv6

4 – IPv4

6 – IPv6

This parameter is available only in Binary mode.

DNSMode:

1 - The module can obtain DNS Server IP address during the command "Set IP Params" if the DHCP server in the Access Point supports it. In such a case, value of '1' should be used if the module wants to read the DNS Server IP obtained by the module

0 - Value of '0' should be used if the user wants to specify a primary and secondary DNS server address.

primary_dns_ip.ipv4_address:

This is the IPv4 address of the Primary DNS server to which the DNS Resolution query will be sent. Should be set to '0' if DNSMode =1. Only first 4 bytes of ipv4 address are filled, rest 12 bytes are zero.

primary_dns_ip.ipv6_address:

This is the IPv6 address of the Primary DNS server to which the DNS Resolution query will be sent. Should be set to '0' if DNSMode =1.

secondary_dns_ip.ipv4_address:

This is the IPv4 address of the Secondary DNS server to which the DNS Resolution query will be sent.

If DNSMode =1 or if the user does not want to specify a secondary DNS Server IP address, this parameter should be set to '0'. Only first 4 bytes of ipv4 address are filled, rest 12 bytes are zero.

secondary_dns_ip.ipv6_address:

This is the IPv6 address of the Secondary DNS server to which the DNS Resolution query will be sent.

If DNSMode =1 or if the user does not want to specify a secondary DNS Server IP address, this parameter should be set to '0'

Response:

AT Mode:

For IPv4:

Result Code	Description
OK< primary_dns_ip.ipv4_address >< secondary_dns_ip.ipv4_address >	Successful execution of command.
ERROR<Error code>	Failure.

For IPv6:

Result Code	Description
OK< primary_dns_ip.ipv6_address >< secondary_dns_ip.ipv6_address >	Successful execution of command.
ERROR<Error code>	Failure.

Binary Mode:

```
typedef struct{
    union{
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    }primary_dns_ip;
    union{
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    }secondary_dns_ip;
}rsi_dnsserverResponse;
```

Response Parameters:

primary_dns_ip.ipv4_address(16 bytes): IPv4 address of the primary DNS server. Only first 4 bytes of IPv4 address is filled, rest 12 bytes are zero.

primary_dns_ip.ipv6_address(16 bytes): IPv6 address of the primary DNS server
secondary_dns_ip.ipv4_address (16 bytes): IP address of the secondary DNS server. Only first 4 bytes of IPv4 address is filled, rest 12 bytes are zero.

secondary_dns_ip.ipv6_address (16 bytes): IPv6 address of the secondary DNS server.

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C, 0xFFFF8,0xFF74,0xBBA8,0BBBB2,0xBBAF,0xBB17,0BBBB3

Relevance:

This command is relevant in Operating Modes 0, 1, 2, 6.

Example :

AT Mode:

For IPv4:

at+rsi_dnsserver=1,0,0\r\n

0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x64 0x6E 0x73 0x73 0x65 0x72 0x76 0x65 0x72 0x3D 0x31 0x2C 0x30 0x2C 0x30 0x0D 0x0A

Response:

OK<primary=1.2.3.4><secondary=5.6.7.8>\r\n

0x4F 0x4B 0x01 0x02 0x03 0x04 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x05 0x06 0x07 0x08 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x0D 0x0A

Command:

```
at+rsi_dnsserver=0,8.8.8.8,0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x64 0x6E 0x73 0x73 0x65 0x72 0x76 0x65 0x72 0x3D 0x30 0x2C 0x38 0x2E
0x38 0x2E 0x38 0x2E 0x38 0x2C 0x30 0x0D 0x0A
```

Response:

```
OK< primary=8.8.8.8><secondary =0>\r\n
0x4F 0x4B 0x08 0x08 0x08 0x00 0x00 0x00 0x00 0x0D 0x0A
```

For IPv6:

```
at+rsi_dnsserver6=1,0,0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x64 0x6E 0x73 0x73 0x65 0x72 0x76 0x65 0x72 0x36 0x3D 0x31 0x2C 0x30
0x2C 0x30 0x0D 0x0A
```

Response:

```
OK< primary v6 address=2001:db8:1:0:0:0:2>< secondary v6 address = 2001:db8:1:0:0:0:3>\r\n
0x4F 0x4B 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x02 0x00 0x00 0x00 0xB8 0x0D 0x01
0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x03 0x00 0x00 0x00 0x0D 0x0A
```

Command:

```
at+rsi_dnsserver6=0,2001:DB8:1:0:0:0:5,0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x64 0x6E 0x73 0x73 0x65 0x72 0x76 0x65 0x72 0x36 0x3D 0x30 0x2C 0x32
0x30 0x30 0x31 0x3A 0x44 0x42 0x38 0x3A 0x31 0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x35 0x2C 0x30
0x0D 0x0A
```

Response:

```
OK< primary v6 address = 2001:DB8:1:0:0:0:5 ><secondary v6 address=0>\r\n
0x4F 0x4B 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x05 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x0D 0x0A
```

11.43 DNS Resolution

Description:

This command is to obtain the IP address of the specified domain name.

Command Format:

AT Mode:

For IPv4:

```
at+rsi_dnsget=< aDomainName >,< uDNSServerNumber >\r\n
```

For IPv6:

```
at+rsi_dnsget6=< aDomainName >,< uDNSServerNumber >\r\n
```

Binary Mode:

```
#define MAX_NAME_LEN 90 struct {
uint8 ip_version[2];
uint8 aDomainName [MAX_URL_LEN];
uint8 uDNSServerNumber[2];
}dnsQryFrameSnd ;
```

Command Parameters:

ip_version: IP version used, either 4 or 6. This parameter is available in Binary mode.

aDomainName:

This is the domain name of the target website. A maximum of 90 characters is allowed.

uDNSServerNumber:

Reserved.

Response:

AT Mode:

For IPv4:

Result Code	Description
OK< ip_version >< ulPCount >< aIPAddr.ipv4_address >..repeats for 10 times	Successful execution of command
ERROR<Error code>	Failure.

For IPv6:

Result Code	Description
OK< ip_version >< ulPCount >< aIPAddr.ipv6_address >..repeats for 10 times	Successful execution of command
ERROR<Error code>	Failure.

Binary Mode:

```
#define MAX_DNS_REPLY 10
typedef struct TCP_EVT_DNS_Query_Resp {
    uint8 ip_version[2];
    uint8 ulPCount[2];
    union{
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    }aIPAddr[MAX_DNS_REPLY];
}TCP_EVT_DNS_Query_Resp;
```

Response Parameters:

ip_version(2 bytes):

IP version used , either 4 or 6.This parameter is available only in Binary mode.

ulPCount(2 bytes):

Number of IP addresses resolved aIPAddr.ipv4_address(16 bytes): Individual IPv4 addresses, up to a maximum of 10.

Only first 4 bytes are filled in ipv4 address, rest 12 bytes are zero.

aIPAddr.ipv6_address(16 bytes):

Individual IPv6 addresses, up to a maximum of 10.

Note:
Maximum timeout for DNS resolution is 120 seconds.

Possible error codes:

Possible error codes are 0x0015,0x0021, 0x0025, 0x002C,0xFFBB,0xBBA1,0xBBAA,0xBBA3,0xBBA4,0xBBAC

Relevance:

This command is relevant in Operating Modes 0, 1, 2 and 6.

Example:

AT Mode:

For IPv4:

at+rsi_dnsget=www.reyax.com,1\r\n

0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x64 0x6E 0x73 0x67 0x 65 0x74 0x3D 0x77 0x77 0x77 0x2E 0x72 0x65 0x79
0x61 0x78 0x2E 0x63 0x6F 0x6D 0x2C 0x31 0x0D 0x0A

Response:

OK<num_IPAddr=1><IPAddr1=201.168.1.100>\r\n

0x4F 0x4B 0x01 0x00 0xC9 0xA8 0x01 0x64 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x0D
0x0A

For IPv6:

```
at+rsi_dnsget6=www.reyax.com,1\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x64 0x6E 0x73 0x67 0x 65 0x74 0x36 0x3D 0x77 0x77 0x77 0x2E 0x72 0x65
0x79 0x61 0x78 0x2E 0x63 0x6F 0x6D 0x2C 0x31 0x0D 0x0A
```

Response:

```
OK<num_IPAddr=1><IPv6Addr1=2001:DB8:1:0:0:0:0:6>\r\n
0x4F 0x4B 0x01 0x00 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x06 0x00 0x00 0x00 0x0D
0x0A
```

11.44 DNS UPDATE

Description:

This command is to update client host name (type A record) in DNS server.

Command Format:

AT Mode:

```
at+rsi_dnsupdate=< ipversion >,< aZoneName >,< aHostName >,<uDNSServerNumber >,< ttl >\r\n
```

Command Parameters:

ip_version:

IP version used 4 (No support for ip version 6).
This parameter is available in Binary mode.

aZoneName:

This is the zone name of the Domain.
A maximum of 31 characters is allowed.

aHostName:

This is the host name of the Domain.
A maximum of 31 characters is allowed.

uDNSServerNumber:

DNS Server number.

ttl:

Time To Live, Time in seconds for which hostname should be active.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of command
ERROR<Error code>	Failure

Binary Mode:

```
#define MAX_ZONE_LEN 31
#define MAX_HOST_NAME_LEN 31
typedef union {
    struct {
        uint8 ip_version;
        uint8 aZoneName[MAX_ZONE_LEN];
        uint8 aHostName[MAX_HOST_NAME_LEN];
        uint8 uDNSServerNumber[2];
        uint8 ttl[2];
    }dnsUpdateFrameSnd;
    uint8 uDnsUpdateBuf[MAX_ZONE_LEN + MAX_HOST_NAME_LEN + 5];
}rsi_uDnsUpdate;
```

Command Parameters:

ip_version:

IP version used 4 (No support for ip version 6).
This parameter is available in Binary mode.

aZoneName:

This is the zone name of the domain.
A maximum of 31 characters is allowed.

aHostName:

This is the host name of the domain.
A maximum of 31 characters is allowed.

uDNSServerNumber(2 bytes):

DNS Server number.

ttl(2 bytes):

Time To Live, Time in seconds for which service should be active.

Possible error codes:

Possible error codes are 0x0015,0x0021, 0x0025,0x002C,0xFFBB,0xBBA1,0xBBAA,0xBBA3,0xBBA4,0xBBAC

Relevance:

This command is relevant in Operating Modes 0, 1, 2 and 6.

Example:

AT Mode:

at+rsi_dnsupdate=4,RPS,REYAX,1,53 \r\n

Response:

OK\r\n
0x4F 0x4B 0x0D 0x0A

11.45 HTTP GET

Description:

This command is used to transmit HTTP GET request from the module to a remote HTTP server.
A subsequent HTTP GET request can be issued only after receiving the response of the previously issued HTTP GET request. Module acts as a HTTP client when this command is issued.

Command Format:

AT Mode:

For IPv4:

at+rsi_httpget=< https_enable >,< http_port >,< User_name >,< Password >,< Host_name >,< Ip_address >,< url >,< Extended_header >\r\n

For IPv6:

at+rsi_httpget6=< https_enable >,< http_port >,< User_name >,< Password >,< Host_name >,< Ip_address >,< url >,< Extended_header >\r\n

Binary Mode:

```
#defineHTTP_BUFFER_LEN1200
typedef struct
{
uint8 ip_version[2];
uint8 https_enable[2];
uint8 http_port[2];
uint8 buffer[HTTP_BUFFER_LEN];
}HttpReqFrameSnd;
```

Command Parameters:

ip_version:

ip version (4 or 6).

This field is available only in Binary mode.

https_enable:

Set BIT(0) to enable HTTPS.

Set BIT(1) to enable NULL delimiter for HTTP buffer instead of comma

Set BIT(2) to use SSL TLS 1.0 version if HTTPS is enabled.

Set BIT(3) to use SSL TLS 1.2 version if HTTPS is enabled.

Set BIT(4) to use SSL TLS 1.1 version if HTTPS is enabled

Note:

If SSL is enabled by default it will use SSL TLS 1.0 and TLS 1.2 version. BIT(2) and BIT(3) are valid only when HTTPS is enabled.

Note:

If SSL is enabled module will use same SSL version until module reboots.Set BIT(6) to enable HTTP version 1.1.

http_port:

HTTP server port number.

If this is not mentioned default port numbers will be used.

Buffer:

This field available in Binary mode which contains following values in the order of < User_name >,< Password >,< Host_name >,< Ip_address >,< url >,< Extended_header >

If BIT(1) is not set in https_enable field

< User_name >,< Password >,< Host_name >,< Ip_address >,< url >,< Extended_header > fields should be delimited with comma(,)

If BIT(1) is set in https_enable field

< User_name >\0< Password >\0< Host_name >\0< Ip_address >\0<URL>\0< Extended_header > fields should be delimited with NULL('\0')

User_name:

User_name for HTTP/HTTPS server authentication.

Password:

Password for HTTP/HTTPS server authentication.

Host_name:

Host name of the HTTP/HTTPS server.

Ip_address:

IPv4/IPv6 address of HTTP/HTTPS server.

url: requested URL.

Extended_header:

To append user configurable header fields to the default HTTP/HTTPS header

Note:

1. Maximum supported length for User_name, Password together is 278 bytes..
2. Maximum supported length for Buffer is (872-(length of User_name+length of Password)) bytes excluding delimiters.
3. If username, password, hostname and extended http headers are not required, user should send empty string separated by delimiter.
4. If content of any field contains comma(,) then NULL delimiter should be used.
5. Host needs to do byte stuffing in extended header field. Please refer the note Data Stuffing.

For example,
 Https_enable = BIT(0)
 http_port = 443
 Username : username
 Password : password
 Hostname: www.google.com
 IP = 192.168.40.50
 URL=/index.html
 Extended HTTP Header = ContentType: /r\n

Response:

Module may give http response in multiple chunks for a single HTTP GET request.

AT Mode:

Result Code	Description
AT+RSI_HTTPRSP=< more >< offset >< data_len >< data >	After the module sends out the HTTP GET request to the remote server, it may take some time for the response to come back. The response from the remote server is sent out to the Host from the module in the following form: AT+RSI_HTTPRSP=<More><Data Offset><Data Length><Data> The string AT+RSI_HTTPRSP is in uppercase ASCII.
ERROR<Error_code>	Failure

Binary Mode:

```
typedef struct TCP_EVT_HTTP_Data_t
{
    uint8 more[4];
    uint8 offset[4];
    uint8 data_len[4];
    uint8 data[1400];
}rsi_uHttpRsp;
```

Response Parameters:

More(4 bytes):

This indicates whether more HTTP data for the HTTP GET request is pending or not.

0—More data is pending. Further interrupts may be raised by the module till all the data is transferred to the Host.

1— End of HTTP data.

Offset(4 bytes): Always contains '0'.

data_len(4 bytes): data length in current chunk.

Data(Maximum 1400 bytes): Actual http data.

Possible error codes:

Possible error codes for this command are 0x0015,0x0021, 0x0025, 0x002C, 0xFF74, 0xBBF0

Relevance:

This command is relevant when the module is configured in Operating Mode 0,1, 2 and 6.

Example:

AT Mode:

For IPv4:

Https_enable : 0

http_port : 80

Username : username

Password : password

Host_name : www.google.com

IP Address: 192.168.40.86

URL: /index.html

Extended HTTP Header: ContentType: /\r\n

the below command is used

```
at+rsi_httpget=0,80,username,password,hostname,192.168.40.86,/index.html,ContentType: /\r\n\r\n
```

For IPv6:

Https_enable : = 0, to disable https

Http_port :8080

Username : username

Password : password

Hostname :www.google.com

IP Address: 2001:DB8:1:0:0:0:4

URL: /index.html

Extended HTTP Hedaer: ContentType: /\r\n

the below command is used

```
at+rsi_httpget6=0,8080,username,password,hostname,2001:DB8:1:0:0:0:4,/index.html,ContentType: /\r\n\r\n
```

11.46 HTTP POST

Description:

This command is used to transmit HTTP POST request to a remote HTTP server.

A subsequent HTTP POST request can be issued only the response to a previously issued HTTP POST request is received. Module acts as a HTTP client when this command is issued.

Command Format:

AT Mode:

For IPv4:

```
at+rsi_httppost=< https_enable >,< http_port >,< User_name >,< Password >,< Host_name >,< Ip_address >,< url >,< Extended_header >,< Data/Data_length >\r\n
```

For IPv6:

```
at+rsi_httppost6=< https_enable >,< http_port >,< User_name >,< Password >,< Host_name >,< Ip_address >,< url >,< Extended_header >,< Data/Data_length >\r\n
```

Binary Mode:

```
#define HTTP_BUFFER_LEN 1200
struct
{
    uint8 ip_version[2];
    uint8 https_enable[2];
    uint16 http_port;
    uint8 buffer[HTTP_BUFFER_LEN];
} HttpReqFrameSnd;
```

Command Parameters:

ip_version:

ip version (4 or 6).

This field is available only in Binary mode.

https_enable:

Set BIT(0) to enable HTTPS.

Set BIT(1) to enable NULL delimiter for HTTP buffer instead of comma

Set BIT(2) to use SSL TLS 1.0 version.

Set BIT(3) to use SSL TLS 1.2 version.

Set BIT(4) to use SSL TLS 1.1 version.

Note:

If SSL is enabled by default, it will use SSL TLS 1.0 and TLS 1.2 version. BIT(2) and BIT(3) are valid only when HTTPS is enabled.

Note:

If SSL is enabled, module will use same SSL version until module reboots.

Set BIT(5) to enable HTTP post data feature.

Set BIT(6) to enable HTTP version 1.1.

http_port:

HTTP server port number.

If this is not mentioned default port numbers will be used.

buffer:

This field available in Binary mode which contains following values in the order of < User_name >,< Password >,< Host_name >,< Ip_address >,< url >,< Extended_header >,< Data >.

Data is the actual data to be posted to the server. The parameter Buffer is a character buffer.

If BIT(1) is not set in https_enable field

< User_name >,< Password >,< Host_name >,< Ip_address >,< url >,< Extended_header >,< Data > fields should be delimited with comma(,)

If BIT(1) is set in https_enable field

< User_name >'\0'< Password >'\0'< Host_name >'\0'< Ip_address >'\0'<URL>'\0'< Extended_header >'\0'< Data > fields should be delimited with NULL('\0')

User_name: User_name for HTTP/HTTPS server authentication.

Password: Password for HTTP/HTTPS server authentication.

Host_name: Host name of the HTTP/HTTPS server.

Ip_address: IPv4/IPv6 address of HTTP/HTTPS server.

url: requested URL.

Extended_header: To append user configurable header fields to the default HTTP/HTTPS header

Data: Post data to be send.

Data/Data_length: Post data to be send/ Total length of the http data.

Note:

1. When BIT(6) is enabled in https_enable feature bitmap, hostname is mandatory (To support HTTP version 1.1).
2. When BIT(5) is enabled in https_enable feature bitmap, instead of Data, host need to give total HTTP data length.
3. Maximum supported length for User_name, Password together is 278 bytes.
4. Maximum supported length for Buffer is (872-(length of User_name + length of Password)) bytes excluding delimiters.
5. If username, password, hostname and extended http headers are not required, user should send empty string separated by delimiter.
6. If content of any field contains comma(,) then NULL delimiter should be used.

Example 1:

```
Https_enable = 0
Http_port = 80
Username = username
Password = password
Hostname = www.google.com
IP = 192.168.40.50
URL=/index.html
Extended HTTP Header = ContentType: /\r\n
Data=<data>
```

Example 2 (Set BIT(5) in https_enable field):

```
Https_enable = 32
Http_port = 80
Username = username
Password = password
Hostname = posttestserver.com
IP = 64.90.48.15
URL=/post.php
Extended HTTP Header = ContentType: */*\r\n
Data_length= 1800
```

Response:

Module may give http response in multiple chunks for a single HTTP POST request.

AT Mode:

Result Code	Description
AT+RSI_HTTPRSP=< more >< offset >< data_len >< data >	After the module sends out the HTTP POST request to the remote server, it may take some time for the response to come back. The response from the remote server is sent out to the Host from the module in the following form: AT+RSI_HTTPRSP=< more >< offset >< data_len >< data > The string AT+RSI_HTTPRSP is in uppercase ASCII.
ERROR<Error_code>	Failure

Binary Mode:

```
typedef struct TCP_EVT_HTTP_Data_t
{
    uint32 more;
    uint32 offset;
    uint32 data_len;
    uint8 data[1400];
}rsi_uHttpRsp;
```

Response Parameters:

More(4 bytes): This indicates whether more HTTP data for the HTTP GET request is pending or not.
 0–More data is pending. Further interrupts may be raised by the module till all the data is transferred to the Host.
 1– End of HTTP data.
 2– HTTP post request success response.

Offset(4 bytes): Always contains '0'.

data_len(4 bytes): data length in current chunk.

Data(Maximum 1400 bytes): Actual http data.

Possible error codes:

Possible error codes for this command are 0x0015,0x0021, 0x0025, 0x002C, 0xFF74, 0xBBF0

Relevance:

This command is relevant when the module is configured in Operating Mode 0,1,2 and 6 .

Example 1:

AT Mode:

For IPv4:

```
at+rsi_httppost=1,443,username,password,hostname,192.168.40.86,/index.html, ContentType: /
\r\n,<data=abcd>\r\n
```

For IPv6:

```
at+rsi_httppost6=0,443,username,password,hostname,2001:DB8:1:0:0:0:4,/index.html, ContentType: /
\r\n,<data=abcd>\r\n
```

Example 2:

AT Mode:

For IPv4:

```
at+rsi_httppost=32,80,username,password,posttestserver.com,64.90.48.15,/index.html,
ContentType: */*\r\n, 100\r\n
```

```
at+rsi_httppost=65,443,username,password,posttestserver.com,64.90.48.15,/index.html,
ContentType: */*\r\n, 100\r\n
```

```
at+rsi_httppost=97,443,username,password,posttestserver.com,64.90.48.15,/index.html,
ContentType: */*\r\n, 100\r\n
```

For IPv6:

```
at+rsi_httppost6=32,80,username,password,hostname,2001:DB8:1:0:0:0:4,/index.html,
ContentType: */*\r\n, 100\r\n
```

```
at+rsi_httppost6=65,443,username,password,hostname,2001:DB8:1:0:0:0:4,/index.html,
ContentType: */*\r\n, 100\r\n
```

```
at+rsi_httppost6=97,443,username,password,hostname,2001:DB8:1:0:0:0:4,/index.html,
ContentType: */*\r\n, 100\r\n
```

11.47 HTTP POST DATA

Description:

This command is used to transmit HTTP POST request to a remote HTTP server. A subsequent HTTP POST request can be issued only the response to a previously issued HTTP POST request is received. Module acts as a HTTP client when this command is issued.

Command Format:

AT Mode:

at+rsi_httppost_data=< [current_chunk_length](#) >,< [Data](#)>\r\n

current_chunk_length: Length of the current data.

Data: HTTP data.

Note:

httppost_data command is valid only when BIT(5) is enabled in the https_enable feature bitmap in HTTP POST command.

Binary Mode:

```
#define HTTP_POST_BUFFER_LEN 900
struct
{
    uint8 current_chunk_length[2];
    uint8 buffer[HTTP_POST_BUFFER_LEN ];
}HttpPostDataReqFrameSnd;
```

Response:

Module may give http response in multiple chunks for a single HTTP POST request.

AT Mode:

Result Code	Description
AT+RSI_HTTPPOSTRSP= < more >< offset >< data_len >< data >	<p>After the module sends out the HTTP POST request to the remote server, it may take some time for the response to come back.</p> <p>The response from the remote server is sent out to the Host from the module in the following form: AT+RSI_HTTPRSP=<More><Data Offset><Data Length><Data></p> <p>The string AT+RSI_HTTPRSP is in uppercase ASCII.</p>
ERROR< Error_code >	Failure

Response Parameters:

More(4 bytes): This indicates whether more HTTP data for the HTTP POST request is pending or not .

4- More data is pending from host

5-End of HTTP data content length

8–More data is pending. Further interrupts may be raised by the module till all the data is transferred to the Host.

9– End of HTTP data from server.

Offset(4 bytes): Always contains „0?.

data_len(4 bytes): data length in current chunk.

Data(Maximum 1400 bytes): Actual http data.

Possible error codes:

Possible error codes for this command are as follows, 0x0015,0x0021, 0x0025, 0x002C, 0xFF74, 0xBBF0, 0xBB38, 0xBBEF, 0xBB3E, 0xBB38, 0xBBE7.

Relevance:

This command is relevant when the module is configured in Operating Mode 0,1,2 and 6 .

11.48 HTTP PUT

Description:

This command is used to transmit HTTP PUT request to a remote HTTP server. Module acts as a HTTP client when this command is issued.

This section explains different commands to use HTTP client PUT.

This command should be given only after [Set IP Parameters](#) command.

Following table explains list of HTTP PUT commands and their description.

HTTP PUT Command	Description
PUT_CREATE	Creates HTTP client thread and HTTP client socket. This should be the first command to use the HTTP client PUT
PUT_START	Connects to the specified HTTP server and creates the specified resource.
PUT_PACKET	To send the resource data packet
PUT_DELETE	To delete the HTTP client thread and socket

- PUT_CREATE should be called as a first command to use HTTP PUT.
- Once put start is successful PUT_PACKET should be called to send the resource data packet for the previously create resource.
- Once put create is successful PUT_START should be called to create the specified resource on the specified HTTP server.
- Call PUT_DELETE to delete HTTP Client thread and socket.

AT Mode:

HTTP PUT client has different command types. Based on the command type following parameters will change accordingly.

at+rsi_httpput=<command_type>,<remaining parameters>\r\n

Following are available command types.

HTTP PUT command	Command Type	Command Format
PUT create	1	at+rsi_httpput=1\r\n

HTTP PUT command	Command Type	Command Format
PUT start	2	at+rsi_httpput=2,<ip_version>,<https_enable>,<port number>,<total contentlength>,<http buffer>\r\n Ip_version: IP version to use. 4 – For IPv4 6 – For IPv6 ip_address: Ipv4/Ipv6 address of the HTTP server. port number: HTTP server port number total_length: Total content length of the HTTP PUT data http_buffer: http buffer contains the username, password, host name, ip address, URL address, extended http header.
PUT PACKET	3	at+rsi_httpput=3,<current length>,<http buffer>\r\n current length : length of the current http put content chunk http_buffer: http buffer contains the put data
PUT DELETE	4	at+rsi_httpput=4\r\n

Binary Mode:

```

#define HTTP_CLIENT_PUT_CREATE 1
#define HTTP_CLIENT_PUT_START 2
#define HTTP_CLIENT_PUT_PACKET 3
#define HTTP_CLIENT_PUT_DELETE 4
#define RSI_HTTP_CLIENT_PUT_BUFFER_LENGTH 1024
typedef struct
{
    /*! HTTP server ip version
uint8 ip_version;
    /*! HTTPS bit map
uint8 https_enable[2];
    /*! HTTP server port number
uint8 port_number[4];
    /*! HTTP Content Length
uint8 content_length[4];
} rsi_http_client_put_start_t;
typedef struct
{
    /*! Current chunk length
uint16 current_length;
} rsi_http_client_put_data_req_t;
typedef struct
{
    /*! Command type
uint8 command_type;
    union
    {
        rsi_http_client_put_start_t http_client_put_start;
        rsi_http_client_put_data_req_t http_client_put_data_req;
    } http_client_put_struct;
uint8 http_put_buffer[RSI_HTTP_CLIENT_PUT_BUFFER_LENGTH];
} rsi_http_client_put_req_t;
    
```

Note:

1. Maximum supported PUT buffer length is 900 bytes.
2. Maximum timeout for, http put start command response is 20 Seconds.
3. Maximum timeout for, http put packet command response is 10 Seconds.

ip_version: ip version (4 or 6). This field is available only in Binary mode.

https_enable:

Set BIT(0) to enable HTTPS.

Set BIT(1) to enable NULL delimiter for HTTP buffer instead of comma

Set BIT(2) to use SSL TLS 1.0 version.

Set BIT(3) to use SSL TLS 1.2 version.

Set BIT(4) to use SSL TLS 1.1 version

Note:

If SSL is enabled by default it will use SSL TLS 1.0 and TLS 1.2 version. BIT(2) and BIT(3) are valid only when HTTPS is enabled.

Note:
If SSL is enabled module will use same SSL version until module reboots.

Set BIT(6) to enable HTTP version 1.1.

port_number:

HTTP server port number.

If this is not mentioned default port numbers will be used.

http_put_buffer:

This field contains following values in the order of < User_name >,< Password >,< Host_name >,< Ip_address >,< url

>,< Extended_header >.

The parameter Buffer is a character buffer.

If BIT(1) is not set in https_enable field

< User_name >,< Password >,< Host_name >,< Ip_address >,< url >,< Extended_header >,< Extended_header > fields should be delimited with comma(,)

If BIT(1) is set in https_enable field

< User_name >'\0'< Password >'\0'< Host_name >'\0'< Ip_address >'\0'<URL>'\0' < Extended_header > fields should be delimited with NULL('\0')

content_length: Total length of the resource content.

User_name: User_name for HTTP/HTTPS server authentication.

Password: Password for HTTP/HTTPS server authentication.

Host_name: Host name of the HTTP/HTTPS server.

Ip_address: IPv4/IPv6 address of HTTP/HTTPS server.

url: requested URL.

Extended_header: To append user configurable header fields to the default HTTP/HTTPS header

current_length: Current content chunk length

data: resource data to be send (This parameter is valid only for PUT PACKET command).

Note:

- 1) Maximum supported length for User_name, Password together is 278 bytes..
- 2) Maximum supported length for Buffer is (872-(length of User_name+length of Password)) bytes excluding delimiters.
- 3) If username, password, hostname and extended http headers are not required, user should send empty string separated by delimitert.
- 4) If content of any field contains comma(,) then NULL delimiter should be used.5) When BIT(6) is enabled in https_enable feature bitmap, hostname is mandatory (To support HTTP version 1.1)

AT Mode:

Result Code	Description
AT+RSI_HTTPRSP= < command_type>< end_of_file >< offset>< data_len >< data >	After the module sends out the HTTP PUT request to the remote server, it may take some time for the response to come back. The response from the remote server is sent out to the Host from the module in the following form: AT+RSI_HTTPRSP=<command_type><end_of_file >< Offset><DataLength><Data> The string AT+RSI_HTTPRSP is in uppercase ASCII.
ERROR<Error_code>	Failure

Response:

```

    //! HTTP Client PUT response structure
    typedef struct rsi_http_client_put_rsp_s
    {
        //! Receive HTTP Client PUT command type
        uint8 command_type;
    }rsi_http_client_put_rsp_t;

    //! HTTP Client PUT PKT response structure
    typedef struct rsi_http_client_put_pkt_rsp_s
    {
        //! Receive HTTP client PUT command type
        uint8 command_type;
        //! End of file/resource content
        uint8 end_of_file;
    }rsi_http_client_put_pkt_rsp_t;
    
```

Response Parameters:

command_type:

HTTP Client PUT command type

end_of_file:

End of file or HTTP resource conten

0- More data is pending from host

1- End of HTTP file/resource content

Response from Server:

//! HTTP Client PUT response structure for server response for Put Packet command:

```

typedef struct rsi_http_client_put_rsp_s {
    //! Receive HTTP Client PUT command type
    Uint32command_type;
    //! End of file/resource content
    Uint32 end_of_file
    //! Offset(4 bytes): Always contains '0'.
    Uint32 offset;
    //!data length in current chunk
    Uint32 data_len;
    //!Data(Maximum 1024 bytes): Actual http data from server.
    Uint32 data;
}rsi_http_client_put_rsp_t;
    
```

Response Parameters:

command_type:

"5", HTTP Client PUT packet command type during the response from the server.

end_of_file (Valid for HTTP PUT PKT):

End of file or HTTP resource content.

– 8 - More data pending from server

– 9 - End of HTTP file from server/resource content

Offset(4 bytes): Always contains '0'.

Data_length:

data_len data length in current chunk

Data:

(Maximum 1024 bytes): Actual http data from server.

Possible Error Codes:

Possible Error codes for this command are 0x0021, 0x0015, 0x0025, 0xBB38.

Relevance:

This command is relevant in Operating Modes 0, 1, 2, 6.

Example:

AT Mode:

HTTP client PUT Service:

at+rsi_httpput=1\r\n

at+rsi_httpput=2,4,0,80,19,username,password,192.168.1.100,192.168.1.100,/,,\r\n

at+rsi_httpput=3,19,<html><body></html>\r\n

at+rsi_httpput=4\r\n

11.49 DFS Client (802.11h)

Description:

DFS client implementation is internal to the module. In 5 GHz band, the module does only passive scan in DFS channels. If the Access Point detects radar signals, it indicates to the module (client) to switch to a different channel by using the "channel switch frame". The module performs channel switch as per the AP's channel switch parameters. There is no command required to enable this feature, it is enabled by default.

11.50 Query Firmware Version

Description:

This command is used to query the version of the firmware loaded in the module.

Command Format:

AT Mode:

at+rsi_fwversion?\r\n

Binary Mode:

No payload required for this command.

Response:

AT Mode:

Result Code	Description
OK< fwversion ><\0>	Successful execution of command. All values returned in ASCII.
ERROR<Error code>	Failure.

Binary Mode:

```
struct {
    uint8fwversion[20];
}rsi_qryFwversionFrameRcv;
```

Response Parameters:

Fwversion: Firmware version.

Possible error codes:

Possible error codes for this command are 0x002c.

Relevance:

This command is relevant In all modes.

Example:

AT Mode:

```
at+rsi_fwversion?\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x66 0x77 0x76 0x65 0x72 0x73 0x69 0x6F 0x6E 0x3F 0x0D 0x0A
```

Response:

```
OK 1.1.0\r\n
0x4F 0x4B 0x31 0x2E 0x31 0x2E 0x30 0X00 0x0D 0x0A
```

11.51 Query RSSI Value

Description:

This command is used to retrieve the RSSI value for Access Point to which the module is connected.

Command Format:

AT Mode:

```
at+rsi_rssi?\r\n
```

Binary Mode:

No Payload required.

Response:

AT Mode:

Result Code	Description
OK< rssiVal >	Successful execution of command
ERROR<Error code>	Failure.

Binary Mode:

```
struct{
uint8 rssiVal[2];
}rsi_rssiFrameRcv;
```

Response Parameters:

rssiVal(2 bytes) : RSSI value (-n dBm) of the Access Point to which the module is connected. It returns absolute value of the RSSI. For example, if the RSSI is -20dBm, then 20 is returned.

Possible error codes:

Possible error codes for this command are 0x0021, 0x0025, 0x002C.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1(WiFi Direct client mode) and 2.

Note:
Closer the RSSI value to '0', stronger the signal strength.

Example:

AT Mode:

```
at+rsi_rssi?\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x72 0x73 0x73 0x69 0x3F 0x0D 0x0A
```

Response:

```
For a RSSI of -20dBm, the return string is
OK < rssiVal =-20> \r\n
0x4F 0x4B 0x14 0x0D 0x0A
```

11.52 Query MAC Address

Description:

This command is used to query the MAC address of the module. This command can be issued anytime after init command.

Command Format:

AT Mode:

at+rsi_mac?\r\n

Binary Mode:

No payload required for this command

Response:

For None Concurrent Mode:

AT Mode:

Result Code	Description
OK< macAddress >	Successful execution of command.
ERROR<Error code>	Failure.

Binary Mode:

```
struct {
    uint8macAddress[6];
}rsi_qryMacFrameRecv;
```

Response Parameters:

macAddress(6 bytes): MAC address of the module.

Possible error codes:

Possible error codes for this command are 0x002c .

Relevance:

This command is relevant in all operating modes.

Example:

AT Mode:

at+rsi_mac?\r\n

0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6D 0x61 0x63 0x3F 0x0D 0x0A

Response:

If the MAC ID is 0x00 0x23 0xA7 0x1B 0x8D 0x31, then the response is

OK< macAddress >\r\n

0x4F 0x4B 0x00 0x23 0xA7 0x1B 0x8D 0x31 0x0D 0x0A

For Concurrent Mode:

Response:

AT Mode:

Result Code	Description
OK<macAddress 1> <macAddress2>	Successful execution of command.
ERROR<Error code>	Failure.

Binary Mode:

```
struct {
    uint8macAddress1[6];
    uint8macAddress2[6];
}rsi_qryMacFrameRecv;
```

Response Parameters:

macAddress1(6 bytes), macAddress2(6 bytes): MAC address of the module for two interfaces.

Possible error codes:

Possible error codes for this command are 0x002c .

Relevance:

This command is relevant in all operating modes.

Example:

AT Mode:

at+rsi_mac?\r\n

0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6D 0x61 0x63 0x3F 0x0D 0x0A

Response:

OK< macAddress1 >< macAddress2 >\r\n

0x4F 0x4B 0x00 0x23 0xA7 0x1B 0x8D 0x31 0x00 0x23 0xA7 0x1B 0x8D 0x32 0x0D 0x0A

11.53 Query Network Parameters

Description:

This command is used to retrieve the WLAN and IP configuration parameters. This command should be sent only after the connection to an Access Point is successful.

Command Format:

AT Mode:

at+rsi_nwparams?\r\n

Binary Mode:

No payload required for this command.

Response:

AT Mode:

Result Code	Description
OK< wlan_state >< Chn_no >< psk >< mac_addr >< ssid >< connType >< sec_type >< dhcpMode >< ipaddr >< subnetMask >< gateway >< num_open_socks >< prefix_length >< ipv6addr >< defaultgw6>< tcp_stack_used >[< sock_id >< socket_type >< sPort >< dPort >< destIPaddr.ipv4_address/ destIPaddr.ipv6_address >] upto Max sockets supported.	Successful execution of command
ERROR<Error Code>	Failure.

Binary Mode:

```
#define RSI_SSID_LEN 34
#define MN_NUM_SOCKET 10
struct sock_info_query_t {
    uint8 sock_id[2];
    uint8 socket_type[2];
    uint8 sPort[2];
    uint8 dPort[2];
    union{
        uint8ipv4_address[4];
        uint8ipv6_address[16];
    }destIPAddr;
    }sock_info_query_t;
struct EVT_NET_PARAMS {
    uint8 wlan_state;
    uint8 Chn_no;
    uint8 psk[64];
    uint8 mac_addr[6];
    uint8 ssid[RSI_SSID_LEN];
    uint8 connType[2];
    uint8 sec_type;
    uint8 dhcpMode ;
    uint8 ipaddr[4];
    uint8 subnetMask[4];
    uint8 gateway[4];
    uint8 num_open_socks[2];
    uint8 prefix_length[2];
    uint8 ipv6addr[16];
    uint8 defaultgw6[16];
    uint8 tcp_stack_used;
    sock_info_query_t socket_info[MN_NUM_SOCKET];
} rsi_qryNetParmsFrameRcv;
```

Response Parameters:

wlan_state(1 byte):

This indicates whether the module is connected to an Access Point or not.

0 – Not Connected

1 – Connected

Chn_no(1 byte):

Channel number of the AP to which the module joined

Psk(64 bytes):

Pre-shared key used

Mac_Addr(6 bytes):

MAC address of the module

ssid(34 bytes):

This value is the SSID of the Access Point to which the module is connected

ConnType(2 byte):

0x0001 – Infrastructure

Sec_type(1 byte):

Security mode of the AP to which the module joined.

0– Open mode

1– WPA security 2– WPA2 security

- 3- WEP
- 4- WPA-Enterprise
- 5- WPA2-Enterprise

Ipaddr(4 bytes):

This is the IP Address of the module.

SubnetMask(4 bytes):

This is the Subnet Mask of the module

Gateway(4 bytes):

This is the Gateway Address of the module.

dhcpMode(1 byte):

This value indicates whether the module is configured for DHCP or Manual IP configuration for both IPv4 and IPv6.

dhcp_mode (0 bit)-

0 – Static IP configuration for IPv4

1 – Dynamic IP configuration for IPv4

dhcp_mode (1 bit)-

0 – Static IP configuration for IPv6

1 – Dynamic IP configuration for IPv6

Num_open_socket(2 bytes):

This value indicates the number of sockets currently opened

Prefix_length(2 bytes):

Prefix length of IPv6 address.

Ipv6addr(16 bytes):

This is the IPv6 Address of the module

Defaultgw6(16 bytes):

This is the IPv6 address of the default router

tcp_stack_used(1 byte):

TCP/IP stack used

1-IPv4

2-IPv6

4-Both IPv4 and IPv6 (dual stack).

Sock_id(2 bytes):

Socket handle of an existing socket

Socket_type(2 bytes):

Type of socket

0-TCP/SSL/websocket Client

2- TCP/SSL Server (Listening TCP)

4- Listening UDP

Sport(2 bytes):

Port number of the socket in the module.

Dport(2 bytes):

Destination port number of the remote peer.

destIpaddr.ipv4_address(16 bytes):

IPv4 address of the remote terminal.

Only first 4 bytes of ipv4 address gets filled, remaining 12 bytes are zero.

destIpaddr.ipv6_address(16 bytes):

IPv6 address of the remote terminal

If the Set IP Params command was not sent to the module before Query Network Parameters command, the module returns a default values for following fields which should be ignored are outlined below:

dhcpMode, ipaddr, subnetMask, gateway, num_open_socks, prefix_length, ipv6addr, defaultgw6, tcp_stack_used, socket_info

Possible error codes:

Possible error codes for this command are 0x0021, 0x002C.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2.

Example:

AT Mode:

```
at+rsi_nwparams?\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6E 0x77 0x70 0x61 0x6D 0x73 0x3F 0x0D 0x0A
```

Response:

Response when nwparams command was given before ipconfig command so ipparameters are not set in this response, and sockets are not opened yet. Here SSID is 'cisco' and gateway is '192.168.100.76'.

Note:
Command will not get PSK, it will get PMK to reduce connection time with AP from the next boot up. In the nwparams response structure you can find 32 bytes of PMK remaining are filled with Zeros.

```
OK< wlan_state >< Chn_no >< psk >< mac_addr >< ssid >< connType >< sec_type >< dhcpMode >< ipaddr ><
subnetMask >< gateway >< num_open_socks >< prefix_length >< ipv6addr >< defaultgw6>< tcp_stack_used >[<
sock_id >< socket_type >< sPort >< dPort >< destIPaddr.ipv4_address/ destIPaddr.ipv6_address >]
OK< wlan_state =0x01>< Chn_no =0x06>< psk =0x00(repeats 63 times)>< mac_addr =0x00 0x23 0xA7 0x16 0x16
0x16>< ssid =0x63 0x69 0x73 0x63 0x6F 0x00<repeats 27 times>>< connType =0x01 0x00>< sec_type =0x00 ><
dhcpMode =0x01>< ipaddr =0x00 0x00 0x00 0x00 >< subnetMask =0xFF 0xFF 0xFF 0x00 0>< gateway =0xC0 0xA8
0x64 0x4C>< num_open_socks =0x00 0x00>< prefix_length =0x00 0x00>< ipv6addr =0x00(16times)><
defaultgw6=0x00(16 times) > [<sock_id =0x00 0x00>< socket_type =0x00 0x00>< sPort =0x00 0x00>< dPort =0x00
0x00>< destIPaddr.ipv4_address/ destIPaddr.ipv6_address =0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x00 0x00 0x00 0x00>]<repeats 11 times > 0x0D 0x0A.
```

11.54 Query Group Owner Parameters

Description:

This command is used to retrieve Group Owner (in case of Wi-Fi Direct) or connected client (in case of AP) related parameters.

This command should issue to the module only if the module has become a Group Owner in Wi-Fi Direct mode, or has been configured as an Access Point.

Command Format:

AT Mode:

```
at+rsi_goparams?\r\n
```

Binary Mode:

There is no payload for this command.

Response:

AT Mode:

Result Code	Description
OK< ssid >< bssid >< channel_number >< psk >< ipv4_address >< ipv6_address >< sta_count > [< ip_version >< mac >< ip_address. ipv4_address/ ip_address. ipv6_address >] ...Upto 10 sockets	Successful execution of command.
ERROR<Error Code>	Failure.

Binary Mode:

```
#define      MAX_STA_SUPPORT_IN_GO_COMMAND_RSP 16
struct go_sta_info_s{
uint8 ip_version[2];
uint8 mac[6];
union {
uint8 ipv4_address[4];
uint8 ipv6_address[16];
}ip_address;
};typedef struct {
uint8      ssid[34];
uint8      bssid[6];
uint8      channel_number[2];
uint8      psk[64];
uint8      ipv4_address[4];
uint8      ipv6_address[16];
uint8      sta_count[2];
struct go_sta_info_s sta_info[MAX_STA_SUPPORT];
}rsi_qryGOParamsFrameRcv;
```

Response Parameters:

SSID(34 bytes):

SSID of the Group Owner/Access point.

BSSID(6 bytes):

MAC address of the module

Channel_number(2 bytes):

Channel number of the group owner/Access point.

PSK(64 bytes):

PSK configured in Wi-Fi Direct GO/Access point.

IPv4 address(4 bytes):

IPv4 Address of the module.

IPv6 address(16 bytes):

IPv6 Address of the module.

Sta_count(2 bytes):

Number of clients associated to the Group Owner/Access point.

The least significant byte is returned first.

A maximum of 16 clients is supported.

Ip_version (2 bytes):

IP version of the connected client.

MAC(6 bytes):

MAC address of the connected client

ip_address. ipv4_address/ ip_address. ipv6_address(16 bytes):

IPv4/IPv6 address of the connected client. Last 12 bytes will be set to '0' in case of IPv4.

Possible error codes:

Possible error codes for this command are 0x0021, 0x0022, 0x0025, 0x002C.

Relevance:

This command is relevant when the module is configured in Operating Mode 1, 6 .

Example:

AT Mode:

at+rsi_goparams?\r\n

0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x67 0x70 0x61 0x72 0x61 0x6D 0x73 0x3F 0x0D 0x0A

Response:

```
OK< ssid =red>< bssid =0023A7556677>< channel_number =6>< psk =1234>< ipv4_address =192.168.40.10><
ipv6_address =0x0(16 times)>< sta_count =1>
[< ip_version =4>< mac =68234286A3B2>< ip_address. ipv4_address/ ip_address. ipv6_address
=192.168.40.12>]\r\n 0x4F 0x4B 0x72 0x65 0x64 0x00<repeats 30 times> 0x00 0x23 0xA7 0x55 0x66 0x77 0x06
0x00 0x31 0x32 0x33 0x34 0x00<repeats 60 times> 0x00 0xC0 0xA8 0x28 0x0A 0x01 0x04 0x00 0x00 0x68 0x23
0x42 0x86 0xA3 0xB2 0xC0 0xA8 0x28 0x0C 0x0D 0x0A
```

11.55 Soft Reset

Description:

This command acts as a software reset to the module. The module will reset all information regarding the WLAN connection and IP configuration after receiving this command. The Host has to start right from the beginning, from issuing the first command "Set Operating Mode" after issuing this command. This command is valid only in case of UART and USB-CDC interface.

Note:

Only OK response comes in UART /USB-CDC, there will not be any CARD READY indication.

Command Format:

AT Mode:

```
at+rsi_reset\r\n
```

Binary Mode:

There is no payload for this command. This command is applicable only in case of UART, USB and USB-CDC.

Command Parameters:

N/A

Response:

AT Mode:

Result Code	Description
OK	Success
ERROR<Error Code>	Failure.

Binary Mode:

No payload required

Response Parameters:

N/A

Possible error codes:

Possible error codes are 0xFF82.

Relevance:

This command is relevant in all operating modes.

Example:

AT Mode:

```
at+rsi_reset\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x72 0x65 0x73 0x65 0x74 0x0D 0x0A
```

Response:

```
OK\r\n
0x4F 0x4B 0x0D 0x0A
```

11.56 Set/Reset multicast filter

Description:

This command is to set/reset the multicast MAC address bitmap to filter multicast packets. This command should be given after init command.

Payload:

AT Mode:

at+rsi_multicast_filter=< uMcastBitMapFrame >\r\n

Binary Mode:

uint16 uMcastBitMapFrame;

Payload Parameters:

uMcastBitMapFrame:

There are two bytes in the payload which represent 2 parts. Lower byte represent the command type (cmd as mentioned below) and higher byte is the hash value (6 Bits) generated from the desired multicast MAC address (48 Bits) using hash function.

uMcastBitMapFrame	Functionality
uMcastBitMapFrame[0:1]	These 2 bits represents the command type. Possible values are as follows, 1. RSI_MULTICAST_MAC_ADD_BIT (To set particular bit in multicast bitmap) 2. RSI_MULTICAST_MAC_CLEAR_BIT (To reset particular bit in multicast bitmap) 3. RSI_MULTICAST_MAC_CLEAR_ALL (To clear all the bits in multicast bitmap) 4. RSI_MULTICAST_MAC_SET_ALL (To set all the bits in multicast bitmap)
uMcastBitMapFrame[2:7]	reserved
uMcastBitMapFrame[8:13]	6bit hash value generated from the hash algorithm which corresponds to the multicast MAC address is used to set/reset corresponding bit in multicast filter bitmap. This field is valid only if 0 or 1 is selected in command type (uMcastBitMapFrame[0:1])
uMcastBitMapFrame[14:15]	reserved

Response:

AT Mode:

Result Code	Description
OK	Successful execution of command.
ERROR<Error code>	Failure.

Binary Mode:

N/A

Response Parameters:

N/A

Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002c.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

Note:

The Hash function is 8 CRC generator with the 2 MSB's ignored.

11.57 Join or Leave Multicast group

Description:

This command is used to join or leave a multicast group.

Command Format:

AT Mode:

For IPv4:

at+rsi_multicast=< req_type >,< group_address. ipv4_address >\r\n

For IPv6:

at+rsi_multicast6=< req_type >,< group_address. ipv6_address >\r\n

Binary Mode:

```
struct {
    uint8 ip_version[2];
    uint8 req_type[2];
    union{
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    }group_address;
    } multicastFrameSnd;
```

Command Parameters:

ip_version:

IP version 4 or 6.

This parameter is available only in Binary mode.

req_type:

Request type i.e. join request or leave request

0 - Leave multicast group

1 - Join multicast group

group_address.ipv4_address/ group_address.ipv6_address:

IPv4/IPv6 address of multicast group. Last 12 bytes are set to '0' in case of IPv4.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of command.
ERROR<Error code>	Failure.

Binary Mode:

N/A

Response Parameters:

N/A

Possible error codes:

Possible error codes 0x0021, 0x0025, 0x002C, 0xBB21,0xBB4c,0xBB17,0xBB55.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 and 6.

Example:

AT Mode:

For IPv4:

To join a multicast group:

at+rsi_multicast=1,239.0.0.0\r\n

0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6D 0x75 0x6C 0x74 0x69 0x63 0x61 0x73 0x74 0x3D 0x31 0x2C 0x32 0x33

0x39 0x2E 0x30 0x2E 0x30 0x2E 0x30 0x0D 0x0A

Response:

```
OK \r\n
0x4F 0x4B 0x0D 0x0A
To leave a multicast group:
at+rsi_multicast=0,239.0.0.0\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6D 0x75 0x6C 0x74 0x69 0x63 0x61 0x73 0x74 0x3D 0x30 0x2C 0x32 0x33
0x39 0x2E 0x30 0x2E 0x30 0x2E 0x30 0x0D 0x0A
```

Response:

```
OK \r\n
0x4F 0x4B 0x0D 0x0A For IPv6:
To join multicast ipv6 group:
at+rsi_multicast6=1,FF0E:0:0:0:0:0:1\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6D 0x75 0x6C 0x74 0x69 0x63 0x61 0x73 0x74 0x3D 0x31 0x2C 0x46 0x46
0x30 0x45 0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x31 0x0D 0x0A
```

Response:

```
OK \r\n
0x4F 0x4B 0x0D 0x0A
To leave multicast ipv6 group:
at+rsi_multicast6=0,FF0E:0:0:0:0:0:1\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x6D 0x75 0x6C 0x74 0x69 0x63 0x61 0x73 0x74 0x36 0x3D 0x30 0x2C 0x46
0x46 0x30 0x45 0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x30 0x3A 0x31 0x0D 0x0A
```

Response:

```
OK \r\n
0x4F 0x4B 0x0D 0x0A
```

Note:

if MDNS feature is enabled,multicast group is not supported.

11.58 Ping From Module

Description:

This command is used to send the ping request to the target IP address.

Command Format:

AT Mode:

```
at+rsi_ping=< ip_version >,< ping_address. ipv4_address/ ping_address. ipv6_address >,< ping_size >,< timeout >\r\n
```

Binary Mode:

```
typedef struct rsi_ping_request_s {
    uint8 ip_version[2];
    uint8 ping_size[2];
    union {
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    }ping_address;
    uint8 timeout[2];
} rsi_ping_request_t;
```

Command Parameters:

ip_version:

IP version of the ping request.

4 - For IPV4
6 - For IPV6.

ping_size:

ping data size to send. Maximum supported is 300 bytes.

Ping_address.ipv4_address /Ping_address.ipv6_address:

Destination IPv4/IPv6 address.

Response:

AT Mode:

Result Code	Description
OK< ip_version>< ping_size > < ping_address. ipv4_address/ ping_address. ipv6_address>	Successful execution of command
ERROR<Error code>	Failure.

Binary Mode:

```
typedef struct {
    uint8 ip_version[2];
    uint8 ping_size[2];
    union {
        uint8 ipv4_addr[4];
        uint8 ipv6_addr[16];
    }ping_address;
} rsi_uPingRsp;
```

Response Parameters:

ip_version(2 bytes):

IP version of the ping reply.

ping_size (2 bytes):

Contains the length of the data which is present in the ping reply.

ping_address. ipv4_address/ping_address.ipv6_address:

Ipv4/IPv6 address of the ping reply. Last 12 bytes are set to '0' in case of IPv4. timeout: ping request command response timeout.

Note:
Default ping request command response timeout is 1 second.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

Possible Error Codes:

Possible error codes are 0x0025, 0x002C,0x002F, 0xBB29, 0xFF74,0x0015,0xBB21,0xBB4B,0xBB55.

Example:

AT Mode:

For IPv4:

```
at+rsi_ping=4,192.168.1.100,10\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x70 0x69 0x6E 0x67 0x3D 0x34 0x2C 0x31 0x39 0x32 0x2E 0x31 0x36 0x38
0x2E 0x31 0x2E 0x31 0x30 0x30 0x2C 0x31 0x30 0x0D 0x0A
```


webpage:

The HTML content chunk.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of command.
ERROR<Error code>	Failure.

Binary Mode:

There is no response payload.

Response Parameters:

There is no response payload.

Possible Error codes:

Possible error codes are 0x0021, 0x0015,0x0025, 0x00C1, 0x00C2, 0x00C3 , 0x00C5, 0x00C6,0x00C8

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

Example:

The host can also overwrite an existing page, this is achieved by issuing this same command with the same filename. No explicit erase is required. However the size of the new file cannot exceed the size of the old file rounded upto the 4K chunk boundary. Precisely, if an old file used 2 chunks of 4K (i.e. Upto 8K in size), then the new file can't exceed 8K in size. To overcome this limitation, the host should erase the existing file and then write a new file which can exceed the size of the old file provided the device has enough space available.

AT Mode:

at+rsi_webpage=sample.html,2783,1024,0,<html><head><title></title>[1024-chars]\r\n

Response:

OK\r\n

E.g.:

at+rsi_webpage=page1.html,1024,1024,0,<html><head><title></title>[1024-chars]\r\n

11.59.2 Loading the dynamic webpage(Create JSON)

Description:

This command is used to load the associate json data with the static WebPages.

Command Format:

AT Mode:

at+rsi_jsoncreate= < filename >,< total_len >,< current_len >,< has_json_data >,< webpage >\r\n

Binary Mode:

```
typedef struct rsi_jsonCreateObject_s {
#define RSI_JSON_MAX_CHUNK_LENGTH 1024
char filename[24];
uint8 total_length[2];
uint8 current_length[2];
char json_data[RSI_JSON_MAX_CHUNK_LENGTH];
} rsi_jsonCreateObject_t;
```

Command Parameters:

filename:

The webpage file with which this JSON data is associated.

total_length:

total length of the JSON

current_length:

length of current JSON chunk

json_data:

This is the JSON Object that stores the data of the webpage.

Note:
Maximum supported JSON length is 512Check length bytes.

Response :

AT Mode:

Result Code	Description
OK	Success.
ERROR<Error code>	Failure.

Binary Mode:

There is no response payload.

Response Parameters:

There is no response payload.

Possible Error codes:

Possible error codes are 0x0015, 0x0021, 0x0025,0x002C, 0x00B1,0x00B2,0x00B3,0x00B4,0x00B5,0x00B6.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

Example:

AT Mode:

Webpage should already be present in modules flash with bool json set to 1 before issuing this command.
at+rsi_jsoncreate=sample.html,60,60,{"temp":27, "accx":2.4, "accy":2.6, "accz":1.1, "enabled":true}\r\n

Response:

OK\r\n

Webpage should already be present in modules flash with bool json set to 1 before issuing this command.

Command:

at+rsi_jsoncreate=sample.html,60,60,{"temp":27, "accx":2.4, "accy":2.6, "accz":1.1, "enabled":true}\r\n

Response:

OK\r\n

11.60 Clearing the webpage

These commands are used to erase the webpage and information related to webpage from the flash.

11.60.1 Erasing the webpage

Description:

This command is used to erase the webpage file from the FLASH. This command should be issued before join command. The erase command should be used specifying the filename, This will free up the number of 4K chunks the existing file was using, for writing new files.

Command Format:

AT Mode:

at+rsi_erasefile= < filename> \r\n

Binary Mode:

```
typedef struct rsi_tfs_erase_file_s {
    char filename[24];
} rsi_tfs_erase_file_t;
```

Command Parameters:

filename:

name of the webpage file that has to be erased.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of command.
ERROR<Error code>	Failure.

Binary Mode:

There is no response payload.

Response Parameters:

There is no response payload.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

Possible Error codes:

Possible error codes are 0x0021, 0x0025,0x002C, 0x00C4

Example:

AT Mode:

at+rsi_erasefile=sample.html\r\n

Response:

OK\r\n

11.60.2 Erasing the JSON Data

Description:

This command is used to erase the JSON data file associated with a webpage in the FLASH.

Command Format:

AT Mode:

at+rsi_erasejson= <filename> \r\n

Binary Mode:

```
typedef struct rsi_tfs_erase_file_s {
    char filename[24];
} rsi_tfs_erase_file_t;
```

Command Parameters:

filename:

name of the webpage file of which JSON data has to be erased.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of command.
ERROR<Error code>	Failure.

Binary Mode:

There is no response payload.

Response Parameters:

There is no response payload.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

Possible Error Codes:

Possible error codes are 0x0021, 0x0025, 0x002C, 0x00B4.

Example:

AT Mode:

at+rsi_erasejson=sample.html\r\n

Response:

OK\r\n

11.60.3 Clear all the WebPages

Description:

This command is used to erase all the WebPages in the file system.

Command Format:

AT Mode:

at+rsi_clearfiles= <clear> \r\n

Binary Mode:

```
typedef struct rsi_tfs_clear_files_s {
    uint8 clear;
} rsi_tfs_clear_files_t;
```

Command Parameters:

clear:

set '1' to clear files.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of command.
ERROR<Error code>	Failure.

Binary Mode:

There is no response payload.

Response Parameters:

There is no response payload.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

Possible Error Codes:

Possible error codes are 0x0021, 0x0025, 0x002C.

Example:

AT Mode:

Command:

at+rsi_clearfiles=1\r\n

Response:

OK\r\n

11.61 Loading of Store configuration page

RYWB116 allows two kinds of WebPages to be stored: static and dynamic. Static pages allow plain html, css and JavaScript; whereas dynamic pages allow JSON data to be associated with the static WebPages. Store configuration page is a static web page.

To load store configuration page Host need to use "store_config.html" as a URL name and no need of loading the associated JSON data (Dynamic web page).

The size of the page should not exceed the 40K .

The field present in the webpage can be disable by the host. But host can't change the webpage fields structure. Host can change the "LOGO" and "TITLE" which are present in the store configuration page.

For loading Store configuration page refer section : Loading the webpage.

11.61.1 Web Page Bypass

Description:

This command is used to send URL response.

When unavailable page request is received, module will give asynchronous indication to host for requesting web page. Host has to respond with URL RESPONSE frame.

When module receives the query then it checks that if it already has the page in its memory. If yes, it sends out the page to the remote terminal and the query is serviced. If not it sends the asynchronous URL REQUEST.

Asynchronous Message is as follows.

AT Mode:

AT+RSI_URLREQ< url_length> < url_name >< request_type > <post_content_length >< post_data >\r\n

After receiving this asynchronous frame from module, host has to respond with URL RESPONSE frame with the following payload.

Note:

Please note that whenever you are giving url request from a browser to the module, .html should be given.

Binary Mode:

```
#define MAX_URL_LENGTH 40
#define MAX_POST_DATA_LENGTH 512

typedef struct{
uint8 url_length;
uint8 url_name[MAX_URL_LENGTH];
uint8 request_type;
uint8 post_content_length[2];
uint8 post_data[MAX_POST_DATA_LENGTH];
}rsi_urlReqFrameRcv;
```

url_length(1 byte):

This is the number of characters in the requested URL.

url_name (41 bytes):

This is actual URL name.

request_type(1 byte):

type of the request received.

- 0 – HTTP GET request
- 1 – HTTP POST request

post_content_length(2 bytes):

length of the post content

post_data(512 bytes):

HTTP POST received.

post_content_length, post_data fields are valid if request_type is HTTP POST.

These fields can be ignored in case of request_type is HTTP GET.

Command Format:

AT Mode:

at+rsi_urlrsp=< total_len >,< more_chunks >,< webpage >\r\n

The Host , after receiving this asynchronous message from the module, should fetch the page from its memory and give it back to the module with the message

at+rsi_urlrsp=< total_len >,< more_chunks >,< webpage >\r\n

Binary Mode:

```
#define MAX_HOST_WEBPAGE_SEND_SIZE 1400
typedef struct {
    uint8 total_len[4];
    uint8 more_chunks;
    uint8 webpage[MAX_HOST_WEBPAGE_SEND_SIZE];
} HostWebpageSnd_t;
```

Command Parameters:

total_len:

This is the total number of characters in the page.

If the queried web page is not found, the Host should send '0' for this parameter.

more_chunks:

'0'- There are no more segments coming from the Host after this segment

'1'- There is one more segment coming from the Host after this Segment

webpage:

This is the actual source code of the current segment

Response:

AT Mode:

Result Code	Description
OK	Successful execution of command.
ERROR<Error code>	Failure.

Binary Mode:

There is no response payload.

Response Parameters:

There is no response payload.

Relevance:

This command is relevant when the module is configured in Operating Mode 0, 1, 2 or 6.

Possible Error Codes:

Possible error codes are 0x0015,0x0021,0x0025,0x002C.

Example:

AT Mode:

Example 1:

If the web page source code is of 3000 characters, the Host should send it through 3 segments, the first two of 1400 bytes, and the last one of 200 bytes as shown:

```
AT+RSI_URLRSP=< total_len =3000>,< more_chunks =1>,< webpage =code of the 1st segment>\r\n
AT+RSI_URLRSP=< total_len =3000>,< more_chunks =1>,< webpage =code of the 2nd segment>\r\n
AT+RSI_URLRSP=< total_len =3000>,< more_chunks =0>,< webpage =code of the 3rd segment>\r\n
```

Example 2:

If the queried web page is not found in the Host, then host should send

```
AT+RSI_URLRSP=0\r\n
```

11.61.2 Set Region

Description:

This command used to configure the device to operate according to the regulations of its operating country. This command should be immediately followed by init command.

Command Format:

AT Mode:

```
at+rsi_setregion=<setregion_code_from_user_cmd>,<region_code>/r/n
```

Binary Mode:

```
typedef struct{
uint8 setregion_code_from_user_cmd;

uint8 region_code;

}setRegionFrameSnd;
```

Command Parameters:

setregion_code_from_user_cmd:

Enable/Disable set region code from user.

- 1 - Enable - Use the region information from user command
- 0 – Disable - Use the region information from beacon(country le)

Note:

1. In Wi-Fi Direct mode, setting the region information from beacon is not supported.
2. For world mode domain, setting the region information from beacon is not supported.

Region_code:

- 0/1-US domain(Default)
- 2-Europe domain
- 3-Japan Domain
- 4-World mode domain

Response:

AT Mode:

Result Code	Description
OK< region_code >	Successful execution
ERROR	Failure.

Binary Mode:

```
typedef struct {
    uint8 region_code;
}rsi_uSetRegionRsp;
```

Response Parameters:

region_code(1 bytes):

0x01(US domain)

0x02(Europe domain)

0x03(Japan Domain)

0x04(Other than above three domains)

Note:

1. In dual band mode, If country element extracted from beacon in 2.4Ghz band and 5Ghz band are not matching, error is thrown and region is set to US
2. Refer to the tables below for the region supported and domain rules followed by Reyax module

Relevance:

This command is relevant when the module is configured in Operating Mode 0,1,2,8 modes.

The tabulated rules are followed for the regions supported by the Reyax module.

Rule No	band	First Channel	Number of Channels	Last Channel	Maximum power in dBm	scan type
1	2.4GHz	1	11	11	27	Active
2	5GHz	36	4	48	16	Active
3	5GHz	52	4	64	23	Passive
4	5GHz	100	5	116	23	Passive
5	5GHz	132	3	140	23	Passive
6	5GHz	149	5	165	29	Active

Table 11-17: Regulations followed for US domain

Rule No	band	First Channel	Number of Channels	Last Channel	Maximum power in dBm	scan type
1	2.4GHz	1	13	13	20	Active
2	5GHz	36	4	48	23	Active
3	5GHz	52	4	64	23	Passive
4	5GHz	100	11	140	30	Passive

Table 11-18: Regulations followed for Europe domain

Rule No	band	First Channel	Number of channels	Last Channel	Maximum power in dBm	scan type
1	2.4GHz	1	14	14	20	Active
2	5GHz	36	4	48	20	Active
3	5GHz	52	4	64	20	Passive
4	5GHz	100	11	140	30	Passive

Table 11-19: Regulations followed for Japan domain

Note:

Though the transmit power levels w.r.t to region are greater than 20dBm, Reyax module is supporting maximum of 18dBm.

Possible Error Codes:

Possible error codes for this command are 0x0021, 0x0025, 0x002C, 0xFF82, 0x00CC, 0x00C7, 0x00CD,0x00CE

Example:

AT Mode:

Command:

Setting Japan region.
at+rsi_setregion=1,3\r\n

Command:

Setting world mode region domain.
at+rsi_setregion=1,4\r\n

Response:

OK\r\n

11.62 Set Region of Access point

Description:

This command is used to set the region domain of the module in Access point mode. This command helps device to self-configure and operate according to the regulations of its operating country and includes parameters like country name, channel quantity and maximum transmission level. These parameters are added in Country information element in the beacons and probe responses. This command should be immediately followed by init command.

Command Format:

AT Mode:

at+rsi_setregion_ap=<setregion_code_from_user_cmd>,<country_code>,<no_of_rules>,[<first_channel>,<Number of channel>,<max_tx_power>,< First channel >,<Number of channels>,<max_tx_power>],.....no of rules times/r/n

Binary Mode:

```
#define MAX_POSSIBLE_CHANNEL 24
struct{
uint8 setregion_code_from_user_cmd;
uint8 country_code[3];
uint8 no_of_rules[4];
struct{
uint8 first_channel;
uint8 no_of_channels;
uint8 max_tx_power;
}channel_info[MAX_POSSIBLE_CHANNEL];
}setRegionApFrameSnd;
```

Command Parameters:

setregion_code_from_user_cmd:

set region code from user command enable/disable

1- Enable-Get the region information from user command

0- Disable-Get the region information based on region code from module's internal memory

Note:

In Wifi Direct mode, setting the region information from user command is not supported.
Country code: Country code is of 3 bytes. Country code is case sensitive and should be in Uppercase. If the first parameter is 1, the second parameter should be one of these 'US', 'EU', 'JP' country codes.

Note:

If the country code is of 2 characters, 3rd character should be <space>.

Note:

The below parameters are considered only if the first parameter is 1.

Number of rules:

Number of rules for the given domain

First channel:

Start channel for the nth rule

Number of channels:

number of channels holding the same rule from the start channel

Maximum transmit power:

Maximum transmit power used in that set of channels.

Response:

AT Mode:

Result Code	Description
OK	Successful execution
ERROR	Failure.

Binary Mode:

There is no response payload for this command.

Relevance:

This command is relevant when the module is configured in Operating Mode 6.

Note:

1. AP configuration in DFS channels (52 to 140) is not supported
2. Though the transmit power levels w.r.t., to region are greater than 20dBm, Reyax module is supporting maximum of 18dBm

Possible Error Codes:

Possible error codes for this command are 0x0021, 0x0025, 0x002C, 0x00ca, 0x00cb, 0x00cc, 0xFF71, 0xFF82

Example:

AT Mode:

Example:1

```
at+rsi_setregion_ap=1,US<space>,2,1,4,23,5,7,30\r\n
```

Explanation:

From the above command, consider the first rule 1,4,23

First channel is given as 1, and no of channels is 4. this means channels 1 to 4 (1,2,3,4) holds the maximum Tx power 23dBm

Consider the second rule 5,7,30

First channel is given as 5, and no of channels is 7. this means channels 5 to 11 (5,6,7,8,9,10,11) holds the maximum Tx power 30dBm

Note:

The Country code given in the command reflects as it is in the beacon frame.

Example: 2

Command:

at+rsi_setregion_ap=0,US<space>\r\n

Response:

OK\r\n

Note:

Refer to the tables in the Set Region section for the region supported and domain rules followed by REYAX module

11.63 PER statistics of the module

Description :

This command is used to get the Transmit(TX) & Receive(RX) packets statistics. When this command is given by the host by enabling this feature with valid channel number ,module gives the statistics to host for every second until this feature is disabled. This command can be given after init command.

Command Format:

AT Mode:

at+rsi_per_stats=< per_stats_enable >,< per_stats_channel >\r\n

Binary Mode:

```
struct {
    uint8 per_stats_enable[2];
    uint8 per_stats_channel[2];
} perStatsFrameSnd;
```

Command Parameters:

per_stats_enable:

Enable /disable per status feature

0 – Enable

1 – Disable

per_stats_channel:

valid channel number in which user wants to get the stats. Channel number is not required if the first parameter is 1(Disable)

Response:

AT Mode:

OK	Successful execution
ERROR	Failure

Once PER stats is enabled, module sends asynchronous message for every second. Following list of fields will be given to host.

Result Code	Description
AT+RSI_PER_STATS=<tx_pkts >,<reserved_1>,<tx_retries >,<crc_pass>,<crc_fail>,<cca_stk>,<cca_not_stk>,<pkt_abort>,<fls_rx_start>,<cca_idle>,<reserved_2>,<rx_retries >,<reserved_3>,<cal_rssi>,< reserved_4>,<xretries>,<max_cons_pkts_dropped>,<reserved_5><bss_broadcast_pkts>,<bss_multicast_pkts>,<bss_filter_matched_multicast_pkts>	

Binary Mode:

There is no response payload for this command. Once PER stats is enabled, module sends asynchronous message for every 1 second. Following list of fields will be given to host.

```
typedef struct per_stats_s {
    uint8 tx_pkts[2];
    uint8 reserved_1[2];
    uint8 tx_retries[2];
    uint8 crc_pass[2];
    uint8 crc_fail[2];
    uint8 cca_stk[2];
    uint8 cca_not_stk[2];
    uint8 pkt_abort[2];
    uint8 fls_rx_start[2];
    uint8 cca_idle[2];
    uint8 reserved_2[26];
    uint8 rx_retries[2];
    uint8 reserved_3[2];
    uint8 cal_rssi[2];
    uint8 reserved_4[4];
    uint8 xretries[2];
    uint8 max_cons_pkts_dropped[2];
    uint8 reserved_5[2];
    uint8 bss_broadcast_pkts[2];
    uint8 bss_multicast_pkts[2];
    uint8 bss_filter_matched_multicast_pkts[2];
}rsi_uPerStatsRsp;
```

Response Parameters:

tx_pkts(2 bytes):

Number of TX packets transmitted

reserved_1(2 bytes):

Reserved

tx_retries(2 bytes):

Number of TX retries happened

crc_pass(2 bytes):

Number of RX packets that passed CRC

crc_fail(2 bytes):

Number of RX packets that failed CRC

cca_stk(2 bytes):

Number of times cca got stuck

cca_not_stk(2 bytes):

Number of times cca didn't get stuck

pkt_abort(2 bytes):

Number of times RX packet aborts happened

fls_rx_start(2 bytes):

Number of false rx starts.If Valid wlan packet is recived and is dropped due to some reasons.

cca_idle(2 bytes):

CCA idle time

reserved_2(2 bytes):

Reserved

rx_retries(2 bytes):

Number of RX retries happened

reserved_3(2 bytes):

Reserved

cal_rssi(2 bytes):

The calculated RSSI value of recently received RX packet

reserved_4(4 bytes):

Reserved

xretries(2 bytes):

Number of TX Packets dropped after maximum retries

max_cons_pkts_dropped(2 bytes):

Number of consecutive packets dropped after maximum retries

reserved_5(2 bytes):

Reserved

bss_broadcast_pkts(2 bytes):

BSSID matched broadcast packets count.

bss_multicast_pkts(2 bytes):

BSSID matched multicast packets count.

bss_filter_matched_multicast_pkts(2 bytes):

BSSID and multicast filter matched packets count. The filtering is based on the parameters given in multicast filter command [Set/Reset Multicast filter](#). If multicast filter is not set then this count is equal to bss_multicast_pkts count.

Note:

1. In PER mode(opermode 8) following stats related to RX packets (crc_pass, crc_fail, cca_stk, cca_not_stk, pkt_abort, fls_rx_start, cca_idle) are only valid, remaining fields can be ignored
2. The multicast stats are valid only in associated state in client mode and are invalid in non-associated state. In associated state, the stats are for packets which are destined for the module's MAC address only. And in non associated state, the stats are for all the packets received, irrespective of the destination MAC address.
3. The parameters valid in other than PER mode(opermode 0,1,2,6) mode : tx_pkts, tx_retries cal_rssi, xretries, crc_pass, max_cons_pkts_dropped, crc_fail, cca_stk, cca_not_stk, pkt_abort, fls_rx_start, cca_idle, bss_broadcast_pkts, bss_multicast_pkts, bss_filter_matched_multicast_pkts

Relevance:

This command is valid in all operating modes.

Possible Error Codes:

Possible error codes for this command are 0x0021, 0x0025, 0x002c, 0x000A.

11.64 Query WLAN Connection Status

Description:

This command queries the WLAN connection status of the Wi-Fi module.

This command is available only in Binary mode.

Command Format:

No Payload required.

Command Parameters:

No parameters

Response:

```
typedef struct {
    uint8 state[2];
} rsi_conStatusFrameRcv;
```

Response Parameters:

State(2 bytes):
 1 - Connected to AP
 0 - Not connected to AP

Possible error codes:

Possible error codes are 33, 37, 44

Relevance:

This command is relevant when the module is configured in Operating Mode 0, and 2.

11.65 Remote Socket Closure

Description:

This is an asynchronous message which will be given to host in the following cases.

1. When the remote peer closes connected TCP/SSL/Web socket.
2. When module is not able to send data over socket because of unavailability of remote peer.
3. When remote peer disappears without intimation then module closes socket after TCP keep alive time(~20 minutes) and sends this message to host.

Command Format:

N/A

Command Parameters:

N/A

Response:

AT Mode:

AT+RSI_CLOSE< socketDsc >< bytesSent >\r\n

Binary Mode:

```
struct {
    uint8 socketDsc[2];
    uint8 sentBytesCnt[4];
} rsi_socketCloseFrameRecv;
```

Response Parameter:

socketDsc(2 bytes):

Socket descriptor of the socket which is closed. sentBytesCnt(4 bytes): Number of bytes sent successfully on that socket.

Possible error codes:

No possible error code as it is asynchronous message from module to host.

Relevance:

This command is relevant when the module is configured in Operating Mode 0,1 , 2 and 6.

11.66 Bytes Transmitted Count On Socket

Description:

This command is used to get the number of bytes transmitted successfully by the module on a given socket.

Command Format:

AT Mode:

at+rsi_bytes_sent_count=< sock_handle >\r\n

Binary Mode:

uint16 socketDescriptor

Command Parameters:

socketDescriptor: socket handle on which number of bytes have been successfully transmitted.

Response:

AT Mode:

OK<sock_handle><SentBytescnt >	Success.
ERROR	Failure.

Binary Mode:

```
typedef struct {
    uint8 sock_handle[2];
    uint8 SentBytes[4];
}rsi_SentBytesRsp;
```

Response Parameters:

socket_handle(2 bytes):

Socket handle on which number of bytes have been successfully transmitted.

SentBytescnt(4 bytes): Number of bytes sent successfully on the given socket handle

Relevance:

This command is relevant when the module is configured in Operating Mode 0,1 , 2 and 6.

Possible Error Codes:

Possible error codes for this command are 0xFF86, 0xFFFA, 0xFF82, 0x002C, 0x0025, 0x0021.

11.67 Debug prints on UART

Description:

This command is used for debug prints on UART interfaces 1 and 2. Host can get 4 types of debug prints based on the assertion level and assertion type.

Note:
To select UART 1 or 2 interfaces in bit(27) of ext_custom_feature_bit_map

PIN Configuration:

UART 1 : From Host GPIO_9 is for Tx and GPIO_8 is for Rx

UART 2 : From Host GPIO_6 is for Tx and GPIO_10 is for Rx

Command Format:

AT Mode:

at+rsi_debug=< assertion_type >,< assertion_level >\r\n

Binary Mode:

```
struct {
    uint8 assertion_type[4];
    uint8 assertion_level[4];
} debugFrameSnd;
```

Command Parameters:

assertion_type:

Possible values are 0 to 4.

assertion_level:

Possible values 0 to 15. 1 being least level and 15 being highest level of debug prints. 0 is to disable all the prints.

Note:

1. If debug prints are enabled once, to disable the debug prints host is supposed to give the same command with assertion type and assertiobn level as 0.
2. Baud rate for UART 2 on host application side should be 460800.

Response:

AT Mode:

OK	Successful execution
ERROR	Failure.

Binary Mode:

There is no response payload for this command.

Possible Error Codes:

Possible error codes for this command are 0x0021, 0x0025, 0x002C, 0xFF8

Relevance:

This command can be given at any time.

11.68 Asynchronous message for connection state notification

Description:

Asynchronous message are used to indicate module state to host. These message are enabled by setting 10th bit in customer feature select bitmap in opermode command, please refer opermode command.

Command Format:

N/A

Response:

AT Mode:

AT+RSI_STATE-I< TimeStamp >,<StateCode>,<reason_code>,<rsi_channel>,<rsi_rssi>,<rsi_bssid>\r\n	This type of asynchronous message is given by the module when it is in scanning state.
AT+RSI_STATE-II< TimeStamp >,<StateCode>,<reason_code>,<rsi_channel>,<rsi_rssi>,<rsi_bssid>\r\n	This kind of message is given by the module once the scan results are observed and decided to join or not to join/ Rejoin to AP.
AT+RSI_STATE-III< TimeStamp >,<StateCode>,<reason_code>,<rsi_channel>,<rsi_rssi>,<rsi_bssid>\r\n	Once the association or disassociation is done, module will give final state asynchronous message

Binary Mode:


```
typedef struct rsi_state_notification_s {
    uint8 TimeStamp[4];
    uint8 stateCode;
    uint8 reason_code;
    uint8 rsi_channel;
    uint8 rsi_rssi;
    uint8 rsi_bssid[6];
}rsi_state_notificaton_t;
```

Response Parameters:

TimeStamp(4 bytes):This is value of counter at the time of message. This counter is continuously incrementing by one per 100ms time.

stateCode(1 byte): This field indicates state of the module. state code contain two parts (upper nibble/lower nibble).

Upper nibble represent the state of rejoin process. Following are the possible values of StateCode represented by the upper nibble of state code.

Scan Trigger State (state-I): Indicates the reason for scan triggered

0x00-Startup (Initial Roam)

0x10-Beacon Loss (Failover Roam)

0x20-De-authentication (AP induced Roam / Disconnect from supplicant)

Scan Result/Decision State(state – II): Indicates a state change based on scan result

0x50-Current AP is best

0x60-Better AP found

0x70-No AP found

Final Connection State (state – III) :Indicates the connection state change

0x80-Associated

0x90-Unassociated

Following are the possible values of StateCode represented by the lower nibble of state code

Indicates reason for state change

0x00-No reason specified

0x01-Authentication denial

0x02-Association denial

0x03-AP not present

0x05-WPA2 key exchange failed

reason_code(1 byte):This is used to get the reason code from firmware point of view. Following are the possible reason code for the failure.

0x00-No reason specified

0x01-Authentication denial

0x02-Association denial

0x10-Beacon Loss (Failover Roam)

0x20-De-authentication (AP induced Roam/Deauth from supplicant)

0x07-PSK not configured

0x09-Roaming not enabled

rsi_channel(1 byte):

Following represents the meaning of AP channel at the given stage.

State-I: channel of association or Invalid if it is startup.

State-II: channel of next association if module finds better AP in bgscan result.

State-III: Channel at the time of association.

If value of rsi_channel is 0, it means channel information is not available.

rsi_rssi(1 byte): Following represents the meaning of AP RSSI at the given stage.

State-I: RSSI of AP at the time of trigger.

State-II: RSSI of next association.

State-III: RSSI at the time of final association.

If value of rsi_rssi is 100, it means RSSI information is not available.
 rsi_bssid(6 bytes): Following represents the meaning of AP MAC at the given stage.
 State-I: MAC of AP at the time of scan trigger.
 State-II: MAC of next association.
 State-III: MAC at the time of association.

Note:
 If the value of AP MAC is 00:00:00:00:00:00, it means MAC information is not available.

Response:
 N/A

Relevance:
 This command is relevant in oper modes 0,1,2 and 6.

Possible Error Codes:
 N/A

Note:
 By default this feature is disabled. To enable this feature host has to set the custom bit 0x400 in opermode command.

11.69 TSF Synchronization packet

Description:

This command is used to send a frame for timing synchronization .This command is valid only if module is connected with the specified peer. If the specified peer is not connected, module will return error code (0x0078) to host.

Command Format in UART mode:
 at+rsi_sync_pkt

Usage:
 at+rsi_sync_pkt=<MAC_address>,<payload>\r\n

Command Parameters:

MAC_address:
 MAC address of receiver

payload:
 payload to be sent to the receiver

Response:

Transmitter End:
 In response to above command, module returns TSF timer value captured after sending the packet on air at transmitter end.

OK<TSF Value (8 bytes)>
 Example: 4f 4b 06 2b 25 02 00 00 00 00 0d 0a

Receiver End:
 On the receiver end, an asynchronous message with senders MAC address, TSF timer value followed by payload is forward to host.

AT+RSI_TSF_SYNC_PKT_RECVD=<Mac Addr(6bytes)> <reserved (2bytes)> <TSF Value(8bytes)> <payload>

Command Format in SPI mode:

Description:

Host will issue the command for sending TSF synchronization packet with frame type (0xC0). At reception of this command, Module will prepare a management frame (Action frame) attaching the payload. The module then captures the timestamp after sending the packet on air and sends back the response frame to host. On the receiver side, the module filters the packet based on Action frame type, attaches the timestamp and forwards the asynchronous packet to the host.

Request Frame Type:

RSI_REQ_HOST_TSF_SYNC_PKT 0xC0

Request Frame Body Structures:

```
#define MAX_PAYLOAD_LENGTH 100
typedef struct rsi_req_tsf_sync_pkt_s
{
    uint8 MAC_address[6];
    uint8 reserved[22]
    uint8 payload[MAX_PAYLOAD_LENGTH];
}rsi_req_tsf_sync_pkt_t;
Response Frame Type:
RSI_RSP_HOST_TSF_SYNC_PKT
0xC0 (Transmitter side)
RSI_RSP_HOST_TSF_SYNC_PKT_RECVD
0xC1 (Receiver side)
Response Frame Body structure on transmitter side:
typedef struct rsi_rsp_tsf_sync_pkt_s
{
    uint32 TSF_value[2];
}rsi_rsp_tsf_sync_pkt_t;
Response Frame Body structure on receiver side:
typedef struct rsi_rsp_tsf_sync_pkt_s
{
    uint8 sender_mac_address[6];
    uint8 reserved[2];
    uint32 Current_TSF_value[2];
    uint8 payload[MAX_PAYLOAD_LENGTH];
}rsi_rsp_tsf_sync_pkt_t;
```

Station connect/disconnect indication in AP mode

Description:

Asynchronous message are used to indicate host in AP mode when the station is connected(frame type 0xC2)/ disconnected(frame type 0xC3).

Command Format:

N/A

Response :

AT Mode:

AT+RSI_CL

AT+RSI_CLIENT_STATION_CONNECTED=< MAC_address >	MAC address of station connected
AT+RSI_CLIENT_STATION_DISCONNECTED=< MAC_address >	MAC address of station disconnected

Binary Mode:

```
typedef struct{
    uint8 MAC_address[6];
}
```

Response Parameters:

MAC_address(6 bytes): MAC address of station connected/disconnected

Relevance:

This command is valid when opermode is 1 or 6.

Possible Error Codes:

N/A

11.70 Station connect/disconnect indication in AP mode

Description:

Asynchronous message are used to indicate host in AP mode when the station is connected(frame type 0xC2)/disconnected(frame type 0xC3).

Command Format:

N/A

Response :

AT Mode:

AT+RSI_CLIENT_STATION_CONNECTED= < MAC_address >	MAC address of station connected
AT+RSI_CLIENT_STATION_DISCONNECTED= < MAC_address >	MAC address of station disconnected

Binary Mode:

uint8 MAC_address[6];

Response Parameters:

MAC_address(6 bytes): MAC address of station connected/disconnected

Relevance:

This command is valid when opermode is 1 or 6.

Possible Error Codes:

N/A

11.71 Transparent Mode Command

Description:

This command is used to Enter/Start transparent mode, parameters for transparent mode are to be provided in this command. On reception of this command, module tries to start transparent mode and replies with "AT+RSI_TMODE " message with status.

Command Format:

AT Mode:

at+rsi_trans_mode_params=<packetization Length>, <Escape character>, <gap time>, <frame time>, <escape time>, <IP version>, <socket type>, <local port>, <Destination port>, <IP Address>, <Max_count>, <Type of service>, <SSL Parameters>, <SSL Ciphers>\r\n

Binary Mode:

N/A

Command Parameters:

Packetization Length:

Possible values are 10 to 1024 Escape character: Any special character

Gap Time(in milliseconds):

Varies from 0 to 65533

Frame time(in milliseconds):

varies from 1 to 65534(should be greater then gap time)

Escape Time(in milliseconds):

Varies from 2 to 65535(should be greater then frame time)

IP Version:

Possible values are 4 or 6

4 - IPV4

6 - IPV6

Socket Type:

Possible values are

0 – TCP

2 – LTCP

4 – LUDP

Local Port number:

Local port number

Destination Port number:

Destination port number

IP Address:

Server IP address if socket type is LUDP/LTCP

Max_count:

Maximum no. of clients in LUDP/LTCP, fixed to 1 in transparent mode.

Type of Service:

Type of service, varies from 0 to 8

SSL parameters:

This field is used to enable SSL for selected socket.

Possible values:

0 – To open TCP socket.

1 - To open SSL client socket.

5 - To open SSL socket with TLS 1.0 version.

9 - To open SSL socket with TLS 1.2 version.

ssl_ciphers : to select various cipher modes, possible values

1- TLS_RSA_WITH_AES_256_CBC_SHA256

2 - TLS_RSA_WITH_AES_128_CBC_SHA256

4 - TLS_RSA_WITH_AES_256_CBC_SHA

8 - TLS_RSA_WITH_AES_128_CBC_SHA

16 - TLS_RSA_WITH_AES_128_CCM_8

32 - TLS_RSA_WITH_AES_256_CCM_8

Response:

AT Mode:

Result Code	Description
AT+RSI_TMODE0	Successfully entered into transparent mode
AT+RSI_TMODE1	Graceful exit from Transparent mode (by giving escape sequence from host after escape time)
AT+RSI_TMODE2	Exited from transparent mode due to WiFi Disconnected.
AT+RSI_TMODE3	Exited from transparent mode due to TCP Remote terminate from Peer.
AT+RSI_TMODE4	Exited from transparent mode due to TCP retries over terminated TCP connection.
AT+RSI_TMODE5	Did not enter transparent mode due to invalid transparent mode params .
AT+RSI_TMODE6	Did not enter transparent mode due to module doesn't have IP
AT+RSI_TMODE7	Did not enter transparent mode as could not create requested socket.
Error Codes	Failure. Possible error codes for this command are 0xFF87, 0x0021,0x0025,0x002C,0xFF8

Binary Mode:

N/A

Relevance:

This command can be given only after successful connection with AP, module should have a valid IP and there should be no prior sockets opened.

Note:

This command is only valid in AT mode using UART interface.

11.72 UART Hardware Flow control

Description:

This command is used to Enable/Disable the Hardware flow control feature. This command is valid only in case of UART host interface.

Command Format:

AT Mode:

at+rsi_uart_hwflowctrl=<uart_hw_flowcontrol_enable>\r\n

Binary Mode:

```
struct {
    uint8 uart_hw_flowcontrol_enable;
}HwFlowControlEnableFrameSnd;
```

Command Parameters:

uart_hw_flowcontrol_enable:

Enable or Disable UART hardware flow control.

1 – Enable

0 - Disable

Response:

AT Mode:

OK	Successful execution
ERROR	Failure

Binary Mode:

N/A

Response Parameters:

N/A

Possible Error Codes:

Possible error codes for this command are 0x004E,0x002C.

Note:

Hardware flow control must be enabled in the module before enabling it in the host.

11.73 Socket Configuration Parameters

Description:

This command is used to set the socket configuration parameters. User is recommended to use this command(optional). Based on the socket configuration, module will use available buffers effectively. This command should be given after IP configuration command and before any socket creation.

Command Format:

AT Mode:

at+rsi_socket_config=<total_sockets>,<total_tcp_sockets>,<total_udp_sockets>,<total_tcp_tx_only_sockets>,<total_tcp_rx_only_sockets>,<total_udp_tx_only_sockets>,<total_udp_rx_only_sockets>,<total_tcp_rx_high_performance_sockets>,<tcp_rx_window_size_cap>,<tcp_ack_window_division_factor>\r\n

Binary Mode:

```
typedef struct{
uint8 total_sockets;
uint8 total_tcp_sockets;
uint8 total_udp_sockets;
uint8 tcp_tx_only_sockets;
uint8 tcp_rx_only_sockets;
uint8 udp_tx_only_sockets;
uint8 udp_rx_only_sockets;
uint8 tcp_rx_high_performance_sockets;
uint8 tcp_rx_window_size_cap;
uint8 tcp_ack_div_factor;
}
```

Command Parameters:

total_sockets:

Desired total number of sockets to open.

total_tcp_sockets:

Desired total number of TCP sockets to open.

total_udp_sockets:

Desired total number of UDP sockets to open.

tcp_tx_only_sockets:

Desired total number of TCP sockets to open which are used only for data transmission.

tcp_rx_only_sockets:

Desired total number of TCP sockets to open which are used only for data reception.

udp_tx_only_sockets:

Desired total number of UDP sockets to open which are used only for data transmission.

udp_rx_only_sockets:

Desired total number of UDP sockets to open which are used only for data reception.

tcp_rx_high_performance_sockets:

Desired total number of high performance TCP sockets to open. High performance sockets can be allocated with more buffers based on the buffers availability. This option is valid only for TCP data receive sockets. Socket can be opened as high performance by setting high performance bit in socket create command.

tcp_rx_window_size_cap:

Desired to increase the tcp rx window size

Following conditions has to be met:

1. total_sockets <= Maximum allowed sockets(10)
2. (total_tcp_sockets + total_udp_sockets) <= total_sockets
3. (total_tcp_tx_only_sockets + total_tcp_rx_only_sockets) <= total_tcp_sockets
4. (total_udp_tx_only_sockets + total_udp_rx_only_sockets) <= total_udp_sockets
5. total_tcp_rx_high_performance_sockets <= total_tcp_rx_only_sockets

tcp_ack_div_factor:

In case of high latency networks inorder to give TCP ACK with respective to the wiondow size. Default value is 2.

Possible values: 2 - tcp_rx_window_size_cap

Response:

AT Mode:

OK	Successful execution
ERROR	Failure.

Binary Mode:

N/A

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible Error Codes:

Possible error codes for this command are x0021,0x0025,0x002C,0xFF6D.

Example

AT Mode:

at+rsi_socket_config=4,2,2,1,1,1,1,1,10\r\n

11.74 RF Current mode Configuration

Description:

This command is used to configure modules RF in different current/power consumption modes. This command should be given only before init command.

Command Format:

AT Mode:

at+rsi_rf_current_mode=< rf_rx_curr_mode >,< rf_tx_curr_mode >,< rf_tx_dbm >\r\n

Binary Mode:

```
typedef struct rf_current_config_s {
    uint8 rf_rx_curr_mode;
    uint8 rf_tx_curr_mode;
    int16 rf_tx_dbm;
} rsi_rf_current_config_t;
```

Command Parameters:

rf_rx_curr_mode:

Current/Power Mode in which modules RF-Receive(RX) should be programmed.

0 – High Current/Power mode

1 – Medium Current/Power mode

2 – Low Current/Power mode

rf_tx_curr_mode:

Current/Power Mode in which modules RF-Transmit(TX) should be programmed.

0 – High Current/Power mode

1 – Medium Current/Power mode

2 – Low Current/Power mode

rf_tx_dbm:

This two bytes are reserved. Set to '0'.

Response:

AT Mode:

OK	Successful execution
ERROR	Failure.

Binary Mode:

N/A

Response Parameters:

N/A

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible Error Codes:

Possible error codes for this command are 0x0021, 0x0025, 0x002C, 0x0051.

Example:

AT Mode:

at+rsi_rf_current_mode=0,0,0\r\n : Program Modules RF TX and RX in high power mode

at+rsi_rf_current_mode=1,1,0\r\n : Program Modules RF TX and RX in medium power mode

at+rsi_rf_current_mode=2,1,0\r\n : Program Modules RF-TX in medium power mode and RF-RX in low power mode.

11.75 Trigger Auto Configuration

Description:

This command is used to trigger the Stored Auto Configuration. This command should be given only after Card Ready response.

Command Format:

AT Mode:

at+rsi_trigger_auto_config\r\n

Binary Mode:

No payload Required.

Response:

AT Mode:

None	Successful execution
ERROR	Failure.

Binary Mode:

N/A

Response Parameters:

N/A

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible Error Codes:

Possible Error codes are 0x0021,0xFF36,0xFF74, 0xFF35

Note:

1. To avail this feature(Wait On Host) user need to set BIT(20) in Custom feature bit map in opermode command.
2. This feature is valid Only when store configuration feature is enabled.
3. Binary Mode: If the last byte of the CARD READY is set to '1' it indicates store configuration is enabled. Now host can choose to either start the auto join by giving this command or stop the auto join and continue with the opermode command.
4. AT mode: If this feature is enabled, after "Loading Done" message "AT+RSI_TRIGGER_AUTO_CONFIG " will come, so that user can give either at+rsi_trigger_auto_config command to trigger the auto configuration, (or) user can continue with the Opermode command.

11.76 Http Abort

Description:

This command is used to abort the HTTP/HTTPS GET/POST

Request .

This command should be given only after Ipconf command.

Command Format:

AT Mode:

at+rsi_http_abort\r\n

Binary Mode:

No payload Required.

Response:

AT Mode:

OK	Successful execution
ERROR	Failure.

Binary Mode:

N/A

Response Parameters:

N/A

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible Error Codes:

Possible Error codes for this command are 0x0021, 0x0025, 0x002C.

11.77 HTTP Server Credentials From Host

Description:

This command is used to set the HTTP Server Credentials.

Request .

This command should be given only after Opermode command.

Command Format:

AT Mode:

at+rsi_credentials=<username>,<password>\r\n

Binary Mode:

```
#define MAX_USERNAME_LEN 31 ( Including NULL character)
#define MAX_PASSWORD_LEN 31 ( Including NULL character)
struct {
    uint8 username[MAX_USERNAME_LEN];
    uint8 password[MAX_PASSWORD_LEN];
} httpCredentialsFrameSnd;
```

username: Username for HTTP Server

password: Password for HTTP Server

Response:

AT Mode:

OK	Successful execution
ERROR	Failure.

Binary Mode:

N/A

Response Parameters:

N/A

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible Error Codes:

Possible Error codes for this command are 0x0021, 0x0025, 0x00F1,0x0015.

11.78 FTP client

Description:

This section explains different commands to use FTP client.

This command should be given only after Set IP Parameters command.

Following table explains list of ftp commands and their description.

FTP Command	Description
Create	Creates FTP objects. This should be the first command for accessing FTP.
Connect	Connects to FTP server.
Make Directory	Creates directory in a specified path.
Delete Directory	Deletes directory in a specified path
Change Working Directory	Changes working directory to a specified path.
Directory List	Lists directory contents in a specified path.
File Read	Reads the file
File Write	Open file to write
File Write Content	Writes content into file which is opened using File Write command. File content can be written in multiple chunks using this command.
File Delete	Deleted file
File Rename	Renames file
Disconnect	Disconnects from FTP server. Once disconnect is done user can connect again using connect command.
Destroy	Destroys FTP objects. Once destroy is given user cant use FTP unless it is created again.

- **Create** should be called as a first command to use FTP.
- Once create is successful **connect** should be called to connect to a FTP server.
- After connection is successful host can issue remaining commands.
- After FTP operations host has to give **disconnect** command to disconnect from FTP server.
- Once disconnect is done, host can again connect to the FTP server using **connect** command.
- To destroy FTP objects host has to give **destroy** command. Once destroy is given user cant use FTP unless it is created again using create command.

Command Format:

AT Mode:

FTP client has different command types. Based on the command type next parameters will change.

at+rsi_ftp=<command_type>,<remaining parameters >\r\n

Following are available command types.

FTP command	Command Type	Command Format
Create	1	at+rsi_ftp=1\r\n
Connect	2	at+rsi_ftp=2,<ip_version>,<IPaddress>,<username>,<password>,<server_port>\r\n ip_version: IP version to use. 4 – For IPv4 6 – For IPv6 IP address: IPv4/IPv6 address for FTP server to connect. username: username of FTP server password: password of FTP server server_port: FTP server port number
Make Directory	3	at+rsi_ftp=3,<Directory_path>\r\n Directory_path: Path of the directory to make.
Delete Directory	4	at+rsi_ftp=4,<Directory_path>\r\n Directory_path: Path of the directory to delete.
Change Working Directory	5	at+rsi_ftp=5,<Directory_path>\r\n Directory_path: Change of directory path.
Directory List	6	at+rsi_ftp=6,<Directory_path>\r\n Directory_path: path of the directory for list.
File Read	7	at+rsi_ftp=7,<file_name>\r\n file_name: name of the file to read.
File Write	8	at+rsi_ftp=8,<file_name>\r\n file_name: name of the file to write.
File Write content	9	at+rsi_ftp_file_content=<end_of_file>,<file_content>\r\n end_of_file: Represents whether end of file is reached or not. 0 – More data is coming to write into file. 1 – Current chunk is the last chunk and no more data is coming. File_content: Content of the file to write.
File Delete	10	at+rsi_ftp=10,<file_name>\r\n file_name: Name of the file to delete.

FTP command	Command Type	Command Format
File Rename	11	at+rsi_ftp=11,<file_name>,<new_file_name>\r\n file_name: Old name of the file. new_file_name: New file name.
Disconnect	12	at+rsi_ftp=12\r\n
Destroy	13	at+rsi_ftp=13\r\n
Passive mode	14	at+rsi_ftp=14\r\n
Active mode	15	at+rsi_ftp=15\r\n

Binary Mode:

```

#define FTP_USERNAME_LENGTH 31
#define FTP_PASSWORD_LENGTH 31
#define FTP_PATH_LENGTH 51
#define FTP_MAX_CHUNK_LENGTH 1400
typedef struct ftp_connect
{
    /*! FTP client IP version
    uint8 ip_version;
    union
    {
        /*! IPv4 address
        UINT8 ipv4_address[4];
        /*! IPv6 address
        UINT8 ipv6_address[16];
    } server_ip_address;
    /*! FTP client username
    uint8 username[FTP_USERNAME_LENGTH];
    /*! FTP client password
    uint8 password[FTP_PASSWORD_LENGTH];
    /*! FTP server port number
    uint8 server_port[4];
    } ftp_connect_t;
typedef struct ftp_command
{
    /*! Directory or file path
    uint8 path[FTP_PATH_LENGTH];
    /*! New file name
    uint8 new_file_name[FTP_PATH_LENGTH];
    } ftp_command_t;
typedef struct
{
    /*! FTP command type
    uint8 command_type;
    union
    {
        /*! structure for FTP connect
        ftp_connect_t ftp_connect;
        /*! Structure for other commands
        ftp_command_t ftp_command;
    } ftp_client_struct;
    } rsi_ftp_client_t;
typedef struct ftp_file_write
{
    /*! command type
    uint8 command_type;
    /*! End of file
    uint8 end_of_file;
    /*! Path of file to write
    uint8 file_content[FTP_MAX_CHUNK_LENGTH];
    } rsi_ftp_file_write_t;
    
```

command_type:

Type of the FTP command.

This parameter is valid for all commands.

Remaining parameters:

ip_version:

IP version to use. This parameter is valid for connect command.

4 – For IPv4

6 – For IPv6

server_ip_address.ipv4_address:

IPv4 address of the FTP server. This parameter is valid for **connect** command.

server_ip_address.ipv6_address:

IPv6 address of the FTP server. This parameter is valid for **connect** command.

username:

username for the FTP server. This parameter is valid for **connect** command.

password:

Password for the FTP server. This parameter is valid for **connect** command.

server_port:

FTP server port number. This parameter is valid for **connect** command.

path:

path of the directory/file.

This parameter is valid for Make Directory, Delete Directory, Change Working Directory, Directory List, File Read, File Write, File rename, File Delete commands.

new_file_name:

New file name.

This parameter is valid for File Rename command.

end_of_file:

Represents whether end of file is reached or not. This parameter is valid for File Write Content command.

0 – More data is coming to write into file.

1 – Current chunk is the last chunk and no more data is coming.

file_content:

Content of the file to write. This parameter is valid for File Write Content command.

Response:

AT Mode:

FTP command	Command Response
Directory List	AT+RSI_FTP_DIR_LIST=<command_type><more><length><data>\r\n command_type: 1 byte. This field contains value '6'. More: 1 byte. Represents whether more response is pending from module or not. 1 – More response is pending 0 – End of response Length: 2 bytes. Length of current chunk response Data: variable bytes. Content of the directory list

FTP command	Command Response
File Read	AT+RSI_FTP_FILE=<command_type><more><length><data>\r\n command_type: 1 byte. This filed contains value '7'. More: 1 byte. Represents whether more response is pending from module or not. 1 – More response is pending 0 – End of response Length: 2 bytes. Length of current chunk response Data: Variable bytes. Content of the file
For all other commands	OK<command_type>\r\n command_type: 1 byte. Type of the FTP command.

Binary Mode:

```
typedef struct ftp_rsp_t
{
    uint8 command_type;
    uint8 more;
    uint16 length;
    uint8 data[1024];
}rsi_ftp_rsp_t;
```

Response Parameters:

command_type: Type of the FTP command.

More:Represents whether more response is pending from module or not.

1 – More response is pending

0 – End of response

Length: Length of current chunk response

Data: Response data

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible Error Codes:

Possible Error codes for this command are 0x0021, 0x0015, 0xFF6B, 0xBB01, 0xBB50, 0xBBD3, 0xBBD4, 0xBBD5, 0xBBD6, 0xBBD9, 0xBBDA, 0xBBDB, 0xBBDC, 0xBBDD, 0xBBDE.

Example:

AT Mode:

1.FTP File Read

```
at+rsi_ftp=1\r\n
at+rsi_ftp=2,4,192.168.0.150,admin,test123,201\r\n
at+rsi_ftp=7,file_read1.txt\r\n
at+rsi_ftp=12\r\n
at+rsi_ftp=2,4,192.168.0.150,admin,test123,201\r\n
at+rsi_ftp=7,file_read2.txt\r\n
at+rsi_ftp=12\r\n
at+rsi_ftp=13\r\n
```

2.FTP File Write

```
at+rsi_ftp=1\r\n
at+rsi_ftp=2,4,192.168.0.150,admin,test123,201\r\n
```



```
at+rsi_ftp=8,file_write1.txt\r\n
at+rsi_ftp_file_content=0,This is start of sample data\r\n
at+rsi_ftp_file_content=1,This is end of sample data\r\n
at+rsi_ftp=12\r\n
at+rsi_ftp=13\r\n
```

11.79 SNTP Client

Description:

This section explains different commands to use SNTP client.

This command should be given only after [Set IP Parameters](#) command.

Following table explains list of sntp commands and their description.

SNTP Command	Description
Create	Creates SNTP objects. This should be the first command To get time updates from the SNTP server
Get Time	To Get the Current time in seconds
Get Time-Date	To Get the Current time in Time-Date format
Get Server Address	To Get the SNTP server Details.
Get Server Info	To Get the SNTP server Details.
Delete	To Delete the SNTP client.

- Create should be called as a first command to use SNTP.
- Once create is successful Get Server Address should be called to get details of the SNTP server.
- Call Get Time to get the time in seconds from SNTP server.
- Call Get Time Date to get the Time Date format from SNTP server.

Command Format:

AT Mode:

SNTP client has different command types. Based on the command type next parameters will change.

```
at+rsi_sntp=<command_type>,<remaining parameters>\r\n
```

Following are available command types.

SNTP command	Command Type	Command Format
Create	1	at+rsi_sntp=1,<ip_version>,<IPaddress><sntp method>\r\n ip_version: IP version to use. 4 - For IPv4 6 - For IPv6 IP address: IPv4/IPv6 address for SNTP server to connect. sntp method: SNTP method to use. 1 - For BroadCast Method 2 - For UniCast Method
Get Time	2	at+rsi_sntp=2\r\n
Get Time Date	3	at+rsi_sntp=3\r\n
Get Server Address	4	at+rsi_sntp=4\r\n
Delete	5	at+rsi_sntp=5\r\n

SNTP command	Command Type	Command Format
Get Server info	6	at+rsi_sntp=6\r\n

Binary Mode:

```
#define SNTP_BROADCAST_MODE 1
#define SNTP_UNICAST_MODE 2
typedef struct
{
    UINT8 command_type;
    UINT8 ip_version;
    union
    {
        UINT8 ipv4_address[4];
        UINT8 ipv6_address[16];
    }server_ip_address;
    UINT8 sntp_method;
}rsi_sntp_client_t
```

command_type:

Type of the SNTP command. This parameter is valid for all commands.

ip_version:

IP version to use. This parameter is valid for create command.

4 – For IPv4

6 – For IPv6

server_ip_address.ipv4_address:

IPv4 address of the SNTP server. This parameter is valid for create command.

server_ip_address.ipv6_address:

IPv6 address of the SNTP server. This parameter is valid for create command.

sntp method:

Mode of the SNTP client to run

1 – For Broadcast

2 – For Unicast

Response:

AT Mode:

SNTP command	Command Response
Create	Ok<1>\r\n
Get Time	OK<Time in seconds>\r\n
Get Time Date	OK<Time in Ddat-Time format>\r\n
Get Server Address	OK<Ip version><Ip address><sntp method>\r\n Ip_version: Ip version of the SNTP server. Ip_address: Ip address of the SNTP server. sntp_method: sntp method of the server.

SNTP command	Command Response
Invalid SNTP server response	AT+RSI_INVALID_SNTP_SERVER=<ip_version><ip_address><sntp_method>\r\n ip_version: Ip version of the SNTP server. ip_address: Ip address of the SNTP server. sntp_method: sntp method of the server.
For remaining commands	OK<Command_type>\r\n Command_type: 1byte. Type of the SNTP command

Binary Mode:

```
typedef struct rsi_sntp_rsp_t
{
uint8 command_type;
}rsi_sntp_rsp_t;
typedef struct rsi_sntp_server_rsp_t
{
UINT8 ip_version;
union
{
UINT8 ipv4_address[4];
UINT8 ipv6_address[16];
}server_ip_address;
UINT8 sntp_method;
}rsi_sntp_server_rsp_t;
```

Response Parameters:

Command_type: Type of the SNTP command.

ip_version: IP version of the SNTP server.

server_ip_address: IP address of the SNTP server.

sntp method: sntp method of the SNTP server

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible Error Codes:

Possible Error codes for this command are 0x0021, 0x0015, 0x0074,0xBB10.

Example:

AT Mode:

1.SNTP client:

at+rsi_sntp=1,4,192.168.0.100,2\r\n

at+rsi_sntp=2\r\n

at+rsi_sntp=3\r\n

at+rsi_sntp=4\r\n

at+rsi_sntp=5\r\n

11.80 MDNS and DNS-SD

Description:

This section explains different commands to use MDNS and DNS-SD.

This command should be given only after Set IP Parameters command.

Following table explains list of MDNS and DNS-SD commands and their description.

MDNSD Command	Command Type	Description
Init	1	Creates MDNS Daemon . This should be the first command to initialize.
Register Service	3	To add a service/start service discovery.
Deinit	6	To Stop MDNS responder in module

- Init should be called as a first command to use MDNS/DNS-SD.
- Once Init is successful, Add a service using Register Service.
- Reset more bit in Register Service command to indicate module to start MDNS/DNS-SD service.
- To stop MDNS/DNS-SD service use Deinit command.

Command Format:

AT Mode:

MDNS/DNS-SD client has different command types. Based on the command type following parameters will change accordingly.

at+rsi_mdns=<command_type>,<remaining parameters>\r\n

Following are available command types.

MDNSD command	Command Type	Command Format
Init	1	at+rsi_mdns=1,<ip_version>,<ttl>,<buffer>\r\n ip_version: IP version to use. 4 – For IPv4 6 – For IPv6 ttl: Time To Live, Time in seconds for which service should be active. buffer: Host name which is to used as host name in Type-A record.
Register Service	3	at+rsi_mdns=3,<port_number>,<ttl>,<more>,<buffer>\r\n port_number: Port number on which service which should be added. ttl: Time To Live, Time in seconds for which service should be active. more: This byte should be set to '1' when there are more services to add. 0 – This is last service, starts MDNS service. 1 – Still more services will be added. buffer: This field contains strings separated by null character(ascii : 0x00(Hex)) Buffer contains 3 string fields separated by NULL, fields are 1. Name to be added in Type-PTR record 2. Name to be added in Type-SRV record(Service name) 3. Text field to be added in Type-TXT record.
Deinit	6	at+rsi_mdns=6\r\n

Binary Mode:

```
#define MDNS_INIT 1
#define MDNS_REGISTER_SERVICE 3
#define MDNS_DEINT 6
typedef struct rsi_mdns_t
{
uint8 command_type;
union
{
mdns_init_t mdns_init;
mdns_reg_srv_t mdns_reg_srv;
} mdns_struct;
uint8 buffer[1000];
} rsi_mdns_t;
typedef struct
{
uint8 ip_version;
uint8 ttl[2];
} mdns_init_t;
typedef struct
{
uint8 port[2];
uint8 ttl[2];
uint8 more;
} mdns_reg_srv_t;
```

command_type:

Type of the MDNSD command.

This parameter is valid for all commands.

ip_version:

IP version to use.

This parameter is valid for Init command.

4 – For IPv4

6 – For IPv6

ttl:

Time To Live, this field is valid for Init command(type - 1), register service command(type - 3).

more:

This field is only valid for Register service command.

Response:

AT Mode:

MDNS command	Command Response
Any MDNS Command	OK<Command Type>\r\n

Binary Mode:

```
typedef struct mdns_rsp_t
{
uint8 command_type;
}rsi_mdns_rsp_t;
```

Response Parameters:

Command_type: Type of the MDNSD command.

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible Error Codes:

Possible Error codes for this command are 0x0021, 0x0015, 0x0074,0xFF2B.

Example:

AT Mode:

MDNSD Add Service:

at+rsi_mdns=1,4,600,http-wsc_obc.local.\r\n

at+rsi_mdns=3,80,600,0,_http._tcp.local.NULL wsc_obc._http._tcp.localNULLtext_field\r\n

at+rsi_mdns=6\r\n

1. Currently registering only one service is supported
2. IPv4 is only supported for MDNS/DNS-SD service
3. NULL – Is a NULL character with ASCII value '0x00'(HEX)
4. If module joins multicast group,MDNS is not supported

11.81 SMTP Client

Description:

This section explains different commands to use SMTP client. This command should be given only after [Set IP Parameters](#) command.

Following table explains list of smtp commands and their description.

SMTP Command	Description
Create	Creates SMTP related thread, This should be the first command to use the SMTP client
Init	To initialize the SMTP client with username, password , from mail address and domain name
Send	To Send the mail the to recipient
Deinit	To Delete the SMTP client

- Create should be called as a first command to use SMTP.
- Once create is successful Init should be called to initialize the SMTP client with username, password, from address and domain name of the SNMP agent.
- Call Send to send the SMTP client mail to the SMTP server agent.
- Call Deinit to delete the SMTP client.

Command Format:

AT Mode:

SMTP client has different command types. Based on the command type following parameters will change accordingly.

at+rsi_smtp=<command_type>,<remaining parameters>\r\n

Following are available command types.

SMTP command	Command Type	Command Format
Create	1	at+rsi_smtp=1\r\n Creates the SMTP client
Init	2	at+rsi_smtp=2,<ip_version>,<ip address>,<auth_type>,<server port>,<smtp buffer>\r\n ip_version: IP version to use. 4 – For IPv4 6 – For IPv6 ip_address: Ipv4/Ipv6 address of the SMTP server agent. auth_type: Authentication type of the SMTP server. 1. For Auth-Login type 2. For Auth_plain type server_port: SMTP server agent port number smtp_buffer:smtp buffer contains server's username, password, from mail address, smtp server local domain name.
Mail send	3	at+rsi_smtp=3,<smtp_feature>,<mail body_length>,<smtp buffer>\r\n smtp_feature: smtp feature bitmap BIT(0): Low priority mail BIT(1): Normal priority mail BIT(2): High priority mail BIT(3): Smtip extended header feature smtp_mail_body_length:Length of the mail body smtp_buffer: smtp buffer contains receipient mail address, mail subject line, mail body, smtp extended header.
Deinit	4	at+rsi_smtp=4\r\n To delete the smtp client

Binary Mode:

```
#define RSI_SMTP_BUFFER_LENGTH 1024
typedef struct
{
    uint8 ip_version;
    union
    {
        uint8 ipv4_address[4];
        uint8 ipv6_address[16];
    } server_ip_address;
    uint8 auth_type;
    uint8 server_port[4];
    } smtp_client_init_t;
typedef struct
{
    uint8 smtp_feature;
    uint8 smtp_client_mail_body_length[2];
    } smtp_mail_send_t;
typedef struct
{
    uint8 command_type;
    union
    {
        smtp_client_init_t smtp_client_init;
        smtp_mail_send_t smtp_mail_send;
    } smtp_struct;
    uint8 smtp_buffer[RSI_SMTP_BUFFER_LENGTH];
    } rsi_smtp_client_t;
```

command_type: Type of the SMTP command. This parameter is valid for all commands.

ip_version:

IP version to use. This parameter is valid for Init command.

4 – For IPv4

6 – For IPv6

ipv4_address:

Ipv4 address of the SMTP agent.

ipv6_address:

Ipv6 address of the SMTP agent.

auth_type:

Authentication method used by the SMTP server agent.

1 for AUTH_PLAIN

3 for AUTH_LOGIN

server_port:

SMTP server agent port number.

smtp_feature:

SMTP client feature bit map

BIT(0):

MAIL_PRIORITY_LOW

BIT(1):

MAIL_PRIORITY_NORMAL

BIT(2):

MAIL_PRIORITY_HIGH

BIT(3):

To Enable SMTP_EXTENDED_HEADER feature

smtp_client_mail_body_length:

Length of the SMTP client mail body.

smtp_buffer:

smtp_buffer contains remaining parameters based on command type.

Note:

1. Maximum supported length for username, password, domain name, receipient mail address, from mail address is 100 bytes each excluding NULL character
2. Maximum supported length for receipient mail address, mail subject line, mail body together is 1024 bytes including NULL characters(3 bytes)
3. Maximum supported length for mail subject line is 750 bytes
4. Maximum supported length for mail body is 950 bytes

Response Parameters:

Command_type: Type of the SMTP command.

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible Error Codes:

Possible Error codes for this command are 0x0021, 0x000e, 0xBBAA, 0xBBAD, 0x002C, 0x0015, 0xBBA5, 0xBB21, 0x003E, 0xBBBB2, 0x003E, 0xBBA5, 0xBBA3, 0xBA0, 0xBBA1, 0xBBA2,0xBBA4, 0xBBA6, 0xBBA7, 0xBBA8, 0xBBA9, 0xBBAA, 0xBBAB, 0xBBAC, 0xBBAD, 0xBBAE, 0xBBAF, 0xBBBB0, 0xBBBB1, 0x0025 ,0xFF74, 0xBBF0.

Example:

AT Mode:

SMTP client mail send Service:

```
at+rsi_smtp=1\r\n
at+rsi_smtp=2,4,192.168.0.100,3,25, usernameNULLpasswordNULL
reyax1@reyax.comNULLmail.reyax.comNULL\r\n
at+rsi_smtp=3,3,4,reyax2@reyax.comNULLsubjectlineNULLbody\r\n
at+rsi_smtp=4\r\n
```

11.82 POP3 Client

Description:

This section explains different commands to use POP3 client. This command should be given only after [Set IP Parameters](#) command.

Following table explains list of pop3 commands and their description.

POP3 Command	Description
Session Create	Creates POP3 client Daemon , this should be the first command to use the POP3 client. This command initiates POP3 client to establish a connection with POP3 server and then gets authenticated to it.
Get mail stats	To get the total number of mails count and size
Get mail list	To get the size of the mail for the passed index
Retrieve mail	To retrieve the mail content for the passed mail index
Mark mail	To mark a mail as deleted for the passed mail index
Unamark mail	To unmark(reset) all the marked(deleted) mails in the current session.

POP3 Command	Description
get server status	To get the pop3 server status
session delete	To delete pop3 client session

- Create should be called as a first command to use POP3.
- Once create is successful call get mail stats to get the mail statistics i.e number of mails present in server and the size of total mails
- Call get mail list to get the size of the mail for the passed index
- Call Retrieve mail to get the mail content for the passed mail index
- Call Mark mail to delete particular mail in the POP3 server, by passing the mail index
- Call Unmark mail to reset all the mails in the current session
- Call get server status to get the pop3 server status
- Call session delete to delete the pop3 client session

Note:

Retrieve mail command should be issued only after get mail list command, Providing index of the intended mail.

Note:

Maximum allowed username and password length is 101 (Including NULL character)

Command Format:

AT Mode:

POP3 client has different command types. Based on the command type following parameters will change accordingly.

at+rsi_pop3=<command_type>,<remaining parameters>\r\n

Following are available command types.

POP3 command	Command Type	Command Format
Session Create	1	at+rsi_pop3=1,<ip_version>,>,<ipaddress>,<serverport>,<auth_type>,<username>,<password>\r\n ip_version: IP version to use. 4 – For IPv4 6 – For IPv6 ip_address: Ipv4/Ipv6 address of the POP3 server. server_port: POP3 server port number auth_type: Authentication type of the POP3 server. For Auth-Login type For Auth_plain type username: username for POP3 server authentication. password: password for POP3 server authentication.
Mail stats	2	at+rsi_pop3=2\r\n To get the mail stats from the POP3 server.
Mail list	3	at+rsi_pop3=3,<mail index>\r\n mail index : Index of the particular mail which is used to get the size of the mail.

POP3 command	Command Type	Command Format
Retrieve mail	4	at+rsi_pop3=4,<mail index>\r\n mail index : Index of the particular mail which is used in the mail list command.
Mark mail	5	at+rsi_pop3=5,<mail index>\r\n mail index : Index of the particular mail which is used for deletion by passing the index
Unmark mail	6	at+rsi_pop3=6\r\n To reset all the marked mails in the current session
server status	7	at+rsi_pop3=7\r\n To get the POP3 server status
session delete	8	at+rsi_pop3=8\r\n To delete the POP3 client session

Binary Mode:

```
#define POP3_CLIENT_MAX_USERNAME_LENGTH 101
#define POP3_CLIENT_MAX_PASSWORD_LENGTH 101
//! POP3 client session create structure
typedef struct pop3_client_session_create
{
    //! POP3 server ip version
    uint8 ip_version;
    union
    {
        //! Server ipv4 address
        uint8 ipv4_address[4];
        //! Server ipv6 address
        uint8 ipv6_address[16];
    } server_ip_address;
    //! POP3 server port number
    uint8 server_port_number[2];
    //! POP3 client authentication type
    uint8 auth_type;
    //! POP3 client username
    uint8 username[POP3_CLIENT_MAX_USERNAME_LENGTH];
    //! POP3 client password
    uint8 password[POP3_CLIENT_MAX_PASSWORD_LENGTH];
} pop3_client_session_create_t;
//! POP3 client request structure
typedef struct {
    //! POP3 client command type
    uint8 command_type;
    //! POP3 client command structure
    union
    {
        //! POP3 client session create structure
        pop3_client_session_create_t pop3_client_session_create;
        //! POP3 client mail index
        uint8 pop3_client_mail_index[2];
    } pop3_struct;
} rsi_pop3_client_t;
```

command_type: Type of the POP3 command. This parameter is valid for all commands.

ip_version: IP version to use. This parameter is valid for session create command.

4 – For IPv4

6 – For IPv6

ipv4_address:

Ipv4 address of the POP3 server.

ipv6_address:

Ipv6 address of the POP3 server.

auth_type:

Authentication method used by the SMTP server agent.

server_port_number:

POP3 server agent port number.

username:

username for POP3 server authentication

password:

password for POP3 server authentication

pop3_client_mail_index:

POP3 mail index number

Response Parameters:

```

    //! POP3 client response structure
    typedef struct rsi_pop3_resp_s
    {
        uint8 command_type;
        //! Total number of mails
        uint8 mail_count[2];
        //! Total size of all the mails
        uint8 size[4];
    } rsi_pop3_resp_t;
    //! POP3 client mail data response structure
    typedef struct rsi_pop3_mail_data_resp_s
    {
        //! Type of the POP3 client command
        uint8 command_type;
        //! More data pending flag
        uint8 more;
        //! Length the mail chunk
        uint8 length[2];
        //! Mail content buffer
        uint8 data[1000];
    } rsi_pop3_mail_data_resp_t;

```

Command_type:

Type of the POP3 command.

mail_count:

Total mails count/ mail index

size:

Total size of the mails/ size of the particular mail

ore(4 bytes):

This indicates whether more POP3 data for the retrieve command is pending or not.

0–More data is pending. Further interrupts may be raised by the module till all the data is transferred to the Host.

1– End of POP3 mail content.

length:

Length of the current pop3 mail content chunk

data:

POP3 client mail content buffer

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible Error Codes:

Possible Error codes for this command are 0x0021, 0x0015, 0x0025,0xFF74,0xBB87,0xBBFF,BBC5.

Example:

AT Mode:

POP3 client mail receive Service:

at+rsi_pop3=1,4,192.168.0.100,3,25,testuser,test123\r\n

at+rsi_pop3=2\r\n

```
at+rsi_pop3=3,100\r\n
at+rsi_pop3=4,100\r\n
at+rsi_pop3=5,100\r\n
at+rsi_pop3=6\r\n
at+rsi_pop3=7\r\n
at+rsi_pop3=8\r\n
```

11.83 IAP Init

Description:

This command initializes the interface between RYWB116 and IAP(iPod Accessory protocol) co processor before starting the Apple Authentication process.

Command:

AT Mode:

N/A

Binary Mode:

No payload required

Command Parameters:

No parameters

Response:

AT Mode:

N/A

Binary mode:

There is no response payload for this command.

Relevance:

This command is relevant in AP mode and Station mode

Note:

This command is required only if IAP co-processor is mounted on RYWB116 chip with I2C interface. This command is not required if IAP chip is mounted on the host MCU. For more information, contact REYAX.

11.84 Load MFI IE

Description:

This command is used to load the MFI Information Element in the beacon generated by the WAC(Wireless accessory configuration) server.

Command:

AT Mode:

N/A

Binary Mode:

```
typedef struct rsi_mfi_load_ie_request_s
{
    uint8 ie_len;
    uint8 ie[200];
}rsi_mfi_load_ie_request_t;
```

Command Parameters:

ie_len: Length of the MFI information element need to be loaded in the beacon of RYWB116 Accessory.

ie: array of MFI information element.

Response:

AT Mode:

N/A

Binary mode:

There is no response payload for this command

Relevance:

This command is relevant in AP mode

Possible Error Codes:

Possible Error codes for this command are 0x0021, 0x0015, 0x002C.

11.85 Over The Air Firmware Upgradation

Description:

This command upgrades the firmware on the module over a TCP socket. It is designed to work with a remote application.

Command Format:

AT Mode:

```
at+rsi_otaf=<ip_version>, <destIPaddr>, <server_port>,<chunk_number>, <rx_timeout>,<tcp_retry_count>\r\n
```

Command Parameters:

ip_version: IP version used, either 4 or 6.

destIPaddr:

IP Address of the target server.

server_port:

destination port. Value ranges from 1024 to 49151.

chunk_number:

chunk number of the firmware to be upgraded. Initially keep it as 1.

rx_timeout:

To configure timeout.

tcp_retry_count:

To configure tcp retransmissions count.

Binary Mode:

```
typedef union {
    struct {
        uint8 ip_version;
        union{
            uint8 ipv4_address[RSI_IP_ADD_LEN];
            uint8
            ipv6_address[RSI_IP_ADD_LEN * 4];
        }server_address;
        uint8
        server_port[4];
        uint8
        chunk_number[2];
        uint8
        time_out[2];
        uint8
        retry_count[2];
    }OtafReqFrameSnd;
    uint8
    uOtafReqBuf[27];
}rsi_uOtafReq;
```

Command Parameters:

ip_version:

IP version used, either 4 or 6.

destIPAddr:

IP Address of the otaf server.

server_port:

Destination port of the otaf server.

chunk_number:

chunk number of the firmware to be upgraded. Initially keep it as 1.

rx_timeout:

tcp packet receive timeout.

tcp_retry_count:

tcp retransmissions count.

Response:

After successful up gradation firmware gives a success indication with an asynchronous message as "AT+RSI_FWUPSUCCESS\r\n".

In addition "reach end of file" message comes at server side.

On firmware upgrade failure, firmware gives error message as "ERROR<Error_Code><Number of chunk where up gradation stopped>".

User needs to give same command again from the chunk number specified here.

Possible error codes:

0xBB01, 0xBB38

Example:

```
at+rsi_otaf = 4, 192.168.0.100, 5001, 1, 100, 10\r\n
```

Response:

AT+RSI_FWUPSUCCESS on success up gradation.

ERROR<Error_Code><number of chunk where up gradation stopped>

ERROR<Error_Code = 0x01 0xBB><number of chunk where upgradation stopped = 0xD2 0x04>

After getting this error give command
 at+rsi_otaf = 4,192.168.0.100, 5001, 1234, 100, 10\r\n

11.86 Read MFI Authentication Certificate

Description:

This command is used to read the IAP co processor Authentication certificate which is used in the authentication process while configuring accessory using MFI WAC server.

Command:

AT Mode:

N/A

Binary Mode:

No request payload required

Response:

AT Mode:

N/A

Binary mode:

There is no response payload for this command

Relevance:

This command is relevant in AP and station mode

Possible Error Codes:

Possible Error codes for this command are 0x0021, 0x0015, 0x002C.

Note:

This command is required only if IAP co-processor is mounted on RYWB116 with I2C interface. This command is not required if IAP chip is mounted on the host MCU. For more information, contact REYAX.

11.87 Generate MFI Authentication Signature

Description:

This command is used to generate signature during Accessory configuration using MFI WAC server. The digest given by the MFI WAC server is sent to the IAP co processor to generate signature.

Command:

AT Mode:

N/A

Binary Mode:

```
typedef struct rsi_mfi_auth_create_request_s
{
    uint32 digest_length;
    uint8 digest[40];
}rsi_mfi_auth_create_request_t;
```

Command Parameters:

digest_length: Input Digest length from the host.

digest: Digest to give to the IAP co processor.

Response:

AT Mode:

N/A

Binary mode:

```
typedef struct rsi_mfi_auth_create_response_s
{
uint8 signature_length[2];
uint8 signature[100];
}rsi_mfi_auth_create_response_t;
```

Response Parameters:

signature_length: Length of signature generated for the given digest.

Signature: Array of signature generated by the IAP co processor

Relevance:

This command is relevant in AP and station mode

Possible Error Codes:

Possible Error codes for this command are 0x0021, 0x0015, 0x002C,0x0055.

Note:
 This command is required only if IAP co-processor is mounted on RYWB116 with I2C interface. This command is not required if IAP chip is mounted on the host MCU. For more information, contact REYAX.

11.88 Storing Configuration Parameters

In client mode:

The module can connect to a pre-configured access point after it boots up (called auto-join in these sections). This feature facilitates fast connection to a known network.

In Access Point mode:

The module can be configured to come up as an Access Point every time it boots-up (called auto-create in these sections)

The feature is valid in operating modes 0, 2 and 6.

11.88.1 Storing Configuration Parameters in Client mode

11.88.2 Store Configuration in Flash Memory

Description:

This command is used to save the parameters into non-volatile memory which are used either to join to an Access point (auto-join mode) or to create an Access point(auto-create mode) .

Command Format:

AT Mode:

at+rsi_cfgsave\r\n

Binary Mode:

There is no payload for this command response:

AT Mode:

OK	Successful execution
ERROR	Failure.

Binary Mode:

There is no response payload for this command

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible error codes:

Possible error codes for this command are 0x0021, 0x0025, 0x002C.

11.88.3 Enable auto-join to AP or Auto-create AP

Description:

This command is used to enable or disable the feature of auto-join or auto-create on power up.

Command Format:

AT Mode:

at+rsi_cfgenable=< cfg_enable >\r\n

Binary Mode:

```
struct {
    uint8 cfg_enable;
}cfgEnableFrameSnd;
```

Command Parameters:

cfg_enable:

0 - Disables auto-join or auto-create

1 - Enables auto-join or auto-create

Response:

AT Mode:

OK	For response payload parameters description, refer to the section Store configuration structure parameters.
ERROR	Failure.

Binary Mode:

There is no response payload for this command.

Relavance:

This command is valid when opermode is 0,1,2 or 6.

Possible error codes:

Possible error codes for this command are 0x0021, 0x0025, 0x002C.

11.88.4 Get Information about Stored Configuration

Description:

This command is used to get the configuration values that have been stored in the module's memory which are used in auto-join or auto-create modes.

Command Format:

AT Mode:

at+rsi_cfgget?

Binary Mode:

There is no payload for this command

Response:

AT Mode:

OK<response payload>	For response payload parameters description, refer section Store configuration structure parameters.
ERROR	Failure.

Binary Mode:

```

#define IP_ADDRESS_SZ 4
#define RSI_SSID_LEN 34
#define WISE_PMK_LEN 32
#define RSI_PSK_LEN 64
#define MAX_HTTP_SERVER_USERNAME 31 (Including NULL Character)
#define MAX_HTTP_SERVER_PASSWORD 31 (Including NULL Character)
typedef struct {
uint8 channel_no[2];
uint8 ssid[RSI_SSID_LEN];
uint8 security_type;
uint8 encryp_mode;
uint8 psk[RSI_PSK_LEN];
uint8 beacon_interval[2];
uint8 dtim_period[2];
uint8 ap_keepalive_type;
uint8 ap_keepalive_period;
uint8 max_sta_support[2];
}rsi_apconfig;
typedef struct {
uint8 index[2];
uint8 key[4][32];
}rsi_wepkey;
typedef union {
struct {
uint8 roam_enable[4];
uint8 roam_threshold[4];
uint8 roam_hysteresis[4];
}roamParamsFrameSnd;
uint8 uRoamParamsBuf[12];
}rsi_uRoamParams;
typedef struct rsi_rejoin_params_s {
uint8 rsi_max_try[4];
int8 rsi_scan_interval[4];
int8 rsi_beacon_missed_count[4];
uint8 rsi_first_time_retry_enable[4];
} rsi_rejoin_params_t;
typedef struct sc_params_s{
uint8 cfg_enable;
uint8 opermode[4];
uint8 feature_bit_map[4];
uint8 tcp_ip_feature_bit_map[4];
uint8 custom_feature_bit_map[4];
uint8 band;
uint8 scan_feature_bitmap;
uint8 join_ssid[RSI_SSID_LEN];
uint8 uRate;
uint8 uTxPower;
uint8 reserved_1;
uint8 reserved_2;
uint8 scan_ssid_len;
uint8 keys_restore;
uint8 csec_mode;
uint8 psk[RSI_PSK_LEN];

```

```

uint8 scan_ssid[RSI_SSID_LEN];
uint8 scan_cnum;
uint8 dhcp_enable;
uint8 ip[IP_ADDRESS_SZ];
uint8 sn_mask[IP_ADDRESS_SZ];
uint8 dgw[IP_ADDRESS_SZ];

uint8 eap_method[32];
uint8 inner_method[32];
uint8 user_identity[64];
uint8 passwd[128];
uint8 go_intent[2];
uint8 device_name[64];
uint8 operating_channel[2];
uint8 ssid_postfix[64];
uint8 psk_key[64];
uint8 pmk[WISE_PMK_LEN];
rsi_apconfig apconfig;
uint8 module_mac[6];
uint8 antenna_select[2];
uint8 reserved_3[2];
rsi_wepkey wep_key;
uint8 dhcp6_enable[2];
uint8 prefix_length[2];
uint8 ip6[16];
uint8 dgw6[16];
uint8 tcp_stack_used;
uint8 bgscan_magic_code[2];

uint8 bgscan_enable[2];

uint8 bgscan_threshold[2];
uint8 rssi_tolerance_threshold[2];
uint8 bgscan_periodicity[2];
uint8 active_scan_duration[2];
uint8 passive_scan_duration[2];
uint8 multi_probe;
uint8 chan_bitmap_magic_code[2];
uint8 scan_chan_bitmap_stored_2_4_GHz[4];
uint8 scan_chan_bitmap_stored_5_GHz[4];

uint8 roam_magic_code[2];
rsi_uRoamParams roam_params_stored;
uint8 rejoin_magic_code[2];
rsi_rejoin_params_t rejoin_param_stored;
uint8 region_request_from_host;
uint8 rsi_region_code_from_host;
uint8 region_code;
uint8 reserved_4[43];
uint8 multicast_magic_code[2];
uint8 multicast_bitmap[2];

uint8 powermode_magic_code[2];
uint8 powermode;
uint8 ulp_mode;
uint8 wmm_ps_magic_code[2];

uint8 wmm_ps_enable;
uint8 wmm_ps_type;
uint8 wmm_ps_wakeup_interval[4];

```

```

uint8 wmm_ps_uapsd_bitmap;
uint8 listen_interval[4];
uint8 listen_interval_dtim;
uint8 ext_custom_feature_bit_map[4];
uint8 private_key_password[82];
uint8 join_bssid[6];
uint8 join_feature_bitmap;
rsi_uHtCaps ht_caps;
uint8 ht_caps_magic_word[2];
uint8 fast_psp_enable;
uint8 monitor_interval[2];
uint8 timeout_value[2];
uint8 timeout_bitmap[4];
uint8 request_timeout_magic_word[2];

//! AP IP parameters in Concurrent mode
UINT8 dhcp_ap_enable;
UINT8 ap_ip[4];
UINT8 ap_sn_mask[4];
UINT8 ap_dgw[4];
uint8 dhcp6_ap_enable[2];
UINT8 ap_prefix_length[2];
UINT8 ap_ip6[16];
UINT8 ap_dgw6[16];
uint8 ext_tcp_ip_feature_bit_map[4];

uint8 http_credentials_avail;
uint8 http_username[MAX_HTTP_SERVER_USERNAME];
uint8 http_password[MAX_HTTP_SERVER_PASSWORD];
}rsi_cfgGetFrameRcv;

```

Note:

Transparent mode parameters are only valid in UART interface in AT command mode only, In binary mode they should be discarded/neglected.

Note:

After firmware upgradation, previous saved configuration may lost due to checksum fail.

Response Parameters:

For response payload parameters description, refer section [Store configuration structure parameters](#).Correct this hyperlink

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible error codes:

Possible error codes for this command are 0x0021, 0x0025, 0x002C.

11.88.5 Store configuration from User

Description:

This command is used to give the configuration values which are supposed to be stored in the module's non-volatile memory and that are used in auto-join or auto-create modes.

This command can be given at any time after opermode is command is given.

Command Format:

AT Mode:

```

at+rsi_usercfg=<length_of_payload>,<Store configuration parameters >\r\n
Binary Mode:
#define IP_ADDRESS_SZ 4
#define RSI_SSID_LEN 34
#define WISE_PMK_LEN 32
#define MAX_HTTP_SERVER_USERNAME 31 (Including NULL Character)
#define MAX_HTTP_SERVER_PASSWORD 31 (Including NULL Character)
typedef struct {
uint8 channel_no[2];
uint8 ssid[RSI_SSID_LEN];

uint8 security_type;
uint8 encryp_mode;
uint8 psk[RSI_PSK_LEN];

uint8 beacon_interval[2];

uint8 dtim_period[2];

uint8 ap_keepalive_type;
uint8 ap_keepalive_period;
uint8 max_sta_support[2];
}rsi_apconfig;
typedef struct {
uint8 index[2];
uint8 key[4][32];
}rsi_wepkey;
typedef union {
struct {
uint8 roam_enable[4];
uint8 roam_threshold[4];
uint8 roam_hysteresis[4];
}roamParamsFrameSnd;
uint8 uRoamParamsBuf[12];
}rsi_uRoamParams;
typedef struct rsi_rejoin_params_s{
uint8 rsi_max_try[4];
int8 rsi_scan_interval[4];
int8 rsi_beacon_missed_count[4];
uint8 rsi_first_time_retry_enable[4];
} rsi_rejoin_params_t;
typedef struct sc_params_s{
uint8 cfg_enable;
uint8 opermode[4];
uint8 feature_bit_map[4];
uint8 tcp_ip_feature_bit_map[4];
uint8 custom_feature_bit_map[4];

uint8 band;

uint8 scan_feature_bitmap;
uint8 join_ssid[RSI_SSID_LEN];

uint8 uRate;

uint8 uTxPower;

uint8 join_feature_bitmap;
uint8 reserved_1;

uint8 scan_ssid_len;

uint8 keys_restore;

uint8 csec_mode;

uint8 psk[RSI_PSK_LEN];

```

```

uint8 scan_ssid[RSI_SSID_LEN];
uint8 scan_cnum;
uint8 dhcp_enable;
uint8 ip[IP_ADDRESS_SZ];
uint8 sn_mask[IP_ADDRESS_SZ];
uint8 dgw[IP_ADDRESS_SZ];

uint8 eap_method[32];
uint8 inner_method[32];
uint8 user_identity[64];
uint8 passwd[128];
uint8 go_intent[2];
uint8 device_name[64];
uint8 operating_channel[2];
uint8 ssid_postfix[64];
uint8 psk_key[64];
uint8 pmk[WISE_PMK_LEN];
rsi_apconfig apconfig;
uint8 module_mac[6];
uint8 antenna_select[2];
uint8 reserved_3[2];
rsi_wepkey wep_key;
uint8 dhcp6_enable[2];
uint8 prefix_length[2];
uint8 ip6[16];
uint8 dgw6[16];
uint8 tcp_stack_used;
uint8 bgscan_magic_code[2];

uint8 bgscan_enable[2];

uint8 bgscan_threshold[2];
uint8 rssi_tolerance_threshold[2];
uint8 bgscan_periodicity[2];
uint8 active_scan_duration[2];
uint8 passive_scan_duration[2];
uint8 multi_probe;
uint8 chan_bitmap_magic_code[2];
uint8 scan_chan_bitmap_stored_2_4_GHz[4];
uint8 scan_chan_bitmap_stored_5_GHz[4];

uint8 roam_magic_code[2];
rsi_uRoamParams roam_params_stored;
uint8 rejoin_magic_code[2];
rsi_rejoin_params_t rejoin_param_stored;
uint8 region_request_from_host;
uint8 rsi_region_code_from_host;
uint8 region_code;
uint8 reserved_4[43];
uint8 multicast_magic_code[2];
uint8 multicast_bitmap[2];

uint8 powermode_magic_code[2];
uint8 powermode;
uint8 ulp_mode;
uint8 wmm_ps_magic_code[2];

uint8 wmm_ps_enable;
uint8 wmm_ps_type;
uint8 wmm_ps_wakeup_interval[4];

```



```

uint8 wmm_ps_uapsd_bitmap;
uint8 listen_interval[4];
uint8 listen_interval_dtim;
uint8 ext_custom_feature_bit_map[4];
uint8 private_key_password[82];
uint8 join_bssid[6];
uint8 fast_psp_enable;
uint8 monitor_interval[2];
uint8 timeout_value[2];
uint8 timeout_bitmap[4];
uint8 request_timeout_magic_word[2];
rsi_uHtCaps ht_caps;
uint8 ht_caps_magic_word[2];
//! AP IP parameters in Concurrent mode
uint8 dhcp_ap_enable;

uint8 ap_ip[4];
uint8 ap_sn_mask[4];
uint8 ap_dgw[4];
uint8 dhcp6_ap_enable[2];
uint8 ap_prefix_length[2];
uint8 ap_ip6[16];
uint8 ap_dgw6[16];
uint8 ext_tcp_ip_feature_bit_map[4];

uint8 http_credentials_avail;
uint8 http_username[MAX_HTTP_SERVER_USERNAME];
uint8 http_password[MAX_HTTP_SERVER_PASSWORD];
}rsi_user_store_config_t;
    
```

Command Parameters:

length_of_payload: Length in bytes of the Store configuration parameters field.

Store configuration parameters: Store configuration parameter in hex format.

For payload parameters description, refer to the section **Store Configuration structure parameters**.

Response:

AT Mode:

OK	Successful execution
ERROR	Failure.

Binary Mode:

There is no response payload.

Relevance:

This command is valid when opermode is 0,1,2 or 6.

Possible Error Codes:

Possible error codes for this 0x003D,0x0021,0x002C,0x0025,0x0015.

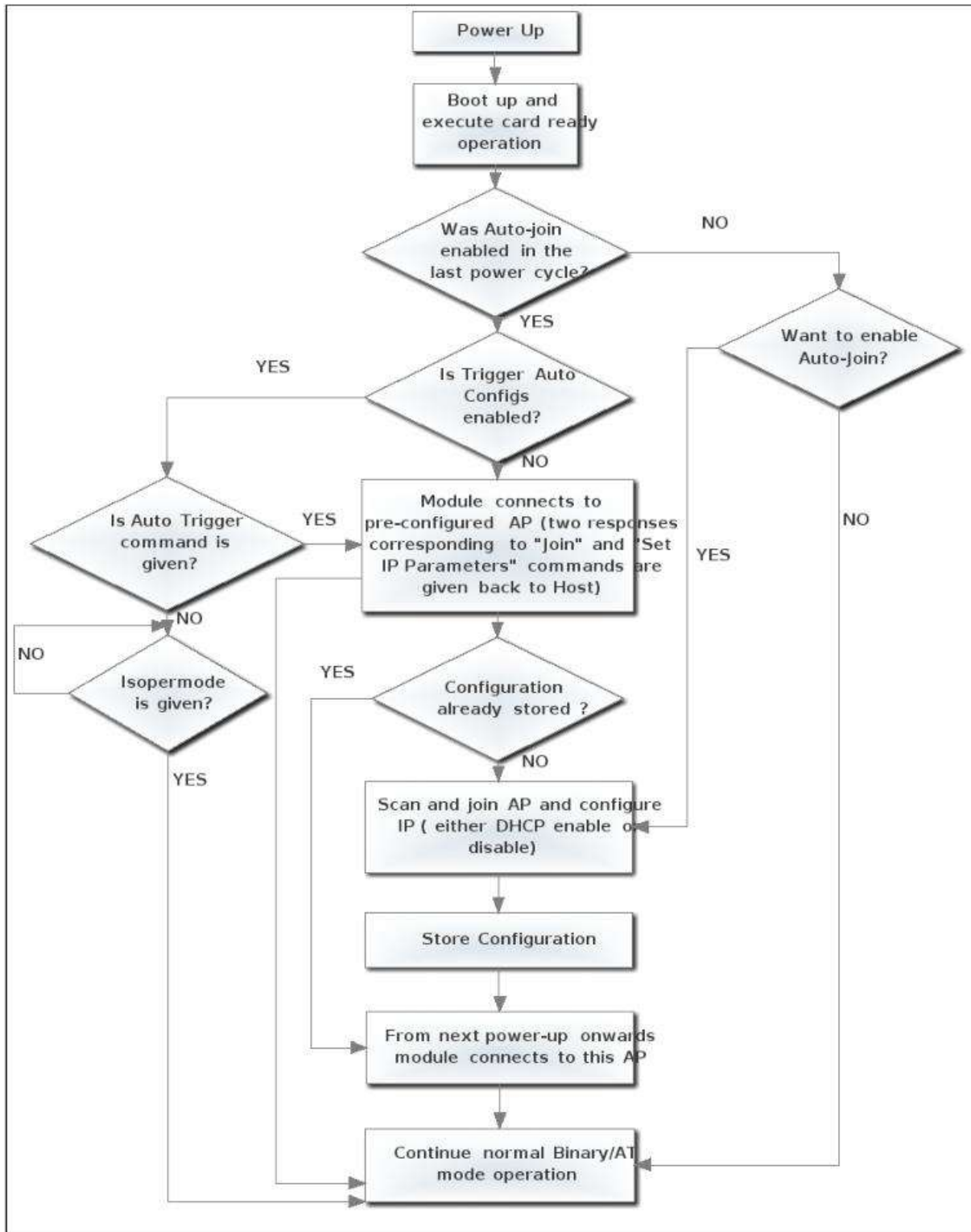


Figure 11-9: Connecting to Pre-configured AP

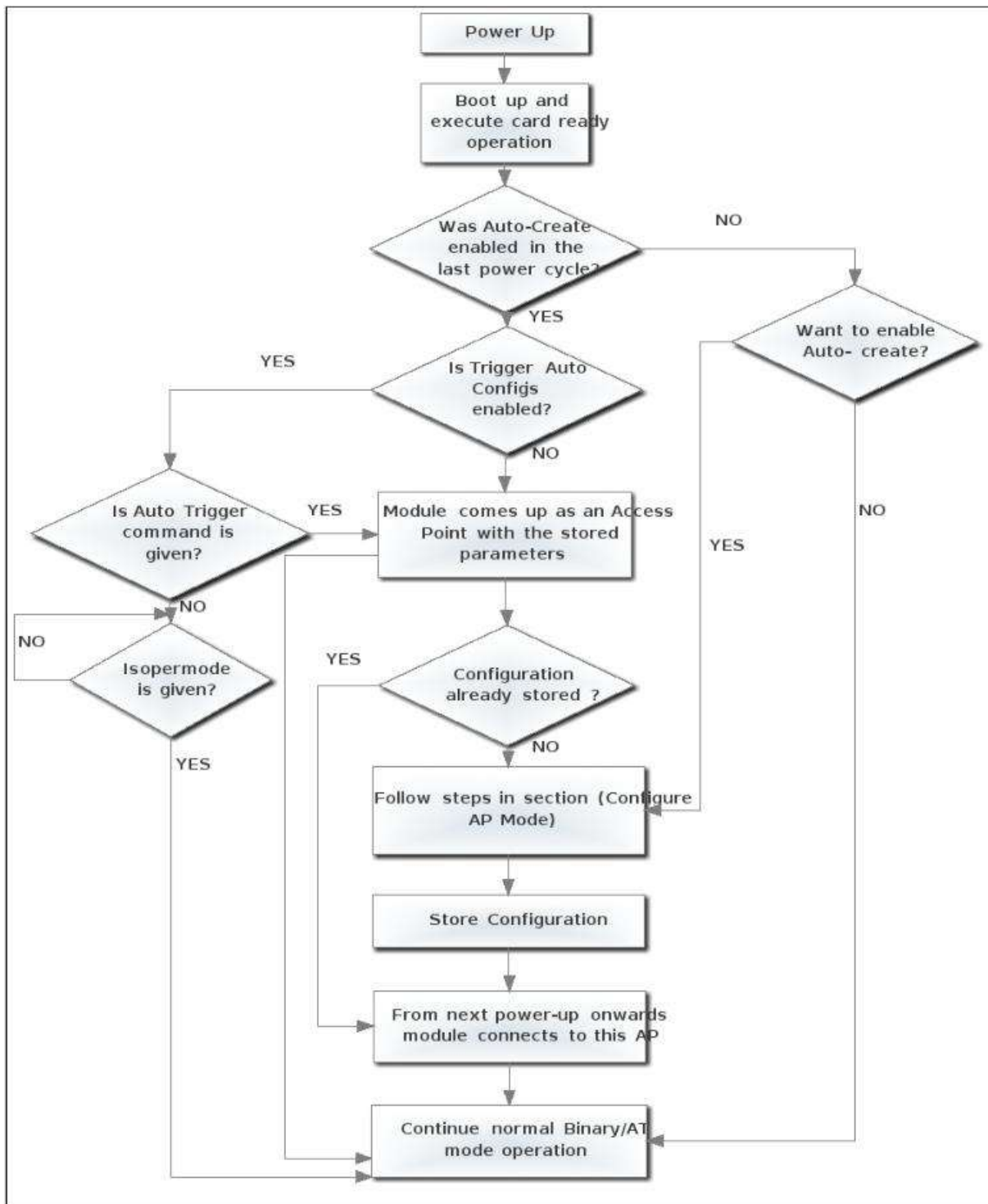


Figure 11-10: Creating Preconfigured AP

11.89 Store configuration structure parameters

The parameters/variables which are used in store configuration are explained in this section. Same structure is used in storing and getting the configuration parameters.

Transparent mode parameters are valid only in AT command mode on UART interface. In Binary mode and on the other interfaces, these parameters can be ignored. In binary mode these parameters are marked as reserved.

cfg_enable (1 byte):

0x00- auto-join or auto-create modes are disabled

0x01- auto-join or auto-create modes are enabled

opermode (4 bytes):

Oper_mode:

Sets the mode of operation. oper_mode contains two parts <wifi_oper_mode,coex_mode>. Lower two bytes represent wifi_oper_mode and higher two bytes represent coex_modes.

oper_mode = ((wifi_oper_mode) | (coex_mode << 16))

Wifi_oper_mode values:

0 - WiFi Client Mode. The module works as a normal client that can connect to an Access Point with different security modes other than enterprise security.

1 – Wi-Fi Direct™ or Autonomous GO. In this mode, the module either acts as a Wi-Fi Direct node or as an Autonomous GO (with intent value 16), depending on the inputs supplied for the command "[Configure Wi-Fi Direct Peer-to-Peer Mode](#)". In Autonomous GO and in Wi-Fi Direct GO mode, a maximum of 4 client devices are supported.

2 – Enterprise Security Client Mode. The module works as a client that can connect to an Access Point with WPA/WPA2-Enterprise security.

6 – Access Point mode. In this mode, the module acts as an Access Point, depending on the inputs supplied for the command "[Configure AP Mode](#)". In Access Point mode, a maximum of 8 client devices are supported.

8 - PER Mode. This mode is used for calculating packet error rate and mostly used during RF certification tests.

coex_mode bit values: enables respective protocol

BIT 0 : Enable/Disable WLAN mode.

0 – Disable WLAN mode

1 – Enable WLAN mode

BIT 1 : Enable/Disable Zigbee mode.

0 – Disable Zigbee mode

1 – Enable Zigbee mode

BIT 2 : Enable/Disable BT mode.

0 – Disable BT mode

1 – Enable BT mode

BIT 3 : Enable/Disable BTLE mode.

0 – Disable BTLE mode

1 – Enable BTLE mode

Note:

In BTLE mode, need to enable BT mode also.

Following table represents possible coex modes supported:

	Description
0	WLAN only mode
3	WLAN and Zigbee coexistence mode
5	WLAN and BT coexistence mode
13	WLAN and BTLE coexistence mode

Table 11:20: Coex Modes Supported

Note:

1. In coexistence mode (3,5,13) module supports only WLAN client mode (Open mode, PSK security).
2. In coexistence mode (0) module supports all WLAN modes and embedded TCP/IP stack.

feature_bit_map: this bitmap used to enable following WLAN features:

feature_bit_map[0]- To enable open mode

0 - Open Mode Disabled

1 - Open Mode enabled (No Security)

feature_bit_map[1]-To enable PSK security

0 - PSK security disabled

1 - PSK security enabled

feature_bit_map[2]-To enable Aggregation

0 - Aggregation disabled

1 - Aggregation enabled

feature_bit_map[3]-To enable LP GPIO hand shake

0 - LP GPIO hand shake disabled

1 - LP GPIO hand shake enabled

feature_bit_map[4]-To enable ULP GPIO hand shake

0 - ULP GPIO hand shake disabled

1 - ULP GPIO hand shake enabled

feature_bit_map[5]-Reserved

feature_bit_map[6]-Reserved

feature_bit_map[7]-To disable WPS support

0 - WPS enable

1 - WPS disable

feature_bit_map[8:31]- Reserved. Should set to be '0'

Note:

feature_bit_map[0], feature_bit_map[1] are valid only in WiFi client mode.

tcp_ip_feature_bit_map: To enable TCP/IP related features.

tcp_ip_feature_bit_map[0]- to enable TCP/IP bypass

0 - TCP/IP bypass mode disabled

1 - TCP/IP bypass mode enabled

tcp_ip_feature_bit_map[1]- to enable http server

0 - HTTP server disabled

1 - HTTP server enabled

tcp_ip_feature_bit_map[2]- to enable DHCPv4 client

0 - DHCPv4 client disabled

1 - DHCPv4 client enabled

tcp_ip_feature_bit_map[3]- to enable DHCPv6 client

0 - DHCPv6 client disabled

1 - DHCPv6 client enabled

tcp_ip_feature_bit_map[4]- to enable DHCPv4 server

0 - DHCPv4 server disabled

1 - DHCPv4 server enabled

tcp_ip_feature_bit_map[5]- to enable DHCPv6 server

0 - DHCPv6 server disabled

1 - DHCPv6 server enabled

tcp_ip_feature_bit_map[6]- To enable Dynamic update of web pages (JSON objects)

0 - JSON objects disabled

1 - JSON objects enabled

tcp_ip_feature_bit_map[7]- to enable HTTP client

0 - To disable HTTP client

1 - To enable HTTP client

tcp_ip_feature_bit_map[8]- to enable DNS client
 0 - To disable DNS client
 1 - To enable DNS client

tcp_ip_feature_bit_map[9]- to enable SNMP agent
 0 - To disable SNMP agent
 1 - To enable SNMP agent

tcp_ip_feature_bit_map[10]- to enable SSL
 0 - To disable SSL
 1 - To enable SSL

tcp_ip_feature_bit_map[11]- to enable PING from module(ICMP)
 0 - To disable ICMP
 1 - To enable ICMP

tcp_ip_feature_bit_map[12]- to enable HTTPS Server
 0 - To disable HTTPS Server
 1 - To enable HTTPS Server

tcp_ip_feature_bit_map[14]- to send configuration details to host on submitting configurations on wireless configuration page
 0 - Do not send configuration details to host
 1 - Send configuration details to host

tcp_ip_feature_bit_map[15]- to enable FTP client
 0 - To disable FTP client
 1 - To enable FTP client

tcp_ip_feature_bit_map[16]- To enable Sntp client
 0 - To disable Sntp client
 1 - To enable Sntp client

tcp_ip_feature_bit_map[17]- To enable IPv6 mode
 0 - To disable IPv6 mode
 1 - To enable IPv6 mode
 IPv6 will also get enabled if DHCP v6 client/DHCP v6 server is enabled irrespective of tcp_ip_feature_bit_map[17].

tcp_ip_feature_bit_map[19]- To MDNS and DNS-SD
 0 - To disable MDNS and DNS-SD
 1 - To Enable MDNS and DNS-SD

tcp_ip_feature_bit_map[20]- To enable SMTP client
 0 - To disable SMTP client
 1 - To Enable SMTP client

tcp_ip_feature_bit_map[21 - 24]- To select no of sockets
 tcp_ip_feature_bit_map[25]- To select Single SSL socket
 0 – selecting single socket is Disabled
 1 – Selecting single socket is enabled

Note:

By default two SSL sockets are supported.

tcp_ip_feature_bit_map[26]- To allow loading Private & Public certificates
 0 – Disable loading private & public certificates
 1- Allow loading private & public certificates

tcp_ip_feature_bit_map[27]- To load SSL certificate on to the RAM

tcp_ip_feature_bit_map[29]- To enable POP3 client
 0 - To disable POP3 client
 1 - To Enable POP3 client

tcp_ip_feature_bit_map[13] set to '0'.

tcp_ip_feature_bit_map[30]- To enable OTAF(On The Air Firmware) upgradation.

tcp_ip_feature_bit_map[31]- This bit is used to enable the tcp_ip extention valid feature bitmap.

1 – To enable Extended tcp_ip feature bitmap

0 – To disable Extended tcp_ip feature bitmap

Note:

SSL (tcp_ip_feature_bit_map[10], tcp_ip_feature_bit_map[12]) is supported only in opermode 0

custom_feature_bit_map: This bitmap used to enable following custom features:

BIT[2]: If this bit is set to '1', the DHCP server behavior, when the module is in AP mode, changes. The DHCP server, when it assigns IP addresses to the client nodes, does not send out a Gateway address, and sends only the assigned IP and Subnet values to the client. It is highly recommended to keep this value at '0' as the changed behavior is required in only very specialized use cases and not in normal AP functionality. The default value of this bit is '0'.

BIT [5] : If this bit is set to '1', Hidden SSID is enabled in case of AP mode. The default value of this bit is '0'.

BIT [6] :To enable/disable DNS server IP address in DHCP offer response in AP mode.

1- In AP mode, DHCP server sends DNS server IP address in DHCP offer

0- Not to include DNS server address in DHCP offer response

BIT[8] - Enable/Disable DFS channel passive scan support

1- Enable

0-Disable

BIT[10] Used to enable/disable Asynchronous messages to host to indicate the module state.

1- Enable asynchronous message to host

0-Disable asynchronous message to host

BIT[11] : To enable/disable packet pending ([Wakeon wireless](#)) indication in UART mode

1- Enable packet pending indication

0- Disable packet pending indication

BIT[12]: Used to bypass AP blacklist feature.

1 – Bypass AP black list feature

0 – Enable AP black list feature

BIT[13-16]:Used to set the maximum number of stations or client to support in AP or wifi Direct mode.Possible values are 1 to 16 in AP mode and 1 to 4 in WiFi Direct mode.

NOTE1: If these bits are not set,default maximum clients supported is set to 4.

BIT[17] : to select between de-authentication or Null data (with power management bit set) based roaming, Depending on selected method station will roam from connected AP to newly selected AP.

0 - To enable de-authentication based roaming

1 - To enable Null data based roaming

BIT[18]: Reserved

BIT[19]: Reserved

BIT[20]: Used to start/stop auto connection process on bootup,until host triggers it using [Trigger Auto Configuration](#) command

0 - Enable

1 - Disable

BIT[22]: Used to enable per station power save packet buffer limit. When enabled, only two packets per station will be buffered when station is in power save

- 1 – Enable
- 0 – Disable

BIT[23] : To enable/disable HTTP/HTTPs authentication

- 1 - Enable
- 0 – Disable

BIT[24]: To enable/disable higher clock frequency in module to improve throughputs

- 1 - Enable
- 0 – Disable

BIT[25]: To give HTTP server credentials to host in get configuration command

- 1 – To include HTTP server credentials in get configuration command response
- 0 – To exclude HTTP server credentials in get configuration command response

BIT[26]: To accept or reject new connection request when maximum clients are connected in case of LTCP.

- 1 - Reject
- 0 – Accept

By default this bit value is zero.

When BIT[26] is zero: For a LTCP socket when maximum clients are connected if a new connection request is received, then this connection request will not be rejected. Instead module will maintain this connection request in LTCP pending list.

This request will be served when any of the connected client is disconnected.

When BIT[26] is set: For a LTCP socket when maximum clients are connected if a new connection request is received, then this connection request will be rejected immediately. Module will not maintain this connection request in LTCP pending list.

Note:

The below parameters are valid based on the operating mode given

Band (1 byte):

0x00- Module configured to operate in 2.4 GHz

0x01- Module configured to operate in 5 GHz

0x02- Dual band(2.4 Ghz and 5Ghz). Dual band is valid in station mode and p2p mode

scan_feature_bitmap(1 byte): Scan feature bitmap

BIT[0]: To enable/disable quick scan feature.

- 1 - To enable quick scan feature.
- 0 - To disable quick scan feature. BIT[1]-BIT[7]: Reserved.

Join_ssid (34 bytes):

SSID of the AP configured in auto-join or in auto-create mode. If the actual length is not 34 bytes, 0x00 filler bytes are appended to make the length 34 bytes.

uRate (1 byte): Data rate to be configured in the module.

Please refer the PER Mode command section, for the data rates supported by the Reyax module

uTXPower (1 byte): Tx power to be configured in the module.

At 2.4GHz

- 0– Low power (7+/-1) dBm
- 1– Medium power (10 +/-1)dBm
- 2– High power (18 +/- 2)dBm

At 5 GHz

- 0– Low power (5+/-1) dBm
- 1– Medium power (7 +/-1) dBm
- 2– High power (12 +/- 2) dBm

join_feature_bitmap(1 byte):

BIT[0]: To enable b/g only mode in station mode, host has to set this bit.

- 0 – b/g/n mode enabled in station mode
- 1 – b/g only mode enabled in station mode

BIT[1]: To take listen interval from join command.

- 0 – Listen interval invalid
- 1 – Listen interval valid

BIT[2]:To enable/disable quick join feature.

- 1 - To enable quick join feature.
- 0 - To disable quick join feature.

BIT[3]-BIT[7]: Reserved.

Reserved_1(1byte):Reserved

Scan_ssid_len(1 byte):Scan ssid length

keys_restore(1byte):Reserved

Csec_mode(1byte): Security mode of access point to connect in auto join mode or security mode of devut in auto create mode.This variable is used to define the security mode of the Access point to which module is supposed to connect.

Possible values:

- 0 – Open mode
- 1 – WPA security
- 2 – WPA2 Security
- 6 - Mixed mode(WPA/WPA2)

Other values are assumed to be don't care.

psk (64 bytes): Pre shared key of the access point to which module wants to associate in auto-join or auto-create mode. Filler bytes of 0x00 are added to make it 64 bytes if the original PSK is less than 64 bytes.

Scan_ssid (34 bytes): SSID of the AP to be scanned in auto-join. If the actual length is not 34 bytes, 0x00 filler bytes are appended to make the length 34 bytes.

Scan_cnum(1 byte):channel number to be scanned in auto join mode. Refer to the [PER Mode](#) command section for the supported channels in 2.4GHz and 5 GHz band

dhcp_enable (1 byte):

- 0x00- DHCP client is disabled in module (auto-join mode)
- 0x01- DHCP client is enabled in module (auto-join mode)

ip (4 bytes): Static IP configured in the module in auto-join or auto-create mode. For auto-join mode, this is valid when dhcp_enable is 0.

Sn_mask(4 bytes): Subnet mask,this is valid only if dhcp_enable is 0.

dgw(4 bytes): Default gateway, this is valid only if dhcp_enable is 0.

eapMethod(32 bytes): Should be one of among TLS, TTLS, FAST or PEAP, ASCII character string used to configure the module in Enterprise security mode

innerMethod(32 bytes): Should be fixed to MSCHAPV2, ASCII character string.This parameter is used to configure the module in Enterprise security mode.

user_identity (64 bytes): User ID in enterprise security mode.

Passwd (128 bytes): Password configured for enterprise security. Refer to the parameter Password in the command `at+rsi_eap`. Filler bytes of 0x00 are used to make the length 128 bytes, of the original length is less than 128 bytes.

Go_intent (2 bytes): This determines whether the device is intended to form a GO (group owner) or work as a Wi-Fi Direct Peer node.. If the number is between 0 and 15, a GO negotiation takes place. If the value is 16, the module forms an Autonomous GO without negotiating with any other device.

Note:

Wi-Fi Direct, currently not supported in store configuration.

Device_name(64 bytes): This is the device name for the module. Another Wi-Fi Direct device would see this name when it scans for Wi-Fi Direct nodes.

Operating_channel(2 bytes): Operating channel to be used in Group Owner (GO). The specified channel is used if the device becomes a GO. The supported channels can be any valid channel.

Ssid_postfix (64 bytes): This parameter is used to add a postfix to the SSID in WiFi Direct GO mode.

Psk_key(64 bytes): The minimum length is 8 characters. This PSK is used by client devices to connect to the module if the module becomes a GO. WPA2-PSK security mode is used in the module in Wi-Fi Direct GO mode.

Pmk(32 bytes): PMK key

channel_no(2 bytes): The channel in which the AP would operate. Refer to the [PER Mode](#) command section for more details on the channels supported by the module. A value of '0' is not allowed.

Ssid(34 bytes): SSID of the AP to be created

security_type(1 byte): Security type of AP to be configured

0-Open
1-WPA
2-WPA2

encryp_mode(1 byte): Encryption type.

0-Open
1-TKIP
2-CCMP

Psk(64 bytes): PSK of the AP in security mode. If the AP is in Open mode, this parameter can be set to '0'.

beacon_interval(2 bytes) :Beacon interval of the AP in milliseconds. Allowed values are integers from 100 to 1000 which are multiples of 100.

dtim_period(2 bytes): DTIM period to be configured in AP mode

ap_keepalive_type:This is the bitmap to enable AP keep alive functionality and to select the keep alive type.

BIT[0]: To enable/disable keep alive functionality.

1 - To enable keep alive functionality.
0 - To disable keep alive functionality.

BIT[1]: To select AP keep alive method.

1 - To enable null data based keep alive functionality.
0 - To enable based keep alive functionality.

ap_keepalive_period:This is the period after which AP will disconnect the station if there are no wireless exchanges from station to AP.Keep alive period is calculated in terms of 32 multiples of beacon interval(i.e if there are no wireless transfers from station to AP with in (32*beacon_interval*keep_alive_period) milli seconds time period,station will be disconnected).If null data based method is selected,AP checks the connectivity of station by sending null data packet. If station does not ack the packet ,that station will be disconnected.

max_sta_support(2 bytes): Number of clients supported. The maximum value allowed is based on the value given in custom feature select bit map[BIT[13] – BIT[16]].max_sta_support should be less than or equal to the value given in custom feature bitmap given in opermode.For example, if this value is 3, not more than 3 clients can associate to the client.

Note:

AP parameters are valid only if opermode is given as 6
Module_mac(6bytes) :Mac address to be set for module.

Note:

Host should send mac address with 00:00:00:00:00:00 values to use module's default mac address.

antenna_select (2 bytes): This variable configures the antenna to be used. RYWB116 provides two options – an inbuilt antenna and a uFL connector for putting in an external antenna.

0– Inbuilt antenna selected
1– UFL connector selected

Reserved_3(2 bytes): reserved

Index(2 bytes): In some APs, there is an option to provide four WEP keys.

0-Key 1 will be used.

1-Key 2 will be used.

2-Key 3 will be used.

3-Key 4 will be used.

Key(32 bytes): Actual keys. There are two modes in which a WEP key can be set in an Access Point- WEP (hex) mode and WEP (ASCII) mode. The module supports WEP (hex) mode only.

dhcpcv6_enable(2 bytes):DHCPv6 mode.

prefix_length(2 bytes) : prefix length of ipv6 address.

ip6(16 bytes): IPv6 address of module.

Dgw6(16 bytes): IPv6 address of default router.

tcp_stack_used(1 byte): shows which TCP stack is used. Possible values are:

0x01- ipv4 Stack

0x02- ipv6 Stack

0x03- dual Stack, both IPv4 and IPv6 Stack

bgscan_magic_code(2 bytes): This magic code is used to validate the bgscan parameter present in flash memory.

bgscan_enable(2 bytes): To enable/Disable bgscan

0 – Disable

1 - Enable

bgscan_threshold(2 bytes): This is the threshold in dBm to trigger the bgscan. After bgscan periodicity, if connected AP RSSI falls below this then bgscan will be triggered.

rss_i_tolerance_threshold(2 bytes): This is difference of last RSSI of connected AP and current RSSI of connected AP. Here last RSSI means RSSI calculated at last time beacon received and current RSSI is RSSI calculated at current beacon received. If this difference is more than rssi_tolerance_threshold and current RSSI is greater than bgscan_threshold then bgscan will be triggered irrespective of periodicity.

bgscan_periodicity(2 bytes): This is time period in seconds to trigger bgscan if RSSI of connected AP is above (assuming RSSI is positive value) than the given bgscan_threshold.

active_scan_duration(2 bytes): This is active scan duration and it is in ms.

passive_scan_duration(2 bytes): This is passive scan duration in ms.

multi_probe(1 byte): If set to one then module will send two probe request one with specific SSID provided during join command and other with NULL ssid (to scan all the access points).

chan_bitmap_magic_code(2 bytes):This variable is used to validate the given scan channel bitmaps.If magic code is 0x4321,then only the scan channel bitmaps are considered as valid.

scan_chan_bitmap_stored_2_4_GHz(4bytes): channel bitmap for scanning in set of selective channels in 2.4 ghz band

scan_chan_bitmap_stored_5_GHz(4bytes): channel bitmap for scanning in set of selective channels in 5 ghz band

roam_magic_code(2 bytes):This magic code is used to validate the roaming parameters stored in the flash memory. roam_enable(4 bytes): To Enable/Disable roaming.

0 – Disable

1 - Enable

roam_threshold(4 bytes): If connected AP RSSI falls below this then module will search for new AP from background scanned list.

roam_hysteresis(4 bytes): If module found new AP with same configuration (SSID, Security etc) and if (connected_AP_RSSI – Selected_AP_RSSI) is greater than roam_hysteresis then it will try to roam to the new selected AP.

rejoin_magic_code(2 bytes): This magic code is used to validate the rejoin parameters stored in the flash memory.

rejoin_max_retry(4 bytes): This is 4 byte unsigned integer. This represents the number of attempt for join before giving up the error.

Note:

If number of rejoin attempts is 0 then module will try infinitely for rejoin.

Rsi_scan_interval(4 bytes): This is 4 byte signed integer. This is time interval in second for the subsequent retry.

Rsi_beacon_missed_count(4 bytes): This is 4 byte signed integer. This is the beacon missed count that module used to declare module connection status. If module found continuous beacon missed is greater than or equal to this value then it will declare connection as disconnected and will start rejoin process again.

Rsi_first_time_retry_enabled(4 bytes):

This is 4 byte unsigned integer. If this is 1 then module will retry to connect for the first time itself for join. Number of attempt and scan interval may be configured by rejoin_max_attempts and scan_interval respectively.

region_request_from_host(1 byte):

If this variable is 1, region of the module is set either in auto join or auto create mode based on the opermode.

- 1 – Enable set region in Auto create or Auto join mode
- 0 – Disable set region in Auto create or Auto join mode

rsi_region_code_from_host(1 byte):

Enable/Disable set region code from user.

If opermode is 0 or 2:

- 1 - Enable - Use the region information from user command
- 0 – Disable - Use the region information from beacon(country le)

If opermode is 6:

- 0- Disable-Get the region information based on region code from internal memory

region_code(1 byte):

If the region code is given as 0(zero), US domain is considered by default and device is configured according to the US domain regulations.

- 1-US domain
- 2-Europe domain
- 3-Japan Domain

Note:

1. All the magic codes should be 0x4321. Firmware validates the respective details if and only if the magic code is matching
2. Below given parameters are transparent mode specific. These variables are named as reserved_6 in binary mode command mode.

Trans_mode_enable(2 bytes): If transparent mode magic word (0x5C5C) is given transparent mode is enabled, after succesfull connection/creation of socket.

packet_len(2 bytes): This is the number of bytes (payload) with which network frames are formed and transmitted (bytes/data received within gap timeout) over TCP/IP network.

Escape_char (1,ASCII): Special character provided which will be detected and its 3 character sequence will have special meaning depending of time of arrival.

Gap_time (2 bytes): Maximum time gap between bytes received from host within which escape characters are not expected/checked.

Frame_time (2 bytes): The timeout period for framing network packet from the bytes received. if this timeout is occurred , bytes available in Rx buffers will be forced to form a network frame and queue it for transmission. Ideally Framing period = 2 * Gap Time.

Escape_time (2 bytes): If escape character sequence is received after framing timeout and within escape time, then module breaks out of transparent mode, making GPIO low. Ideally Escape Time = 2 * Framing period.

Ip_version(2 bytes):Signifies which IP version to be used in transparent mode.

4 – IP version 4

6 - IP version 6

nSocketType (2 bytes): This gives the protocol which is to be used in transparent mode(TCP/UDP/LTCP/LUDP).

0 - TCP

2 – LTCp

4 – LUDP

stLocalPort(2 bytes):station Local port number to be used in transparent mode.

Dst_port(2 bytes): Remote port number, to which module need to communicate with in transparent mode.

Ipv4_address/Ipv6_address(16 bytes):IP(v4/v6) of remote server which is to be communicated with from module(in client mode).

Max_count(2 bytes): maximum no of clients allowed in transparent mode is fixed to 1, so default value should be 1.

TOS(4 bytes): Type of service.

ssl_enabled(1 byte): If ssl socket is to be used corresponding parameters are to be provided here.

0 – To open TCP socket.

1 - To open SSL client socket.

5 - To open SSL socket with TLS 1.0 version.

9 - To open SSL socket with TLS 1.2 version.

Ssl_ciphers(1 byte): If ssl socket is to be used corresponding ciphers used is to be provided here.

BIT(0): 1: TLS_RSA_WITH_AES_256_CBC_SHA256

BIT(1): 2: TLS_RSA_WITH_AES_128_CBC_SHA256

BIT(2): 4: TLS_RSA_WITH_AES_256_CBC_SHA

BIT(3): 8: TLS_RSA_WITH_AES_128_CBC_SHA

BIT(4): 16: TLS_RSA_WITH_AES_128_CCM_8

BIT(5): 32: TLS_RSA_WITH_AES_256_CCM_8

multicast_magic_code(2 bytes):

This magic code is used to validate the multicast parameters stored in the flash memory

multicast_bitmap(2 bytes):

There are two bytes in the command which represent 2 parts. Lower order byte represent the command type (cmd as mentioned below) and higher order byte is the hash value (6 Bits) generated from the desired multicast mac address (48 Bits) using hash function.

multicast_bitmap[0:1]: These 2 bits represents the command type. Possible values are:

0 - RSI_MULTICAST_MAC_ADD_BIT (To set particular bit in multicast bitmap)

1 - RSI_MULTICAST_MAC_CLEAR_BIT (To reset particular bit in multicast bitmap)

2 - RSI_MULTICAST_MAC_CLEAR_ALL (To clear all the bits in multicast bitmap)

3 - RSI_MULTICAST_MAC_SET_ALL(To set all the bits in multicast bitmap)

multicast_bitmap[2:7]: reserved.

multicast_bitmap[8:13]: 6bit hash value generated from the hash algorithm which corresponds to the multicast mac address is used to set/reset corresponding bit in multicast filter bitmap.This field is valid only if 0 or 1 is selected in command type (multicast_bitmap[0:1]).

multicast_bitmap[14:15]: reserved

powermode_magic_code(2 bytes):

This magic code is used to validate the power mode parameters stored in the flash memory

powermode(1 byte):

powermode variable configures the power save mode of the module.

1–Power save Mode 1

2–Power save Mode 2

3–Power save Mode 3

ulp_mode(1 byte):

0 - Low power mode.

1 - Ultra low power mode with RAM retention.

2 - Ultra low power mode without RAM retention.

Refer section Powersave operation for detail description about power save operation.

wmm_ps_magic_code(2 bytes):

This magic code is used to validate the WMM power save parameters stored in the flash memory

wmm_ps_enable(1 byte): To enable or disable WMM

0 - Disable

1- Enable

wmm_ps_type(1 byte):WMM PS type

0 - Tx Based

1- Periodic

wakeup_interval(4 bytes):Wakeup interval in milli seconds.

wmm_ps_uapsd_bitmap(1 byte): Bitmap , 0 to 15 possible values.

wmm_ps_uapsd_bitmap[0]:Access category: voice

wmm_ps_uapsd_bitmap[1]: Access category:video

wmm_ps_uapsd_bitmap[2]: Access category:Back ground

wmm_ps_uapsd_bitmap[3]: Access category:Best effort U-APSD

wmm_ps_uapsd_bitmap[4:7]: All set to '0'. Don't care bits.

Listen_interval(4 byte):

This is valid only if BIT(1) in join_feature_bit_map is set. This value is given in Time units(1024 milliseconds). This parameter to configure maximum sleep duration in power save.

Listen_interval_dtim(1 byte):

This parameter is valid only if BIT(1) is set in the join_feature_bitmap and valid listen interval is given in join command. If this parameter is set, the module computes the desired sleep duration based on listen interval (from join command) and its wakeup align with Beacon or DTIM Beacon (based on this parameter).

0 - module wakes up before nearest Beacon that does not exceed the specified listen interval time.

1 - module wakes up before nearest DTIM Beacon that does not exceed the specified listen interval time.

private_key_password[82](1 byte): Private Key Password is required for

encrypted private key, format is like "\\12345678\\".

join_bssid: This contains BSSID of selected AP.

Note:

1. All the magic codes should be 0x4321.Firmware validates the respective details if and only if the magic code is matching
2. Below given parameters are transparent mode specific.These variables are named as reserved_6 in binary mode command mode.

Fast_psp_enable(1 byte) :

When fast psp is enabled, module will disable power save for monitor interval of time for each data packet received or sent.

Monitor_interval (2 bytes):

This is time in ms to keep module in wakeup state for each Tx or Rx traffic sent or received respectively. Default value for this is 50 ms.

Timeout_value (2 bytes) :

timeout value in ms(default 300ms).

timeout_bitmap (4 bytes):

BIT[0]:

sets timeout for association and authentication request.

Request_timeout_magic_word(2 bytes):

Magic word of request time out.

ht_caps_magic_word (2 bytes):

Magic word of HT caps.

dhcp_ap_enable (1 byte):

DHCPv4 mode enable or disable

ap_ip(4 bytes):

Module IP address

ap_sn_mask(4 bytes):

Sub-net mask

ap_dgw(4 bytes):

Default gateway

dhcpv6_ap_enable(2 bytes):

DHCPv6 mode enable or disable

ap_prefix_length(2 bytes):

prefix length of ipv6 address.

ap_ip6(16 bytes):

IPv6 address of module.

ap_dgw6(16 bytes):

IPv6 address of default router.

ext_tcp_ip_feature_bit_map:

BIT[1] - To use DHCP User class Option

1 – To enable DHCP user class option

0 - To disable DHCP user class option

BIT[2] – To bypass the HTTP servers default root configuration page

1 – To enable HTTP server root path bypass option

0 - To disable HTTP server root path bypass option

Note:

Enable BIT[3] in ext_tcp_ip_feature_bit_map to enable this feature

BIT[3] – Correcting the ACK sequence number in the TCP packet retransmission path

1 – To enable

0 - To disable

BIT[4] – To enable TCP ACK division factor feature

1 – To enable

0 - To disable

BIT[5] – To enable SSL server certificate validation by host. (By enabling this bit server certificate is sent to host and host validates the server certificate and send the valid response to the module)

1 – To enable

0 - To disable

Note:

The above AP IP parameters are valid in concurrent mode.

http_credentials_avail(1 byte):Reserved.

http_username[MAX_HTTP_SERVER_USERNAME](1 byte): HTTP server username.

http_password[MAX_HTTP_SERVER_PASSWORD](1 byte): HTTP server password.

11.90 Store Profile configuration

This command is used to give the configuration (A.P profile, clinet profile, Enterprise profile and P2p Autonomous GO mode profile) values which are supposed to be stored in the module's non-volatile memory and that are used in auto-join or auto-create modes.

Note:

This store profile configuration command will be supported in sapis only.

Transparent mode is only available in

Command Format:

Binary Mode:

```

typedef struct ap_profile
{
    uint8_t ap_profile_magic_word[4];
    uint8_t wlan_feature_bit_map[4];
    uint8_t tcp_ip_feature_bit_map[4];
    uint8_t custom_feature_bit_map[4];
    uint8_t data_rate;
    uint8_t tx_power;
    uint8_t band;
    uint8_t channel[2];
    uint8_t ssid[RSI_SSID_LEN];
    uint8_t security_type;
    uint8_t encryption_type;
    uint8_t psk[RSI_PSK_LEN];
    uint8_t beacon_interval[2];
    uint8_t dtim_period[2];
    uint8_t keep_alive_type;
    uint8_t keep_alive_counter;
    uint8_t max_no_sta[2];
    network_profile_t network_profile;
} ap_profile_t;

typedef struct client_profile
{
    uint8_t client_profile_magic_word[4];
    uint8_t wlan_feature_bit_map[4];
    uint8_t tcp_ip_feature_bit_map[4];
    uint8_t custom_feature_bit_map[4];
    uint8_t listen_interval[4];
    uint8_t data_rate;
    uint8_t tx_power;
    uint8_t band;
    uint8_t ssid[RSI_SSID_LEN];
    uint8_t ssid_len;
    uint8_t channel[2];
    uint8_t scan_feature_bitmap;
    uint8_t scan_chan_bitmap_magic_code[2];
    uint8_t scan_chan_bitmap_2_4_ghz[4];
    uint8_t scan_chan_bitmap_5_0_ghz[4];
    uint8_t security_type;
    uint8_t encryption_type;
    uint8_t psk[RSI_PSK_LEN];
    uint8_t pmk[RSI_PMK_LEN];
    wep_key_ds_t wep_key;
    network_profile_t network_profile;
    uint8_t scan_chan_bitmap_2_4_ghz[4];
    uint8_t scan_chan_bitmap_5_0_ghz[4];
    uint8_t security_type;
    uint8_t eap_method[32];
    uint8_t inner_method[32];
    uint8_t user_identity[64];
    uint8_t passwd[128];
    network_profile_t network_profile;
} eap_client_profile_t;

```

```

typedef struct p2p_profile
{
    uint8_t p2p_profile_magic_word[4];
    uint8_t wlan_feature_bit_map[4];
    uint8_t tcp_ip_feature_bit_map[4];
    uint8_t custom_feature_bit_map[4];
    uint8_t data_rate;
    uint8_t tx_power;
    uint8_t band;
    uint8_t join_ssid[RSI_SSID_LEN];
    uint8_t go_intent[2];
    uint8_t device_name[64];
    uint8_t operating_channel[2];
    uint8_t ssid_postfix[64];
    uint8_t psk_key[64];
    network_profile_t network_profile;
} p2p_profile_t;

typedef struct rsi_config_profile_s
{
    uint8_t
    profile_type[4];
    union
    {
        //! AP config profile
        ap_profile_t
        ap_profile;
        //! Client config profile
        client_profile_t client_profile;
        //! EAP client config profile
        eapclient_profile_t eap_client_profile;
        //! P2P config profile
        p2p_profile_t p2p_profile;
    } wlan_profile_struct;
} rsi_config_profile_t;

typedef struct rsi_profile_req_s
{
    uint8_t
    profile_type[4];
} rsi_profile_req_t;

typedef struct rsi_auto_config_enable_s
{
    uint8_t config_enable;
    uint8_t profile_type[4];
} rsi_auto_config_enable_t;

```

Command Parameters:

length_of_payload: Length in bytes of the Store configuration parameters field.

Store configuration parameters: Store configuration parameter in hex format.

For payload parameters description, refer section Store Configuration structure parameters.

Binary Mode:

There is no response payload.

Relevance:

This command is valid when opermode is 0,1,2 or 6.

11.91 Set RTC time

Description:

This command is used to set/initialize the real time clock of the module from the host.

Note:

To enable this feature, host need to set BIT[28] of custom feature bitmap through opermode command.

Command Format:

at+rsi_host_rtc_time=<second>,<minute>,<hour>,<day>,<month>,<year>\r\n

Binary Mode:

```
struct
{
uint8 second[4];
uint8 minute[4];
uint8 hour[4];
uint8 day[4];
uint8 month[4];
uint8 year[4];
} module_rtc_time;
```

Command Parameters:

second: This is current real time clock seconds, which needs to set for module.

minute: This is current real time clock minute, which needs to set for module.

hour: This is current real time clock hour, which needs to set for module.

day: This is current real time clock day, which needs to set for module.

month: This is current real time clock month, which needs to set for module.

year: This is current real time clock year, which needs to set for module.

Note:

hour is 24 hour format only (valid values are 0 to 23)

Valid values for Month are 0 to 11 (January to December)

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Binary Mode:

No response payload for this command.

Possible error codes:

Possible error codes are 0x0021, 0x0025

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

Below example configure the module rtc time to APRIL 2 10:10:10 2018

at+rsi_host_rtc_time=10,10,10,2,3,2018\r\n

Response:

OK\r\n

0x4F 0x4B 0x0D 0x0A

11.92 FEATURE FRAME

Description:

This command is used to select internal RF type or External RF type and clock frequency.

Command Format:

at+rsi_feat_frame=<pll_mode>, <rf_type> ,<wireless_mode> ,<enable_ppp>, <afe_type>,<features_enable>\r\n

Binary Mode:

```
typedef union {
    struct {
        uint8    pll_mode;                //@ uint8, to set pll mode val
        uint8    rf_type;                 //@ uint8, to select rf type
        uint8    wireless_mode;          //@ uint8, to select wireless mode
        uint8    enable_ppp;             //@ uint8, to select enable ppp
        uint8    afe_type;               //@ uint8, to select afe type
        uint8    reserved[3];            //@ reserved
        uint8    feature_enables[4];     //@ uint32, feature enables
    } FeatureFrameSnd;
    uint8      FeatureFrameReqBuf[12]; } rsi_uFeatureFrame;
```

Command Parameters:

PLL_MODE:

- 0- PLLMODE0 - Used for generating the clocks for 20Mhz Bandwidth operations.
- 1- PLLMODE1 -Used for generating the clocks for 40Mhz Bandwidth operations.
- 2- PLLMODE2-Reserved

RF_TYPE[ONLY FOR 2GHz]:

- 0- To enable External_RF_8111,
- 1- To enable Internal_RF_9116,
- 2- AVIACOM_RF

WIRELESS_MODE:

- 12- To enable LP chain for PER mode
- 0- LP chain disable

ENABLE_PPP:

- 0- Disable_per_packet_TX_programming,
- 1- Enable_per_packet_TX_programming_mode_1,
- 2- Enable_per_packet_TX_programming_mode_2

AFE:

- 0- AFE BYPASS,
- 1- Internal AFE

FEATURE_ENABLES:

- BIT[0] - To enable Preamble duty cycling.
- BIT[4] - To enable LP chain for stand-by associate mode.
- BIT[5] - To enable hardware beacon drop during power save.

Note:

Remaining bits are not user configurable.

Response:

AT Mode:

Result Code Description
 OK Successful execution of the command
 ERROR<Error code> Failure

Possible error codes:

Possible error codes are 0x0021, 0xFF74

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

at+rsi_feat_frame=0,0,0,0,1\r\n

Response:

OK\r\n
 0x4F 0x4B 0x0D 0x0A

11.93 BROADCAST FILTER

Description:

This command is used to program the ignoring broadcast packet threshold levels when station is in powersave mode and is used to achieve low currents in standby associated mode.

Command Format:

at+rsi_filter_bcast=<beacon_drop_threshold><filter_bcast_in_tim><filter_bcast_tim_till_next_cmd>/r/n

Command Parameters:

BEACON DROP THRESHOLD

LMAC beacon drop threshold(ms): The amount of time that FW waits to receive full beacon.
 Default value is 5000ms.

FILTER BROADCAST IN TIM

If this bit is set, then from the next dtim any broadcast data pending bit in TIM indicated will be ignored
 valid values : 0 - 1

Note:

Validity of this bit is dependent on the filter_bcast_tim_till_next_cm

FILTER BROADCAST TIM TILL NEXT COMMAND

0 -filter_bcast_in_tim is valid till disconnect of the STA
 1 - filter_bcast_in_tim is valid till next update by giving the same command

Response:

AT Mode:

Result Code Description
 OK Successful execution of the command
 ERROR<Error code> Failure

Possible error codes:

Possible error codes are 0x0021,

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

at+rsi_filter_bcast=2,1,1\r\n

Response:

OK\r\n
0x4F 0x4B 0x0D 0x0A

11.94 CONFIGURE TX RX Buffer RATIO

Description:

This command is used to configure the tx,rx and global buffer ratio.

Command Format:

at+rsi_buf_alloc = <dynamic_tx_pool><>dynamic_rx_pool<dynamic_global_pool>/r/n

Command Parameters:

DYNAMIC TX POOL

To configure the tx pool ratio.

DYNAMIC RX POOL

To configure the rx pool ratio.

DYNAMIC GLOBAL POOL

To configure the global pool ratio.

Note:

Summation of above three ratios should be max 10 and ratio should be in decimal values.

Response:

AT Mode:

Result Code Description
OK Successful execution of the command
ERROR<Error code> Failure

Possible error codes:

Possible error codes are 0x0021,

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

at+rsi_buff_alloc=1,1,1\r\n

Response:

OK\r\n
0x4F 0x4B 0x0D 0x0A

11.95 ANTENNA SELECTION

Description:

This command is used to configure the antenna.

Command Format:

at+rsi_antenna=<AntennaVal><Gain_2G>,<Gain_5G>,<antenna_path>,<antenna_type>\r\n

Binary Mode:

```
struct {
    uint8 AntennaVal;
    uint8 Gain_2G;
    uint8 Gain_5G;
    uint8 Antenna_path;
    uint8 Antenna_type;
} AntennaSelFrameSnd;
```

Command Parameters:

AntennaVal:

0– RF_OUT_2/Internal Antenna is selected
 1–RF_OUT_1/uFL connector is selected.

Note:

Currently Gain_2g,Gain_5g,antenna_path and antenna_type values are ignored

Response:

AT Mode:

Result Code Description
 OK Successful execution of the command
 ERROR<Error code> Failure

Possible error codes:

Possible error codes are 0x0021, 0x002C

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

at+rsi_antenna=1 \r\n

Response:

OK\r\n
 0x4F 0x4B 0x0D 0x0A
 UART 1 - TX: GPIO_9
 RX: GPIO_8
 BIT[27] : To select UART port for NWP debug prints
 1 - Enable debug prints on UART 1 and is applicable only if host interface is not UART

Note:

UART 1 pins are mapped to the following pins w.r.t to NWP. User needs to ensure that these pins are not used in MCU applications to avoid conflicts of pins usage based on the requirement

UART 1 - TX: GPIO_9
 RX: GPIO_8
 Channel bit maps , e.g. channel_bit_map_2_4 and channel_bit_map_5 used for background scan.

0 - WiFi Client Mode

The module works as a normal client that can connect to an Access Point with different security modes other than enterprise security.

tcp_ip_feature_bit_map[6]
Packet pending ([Wake on Wireless](#)) indication in UART mode
ext_custom_feature_bit_map[0]
number of slaves supported by BT

12 WLAN Error Codes

12.1 Error Codes

This section explains error codes for different commands.

Error Codes (in hexadecimal format)	Description
0x0002	Scan command issued while the module is already associated with an Access Point
0x0003	No AP found
0x0004	Wrong PSK is issued while the module client tries to join an Access Point with WEP security enabled
0x0005	Invalid band
0x0006	Association not done or in an unassociated state
0x0008	Deauthentication received from AP
0x0009	Failed to associate to Access Point during "Join"
0x000A	Invalid channel
0x000E	1. Authentication failure during "Join" 2. Unable to find AP during join which was found during the scan.
0x000F	Missed beacon from AP during the join
0x0013	Non-existent MAC address supplied in "Disassociate" command
0x0014	Wi-Fi Direct or EAP configuration is not done
0x0015	Memory allocation failed or Store configuration checksum failed
0x0016	Information is wrong or insufficient in Join command
0x0018	Push button command given before the expiry of the previous push button command
0x0019	1. Access Point not found 2. Rejoin failure
0x001A	Frequency not supported
0x001C	EAP configuration failed
0x001D	P2P configuration failed
0x001E	Unable to start Group Owner negotiation
0x0020	Unable to join
0x0021	Command given in the incorrect state
0x0022	Query GO parameters issued in the incorrect operating mode
0x0023	Unable to form Access Point
0x0024	Wrong Scan input parameters supplied to "Scan" command
0x0025	Command issued during re-join in progress
0x0026	Wrong parameters the command request
0x0028	PSK length less than 8 bytes or more than 63 bytes
0x0029	Failed to clear or to set the Enterprise Certificate (Set Certificate)
0x002A	Group Owner negotiation failed in Wi-Fi Direct mode
0x002B	Association between nodes failed in Wi-Fi Direct mode/ WPS Failed due to timeout

Error Codes (in hexadecimal format)	Description
0x002C	If a command is issued by the Host when the module is internally executing auto-join or auto-create
0x002D	WEP key is of the wrong length
0x002E	ICMP request timeout error
0x002F	ICMP data size exceeds the maximum limit
0x0030	Send data packet exceeded the limit or length that is mentioned
0x0031	ARP Cache entry not found
0x0032	UART command timeout happened
0x0033	Fixed data rate is not supported by connecting AP
0x0037	Wrong WPS PIN
0x0038	Wrong WPS PIN length
0x0039	Wrong PMK length
0x003a	SSID not present for PMK generation
0x003b	SSID incorrect for PMK generation(more than 34 bytes)
0x003C	Band not supported
0x003D	User store configuration invalid length
0x003E	Error in length of the command(Exceeds number of characters is mentioned in the PRM)
0x003F	Data packet dropped
0x0040	WEP key not given
0x0041	Wrong PSK length
0x0042	PSK or PMK not given
0x0043	Security mode given in join command is invalid
0x0044	Beacon miscount reaches max beacon miss count(Deauth due to beacon miss)
0x0045	Deauth received from the supplicant
0x0046	Deauth received from AP after channel switching
0x0047	Synchronization missed
0x0048	Authentication timeout occurred
0x0049	Association timeout
0x004A	BG scan in given channels is not allowed
0x004B	Scanned SSID and SSID given in Join are not matching
0x004C	Given number of clients exceeded max number of stations supported
0x004D	Given HT capabilities are not supported
0x004E	Uart Flow control not supported
0x004F	ZB/BT/BLE packet received and protocol is not enabled
0x0050	Parameters error
0x0051	Invalid RF current mode
0x0052	Power save support is not present for a given interface
0x0053	Concurrent AP in connected state
0x0054	Connected AP or Station channel mismatch
0x0055	IAP coprocessor error
0x0056	WPS not supported in current operating mode
0x0057	Concurrent AP has not same channel as connected station channel
0x0058	PBC session overlap error

Error Codes (in hexadecimal format)	Description
0x005A	4/4 confirmation of 4 way handshake failed
0X005C	Concurrent mode, both AP and Client should UP, to enable configuration
0x0061	Address family not supported by protocol.
0x0062	Invalid beacon interval provided.
0x005B	MAC address not present in MAC based join
0x00B1	Memory Error: No memory available
0x00B2	Invalid characters in JSON object
0x00B3	Update Commands: No such key found
0x00B4	No such file found: Re-check filename
0x00B5	No corresponding webpage exists with same filename
0x00B6	Space unavailable for new file
0x00C1	Invalid input data, Re-check filename, lengths etc
0x00C2	Space unavailable for new file
0x00C3	Existing file overwrite: Exceeds size of previous file. Use erase and try again
0x00C4	No such file found. Re-check filename
0x00C5	Memory Error: No memory available
0x00C6	Received more webpage data than the total length initially specified
0x00C7	Error in set region command
0x00C8	Webpage current chunk length is incorrect
0x00CA	Error in Ap set region command
0X00CB	Error in AP set region command parameters
0x00CC	Region code not supported
0x00CD	Error in extracting country region from beacon
0x00CE	Module does not have selected region support
0x00D1	SSL Context Create Failed
0x00D2	SSL Handshake Failed. Socket will be closed
0x00D3	SSL Max sockets reached. Or FTP client is not connected
0x00D4	Cipher set failure
0x00F1	HTTP credentials maximum length exceeded
0x0100	SNMP internal error
0x0104	SNMP invalid IP protocol error
0xBB01	No data received or receive timeout
0xBB0A	Invalid SNTP server address
0xBB0B	SNTP client not started
0xBB10	SNTP server not available, Client will not get any time update service from current server
0xBB15	SNTP server authentication failed
0xBB0E	Internal error
0xBB16	Entry not found for multicast IP address
0xBB17	No more entries found for multicast
0xBB21	IP address error
0xBB22	Socket already bound
0xBB23	Port not available
0xBB27	Socket is not created
0xBB29	ICMP request failed

Error Codes (in hexadecimal format)	Description
0xBB33	Maximum listen sockets reached
0xBB34	DHCP duplicate listen
0xBB35	Port Not in close state
0xBB36	Socket is closed or in process of closing
0xBB37	Process in progress
0xBB38	Trying to connect non-existing TCP server socket
0xBB3E	Error in length of the command(Exceeds number of characters is mentioned in the PRM)
0xBB42	Socket is still bound
0xBB45	No free port
0xBB46	Invalid port
0xBB4B	Feature not supported
0xBB50	Socket is not in the connected state. Disconnected from server. In the case of FTP, the user need to give destroy command after receiving this error
0xBB87	POP3 session creation failed/ POP3 session got terminated
0xBB9C	DHCPv6 Handshake failure
0xBB9D	DHCP invalid IP response
0xBBA0	SMTP Authentication error
0xBBA1	No DNS server was specified, SMTP oversize mail data
0xBBA2	SMTP invalid server reply
0xBBA3	DNS query failed, SMTP internal error
0xBBA4	Bad DNS address, SMTP server error code received
0xBBA5	SMTP invalid parameters
0xBBA6	SMTP packet allocation failed
0xBBA7	SMTP GREET reply failed
0xBBA8	Parameter error, SMTP Hello reply error
0xBBA9	SMTP mail reply error
0xBBAA	SMTP RCPT reply error
0xBBAB 0xBBA1	Empty DNS server list, SMTP message reply errorNo DNS server was specified
0xBBAC 0xBBA3	SMTP data reply errorDNS query failed
0xBBAD 0xBBA4	SMTP authentication reply errorBad DNS address
0xBBAE 0xBBA8	SMTP server error replyParameter error
0xBBAF 0xBBAB	DNS duplicate entry.Empty DNS server list
0xBBB1 0xBBAF	SMTP oversize server replyDNS duplicate entry
0xBBB2	SMTP client not initialized
0xBBB3	DNS IPv6 not supported
0xBBC5	Invalid mail index for POP3 mail retrieve command
0xBBD2	SSL handshake failed
0xBBD3	FTP client is not connected or disconnected with the FTP server
0xBBD4	FTP client is not disconnected
0xBBD5	FTP file is not opened
0xBBD6	SSL handshake timeout or FTP file is not closed

Error Codes (in hexadecimal format)	Description
0xBBD9	Expected [1XX response from FTP server but not received
0xBBDA	Expected [2XX response from FTP server but not received
0xBBDB	Expected [22X response from FTP server but not received
0xBBDC	Expected [23X response from FTP server but not received
0xBBDD	Expected [3XX response from FTP server but not received
0xBBDE	Expected [33X response from FTP server but not received
0xBBE1	HTTP Timeout
0xBBE2	HTTP Failed
0xBBE7	HTTP Timeout for HTTP PUT client
0xBBEB	Authentication Error
0xBBED	Invalid packet length, content length and received data length is mismatching
0xBBEF	The server responds before HTTP client request is complete
0xBBF0	HTTP/HTTPS password is too long
0xBBFF	POP3 error for invalid mail index
0xFFFF	Listening TCP socket in the module is not connected to the remote peer or the LTCP the socket is not yet opened in the module
0xFFFFB	Cannot create IP in the same interface in concurrent mode
0xFFFFE	Sockets not available. The error comes if the Host tries to open more than 10 sockets
0xFFFFC	IP configuration failed
0xFFFF7	Byte stuffing error in AT mode
0xFFFF8	1. Invalid command (e.g. parameters insufficient or invalid in the command). Invalid operation (e.g. power save command with the same mode given twice, accessing the wrong socket, creating more than allowed sockets)
0xFFFFA	TCP socket is not connected
0xFFC5	Station count exceeded max station supported
0xFFC4	Unable to send TCP data
0xFFBC	Socket buffer too small
0xFFBB	Invalid content in the DNS response to the DNS Resolution query
0xFFBA	DNS Class error in the response to the DNS Resolution query
0xFFB8	DNS count error in the response to the DNS Resolution query
0xFFB7	DNS Return Code error in the response to the DNS Resolution query
0xFFB6	DNS Opcode error in the response to the DNS Resolution query
0xFFB5	DNS ID mismatch between DNS Resolution request and response
0xFFAB	An invalid input to the DNS Resolution query
0xFF42	DNS response was timed out
0xFFA1	ARP request failure
0xFF9D	DHCP lease time expired
0xFF9C	DHCP handshake failure
0xFF88	This error is issued when WebSocket creation failed

Error Codes (in hexadecimal format)	Description
0xFF87	This error is issued when the module tried to connect to a non-existent TCP server the socket on the remote side
0xFF86	This error is issued when tried to close the non-existent socket. or invalid socket descriptor
0xFF85	Invalid socket parameters
0xFF82	Feature not supported
0xFF81	Socket already open
0xFF80	Attempt to open more than the maximum allowed number of sockets
0xFF7E	Data length exceeds mss
0xFF74	Feature not enabled
0xFF73	DHCP server not set in AP mode
0xFF71	Error in AP set region command parameters
0xFF70	SSL not supported
0xFF6F	JSON not supported
0xFF6E	Invalid operating mode
0xFF6D	Invalid socket configuration parameters
0xFF6C	Web socket creation timeout
0xFF6B	Parameter maximum allowed value is exceeded
0xFF6A	Socket read timeout
0xFF69	An invalid command in the sequence
0xFF42	DNS response timed out
0xFF41	HTTP socket creation failed
0xFF40	TCP socket close command is issued before getting the response of the previous close command
0xFF36	Wait On Host feature not enabled
0xFF35	Store configuration checksum validation failed
0xFF33	TCP keep alive timed out
0xFF2D	TCP ACK failed for TCP SYN-ACK
0xFF2C	Memory limit exceeded in a given operating mode
0xFF2A	Memory limit exceeded in operating mode during auto join/create
0xCC2F	PUF Operation is blocked
0xCC31	PUF Activation code invalid
0xCC32	PUF input parameters invalid
0xCC33	PUF in error state
0XCC34	PUF Operation not allowed
0XCC35	PUF operation Failed
0x5a5a	Auto join or user store configuration going on.

13 PUF Commands

13.1 PUF START

Description:

This command will start PUF if valid Activation code is available in flash. If activation code on flash is valid, this operation returns success or else fails to start PUF. Start operation is must for any further operation with PUF.

Note:

To enable this feature, host need to set BIT[31] of custom feature bitmap and BIT[7] of ext_custom_feature_bit_map through opermode command.

Command Format:

at+rsi_puf_start\r\n

Command Parameters:

No Parameters.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Possible error codes:

Possible error codes are 0x0021, 0xFF74, 0xCC31, 0xCC32, 0xCC33, 0xCC35

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

at+rsi_puf_start\r\n

Response:

OK\r\n

0x4F 0x4B 0x0D 0x0A

13.2 PUF SET KEY

Description:

This command is used to request for set key operation for the given key, a Key code is generated by PUF which is returned if operation is success. This command will return failure if there is a failure in system or if this feature is blocked prior.

Note:

To enable this feature, host need to set BIT[31] of custom feature bitmap and BIT[7] of ext_custom_feature_bit_map through opermode command.

Command Format:

at+rsi_puf_set_key=<key_index>,<key_size>,<key>\r\n

Command Parameters:

Key_index:

Key Index of the key. Valid range is between 0 – 15(To increase randomness).

Key_size:

0 – 128 bit
1 – 256 bit

Key:

Actual key for which key code is generated.

Response:

AT Mode:

Result Code	Description
OK<keycode>	Successful execution of the command
ERROR<Error code>	Failure

Possible error codes:

Possible error codes are 0x0021, 0xFF74, 0xCC31, 0xCC32, 0xCC33, 0xCC35

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

```
at+rsi_puf_set_key=1,0,30313233343536373839656667686970\r\n
```

Response:

```
OK<keycode>\r\n
0x4F 0x4B 0x00 0x01 0x00 0x02 0x79 0x4c 0xa4 0x45 0x0c 0xe2
0xec 0xb4 0x8a 0xb3 0x34 0x52 0xc0 0x80 0x2d 0x37 0xeb 0xda
0xe7 0x36 0x5c 0xfc 0x3f 0xf8 0x88 0xe2 0x19 0xda 0x8c 0xeb
0x1c 0x9b 0xe9 0xb6 0x6b 0xb4 0x19 0x59 0x46 0x21 0x0D 0x0A
```

Note:

Key should be given in the Hexadecimal format.

13.3 PUF DISABLE SET KEY

Description:

This command is used to block set key for further operations on PUF.

Note:

To enable this feature, host need to set BIT[31] of custom feature bitmap and BIT[7] of ext_custom_feature_bit_map through opermode command.

Command Format:

```
at+rsi_puf_dis_set_key\r\n
```

Command Parameters:

No Parameters.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command

Result Code	Description
ERROR<Error code>	Failure

Possible error codes:

Possible error codes are 0x0021, 0xFF74, 0xCC32, 0xCC33, 0xCC34

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

at+rsi_puf_dis_set_key\r\n

Response:

OK\r\n

0x4F 0x4B 0x0D 0x0A

13.4 PUF GET KEY

Description:

This command regenerates the key for the given key code using PUF. If operation is success, key is returned or else error is returned. This command will return failure if there is a failure in system or if this feature is blocked prior.

Note:

To enable this feature, host need to set BIT[31] of custom feature bitmap and BIT[7] of ext_custom_feature_bit_map through opermode command.

Command Format:

at+rsi_puf_get_key=<keycode>\r\n

Command Parameters:

Key_code: Keycode which is prior generated by PUF.

Response:

AT Mode:

Result Code	Description
OK<KEY>	Successful execution of the command
ERROR<Error code>	Failure

Possible error codes:

Possible error codes are 0x0021, 0xFF74, 0xCC31, 0xCC32, 0xCC33, 0xCC35

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

at+rsi_puf_get_key=0010002794ca4450ce2ecb48ab33452c0802d37ebdae7365cfc3ff888e219da8ceb1c9be9b66bb419594621\r\n

Response:

OK0123456789efghip\r\n

0x4F 0x4B 0x30 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0x39 0x65 0x66 0x67 0x68 0x69 0x70 0x0D 0x0A

Note:

Keycode should be given in the Hexadecimal format.

13.5 PUF DISABLE GET KEY

Description:

This command is used to block further get key operations on PUF.

Note:

To enable this feature, host need to set BIT[31] of custom feature bitmap and BIT[7] of ext_custom_feature_bit_map through opermode command.

Command Format:

at+rsi_puf_dis_get_key\r\n

Command Parameters:

No Parameters.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Possible error codes:

Possible error codes are 0x0021, 0xFF74, 0xCC32, 0xCC33, 0xCC34

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

at+rsi_puf_dis_get_key\r\n

Response:

OK\r\n
0x4F 0x4B 0x0D 0x0A

13.6 PUF LOAD KEY

Description:

This command regenerates the key for the given key code using PUF, and loads it into AES engine. If operation is success, key is loaded into AES or else error is returned. This command will return failure if there is a failure in system or if this feature is blocked prior.

Note:

To enable this feature, host need to set BIT[31] of custom feature bitmap and BIT[7] of ext_custom_feature_bit_map through opermode command.

Command Format:

at+rsi_puf_load_key=<keycode>\r\n

Command Parameters:

Key_code: Keycode which is prior generated by PUF.

Response:

AT Mode:

Result Code	Description
OK	Successful execution of the command
ERROR<Error code>	Failure

Possible error codes:

Possible error codes are 0x0021, 0xFF74, 0xCC31, 0xCC32, 0xCC33, 0xCC35

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

```
at+rsi_puf_load_key=0010002794ca4450ce2ecb48ab33452c0802d37ebdae7365cfc3ff888e219da8ceb1c9be9b66bb4 19594621\r\n
```

Response:

```
OK\r\n0x4F 0x4B 0x0D 0x0A
```

Note:

Keycode should be given in the Hexadecimal format.

13.7 PUF INTRINSIC KEY

Description:

This command is used to request for intrinsic key operation for the given keysize, a Key code is generated by PUF which is returned if operation is success. This command will return failure if there is a failure in system or if this feature is blocked prior.

Note:

To enable this feature, host need to set BIT[31] of custom feature bitmap and BIT[7] of ext_custom_feature_bit_map through opermode command.

Command Format:

```
at+rsi_puf_intr_key=<key_index>,<key_size>\r\n
```

Command Parameters:

Key_index: Key Index of the key. Valid range is between 0 – 15(To increase randomness).

Key_size:

0 – 128 bit

1 – 256 bit

Response:

AT Mode:

Result Code	Description
OK<keycode>	Successful execution of the command
ERROR<Error code>	Failure

Possible error codes:

Possible error codes are 0x0021, 0xFF74, 0xCC31, 0xCC32, 0xCC33, 0xCC35

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

at+rsi_puf_set_key=1,0\r\n

Response:

OK<keycode>\r\n

0x4F 0x4B 0x01 0x01 0x00 0x02 0x79 0x4c 0xa4 0x45 0x0c 0xe2 0xec 0xb4 0x8a 0xb3 0x34 0x52 0xc0 0x80 0x2d
0x37 0xeb 0xda 0xe7 0x36 0x5c 0xfc 0x3f 0xf8 0x88 0xe2 0x19 0xda 0x8c 0xeb 0x1c 0x9b 0xe9 0xb6 0x6b 0xb4
0x19 0x59 0x46 0x21 0x0D 0x0A

13.8 AES ENCRYPT

Description:

This command encrypts data inputted with Key provided or with key which is already loaded into AES by PUF. This command provides provision for encryption with AES engine in two modes(ECB, CBC). Parameters should be given to command depending on the mode of usage. The command will return failure if there is an error in input.

Note:
To enable this feature, host need to set BIT[31] of custom feature bitmap and BIT[7]of ext_custom_feature_bit_map through opermode command.

Command Format:

at+rsi_aes_encrypt=<mode>,<key>,<IV>,<data_size>,<data>\r\n

Command Parameters:

Mode	Functionality
BIT[0]	1 – CBC, 0 – ECB
BIT[1]	1 – key size 256 0 – key size 128
BIT[2]	1 – key from AES, 0 – key from PUF
BIT[3:7]	Reserved

Key:

Key which is to be used for encryption.

IV:

Initialization vector (IV) which is used for encryption (valid only for CBC mode).

Data size:

Data size of the data to be encrypted in bytes; the data size should be in multiple of key size. The maximum data size is 1400.

Data:

Data which is to be encrypted.

Response:

AT Mode:

Result Code Description

OK<Encrypted data> Successful execution of the command

ERROR<Error code> Failure

Possible error codes:

Possible error codes are 0x0021, 0xFF74, 0xCC32

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

```
at+rsi_aes_encrypt=5,30313233343536373839656667686970,6162636465666768696A6B6C6D6E6F70,16,3031323334
3536373839656667686970\r\n
```

Response:

```
OK<Encrypted data>\r\n
0x4F 0x4B 0x4E 0x9A 0xF8 0x2D 0x1B 0xBB 0x4D 0x32 0xC3 0x7E 0xAC 0x5C 0x26 0x08 0x85 0x00 0x0D 0x0A
```

Note:
Key, IV, data should be given in the Hexadecimal format.

13.9 AES DECRYPT

Description:

This command decrypts data inputted with Key provided or with key which is already loaded into AES by PUF. This command provides provision for decryption with AES engine in two modes(ECB, CBC). The parameters should be given to command depending on the mode of usage. The command will return failure if there is an error in input.

Note:
To enable this feature, host need to set BIT[31] of custom feature bitmap and BIT[7]of ext_custom_feature_bit_map through opermode command.

Command Format:

```
at+rsi_aes_encrypt=<mode>,<key>,<IV>,<data_size>,<data>\r\n
```

Command Parameters:

Mode	Functionality
BIT[0]	1 – CBC, 0 – ECB
BIT[1]	1 – key size 256 0 – key size 128
BIT[2]	1 – key from AES, 0 – key from PUF
BIT[3:7]	Reserved

Key:

Key which is to be used for decryption.

IV:

Initialization vector (IV) which is to be used for decryption (valid only for CBC mode).

Data size:

Data size of the data to be decrypted in bytes; the data size should be in multiple of key size. The maximum data size is 1400.

Data:

Data which is to be decrypted.

Response:

AT Mode:

Result Code Description

OK<Decrypted data> Successful execution of the command

ERROR<Error code> Failure

Possible error codes:

Possible error codes are 0x0021, 0xFF74, 0xCC32

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

```
at+rsi_aes_decrypt=5,30313233343536373839656667686970, 6162636465666768696A6B6C6D6E6F70, 16,
4E9AF82D1BBB4D32C37EAC5C26088500\r\n
```

Response:

```
OK<Decrypted data>\r\n
0x4F 0x4B 0x30 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0x39 0x65 0x66 0x67 0x68 0x69 0x70 0x0D 0x0A
```

Note:
Key, IV, data should be given in the Hexadecimal format.

13.10 AES MAC

Description:

This command generates Message authentication check (MAC) for the data inputted with provided key as well as initialization vector (IV). The parameters should be given to command depending on the mode of usage. The command will return failure if there is any error in input.

Note:
To enable this feature, host need to set BIT[31] of custom feature bitmap and BIT[7] of ext_custom_feature_bit_map through opermode command.

Command Format:

```
at+rsi_aes_mac=<mode>,<key>,<IV>,<data_size>,<data>\r\n
```

Command Parameters:

Mode	Functionality
BIT[0]	Reserved
BIT[1]	1 – key size 256 0 – key size 128
BIT[2:7]	Reserved

Key:

Key which is to be used for MAC generation.

IV:

Initialization vector (IV) which is to be used for MAC generation.

Data size:

Data size of the data to be used for MAC generation in bytes; the data size should be multiple of key size. The maximum data size is 1400.

Data:

Data which is to be used for MAC generation.

Response:

AT Mode:

Result Code Description

OK<Generayed MAC> Successful execution of the command

ERROR<Error code> Failure

Possible error codes:

Possible error codes are 0x0021, 0xFF74, 0xCC32

Relevance:

This command is relevant in all modes.

Example:

AT Mode:

```
at+rsi_aes_mac=0,30313233343536373839656667686970, 6162636465666768696A6B6C6D6E6F70, 32,
30313233343536373839656667, 68697030313233343536373839656667686970\r\n
```

Response:

```
OK<Generated MAC>\r\n
0x4F 0x4B 0xE1 0x3F 0xDC 0x0E 0x43 0x17 0x97 0x7D 0x05 0x36 0x44 0x0C 0x22 0x13 0xA2 0xC0 0x0D 0x0A
```

Note:

Key, IV, data should be given in the Hexadecimal format

14 Using Different Wi-Fi Operation Modes

The module can be configured in the following modes :

- Wi-Fi Direct™ mode
- Access Point Mode
- Client Mode to connect to an AP in open mode or with Personal Security
- Client mode to connect to an AP with Enterprise Security
- PER mode

14.1 Wi-Fi Direct Mode

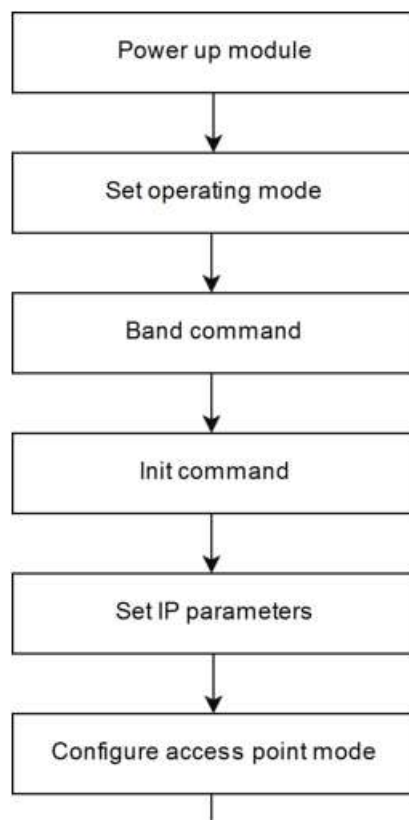
Wi-Fi Direct™ is a standard that enables two Wi-Fi devices to connect and communicate with each other without an Access Point in between. This technology allows seamless and direct peer-to-peer communication between a RYWB116 and a variety of hand-held devices such as smart phones, tablet PCs etc. The flow diagram below shows scenarios of setting up Wi-Fi Direct nodes with a RYWB116 Wi-Fi Direct network. In this mode, the module connects to a Wi-Fi direct node by following the below mentioned steps. The module can either act as a Group Owner or a client. "GO Negotiation" is the phase when this is decided. The decision of which node becomes the group owner depends on the value of Group_Owner_intent. The node with a higher value of Group_Owner_intent would get preference over a lower value in becoming a GO. If the values advertised by both nodes are same, then a tie-break sequence is automatically initiated to resolve the contention. A Group Owner Wi-Fi Direct node behaves as an Access Point to the client Wi-Fi Direct Peer-to-Peer (P2P) nodes. It acts as a DHCP server to dispatch IP addresses to the P2P nodes.

14.2 Access Point Mode

The following sequence of commands should be used to create an Access Point in the module. The module can support eight external clients when it is configured in Access Point mode. By default the module can act as a DHCP server.

Power Up module
Band command
Set operating mode
Set IP parameters

Join command
Module becomes Access Point. Other Wi-Fi nodes can connect
Open sockets
Send and receive data
Init command
Configure Access Point mode



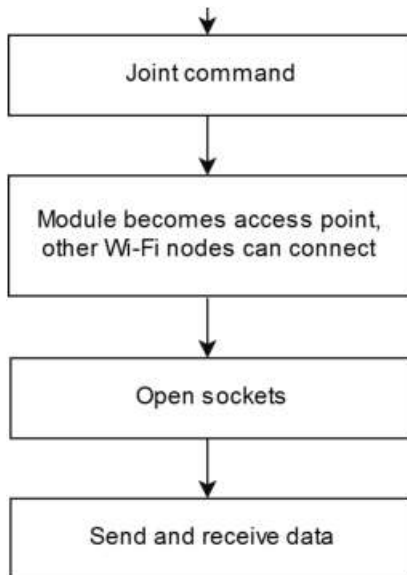
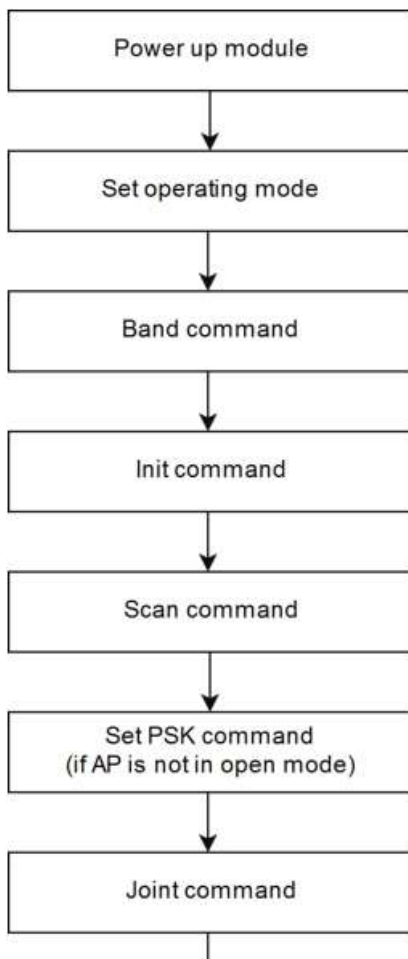


Figure 14-1: Access Point Mode

14.3 Client Mode with Personal Security

In this mode, the module works as a Wi-Fi client. It can connect to an Access Point with open mode or Personal Security.



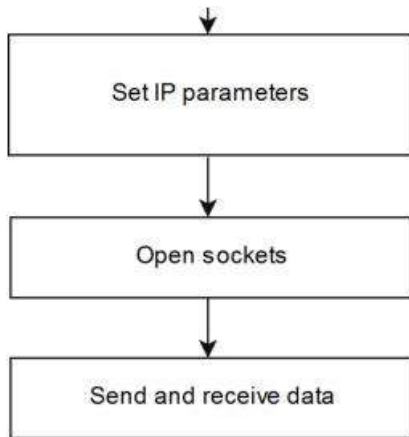
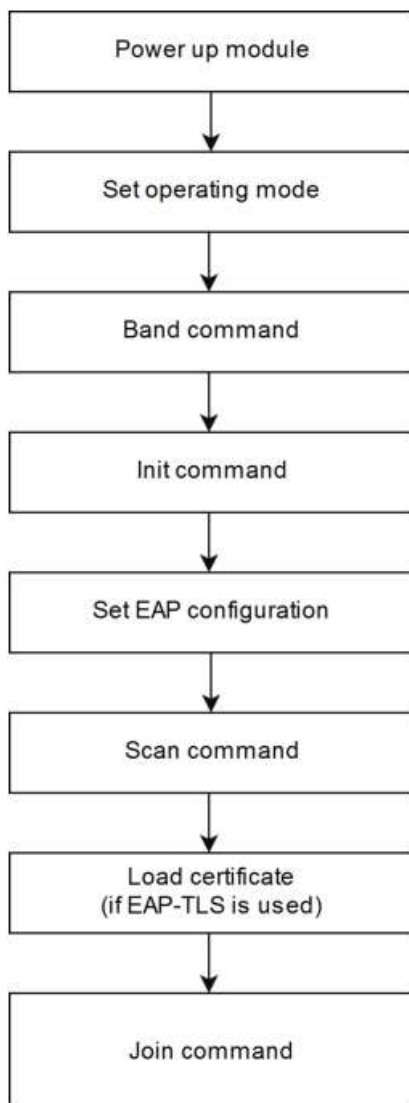


Figure 14-2: Client Mode with Personal Security

14.4 Client Mode with Enterprise Security

In this mode, the module works as a client to connect to an Enterprise security enabled network that Hosts a Radius Server.



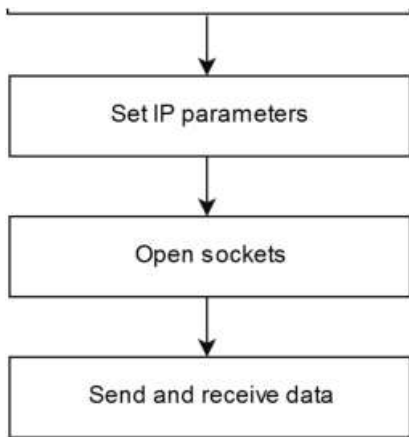


Figure 14-3: Client Mode with Enterprise Security

14.5 PER Mode

This mode is used for Packet Error Rate analysis.

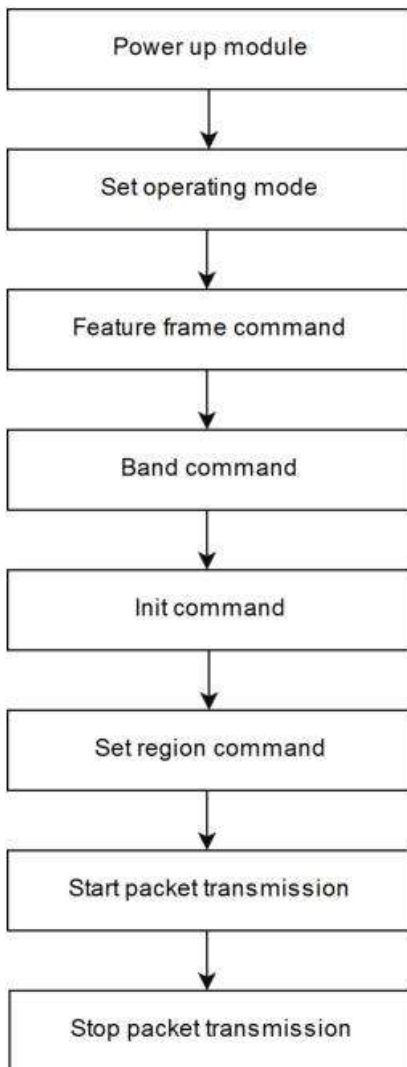


Figure 14-4: PER Mode

15 Wireless Configuration

The module can be configured wirelessly to join a specific AP (referred to as "auto-connect") or create an Access Point (referred to as "auto-create").

15.1 Configuration to Join a Specific AP

Flow 1: In this flow, an AP is first created in the module, to which a remote device connects and configures the module.

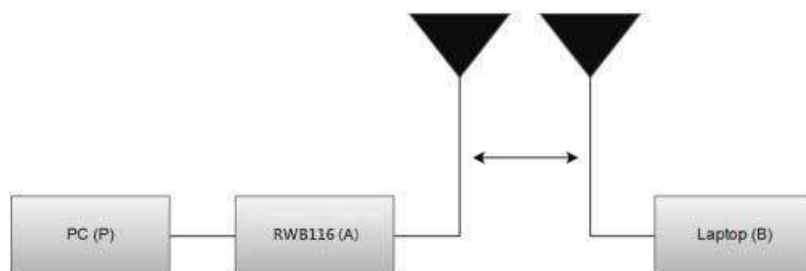


Figure 15-1: Setup for Configuration to Join a Specific AP – Flow 1

1. Connect a PC or Host to the module through any interface and power up the module.
2. Configure the module in order to act as an AP by issuing commands from PC (P) (refer APPENDIX A: Sample flow of commands for Wi-Fi over UART).
3. Connect a Laptop (B) to the created AP. Open the URL <http://<Module's IP address>> in the Laptop. For example, if the module is configured to have an IP of 192.168.2.5, then the URL will be <http://192.168.2.5>. Make sure the browser in the laptop does not have any proxies enabled. This will open the following index page:
4. Enter the login credentials username as "redpine" and password as "admin" and click on OK button to make changes in configurations .
5. In the opened web page , select "Client mode" and enter desired values.
 - a. SSID: This is the SSID of the AP to which the module should connect after configuration is over.
 - b. Band : Single band (2.4 GHz or 5.0 GHz) or dual band (2.4Ghz and 5GHz).
 - c. Tx Power: RF power for Tx (refer to the TxPower parameter in command Join) . Allowed values are 0, 1 and 2.
 - d. Setregion : This is used to configure the device to operate according to the regulations of its operating country.
 - e. Channel: Channel number at which the target AP is present. Refer to the [PER Mode](#) command section for more details.
 - f. Security Enable: This should match the security mode of the AP to which the module should connect.
 - g. IPversion: select IPv4 / IPv6 / Dual stack mode.
 - h. DHCP: If DHCP is selected, the module will work as a DHCPv4 client, otherwise, an IPv4 address should be hard coded in the web page.
 - i. IPv6 DHCP: If IPv6 DHCP is selected, the module will work as a DHCPv6 client, and otherwise, an IPv6 address should be hard coded in the web page.
 - j. Enable optional features like Dynamic webpages, HTTP client, SNMP client, DNS Client, PING,SSL Feature select bit maps based on features used. Refer [Set Operating Mode command](#) for further details.
6. Click on "Submit" button. The information is sent to the module and stored in its internal flash.

The module should now be power cycled or hard reset. It boots up and then automatically scans channels for the target AP and connects to it and gets an IP address. The module will send out two responses to the host, the first corresponds to the "Join" command and the second to the "Set IP Parameters" command. Note that once the module is restarted, no commands need to be given. The module automatically scans and joins the target AP, after which the stored configuration parameters can be retrieved using the command Get Information about Stored Configuration. If the auto-connect feature needs to be disabled, issue the command Enable auto-join to AP or Auto- create AP to the module.

Flow 2: In this flow, the module is connected to an AP. A remote device connects to the same AP and configures the module.

1. Connect a PC or Host to the module through any interface and power up the module.
2. Configure the module to become a client and connect to an AP, by issuing commands from PC (P) (refer APPENDIX A: Sample flow of commands for Wi-Fi over UART).

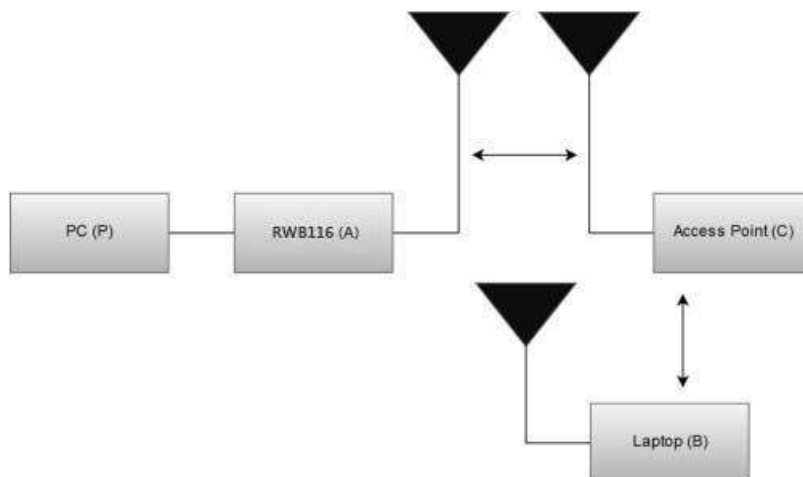


Figure 15-2: Setup for Configuration to Join a Specific AP – Flow 2

3. Connect a Laptop (B) to the same AP. Open the URL <http://<Module's IP address>> in the Laptop. For example, if the module is configured to have an IP of 192.168.2.5, then the URL will be <http://192.168.2.5>. Make sure the browser in the laptop does not have any proxies enabled. This will open the index page as shown in Flow 1 above. Enter the credentials such as username- "redpine" and password -"admin".
4. In the opened web page , select "Client mode" and enter desired values.
 - i. SSID: This is the SSID of the AP to which the module should connect after the configuration is over.
 - ii. Band: Single Band (2.4GHz or 5GHz) or Dual Band (2.4 GHz and 5.0GHz).
 - iii. Tx Power: RF power for Tx (refer to the TxPower parameter in command Join) . Allowed values are 0, 1 and 2.
 - iv. Setregion : This is used to configure the device to operate according to the regulations of its operating country.
 - v. Security Enable: This should match the security mode of the AP to which the module should connect.
 - vi. DHCP: If DHCP is selected, the module will work as a DHCP client, otherwise, an IP should be hard coded in the web page.
 - vii. Channel: Channel number at which the target AP is present. Refer to the [PER Mode](#) command section for more details.



Figure 15-3: Webpage Screenshot

- viii. Security Enable: Select if security mode is enable and fill the PSK, Security Type, encryption Type fields accordingly.
 - ix. IPconfiguration: Select the IP version (IPv4/IPv6/Both) and provide static IP details or enable DHCP.
5. Enable optional features like Dynamic WebPages, HTTP client, SNMP client, DNS Client, Feature select bit maps based on features used. Refer [operation mode command](#) for further details.
 6. Click on "Submit" button. The information is sent to the module and stored in its internal flash.
 7. The module should now be power cycled or hard reset. It boots up and then automatically scans channels for the target AP and connects to it and gets an IP address. The module will send out two responses to the Host, the first corresponds to the "Join" command and the second to the "Set IP Parameters" command. Note that once the module is restarted, no commands need to be given. The module automatically scans and joins the target AP, after which the stored configuration parameters can be retrieved using the command Get Information about Stored Configuration. If the auto-connect feature needs to be disabled, issue the command Enable auto-join to AP or Auto-create AP to the module.

15.2 Configuring to Create an AP

Flow 1:

In this flow, an AP is first created in the module, to which a remote device connects and configures the module.

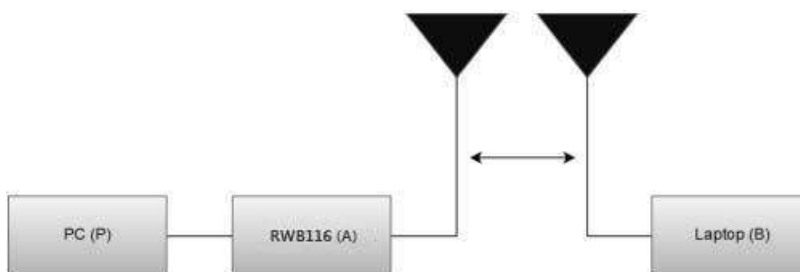


Figure 15-4: Setup for Configuration to Create an AP – Flow 1

1. Connect a PC or Host to the module through any interface and power up the module.
2. Configure the module to become an AP by issuing commands through PC (P). (refer APPENDIX A: Sample flow of commands for Wi-Fi over UART).
3. Connect a Laptop (B) to the created AP. Open the URL <http://<Module's IP address>> in the Laptop. For example, if the module is configured to have an IP of 192.168.2.5, then the URL will be <http://192.168.2.5>. Make sure the browser in the laptop does not have any proxies enabled. This will open the index page as shown in section 6.1 Flow 1 give the credentials username as "redpine" and password as "admin".
4. In the web page that opens, select "Access Point" mode and enter desired values.

- a. SSID: This is the SSID of the AP which will be created after configuration is over.
 - b. Band: Single Band (2.4GHz or 5.0GHz).
 - c. Tx Power: RF power for Tx (refer to the TxPower parameter in command Join) . Allowed values are 0, 1 and 2.
 - d. Setregion : This is used to configure the device to operate according to the regulations of its operating country.
 - e. Security Enable: PSK, security type, encryption type. This is to configure the security mode of the AP.
 - f. Channel: Channel number at which the target AP is present. Refer to the [PER Mode](#) command section for more details. Value of '0' is not allowed.
 - g. Security Type:WPA/WPA2/Mixed
 - h. Encryption type: Type of encryption(TKIP/AES).
 - i. IP, Mask, and Gateway: These parameters set the IP parameters of the AP.
 - j. Beacon Interval and DTIM interval: This to set the beacon parameters of the AP. For example, if beacon interval is 200 (msecs) and DTIM count is 3, the DTIM interval would be $2 \times 300 = 600$ msecs.
5. Enable optional features like aggregation Dynamic Webpages, HTTP client, SNMP client, DNS Client, Feature select bit maps based on features used. Refer [operation mode command](#) for further details.

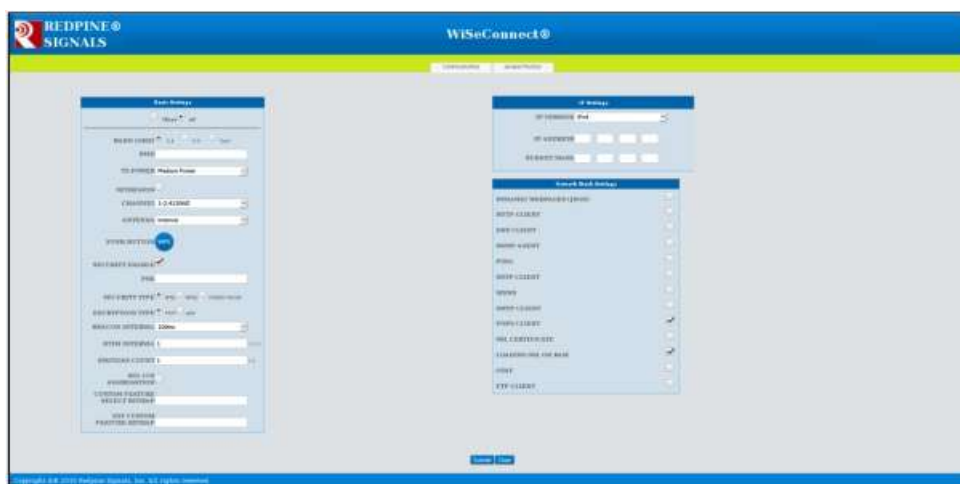
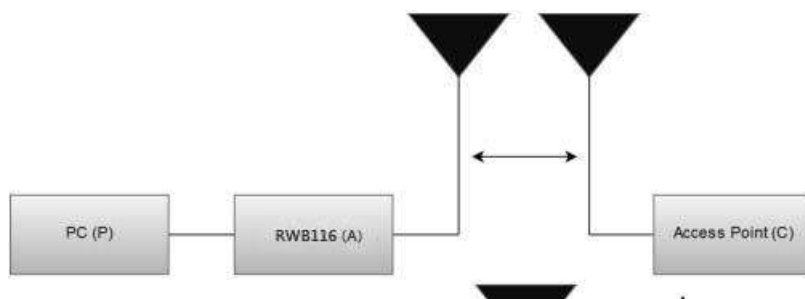


Figure 15-5: Webpage Screenshot

6. Click on "Submit" button. The information is sent to the module and stored in its internal flash.
7. The module should now be power cycled or hard reset. It boots up and then automatically creates an AP with the configured parameters. The module will send out two responses to the Host, the first corresponds to the "Set IP Parameters" command and the second to the "Join" command. Note that once the module is restarted, no commands need to be given. The module automatically and internally executes the commands to create an AP. The stored configuration parameters can be retrieved using the command Get Information about Stored Configuration. If the auto-connect feature needs to be disabled, issue the command Enable auto-join to AP or Auto-create AP to the module.

Flow 2:

In this flow, the module is connected to an AP. A remote device connects to the same AP and configures the module.



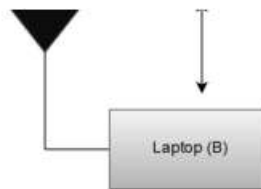


Figure 15-6: Setup for Configuration to Create an AP – Flow 2

1. Connect a PC or Host to the module through any interface and power up the module.
2. Configure the module to become a client and connect to an AP by issuing commands from the PC (P) (refer APPENDIX A: Sample flow of commands for Wi-Fi over UART).
3. Connect a Laptop (B) to the created AP. Open the URL <http://<Module's IP address>> in the Laptop. For example, if the module is configured to have an IP of 192.168.2.5, then the URL will be <http://192.168.2.5>. Make sure the browser in the laptop does not have any proxies enabled. Enter the credentials such as username -"redpine" and password- "admin".
4. In the web page that opens, select "Access Point" mode and enter desired values.
 - a. SSID: This is the SSID of the AP which will be created after configuration is over.
 - b. Band: Single band (2.4GHz) or Dual Band (5GHz).
 - c. Tx Power: RF power for Tx (refer to the TxPower parameter in command Join) . The allowed values are 0, 1 and 2.
 - d. Setregion : This is used to configure the device to operate according to the regulations of its operating country.
 - e. Security Enable: PSK, security type, encryption type: This is to configure the security mode of the AP.
 - f. Channel: Channel number at which the target AP is present. Refer to the [PER Mode](#) command section for more details. Value of '0' is not allowed.
 - g. IP, Mask, and Gateway: These parameters set the IP parameters of the AP.
 - h. Beacon Interval and DTIM count: This to set the beacon parameters of the AP. For example, if beacon interval is 200 (msecs) and DTIM count is 3, the DTIM interval would be 2x300=600 msecs.
5. Enable optional features like Aggregation, Dynamic WebPages, HTTP client, SNMP client, DNS Client, Feature select bit maps based on features used. Refer [operation mode command](#) for further details.



Figure 15-7: Webpage Screenshot

6. Click on "Submit" button. The information is sent to the module and stored in its internal flash. The module should now be power cycled or hard reset. It boots up and then automatically creates an AP with the configured parameters. The module will send out two responses to the Host, the first corresponds to the "Set IP Parameters" command and the second to the "Join" command. Note that once the module is restarted, no commands need to be given. The module automatically and internally executes the commands to create an AP. The stored configuration parameters can be retrieved using the command Get Information about Stored Configuration. If the auto-connect feature needs to be disabled, issue the command Enable auto-join to AP or Auto-create AP to the module.

15.3 Configuration to Join an AP with Enterprise Security

Flow 1: In this flow, an AP is first created in the module, to which a remote device connects and configures the module.

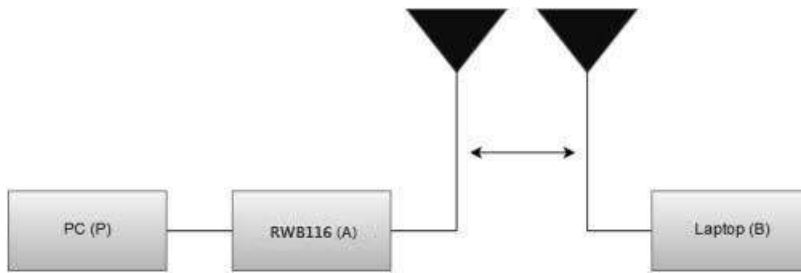


Figure 15-8: Setup for Configuration to Join an AP with Enterprise Security – Flow 1

1. Connect a PC or Host to the module through any interface and power up the module.
2. Configure the module to become an AP by issuing commands from PC (P) (refer APPENDIX A: Sample flow of commands for Wi-Fi over UART).
3. Connect a Laptop (B) to the created AP. Open the URL <http://<Module's IP address>> in the Laptop. For example, if the module was configured to have an IP of 192.168.2.5, then the URL will be <http://192.168.2.5>. Make sure the browser in the laptop does not have any proxies enabled. Enter the credentials such as username -"redpine" and password -"admin".
4. In the web page that opens, select "Enterprise" in security mode and enter desired values.
 - a. SSID: This is the SSID of the AP to which the module should connect after configuration is over.
 - b. Band: Single Band(2.4GHz or 5GHz) or Dual Band(5GHz and 2.4GHz).
 - c. Tx Power: RF power for Tx (refer to the TxPower parameter in command Join) . Allowed values are 0, 1 and 2.
 - d. Setregion : This is used to configure the device to operate according to the regulations of its operating country.
 - e. Security type : This should match the security mode of the AP to which the module should connect.
 - f. DHCP: If DHCP is selected, the module will work as a DHCP client, otherwise, an IP should be hard coded in the web page.
 - g. Channel: Channel number at which the target AP is present. Refer to the [PER Mode](#) command section for more details.
 - h. EAP: EAP method of the target AP.
 - i. Inner method: Inner method of the target AP.
 - j. User identity: User ID. This is present in the user configuration file in the radius sever.
 - k. Password: This should be same as the password in the user configuration file in the Radius Server for that User Identity.
5. Enable optional features like Aggregation, Dynamic WebPages, HTTP client, SNMP client, DNS Client, Feature select bit maps based on features used. Refer [operation mode command](#) for further details.

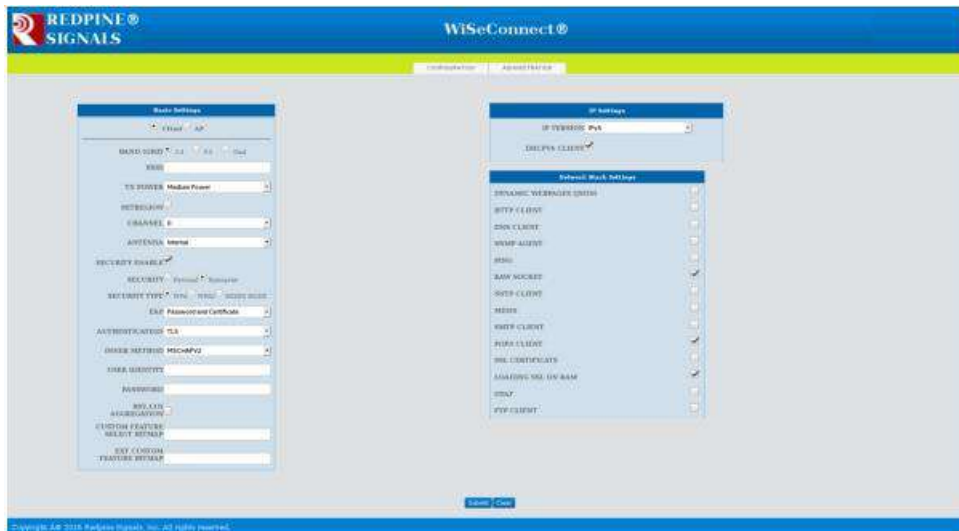


Figure 15-9: Webpage Screenshot

6. Click on "Submit" button. The information is sent to the module and stored in its internal flash.
7. The module should now be power cycled or hard reset. It boots up and then automatically scans channels for the target AP and connects to it and gets an IP address. The module will send out two responses to the Host, the first corresponds to the "Join" command and the second to the "Set IP Parameters" command. Note that once the module is restarted, no commands need to be given. The module automatically scans and joins the target AP after which the stored configuration parameters can be retrieved using the command Get Information about Stored Configuration. If the auto-connect feature needs to be disabled, issue the command Enable auto-join to AP or Auto-create AP to the module.

Flow 2:

In this flow, the module is connected to an AP. A remote device connects to the same AP and configures the module.

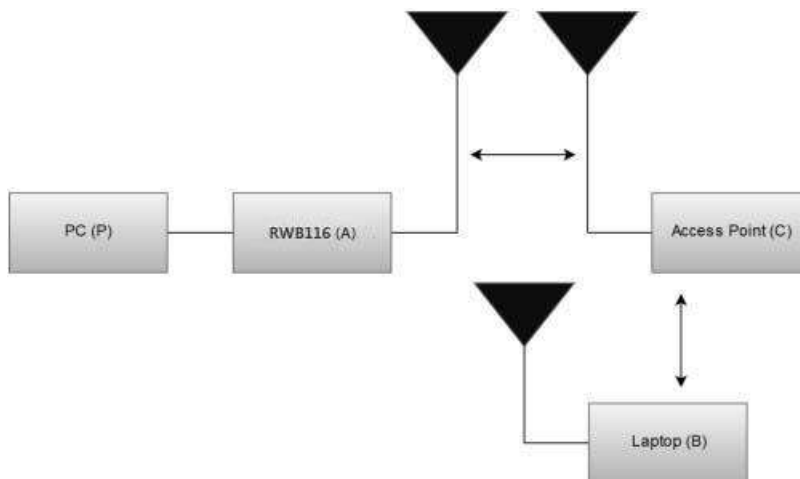


Figure 15-10: Setup for Configuration to Join an AP with Enterprise Security – Flow 2

1. Connect a PC or Host to the module through any interface and power up the module.
2. Configure the module to become a client and connect to an AP by issuing commands from PC (P) (refer APPENDIX A: Sample flow of commands for Wi-Fi over UART).
3. Connect a Laptop (B) to the same AP. Open the URL <http://<Module's IP address>> in the Laptop. For example, if the module is configured to have an IP of 192.168.2.5, then the URL will be <http://192.168.2.5>. Make sure the browser in the laptop does not have any proxies enabled. Enter the credentials such as username- "**redpine**" and password- "**admin**".

4. In the web page that opens, select "Client mode" and enter desired values.
 - a. SSID: This is the SSID of the AP to which the module should connect after configuration is over.
 - b. Data rate: Physical data rate (refer to the [PER Mode](#) command section for more details).
 - c. Tx Power: RF power for Tx (refer to the TxPower parameter in command Join) . Allowed values are 0, 1 and 2.
 - d. Security mode and PSK: This should match the security mode of the AP to which the module should connect.
 - e. DHCP: If DHCP is selected, the module will work as a DHCP client, otherwise, an IP should be hard coded in the web page.
 - f. Channel: Channel number at which the target AP is present. Refer to the [PER Mode](#) command section for more details.
 - g. EAP: EAP method of the target AP.
 - h. Inner method: Inner method of the target AP.
 - i. User identity: User ID. This is present in the user configuration file in the radius sever.
 - j. Password: This should be same as the password in the user configuration file in the Radius Server for that User Identity.
5. Enable optional features like Aggregation, Dynamic WebPages, HTTP client, SNMP client, DNS Client and Feature select bit maps based on features used. Refer [operation mode command](#) for further details.

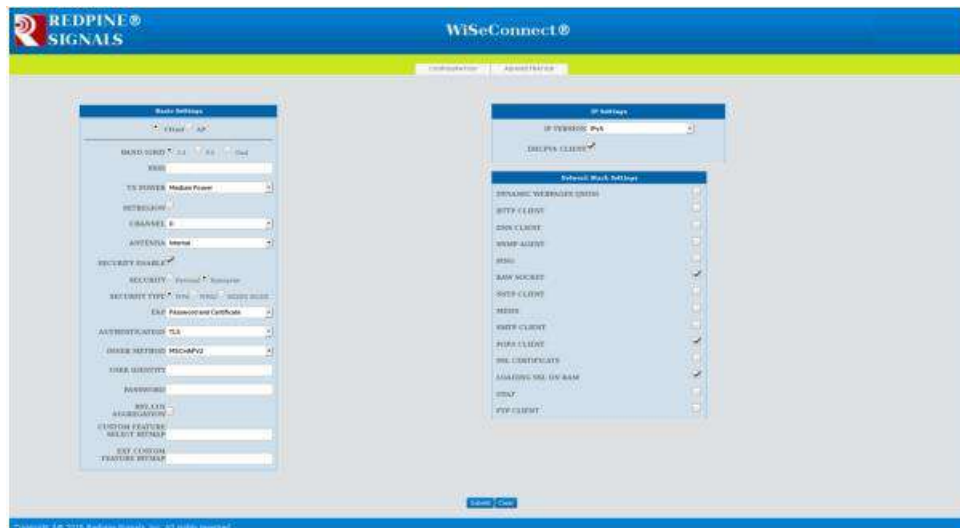
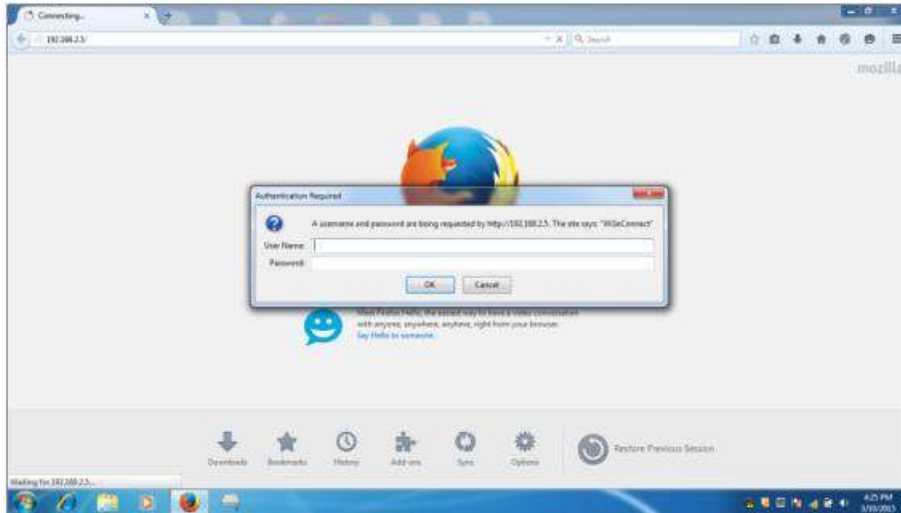


Figure 15-11: Webpage Screenshot

6. Click on "Submit" button. The information is sent to the module and stored in its internal flash.
7. The module should now be power cycled or hard reset. It boots up and then automatically scans channels for the target AP and connects to it and gets an IP address. The module will send out two responses to the Host, the first corresponds to the "Join" command and the second to the "Set IP Parameters" command. Note that once the module is restarted, no commands need to be given. The module automatically scans and joins the target AP, after which the stored configuration parameters can be retrieved using the command Get Information about Stored Configuration. If the auto-connect feature needs to be disabled, issue the command Enable auto-join to AP or Auto-create AP to the module.

16 Wireless Firmware Upgrade

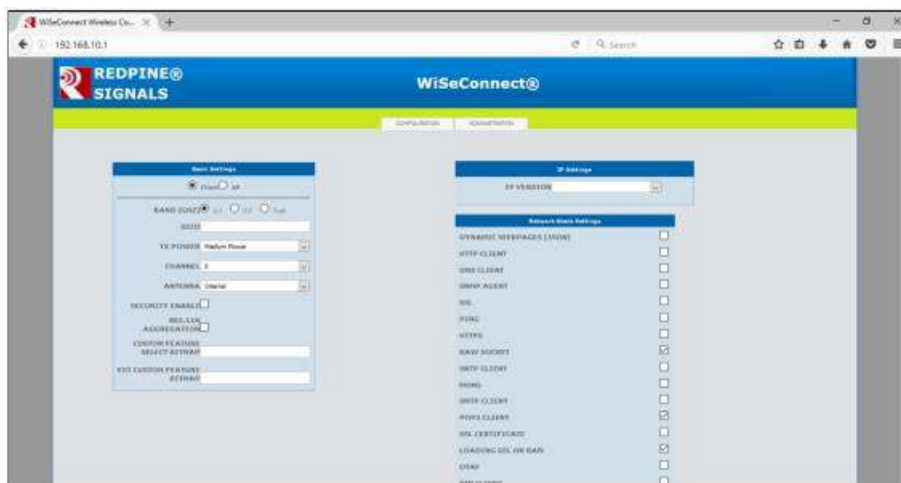
The firmware of the module can be upgraded wirelessly through web server. To upgrade the firmware wirelessly user has to open configuration page. In the given example, module is in WLAN client mode. Some other host and module connected to an AP. Module got IP 192.168.2.5. When opened the module's webpage on the other host, it asks for the login credentials. The credentials for Username should be given as "redpine" and password should be given as "admin" to open the modules configuration page.



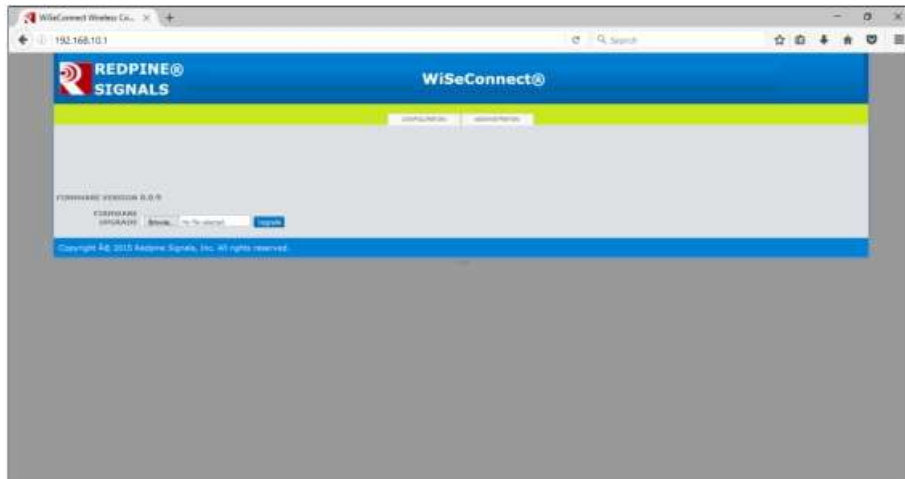
After giving the login credentials, the module's configuration page is opened as shown in the figure below.

Note:

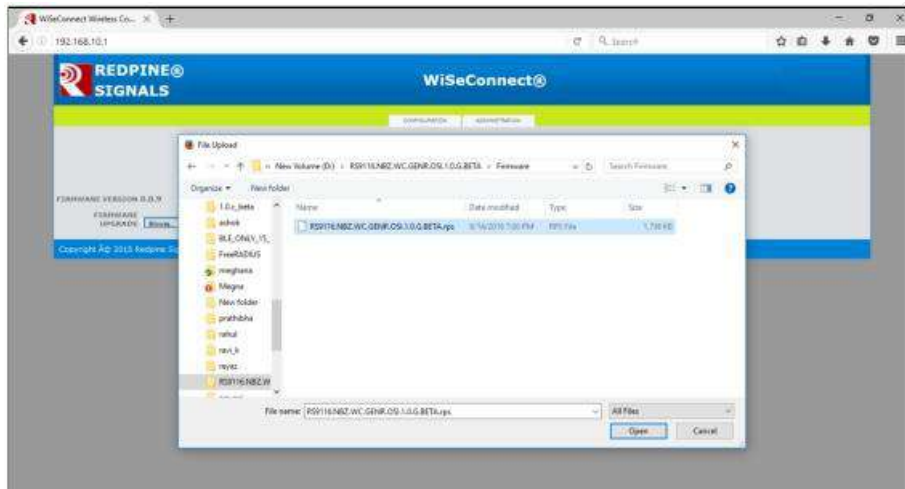
'Authentication Required' pop up window will only appear if BIT[23] in Custom feature bitmap is enabled.



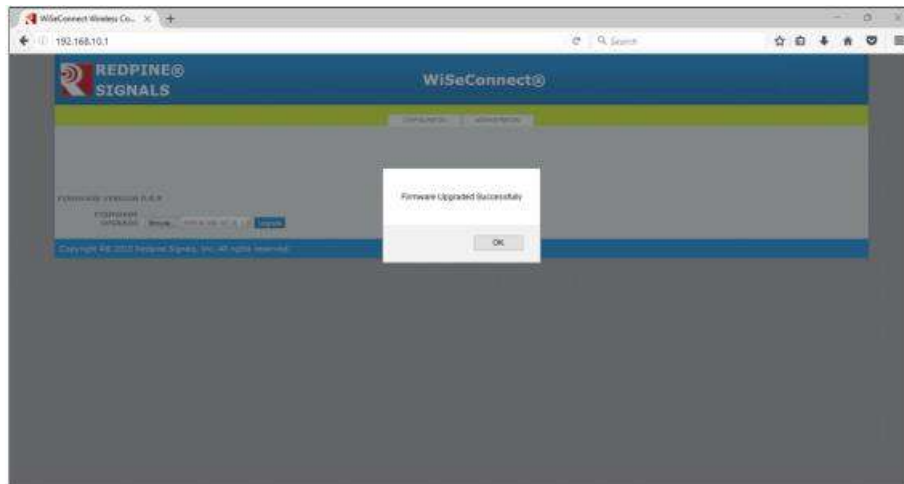
Click on ADMINISTRATION button to go to the wireless firmware up-gradation page.



Browse for the rps file(RS9116.WC.GEN.OSI.x_x_x.rps) on the host to upgrade the module firmware, and click on UPGRADE, as shown in the below screen shot.



Once the remote peer has pressed upgrade button on the webpage, if module is connected through UART or USB- CDC interface host will get asynchronous notification as "AT+RSI_FWUPREQ". So host has to issue AT+RSI_FWUPOK. For SPI and USB interfaces, an asynchronous message with response id 0x59 is sent to host and then host has to respond with request id 0x59 (through API) . If host failed to reply within specified timeout(~20 seconds), request will expire and upgradation process terminates. After the firmware upgraded successful, one popup will come on remote peer screen to intimate the process complete . Similarly asynchronous success message(for UART/USB-CDC "AT+RSI_FWUPSUCCESS" and for SPI/USB response id 0x5A) will be forward to host connected with the module.



Note:

1. Wireless firmware upgradation is supported only for the latest versions of Firefox and Google chrome.
2. When user clicks on upgrade button, module starts erasing flash for storing image. This may take few seconds, then up gradation automatically will start.
3. After wireless firmware upgrade, after reboot user need to wait for few minutes (~ 1.5 minutes) so that bootloader will copy upgraded image into actual flash location.

17 Wake on Wireless

Whenever RYWB116 want to send packets to host, it will de-assert ULP_GPIO_6 pin.

In UART mode following is the sequence:

1. RYWB116 de-assert ULP_GPIO_6 pin when data pending from module and polls for ack (ULP_GPIO_5 pin high) before starting the transfer.
2. After recognizing ULP_GPIO_6 pin de-asserted, host should ack the request from module by asserting ULP_GPIO_5 pin and poll ULP_GPIO_6 pin for module confirmation (ULP_GPIO_6 high).
3. After recognizing ack (ULP_GPIO_5 pin high) from host, module will assert ULP_GPIO_6 pin and start transfer.
4. Once ULP_GPIO_6 is asserted, host should de-assert ULP_GPIO_5 pin and receive the packet from module.

Note:

Host required to set BIT(11) in custom feature bit map of opermode command to enable this feature in UART mode.

In other host interface modes, after completion of packet transfer to host, RYWB116 module will assert the ULP_GPIO_6 pin automatically.

18 Appendix A: Sample flow of commands for Wi-Fi over UART

Sample command sequences are shown below for operating the module in different modes.

18.1 Operate in Wi-Fi Direct Mode to associate to a Wi-Fi Direct Phone

`at+rsi_opermode=1,0,20,0\r\n`

This command sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_wfd=0,directrp,6,re yax,12345678\r\n`

This command starts the Wi-Fi Direct mode of the module. The first parameter in this command is called the Group_Owner_Intent. It gives the willingness of the module to become a Group Owner. It has been set to the lowest value of 0 in this case.

The module responds with "OK".

After issuing this command, the module starts scanning for Wi-Fi Direct devices, and reports any that are found through the asynchronous message AT+RSI_WFDDEV

`at+rsi_join=AndroidP2P,0,2,0\r\n`

This command initiates the association operation between the module and the Wi-Fi Direct phone.

The device name of the Wi-Fi Direct phone in this example is "AndroidP2P8031".

It is assumed that the phone has become a Group Owner.

`at+rsi_ipconf=1\r\n`

The module will acquire an IP address from the phone. A ping can be issued from the phone to the module.

For exchanging data between the module and the Wi-Fi Direct Phone, an application may be written by the user at the mobile phone to open sockets and transfer or receive data.

Sockets at the module can be created by using one of the socket related commands.

For example,

`at+rsi_ltcp=5001,5,0\r\n`

Opens a server TCP socket inside the module with port number 5001 with tos(type of service) type 0 and max clients support count as '5'

To send a test string "This is a test" from the module to the remote node, issue the below command

`at+rsi_snd=2,14,0,0,Thisisatest\r\n`

If the remote node sends data, the module receives the data and transfers to the Host with a AT+RSI_READ message. The first parameter (value 2) is the socket_handle of the socket in the module.

Refer to the section for at+rsi_ltcp for more details.

18.2 Create an Access Point

`at+rsi_opermode=6,1,48,0\r\n`

This command sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_ipconf=0,192.168.50.1,255.255.255.0,192.168.50.1\r\n`

This command can be used optionally in this flow to configure the IP (192.168.50.1 in this example) of the AP. If this command is not issued, a default IP of 192.168.100.76 will be used.

`at+rsi_apconf=1,REYAX,2,2,12345678,300,2,4\r\n`

This command will configure the SSID of the AP to "REYAX" and password will be set to "12345678".

`at+rsi_join=REYAX,0,2\r\n`

This command will create the Access Point with SSID re yax where xy is a pair of alphanumeric character.

A client device (Named "Device A" in this example) can now associate to the AP, open sockets and transfer data.

For example,

`at+rsi_ltcp=5001,5,0\r\n`

Opens a server TCP socket inside the module with port number 5001 with tos (type of service) type 0 and max clients support count as 5.

A client socket at the remote node (Device A) can connect to the server socket.

To send a test string "This is a test" from the module to the remote node, issue the below command

`at+rsi_snd=1,14,0,0,Thisisatest\r\n`

If the remote node (Device A) sends data, the module receives the data and transfers to the Host with a AT+RSI_READ message

Another client (Named "Device B" in this example) can also connect to the Access Point in the module and data transfer can be executed between Device A and Device B through the AP. A maximum of 4 clients are supported.

18.3 Associate to an Access Point (with WPA2-PSK security) as a client

`at+rsi_opermode=0,1,4,0\r\n`

This command sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_scan=0\r\n`

This command scans for Aps and reports the Aps found.

Note:

After a scan, if the user want to join an AP as enterprise client then user need to issue a soft reset first and then follow the flow of commands as in "Associate to an Enterprise Security enabled Access Point as a client"

`at+rsi_psk=1,12345678\r\n`

This command configures the PSK to be used to associate to the Access Point.

`at+rsi_join=Test_AP,0,2,2\r\n`

This command associates the module to the AP.

It is assumed that the SSID of the AP is Test_AP with WPA2-PSK security key of 12345678.

`at+rsi_ipconf=1,0,0,0\r\n`

This configures the IP address of the module in DHCP mode.

`at+rsi_dnserver=1,0,0\r\n`

Optional command to provide the IP address of a DNS server.

`at+rsi_dnsget=<domain_name>,1\r\n`

Optional command to resolve IP of a given domain name.

`at+rsi_ltcp=5001,5,0\r\n`

Opens a server TCP socket inside the module with port number 5001 with tos(type of service) type 0 and max clients support count as 5.

Now connect another client (called "Device A" in this example) to the same Access Point and open a client socket to bind to the module's socket.

To send a test string "This is a test" from the module to the remote node, issue the below command

`at+rsi_snd=1,14,0,0,Thisisatest\r\n`

If the remote node (Device A) sends data, the module receives the data and transfers to the Host with a AT+RSI_READ message

18.4 Associate to an Access Point (with WEP security) as a client

`at+rsi_opermode=0,2,4,0\r\n`

This command sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_scan=0\r\n`

This command scans for APs and reports the APs found.

`at+rsi_wepkey=0,ABCDE12345,0,0,0\r\n`

This command configures the PSK to be used to associate to an Access Point.

`at+rsi_join=Test_AP,0,2,3\r\n`

This command associates the module to the AP.

`at+rsi_ipconf=1,0,0,0\r\n`

This configures the IP address of the module in DHCP mode.

`at+rsi_ltcp=5001,5,0\r\n`

opens a server TCP socket inside the module with port number 5001 with tos(type of service) type 0 and max clients support count as 5.

Now connect another client (called "Device A" in this example) to the same Access Point and open a client socket to bind to the module's socket.

To send a test string "This is a test" from the module to the remote node, issue the below command

`at+rsi_snd=1,14,0,0,Thisistest\r\n`

If the remote node (Device A) sends data, the module receives the data and transfers to the Host with a AT+RSI_READ message

18.5 Associate to a WPS enabled Access Point

`at+rsi_opermode=0,2,4,0\r\n`

This command sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_scan=0\r\n`

This command scans for available Aps and reports the Aps found.

`at+rsi_join=,0,2\r\n`

This command associates the module to the AP using WPS push button method. Note that, we have to send null in place of ssid .

`at+rsi_ipconf=1,0,0,0\r\n`

This command configures the IP address of the module in DHCP mode.

`at+rsi_ltcp=5001,5,0\r\n`

opens a server TCP socket inside the module with port number 5001 with tos (type of service) type 0 and max clients support count as 5.

Now connect another client (called "Device A" in this example) to the same Access Point and open a client socket to bind to the module's socket.

To send a test string "This is a test" from the module to the remote node, issue the below command

`at+rsi_snd=1,14,0,0,Thisistest\r\n`

If the remote node (Device A) sends data, the module receives the data and transfers to the Host with a AT+RSI_READ message.

18.6 Associate to an Enterprise Security enabled Access Point as a client

The example demonstrates the flow for EAP-TLS mode.

`at+rsi_opermode=2,0,4,0\r\n`

This sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_eap=TLS,MSCHAPV2,user1,password1\r\n`

This command sets the Enterprise mode.

`at+rsi_scan=0\r\n`

This command scans for Aps and reports the Aps found.

Note

After a scan, if the user want to join an AP with WPA2-AES PSK then user need to issue a soft reset first and then follow the flow of commands as in “Associate to an Access Point (with WPA2-PSK security) as a client”

`at+rsi_cert=1,cert_len,key_password,<TLScertificate>\r\n`

This command provides the TLS certificate to the module

`at+rsi_join=Test_AP,0,2,4\r\n`

This command associates the module to the AP. It is assumed that the SSID of the AP is Test_AP.

`at+rsi_ipconf=1,0,0,0\r\n`

This command configures the IP address of the module in DHCP mode.

`at+rsi_tcp=5001,5,0\r\n`

opens a server TCP socket inside the module with port number 5001 with tos(type of service) type 0 and max clients support count as 5.

Now connect another client (called “Device A” in this example) to the same Access Point and open a client socket to bind to the module’s socket.

To send a test string “This is a test” from the module to the remote node (Device A), issue the below command

`at+rsi_snd=1,14,0,0,Thisistest\r\n`

If the remote node (Device A) sends data, the module sends the received data with a AT+RSI_READ message to the Host.

18.7 PER Mode command flow in Burst mode

`at+rsi_opermode=8\r\n`

This command sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_feat_frame=0,1,0,0,1,49\r\n`

This command sets the correct RF type and path

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_per=1,18,139,30,0,1,0,0,0,0\r\n`

This command sends the packets in burst mode in channel number 1, with packet length 30, with power 18, with data rate 139.

18.8 PER Mode command flow in Continuous mode

`at+rsi_opermode=8\r\n`

This command sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_feat_frame=0,1,0,0,1,49\r\n`

This command sets the correct RF type and path

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_per=1,18,139,30,0,1,0,0,0,0\r\n`

Before starting Continuous Wave mode, it is required to start Burst mode with power and channel values which is intended to be used in Continuous Wave mode

`at+rsi_per=1,18,139,30,1,1,0,0,0,0\r\n`

This command sends the packets in continuous mode in channel number 1, with packet length 30, with power 18, with data rate 139.

`at+rsi_per=0\r\n`

To stop transmission.

18.9 Enabling BG scan in open mode as a client

`at+rsi_opermode=0,1,4,0\r\n`

This command sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_scan=0\r\n`

This command scans for available APs in the channels mentioned in channel bitmap and reports the APs found.

`at+rsi_join=test,0,2,0\r\n`

This command associates the module to the AP in open mode.

`at+rsi_bgscan=1,1,10,4,10,15,20,1\r\n`

This command enables the back ground scan functionality in module.

Here instant bgscan is enabled hence module will send probe requests in the air on to the channels mentioned in the channel bitmap and results will go to host.

`at+rsi_ipconf=1,0,0,0\r\n`

This command configures the IP address of the module in DHCP mode.

18.10 Enabling Roaming in open mode as a client

`at+rsi_opermode=0,1,4,0\r\n`

This command sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_scan=0\r\n`

This command scans for available APs in the channels mentioned in channel bitmap and reports the APs found.

`at+rsi_join=test,0,2,0\r\n`

This command associates the module to the AP in open mode.

`at+rsi_bgscan=1,1,10,4,10,15,20,1\r\n`

This command enables the back ground scan functionality in module.

Here instant bgscan is enabled hence module will send probe requests in the air and results will go to host and in background scan will be continued based upon the parameters given in the command.

`at+rsi_roam_params=1,5,2\r\n`

This command enables roaming in module.

`at+rsi_ipconf=1,0,0,0\r\n`

This command configures the IP address of the module in DHCP mode.

18.11 Enabling WMM PS in open mode as a client

`at+rsi_opermode=0,1,4,0\r\n`

This command sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_scan=6,test\r\n`

This command scans for available AP in the given channels with the given SSID and reports. if the is AP found.

`at+rsi_wmm_config=1,0,0,1\r\n`

This command enables the WMM feature in the module.

`at+rsi_join=test,0,2,0\r\n`

This command associates the module to the AP in open mode.

`at+rsi_pwmode=1\r\n`

This command configures the power save mode 1 in the module.

`at+rsi_ipconf=1,0,0,0\r\n`

This command configures the IP address of the module in DHCP mode.

18.12 Open a multicast IPv4 socket in client mode

`at+rsi_opermode=0,1,4,0\r\n`

This command sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_scan=0\r\n`

This command scans for APs and reports the APs found.

`at+rsi_join=Test_AP,0,2,0\r\n`

This command associates the module to the AP.

`at+rsi_ipconf=1,0,0,0\r\n`

This configures the IP address of the module in DHCP mode.

`at+rsi_multicast=1,239.0.0.0\r\n`

To join IPv4 multicast group with address 239.0.0.0.

`at+rsi_ludp=5001\r\n`

To open ludp socket with port number 5001.

`at+rsi_multicast=0,239.0.0.0\r\n`

To leave multicast group with address 239.0.0.0.

18.13 Open a multicast IPv6 socket in client mode

`at+rsi_opermode=0,1,8,0\r\n`

This command sets the operating mode of the module.

`at+rsi_band=0\r\n`

This command sets the operating band of the module.

`at+rsi_init\r\n`

This command initializes the module.

`at+rsi_scan=0\r\n`

This command scans for APs and reports the APs found.

`at+rsi_join=Test_AP,0,2,0\r\n`

This command associates the module to the AP.

`at+rsi_ipconf=1,0,0,0\r\n`

This command configures the IP address of the module in DHCP mode.

`at+rsi_ltcp=5001,2,0,1,0\r\n`

Opens a SSL server socket inside the module with port number 5001 with tos (type of service) type 0, with maximum 2 SSL clients support and with all SSL ciphers support.

To send a test string “This is a test” from the module to the remote node (Device A), issue the below command
`at+rsi_snd=1,14,0,0,This is a test\r\n`
If the remote node (Device A) sends data, the module sends the received data with an AT+RSI_READ message to the Host.