

# **RS9116W Wi-Fi AT Command Programming Reference Manual**

Version 2.0

10/21/2020

## Table of Contents

|          |                                                           |           |
|----------|-----------------------------------------------------------|-----------|
| <b>1</b> | <b>Architecture Overview .....</b>                        | <b>6</b>  |
| 1.1      | Overview.....                                             | 6         |
| 1.2      | WLAN Architecture .....                                   | 8         |
| <b>2</b> | <b>Bootloader .....</b>                                   | <b>10</b> |
| <b>3</b> | <b>Host Interfaces .....</b>                              | <b>27</b> |
| 3.1      | UART Interface .....                                      | 27        |
| <b>4</b> | <b>AT Command Mode.....</b>                               | <b>29</b> |
| <b>5</b> | <b>WLAN Commands .....</b>                                | <b>30</b> |
| 5.1      | Set Operating Mode.....                                   | 30        |
| 5.2      | Band .....                                                | 46        |
| 5.3      | WLAN Config .....                                         | 47        |
| 5.4      | Set MAC Address .....                                     | 48        |
| 5.5      | Init.....                                                 | 49        |
| 5.6      | User Configurable Gain Table .....                        | 50        |
| 5.7      | PER Mode .....                                            | 54        |
| 5.8      | Configure AP Mode .....                                   | 60        |
| 5.9      | WPS PIN Method.....                                       | 62        |
| 5.10     | Scan .....                                                | 63        |
| 5.11     | Join .....                                                | 68        |
| 5.12     | Request Timeout .....                                     | 72        |
| 5.13     | Re-Join .....                                             | 72        |
| 5.14     | WMM PS.....                                               | 73        |
| 5.15     | Set Sleep Timer .....                                     | 74        |
| 5.16     | Power Mode.....                                           | 75        |
| 5.16.1   | Power Save Operation.....                                 | 76        |
| 5.16.2   | Power Save Mode 1 .....                                   | 77        |
| 5.16.3   | Power Save Mode 2 .....                                   | 78        |
| 5.16.4   | Power Save Mode 3 .....                                   | 79        |
| 5.16.5   | Power Save Mode 8 .....                                   | 80        |
| 5.16.6   | Power Save Mode 9 .....                                   | 81        |
| 5.17     | PSK/PMK.....                                              | 82        |
| 5.18     | Set WEP Keys .....                                        | 84        |
| 5.19     | Set WEP Authentication Mode.....                          | 85        |
| 5.20     | Set EAP Configuration.....                                | 85        |
| 5.21     | Set Certificate .....                                     | 86        |
| 5.22     | Set Certificate with Indices.....                         | 88        |
| 5.23     | Disassociate .....                                        | 91        |
| 5.24     | Set IP Parameters .....                                   | 92        |
| 5.25     | IP Change Notification .....                              | 93        |
| 5.26     | Set IPv6 Parameters.....                                  | 94        |
| 5.27     | SNMP .....                                                | 95        |
| 5.28     | SNMP Set.....                                             | 96        |
| 5.29     | SNMP Get Response .....                                   | 97        |
| 5.30     | SNMP Get Next Response .....                              | 101       |
| 5.31     | SNMP Trap.....                                            | 102       |
| 5.32     | Open Socket.....                                          | 105       |
| 5.33     | TCP Socket Connection Established .....                   | 112       |
| 5.34     | Query a Listening Socket's Active Connection Status ..... | 112       |
| 5.35     | Close Socket.....                                         | 113       |
| 5.36     | Send Data.....                                            | 114       |
| 5.36.1   | Send Data in AT mode.....                                 | 114       |
| 5.37     | Read Data.....                                            | 118       |
| 5.37.1   | Read Data in AT mode .....                                | 118       |
| 5.37.2   | Receive Data on Socket .....                              | 120       |
| 5.37.3   | Receive Data on Socket in AT mode.....                    | 120       |
| 5.38     | Wireless Firmware Upgrade .....                           | 121       |
| 5.39     | Background Scan (BG scan) .....                           | 122       |
| 5.40     | Roam Parameters.....                                      | 124       |
| 5.41     | HT Caps.....                                              | 125       |
| 5.42     | DNS Server.....                                           | 126       |

|        |                                                              |     |
|--------|--------------------------------------------------------------|-----|
| 5.43   | DNS Resolution .....                                         | 127 |
| 5.44   | DNS UPDATE.....                                              | 128 |
| 5.45   | HTTP Get.....                                                | 129 |
| 5.46   | HTTP Post .....                                              | 132 |
| 5.47   | HTTP Post Data.....                                          | 135 |
| 5.48   | HTTP Put.....                                                | 136 |
| 5.49   | DFS Client (802.11h) .....                                   | 138 |
| 5.50   | Query Firmware Version .....                                 | 139 |
| 5.51   | Query RSSI Value .....                                       | 139 |
| 5.52   | Query MAC Address.....                                       | 140 |
| 5.53   | Query Network Parameters .....                               | 141 |
| 5.54   | Soft Reset.....                                              | 143 |
| 5.55   | Set/Reset Multicast Filter.....                              | 144 |
| 5.56   | Join or Leave Multicast Group .....                          | 144 |
| 5.57   | Ping from Module.....                                        | 146 |
| 5.58   | Loading the Webpage.....                                     | 147 |
| 5.58.1 | Loading the static webpage .....                             | 147 |
| 5.58.2 | Loading the dynamic webpage (Create JSON).....               | 148 |
| 5.59   | Clearing the Webpage .....                                   | 149 |
| 5.59.1 | Erasing the webpage .....                                    | 149 |
| 5.59.2 | Erasing the JSON Data.....                                   | 149 |
| 5.59.3 | Clear all the Webpages.....                                  | 150 |
| 5.60   | Loading of Store Configuration Page.....                     | 151 |
| 5.61   | Web Page Bypass .....                                        | 151 |
| 5.62   | Set Region .....                                             | 152 |
| 5.63   | Set Region of Access Point .....                             | 154 |
| 5.64   | PER Statistics of the Module .....                           | 156 |
| 5.65   | Remote Socket Closure.....                                   | 157 |
| 5.66   | Bytes Transmitted Count on Socket .....                      | 158 |
| 5.67   | Debug Prints on UART .....                                   | 158 |
| 5.68   | Asynchronous Message for Connection State Notification ..... | 159 |
| 5.69   | TSF Synchronization Packet.....                              | 161 |
| 5.70   | Station Connect/Disconnect Indication In AP Mode.....        | 161 |
| 5.71   | Transparent Mode Command .....                               | 162 |
| 5.72   | UART Hardware Flow control .....                             | 163 |
| 5.73   | Socket Configuration Parameters .....                        | 164 |
| 5.74   | RF Current Mode Configuration.....                           | 165 |
| 5.75   | Trigger Auto Configuration.....                              | 166 |
| 5.76   | HTTP Abort.....                                              | 167 |
| 5.77   | HTTP Server Credentials from Host .....                      | 167 |
| 5.78   | FTP Client.....                                              | 168 |
| 5.79   | SNTP Client .....                                            | 171 |
| 5.80   | MDNS and DNS-SD .....                                        | 173 |
| 5.81   | SMTP Client.....                                             | 175 |
| 5.82   | POP3 Client.....                                             | 177 |
| 5.83   | IAP Init .....                                               | 179 |
| 5.84   | Load MFI IE .....                                            | 180 |
| 5.85   | Over the Air Firmware Upgradation .....                      | 180 |
| 5.86   | Read MFI Authentication Certificate .....                    | 181 |
| 5.87   | Generate MFI Authentication Signature.....                   | 182 |
| 5.88   | Storing Configuration Parameters.....                        | 182 |
| 5.88.1 | Storing Configuration Parameters in Client mode .....        | 182 |
| 5.88.2 | Store Configuration in Flash Memory .....                    | 182 |
| 5.88.3 | Enable auto-join to AP or Auto-create AP.....                | 183 |
| 5.88.4 | Get Information about Stored Configuration .....             | 183 |
| 5.88.5 | Store configuration from User .....                          | 184 |
| 5.89   | Store Configuration Structure Parameters.....                | 186 |
| 5.90   | WLAN Statistics .....                                        | 198 |
| 5.91   | Set RTC Time .....                                           | 199 |
| 5.92   | Get RTC Time.....                                            | 200 |
| 5.93   | Feature Frame .....                                          | 201 |
| 5.94   | Get RAM Dump .....                                           | 202 |
| 5.95   | Configure TX RX Buffer Ratio.....                            | 203 |
| 5.96   | Antenna Selection.....                                       | 204 |
| 5.97   | Band .....                                                   | 205 |
| 5.98   | MQTT Client .....                                            | 205 |

|           |                                                      |            |
|-----------|------------------------------------------------------|------------|
| <b>6</b>  | <b>WLAN Error Codes .....</b>                        | <b>213</b> |
| <b>7</b>  | <b>Wireless Features and Mechanisms .....</b>        | <b>221</b> |
| 7.1       | Connect Application .....                            | 221        |
| 7.1.1     | Description .....                                    | 221        |
| 7.1.2     | Application Steps .....                              | 221        |
| 7.2       | Firmware Upgrade Mechanisms .....                    | 224        |
| 7.3       | Power Save Modes .....                               | 227        |
| 7.3.1     | Power Save .....                                     | 227        |
| 7.3.2     | Power Save Operations .....                          | 227        |
| 7.4       | Wake on Wireless .....                               | 234        |
| 7.4.1     | Active High Interrupt Mode .....                     | 234        |
| 7.4.2     | Active Low Interrupt Mode .....                      | 235        |
| <b>8</b>  | <b>WLAN AT Command Changes/Enhancements .....</b>    | <b>238</b> |
| <b>9</b>  | <b>Revision History .....</b>                        | <b>239</b> |
| <b>10</b> | <b>Appendix A: Wi-Fi Operation Modes .....</b>       | <b>243</b> |
| <b>11</b> | <b>Appendix B: Wireless Configuration .....</b>      | <b>247</b> |
| <b>12</b> | <b>Appendix C: Sample AT Command Sequences .....</b> | <b>256</b> |

## About this Document

This document is about the RS9116 WiSeConnect architecture, boot-loader features, different command modes, and supported host interfaces.

It lists and describes AT commands to operate the RS9116W-WiSeConnect Module Family for Wi-Fi mode. Wi-Fi AT commands are provided along with the command parameters and their valid values with expected responses from the modules.

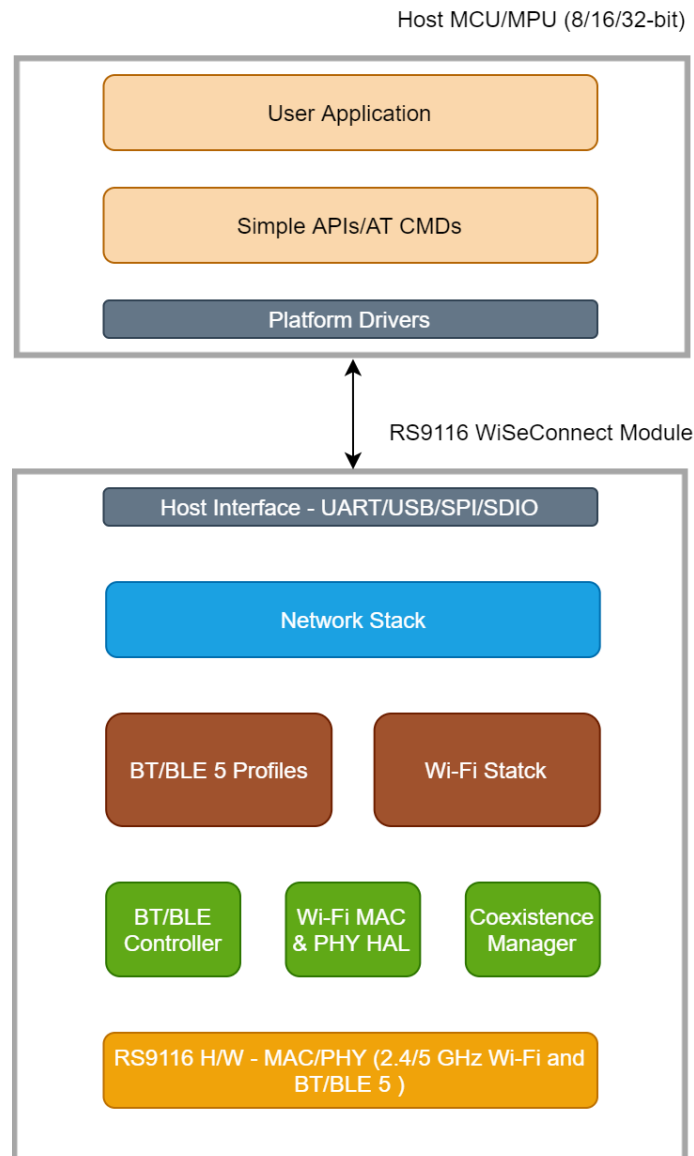
This document explains implementing application software on the Host to control and operate the RS9116W module.

# 1 Architecture Overview

## 1.1 Overview

RS9116 WiSeConnect module includes Wi-Fi, TCP/IP and BT 5 stacks embedded in its internal flash memory. This module requires a separate application processor which acts as a host.

Host can communicate with RS9116 module using one of the interfaces listed below.



**Figure 1: RS9116W Block Diagram**

RS9116 supports following interfaces for interacting with host.

- SPI
- UART
- USB
- SDIO

**Note:**

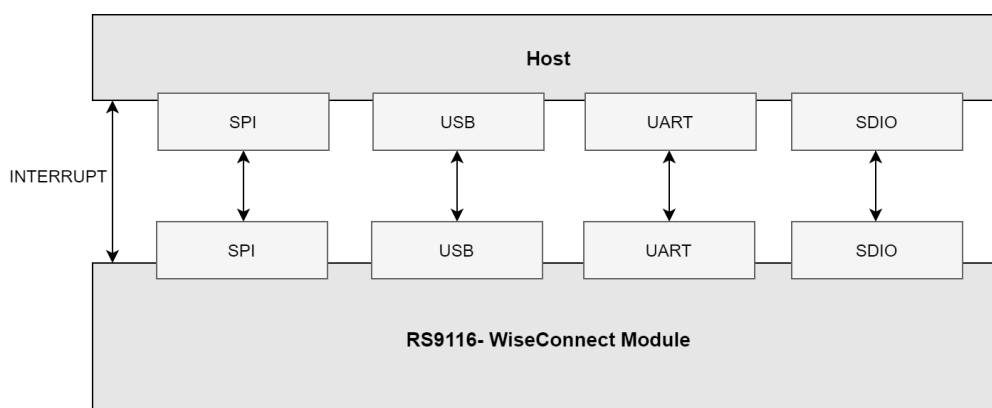
USB and SDIO interfaces are currently not supported.

Host can use either Simple APIs or AT Commands for configuring the module.

There are two modes for host interaction:

- **AT Mode (ASCII)**  
In this mode, host should use AT Commands for interacting with RS9116 Module. This mode can be used only with UART or USB-CDC interfaces. Section '**AT Command Mode**' provides more details about this mode. Section '**WLAN Commands**' describes all commands and other required details.
- **Binary Mode**  
In this mode, host should use Binary Commands for interacting with RS9116 Module. This mode can be used with UART, SPI, USB and SDIO interfaces. Section '**Binary Command Mode**' provides more details about this mode. Section '**WLAN Commands**' describes all commands and other required details.

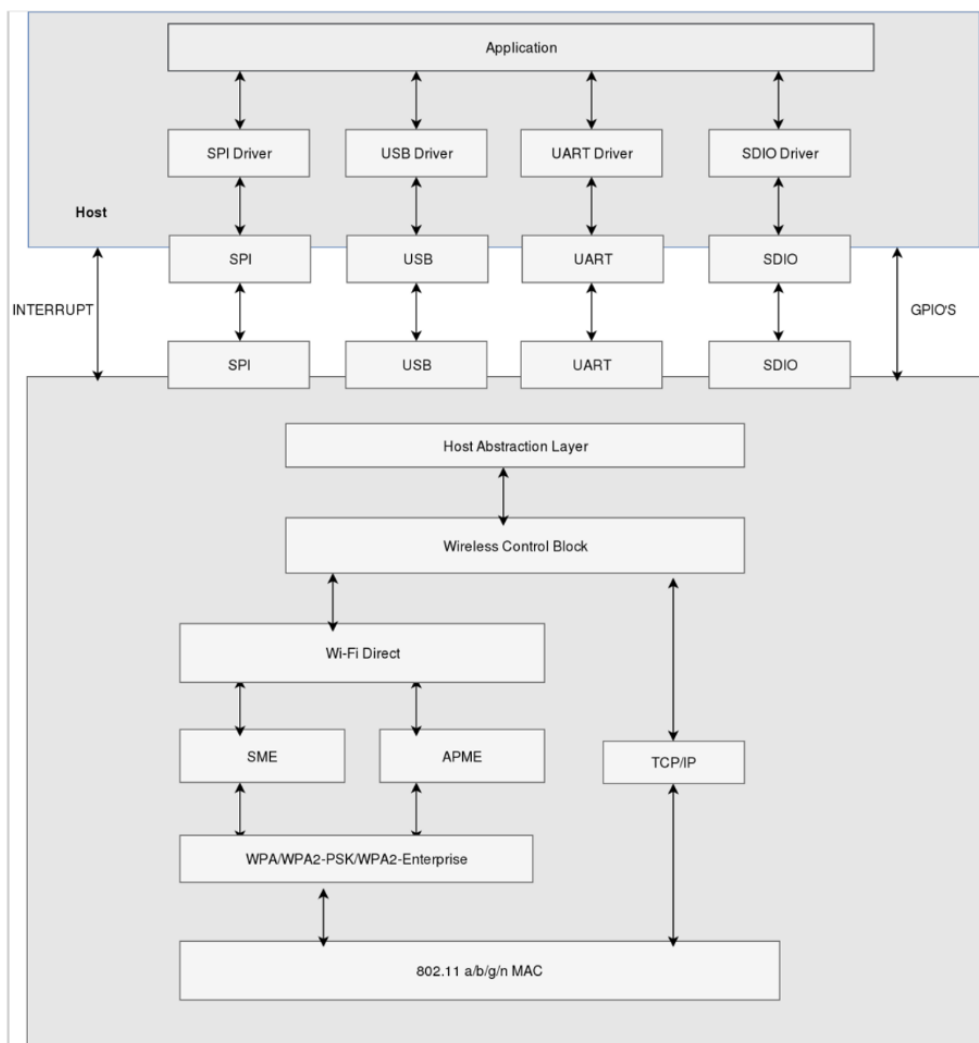
Host Interface block diagram is shown below,



**Figure 2: RS9116W Host Interface Block Diagram**

## 1.2 WLAN Architecture

The following figure depicts the WLAN software architecture of the RS9116-WiSeConnect.



**Figure 3: RS9116W Software Architecture**

### Application

The application layer invokes Simple APIs or AT Commands provided by SPI/ UART/USB/SDIO driver. The application developer can use these APIs to build wireless applications.

### SPI

The SPI interface on the RS9116-WiSeConnect 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 must configure the interrupt in level trigger mode.

### USB

The USB interface on the RS9116-WiSeConnect transmits/receives data to/from the Host in USB mode.

### UART

The UART interface on the RS9116-WiSeConnect transmits/receives data to/from the Host in UART mode.

### SDIO

The SDIO interface on the RS9116-WiSeConnect transmits/receives data to/from the Host in SDIO mode.

## **Host Abstraction Layer (HAL)**

The HAL abstracts the lower layers in the Host interface to which the RS9116-WiSeConnect is connected. The HAL interacts with the Wireless Control Block layer for the processing of the frames obtained from or destined to the Host.

## **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.

## **Wi-Fi Control Frames (WCF)**

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 RS9116-WiSeConnect. Configuration of the RS9116-WiSeConnect from the Host for Wi-Fi access is through AT commands or Binary commands.

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

## **Station Management Entity (SME)**

The SME is the core layer which manages the Wi-Fi connectivity in Station 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.

## **Access point Management Entity (APME)**

The APME is the core layer which manages the connectivity in Access Point 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.

## **WPA Supplicant**

The main functionality of WPA supplicant is to support the key negotiation between Wi-Fi devices in a secure mode. This functionality depends on the mode in which RS9116-WiSeConnect operates in Station mode, Access point 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.

## 2 Bootloader

This section briefs about features supported by the Network and Security Processor's (NWP) bootloader.

### Basic Features

- Load default firmware
- Load selected firmware
- Upgrade firmware from the host
- Selecting default images
- Enable / Disable host interaction bypass
- Support for multiple host interfaces (SDIO/SPI/UART/USB/USB-CDC)
- Firmware integrity check
- Upgrading keys
- JTAG selection

The RS9116W 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 must perform based on the selections made by the user.
2. **Bypass mode:** In this mode, bootloader interactions are completely bypassed and uses the stored bootup configurations (which are selected in host interaction mode) & loads default firmware image in the module. This mode is recommended for final production of software to minimize the bootup time.

### Host Interaction Mode

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

### Host Interaction Mode in UART / USB-CDC

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

### Startup Operation

After powering up, host is required to carry out ABRD (Auto baud rate detection) operation. After successful ABRD, the module displays 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, or corresponding error messages are given to host. In case of integrity failure and when the backup integrity check passes, "LAST CONFIGURATION NOT SAVED" message is displayed. When backup integrity also fails, "BOOTUP OPTIONS CHECKSUM FAILED" is displayed before displaying the bootup options.

### Hyper Terminal Configuration

RS9116W uses the following UART interface configuration for communication:

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

**Data bits:** 8

**Parity:** None

**Stop bits:** 1

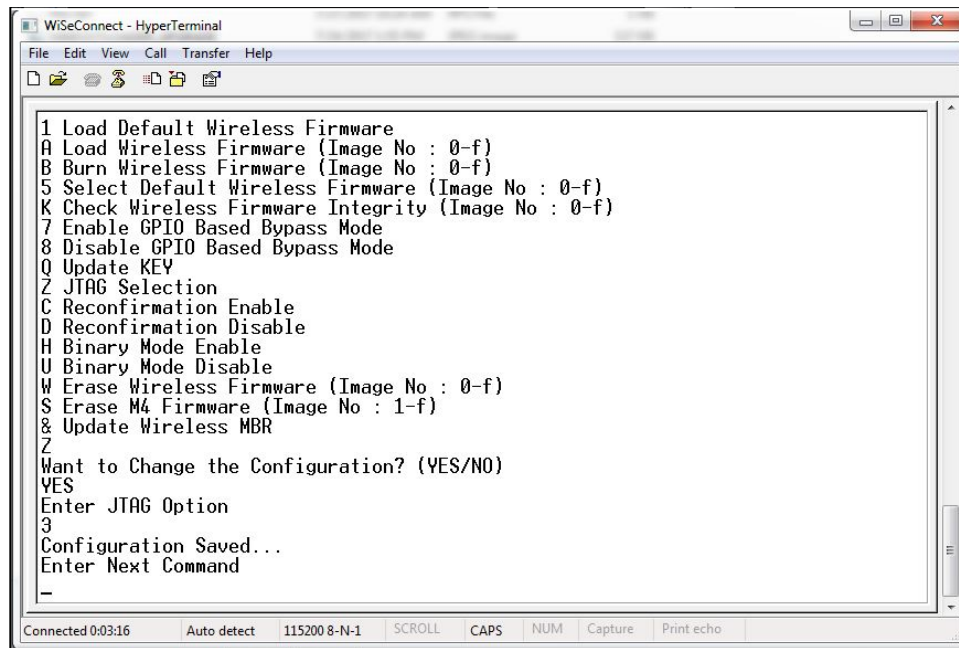
**Flow control:** None

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

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

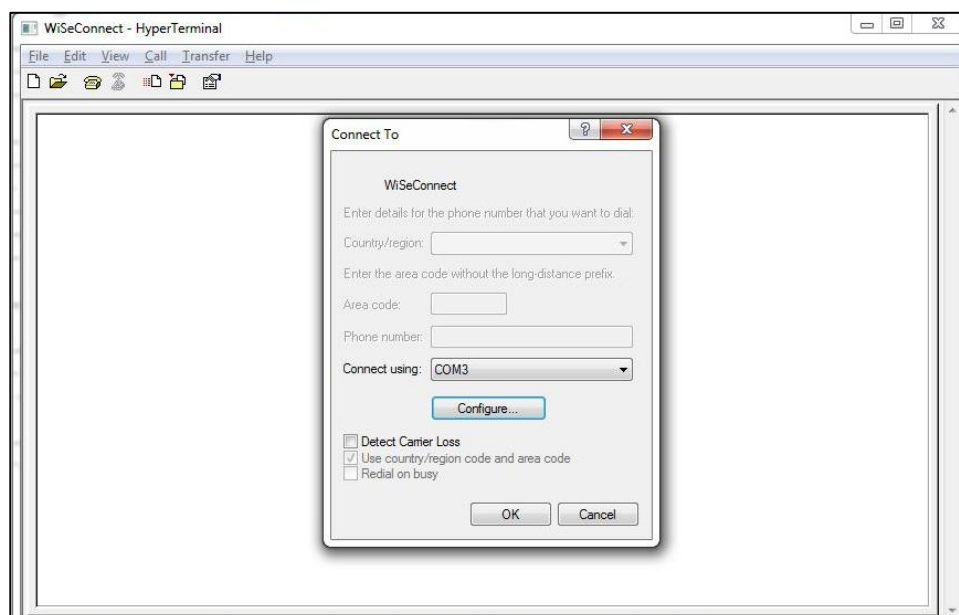
**Note:**

Default baud rate of the module is 115200.



**Figure 4: HyperTerminal Name Field Configuration**

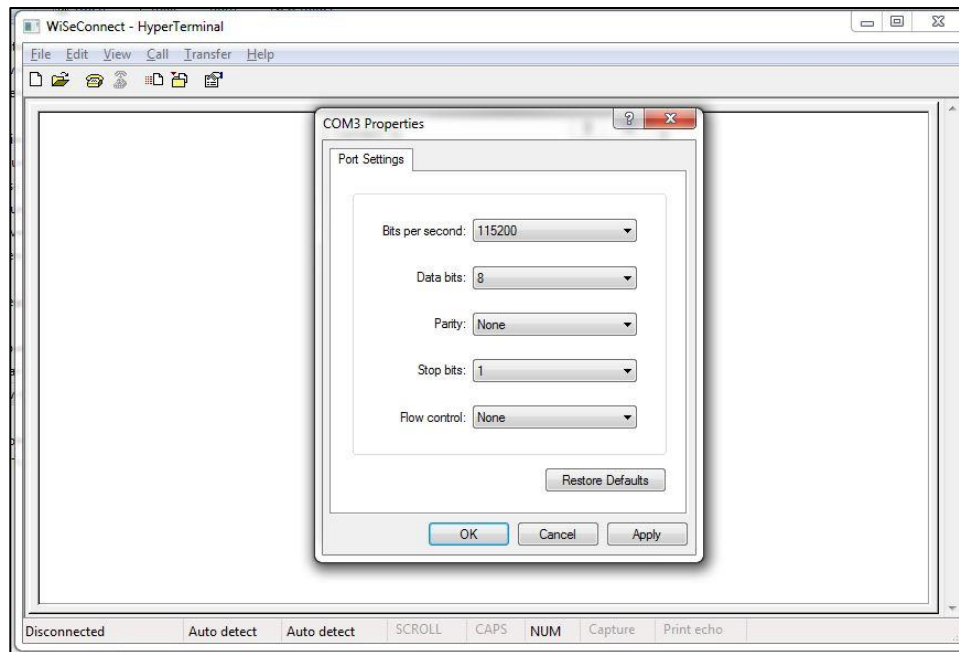
- After clicking **"OK"**, the following dialog box is displayed as shown in the figure below.



**Figure 5: 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 6: 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 RS9116W 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. RS9116W 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

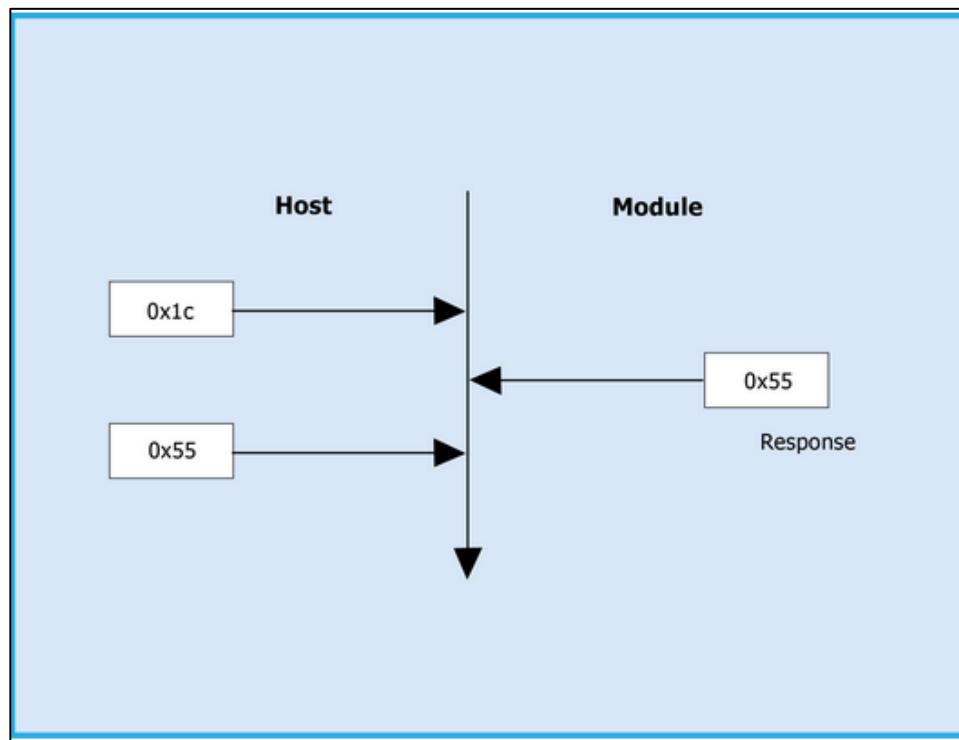
**Flow control:** None

To perform ABRD on the RS9116W, the host must follow the procedure outlined below.

- Configure the UART interface of the Host at desired baud rate.
- Power on the RS9116W.
- 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 to 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.
- If the '0x55' response is not received from the module, the host has to re-transmit 0x1C, after a delay of 200ms.
- 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.

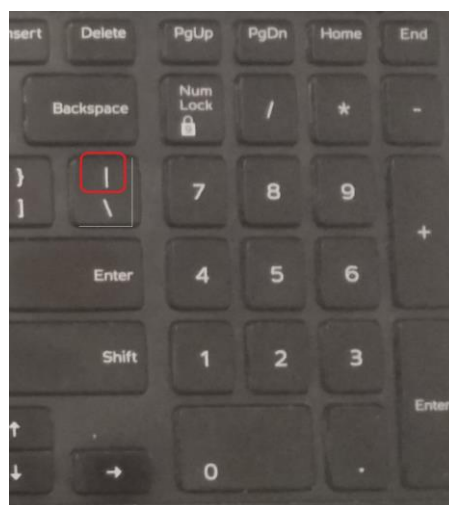


**Figure 7: ABRD Exchange between Host and Module**

Below are the bootup options, Firmware upgrade and Firmware loading procedures for WiSeConnect Product.

**Start-Up Messages on Power-Up**

After powering up the module, do the ABRD process by giving "shift + | " followed by 'U'. Pipe symbol is shown below, you will see a welcome message on the host, followed by boot up options:



**Figure 8: Pipe Symbol on Keyboard**

**Note:**

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

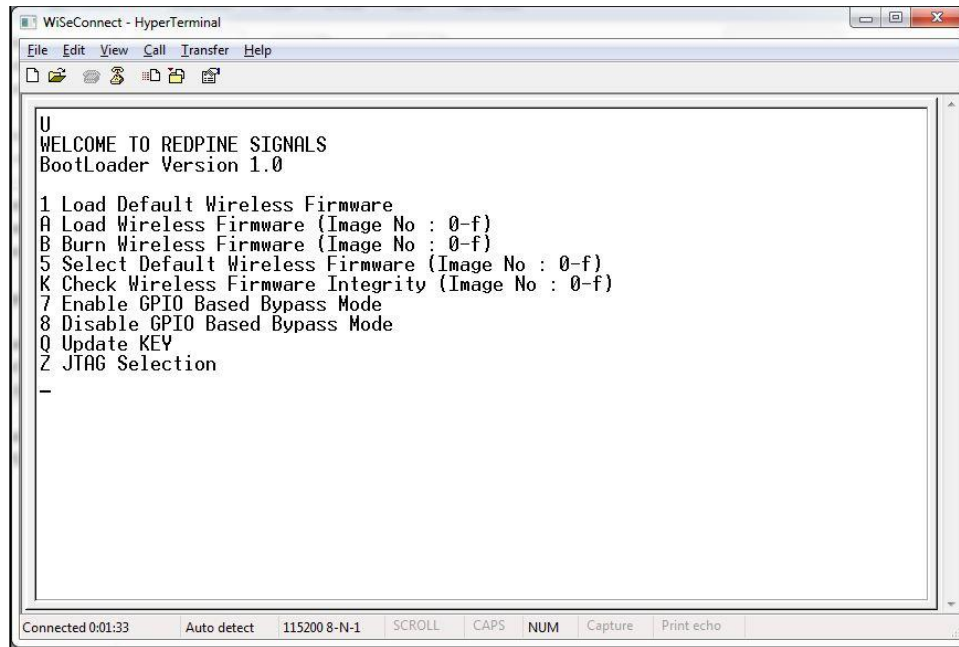


Figure 9: RS9116-WiSeConnect Module UART / USB-CDC Welcome Message

### Loading the Default Wireless Firmware in the Module

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

#### 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.

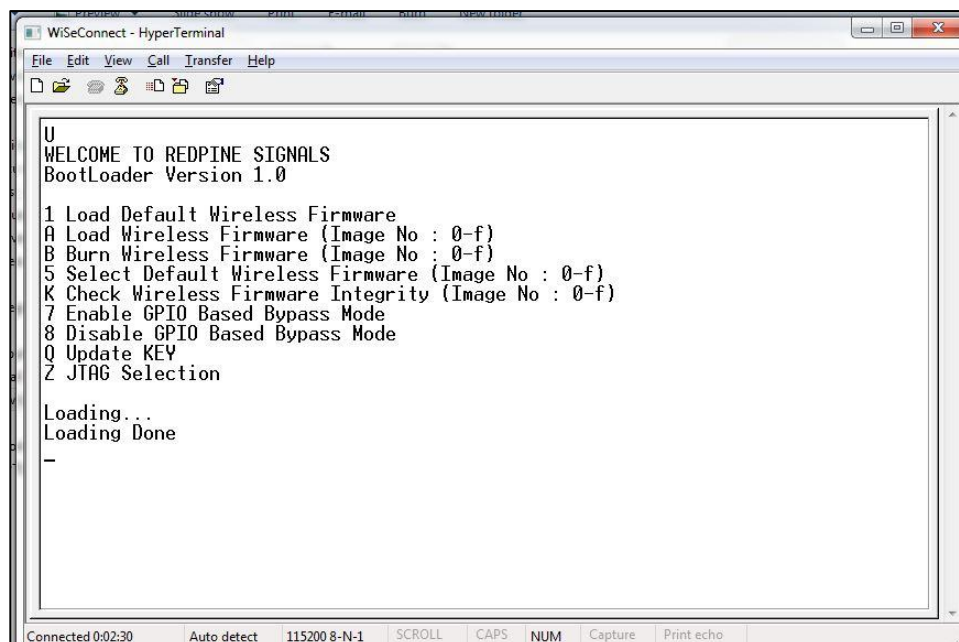


Figure 10: RS9116-WiSeConnect Module UART / USB-CDC Default Firmware Loaded

#### Note:

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

## 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)".

### 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 must select one of the images as default image by selecting option 5 (Select Default Wireless Firmware).
2. In Host interaction mode, if no option is 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 prompts "Valid firmware not present".

## 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)" is 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.

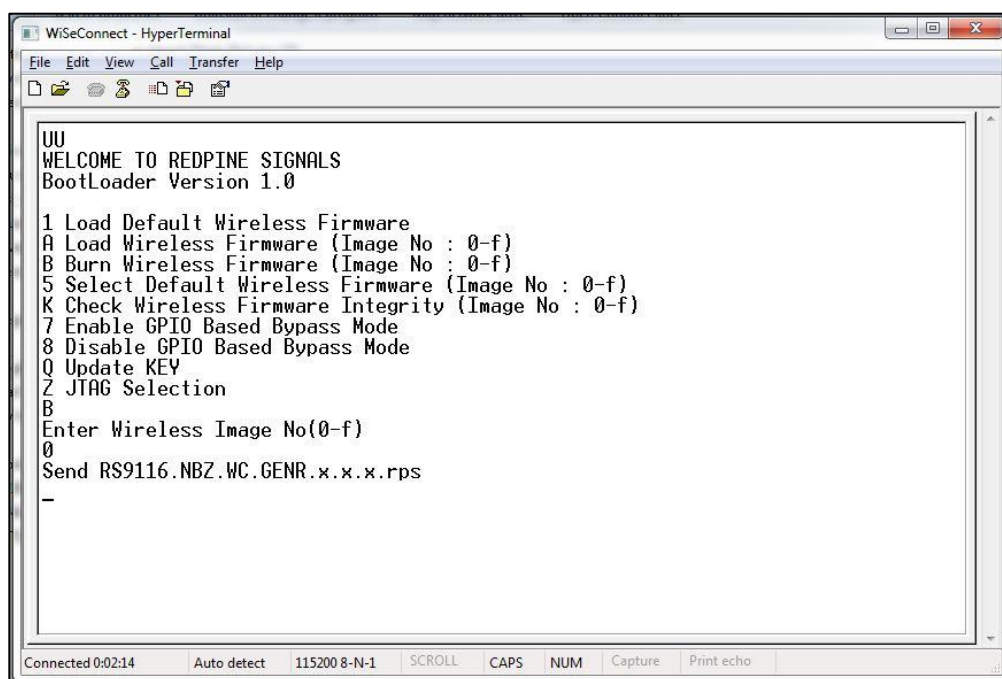
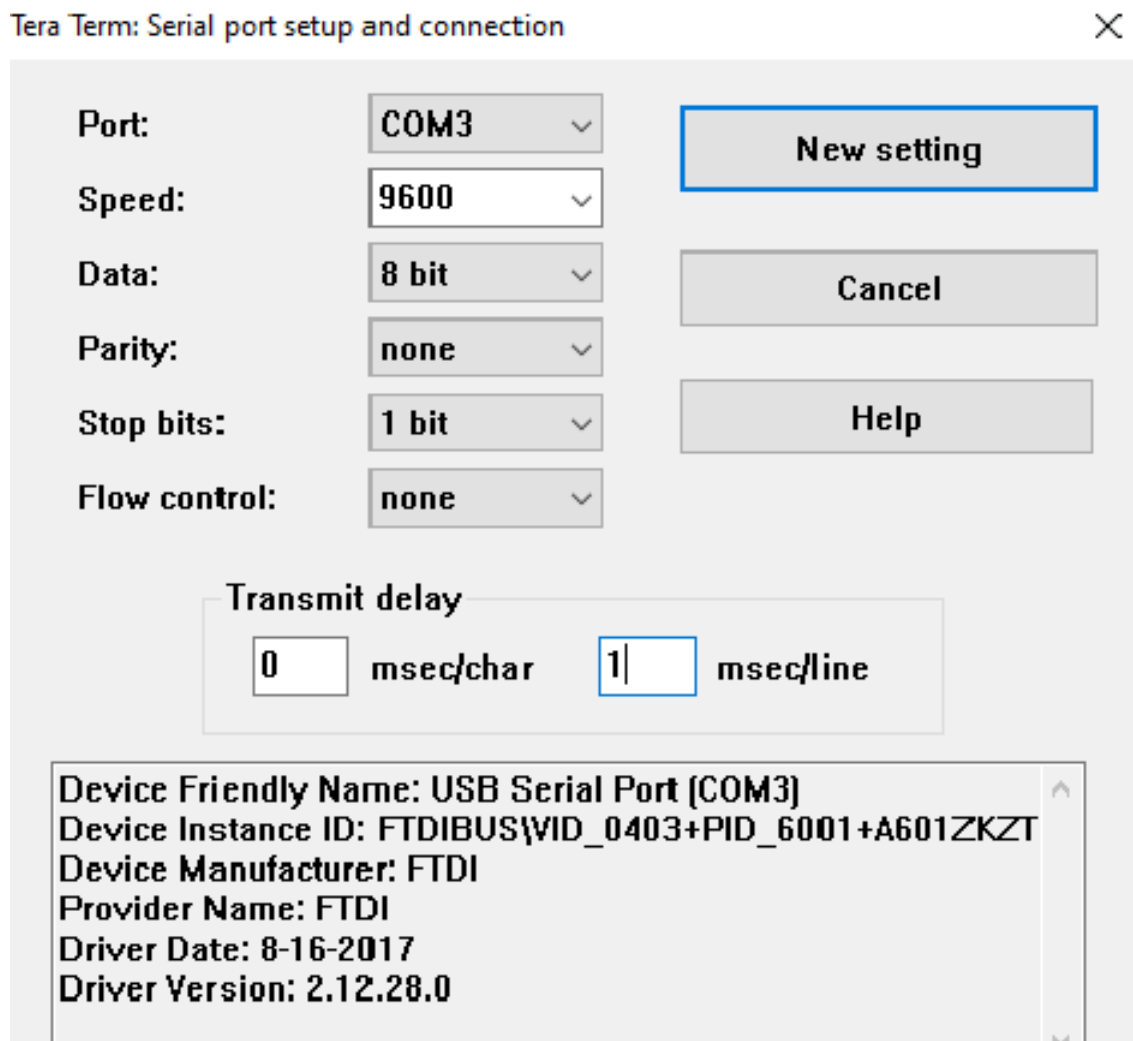


Figure 11: RS9116-WiSeConnect Module Firmware Upgrade File Prompt Message

**Note:**

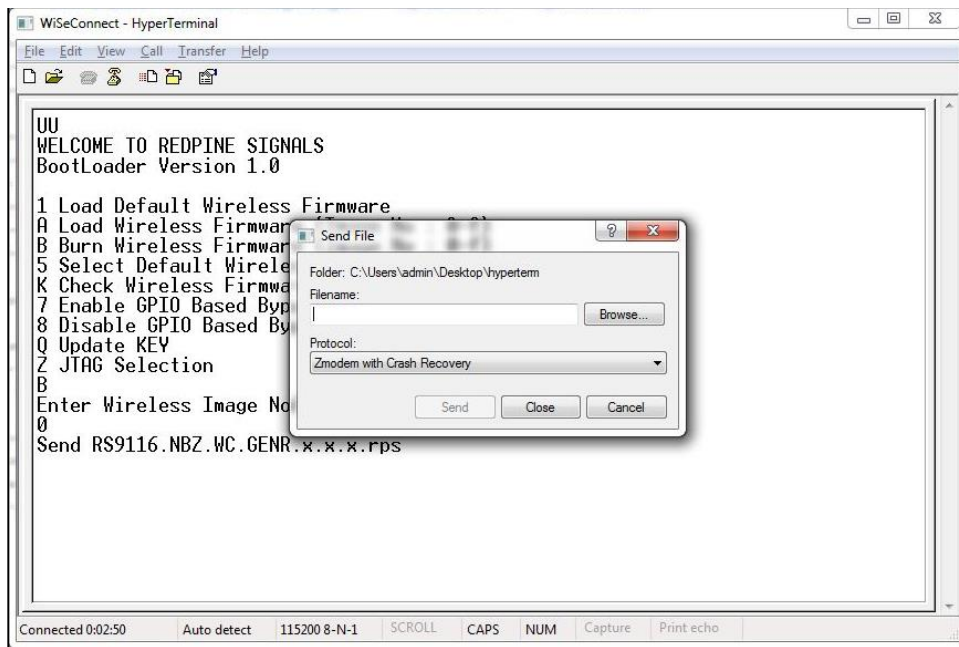
On faster machine using Tera Term it is recommended to configure transmit delay to avoid file transfer to freeze.

After detection of serial port, change transmit delay from 0 msec/line to 1 msec/line to get 'firmware up-gradation successful' as shown in the figure below.



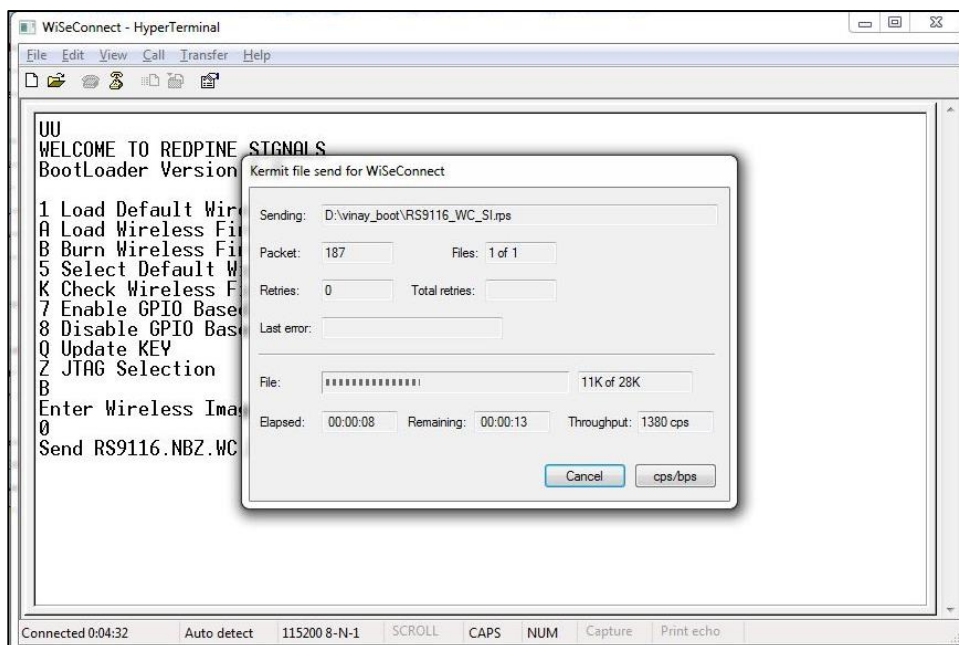
**Figure 12: Serial Port Setup and Connection**

- 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. After this, click the "Send" button to transfer the file.
- If the valid firmware is not present, then a message prompts "Valid firmware not present".



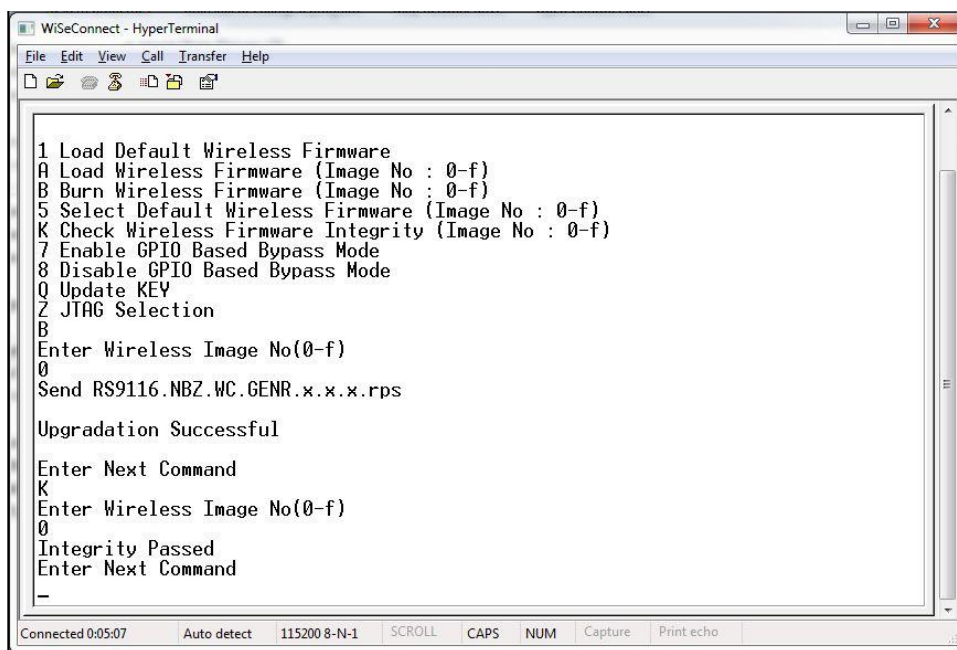
**Figure 13: RS9116-WiSeConnect Module Firmware Upgrade File Selection Message**

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



**Figure 14: RS9116-WiSeConnect 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 case of failure. It displays "Upgradation Failed and default image invalid, Bypass disabled" in 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.



```

WiSeConnect - HyperTerminal
File Edit View Call Transfer Help
1 Load Default Wireless Firmware
A Load Wireless Firmware (Image No : 0-f)
B Burn Wireless Firmware (Image No : 0-f)
5 Select Default Wireless Firmware (Image No : 0-f)
K Check Wireless Firmware Integrity (Image No : 0-f)
7 Enable GPIO Based Bypass Mode
8 Disable GPIO Based Bypass Mode
Q Update KEY
Z JTAG Selection
B
Enter Wireless Image No(0-f)
0
Send RS9116.NBZ.WC.GENR.x.x.x.rps
Upgradation Successful
Enter Next Command
K
Enter Wireless Image No(0-f)
0
Integrity Passed
Enter Next Command
-
Connected 0:05:07 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo

```

**Figure 15: RS9116-WiSeConnect 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 figure.
- The module is ready to accept commands from the Host.

### 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.

#### SPI Startup Operations1 SPI Startup Messages on Powerup

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:

**Table 1: HOST\_INTF\_REG\_IN Register Values**

| 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 2: Bootloader Message Exchange Registers**

| Register Name         | Memory Read/Write Address |
|-----------------------|---------------------------|
| HOST_INTF_REG_OUT     | 0x4105003C                |
| HOST_INTF_REG_IN      | 0x41050034                |
| PING Buffer           | 0x18000                   |
| PONG Buffer           | 0x19000                   |
| RSI_INT_MASK_REG_ADDR | 0x41050000                |

**Table 3: Bootloader Message Codes**

| 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                 |
| 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                 |
| PONG_BUFFER_VALID                | 'O'           | 0x4F                 |
| POLLING_MODE                     | 'P'           | 0x50                 |
| DISABLE_FWUPGRADE                | 'T'           | 0x54                 |
| ENABLE_FWUPGRADE                 | 'N'           | 0x4E                 |

**Table 4: Bootloader Response 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                  |

| Bootloader Interaction Messages                 | Response Codes                     | Response Codes in Hex |
|-------------------------------------------------|------------------------------------|-----------------------|
| 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 (Safe Upgrade in Progress) |                                    | 0xF7                  |
| FLASH_NOT_PRESENT                               |                                    | 0xFA                  |
| IMAGE_INTEGRITY_FAILED                          |                                    | 0xFB                  |
| BOOT_FAIL                                       |                                    | 0xFC                  |
| BOARD_READY                                     | (BL_VER_HIGH << 4  <br>BL_VER_LOW) | 0x10                  |
| LAST_CONFIG_NOT_SAVED                           |                                    | 0xF1                  |
| BOOTUP_OPTIONS_INTEGRITY_FAILED                 |                                    | 0xF2                  |
| FWUP_BUFFER_VALID                               |                                    | 0x5AA5                |

### SPI Startup Messages on Powerup Table

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.

### 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.

#### 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.

By default, Active high firmware will be selected by the Bootloader. To select the active low firmware, follow the procedure after board ready is received.

- Read the RSI\_INT\_MASK\_REG\_ADDR register value
- Set BIT(9) in the read value and write back the value to the RSI\_INT\_MASK\_REG\_ADDR address

**Note:**

Hardware changes are required to support ACTIVE\_LOW /ACTIVE\_HIGH interrupts.

ACTIVE\_LOW interrupt requires pull up on the interrupt pin.

ACTIVE\_HIGH interrupt requires pull down on the interrupt pin.

**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.

## Loading Selected Wireless Firmware in the Module

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

### Load Selected Wireless Firmware

1. Upon receiving Board ready, 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.

## Upgrading Wireless Firmware in the Module

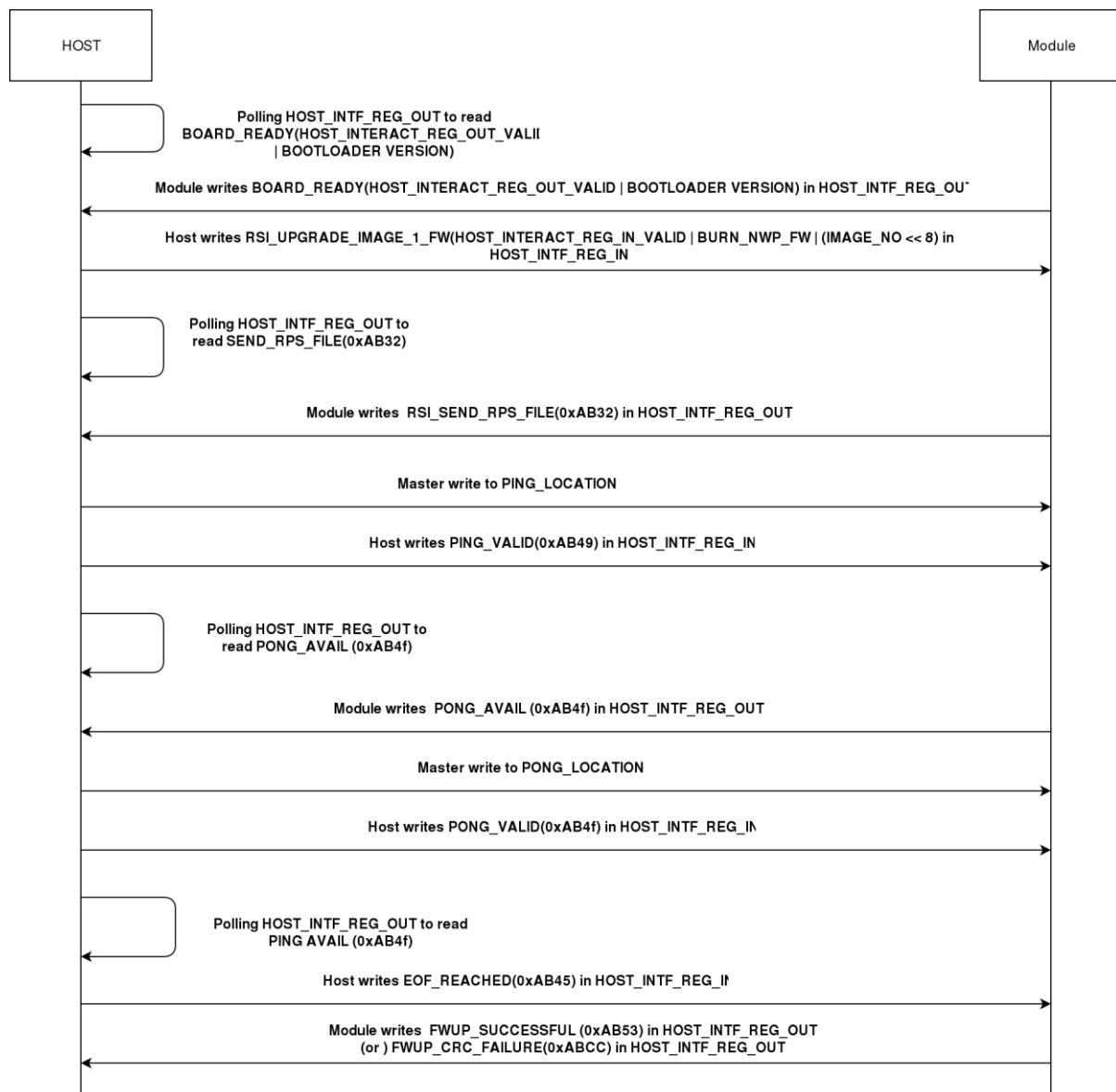
With this option, host can select to upgrade the firmware in the flash of the module.

### 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 16: Wireless Firmware Upgradation through SPI/USB**

## GPIO Based Bootloader Bypass Mode for WiSeConnect Product

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 upon 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.

### Bypass Mode in UART / USB-CDC

#### Making Default Wireless Firmware Selection

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

#### Selecting a valid Image as the Default Image

- After the welcome message is displayed, user 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 number
- 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".

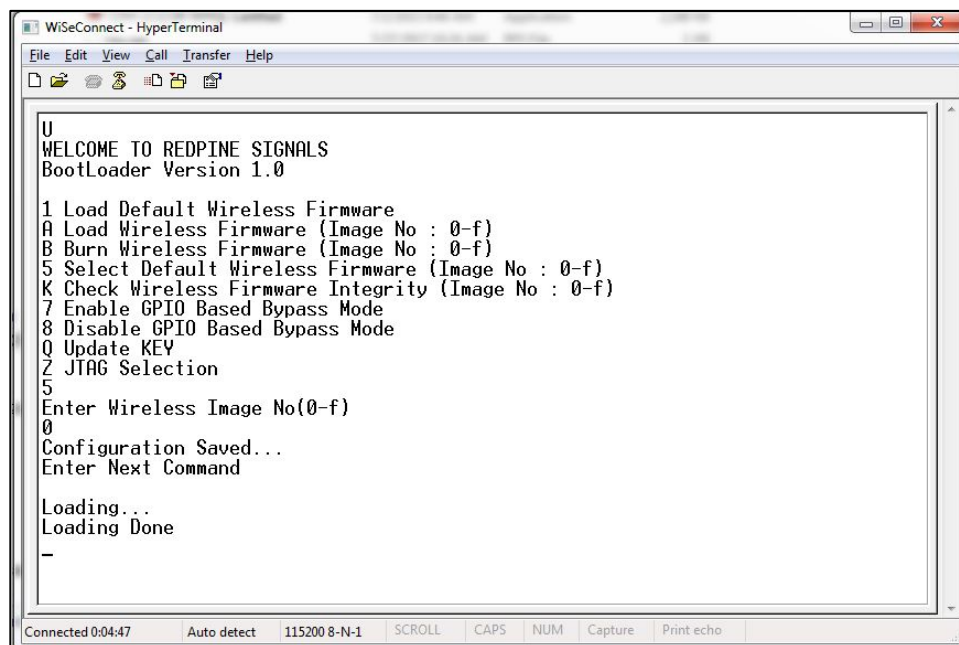


Figure 17: Making Image no - 0 as the Default Image

### Enable/Disable GPIO Based Bypass Option

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

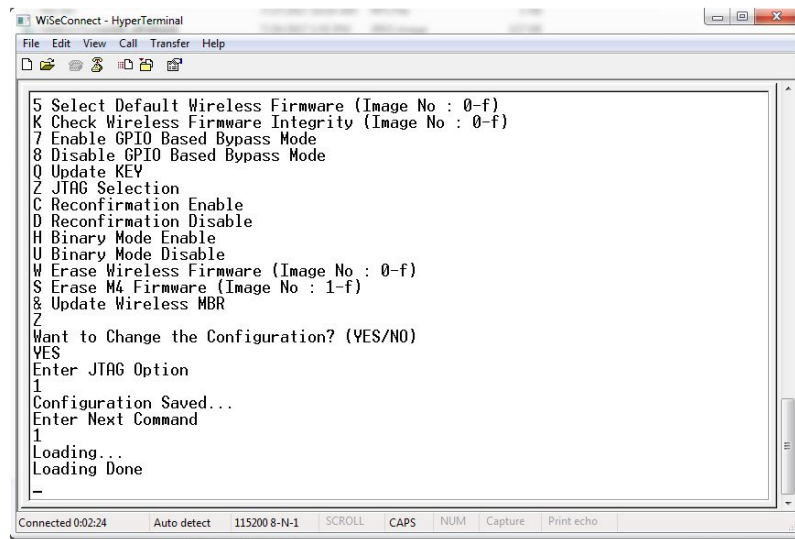
#### Enabling the GPIO Based Bypass Mode

If user select option 7, GPIO based Bootloader 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, user 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".
- Then select option 7 to "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.



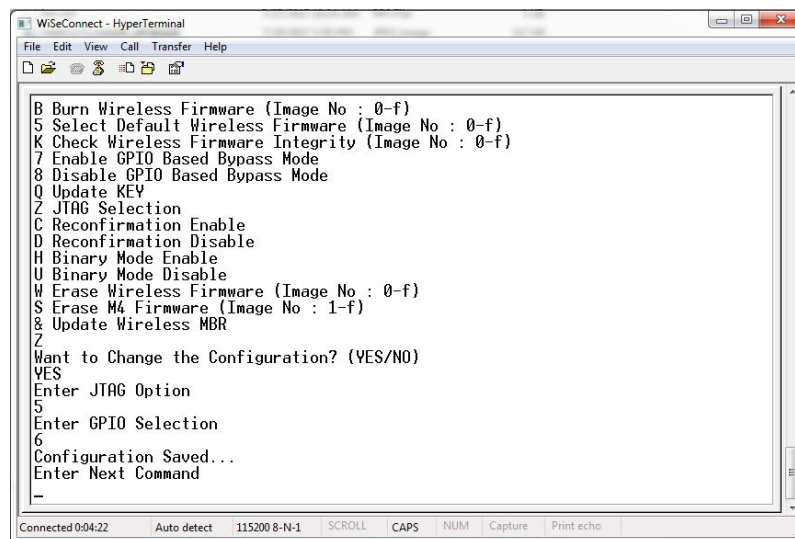
```

5 Select Default Wireless Firmware (Image No : 0-f)
K Check Wireless Firmware Integrity (Image No : 0-f)
7 Enable GPIO Based Bypass Mode
8 Disable GPIO Based Bypass Mode
Q Update KEY
Z JTAG Selection
C Reconfirmation Enable
D Reconfirmation Disable
H Binary Mode Enable
U Binary Mode Disable
W Erase Wireless Firmware (Image No : 0-f)
S Erase M4 Firmware (Image No : 1-f)
& Update Wireless MBR
Z
Want to Change the Configuration? (YES/NO)
YES
Enter JTAG Option
1
Configuration Saved...
Enter Next Command
1
Loading...
Loading Done
-

```

Connected 0:02:24 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo

**Figure 18: Enabling the GPIO-based Bypass Mode: Valid Default Firmware**



```

B Burn Wireless Firmware (Image No : 0-f)
5 Select Default Wireless Firmware (Image No : 0-f)
K Check Wireless Firmware Integrity (Image No : 0-f)
7 Enable GPIO Based Bypass Mode
8 Disable GPIO Based Bypass Mode
Q Update KEY
Z JTAG Selection
C Reconfirmation Enable
D Reconfirmation Disable
H Binary Mode Enable
U Binary Mode Disable
W Erase Wireless Firmware (Image No : 0-f)
S Erase M4 Firmware (Image No : 1-f)
& Update Wireless MBR
Z
Want to Change the Configuration? (YES/NO)
YES
Enter JTAG Option
5
Enter GPIO Selection
6
Configuration Saved...
Enter Next Command
-

```

Connected 0:04:22 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo

**Figure 19: Enabling the GPIO-based Bypass Mode: Invalid Firmware**

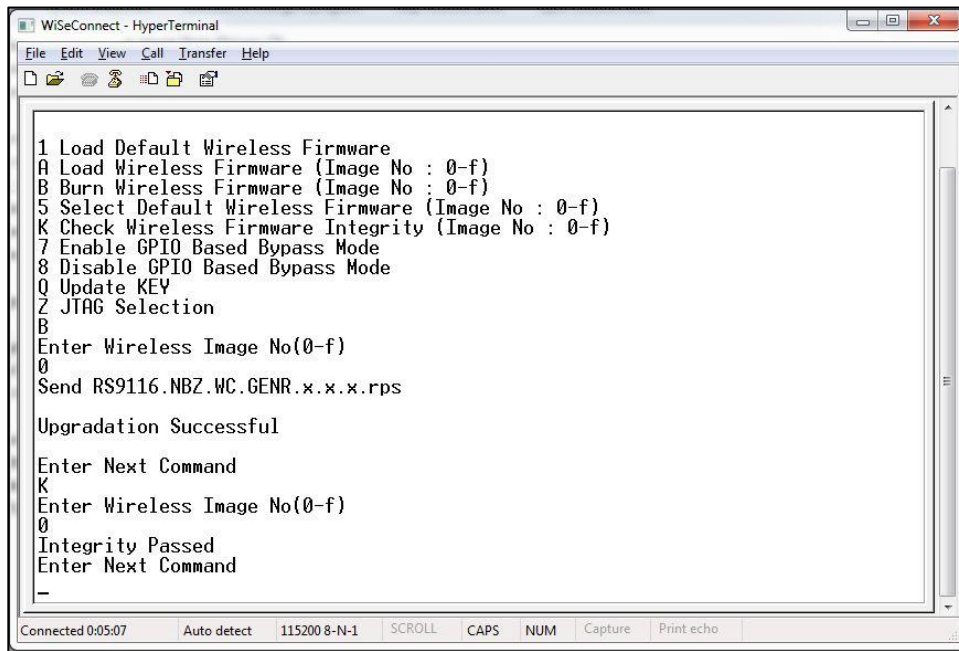
### Disabling the GPIO Based Bypass Mode

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

UULP\_GPIO\_2 needs to be de-asserted upon power up to move to host interaction mode, to select bootup options like disable Bypass mode or to change the default image.

## 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 must be verified as shown in the figure below.



```

WiSeConnect - HyperTerminal
File Edit View Call Transfer Help

1 Load Default Wireless Firmware
A Load Wireless Firmware (Image No : 0-f)
B Burn Wireless Firmware (Image No : 0-f)
5 Select Default Wireless Firmware (Image No : 0-f)
K Check Wireless Firmware Integrity (Image No : 0-f)
7 Enable GPIO Based Bypass Mode
8 Disable GPIO Based Bypass Mode
Q Update KEY
Z JTAG Selection
B
Enter Wireless Image No(0-f)
0
Send RS9116.NBZ.WC.GENR.x.x.x.rps

Upgradation Successful

Enter Next Command
K
Enter Wireless Image No(0-f)
0
Integrity Passed
Enter Next Command
-

Connected 0:05:07 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo

```

**Figure 20: Integrity Check Passed**

## Bypass Mode in SPI / USB

### Selecting the Default Image

1. Upon receiving Board ready, 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.

### Enable/Disable GPIO Based Bootloader Bypass Mode

1. Upon receiving Board ready, 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 needs to be de-asserted on power up to move to host interaction mode, to select bootup options like disable Bypass mode or to change the default image.

## 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 which is 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.

## Other Operations

This section contains additional, less frequently used bootloader options.

### Update KEY

**Note:**

This feature is not enabled in the current release.

## JTAG Selection

**Note:**

This feature is not enabled in the current release.

## 3 Host Interfaces

RS9116 WiSeConnect Module supports SPI, USB, UART and SDIO for interfacing to host. This section describes UART interface in detail including the supported features, protocols and commands.

Only UART and USB-CDC interfaces are supported in AT mode.

**Note:**

USB and SDIO interfaces are currently not supported.

### 3.1 UART Interface

This section describes RS9116-WiSeConnect UART interface, including the commands and processes to operate the module via UART.

UART on the RS9116-WiSeConnect is used as a host interface to configure the module to send data and to receive data.

**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:**

For baud rates greater than 115200, it is mandatory to enable UART hardware flow control.

**Hardware Interface**

RS9116W uses TTL serial UART at an operating voltage of 3.3V. Host UART device must be configured with the following settings:

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

**Software Protocol****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:**

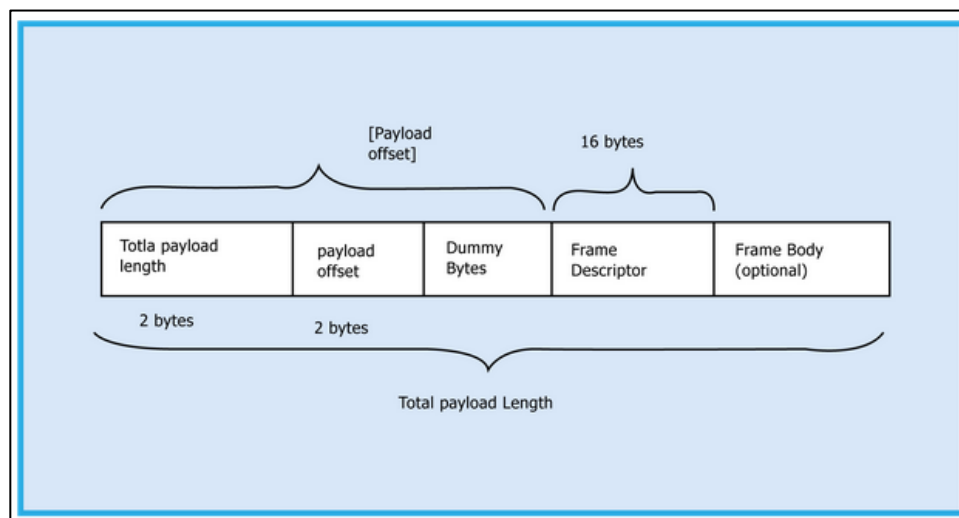
1. To send management commands to the module from the Host.

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 must 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

The RS9116W responds with either an 'OK' or 'ERROR' string, for Management or Data frames along with a result or error code.

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



**Figure 21: 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.

## 4 AT Command Mode

The Wi-Fi AT command set represents the frames that are sent from the Host to operate the RS9116W-WiSeConnect. 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 RS9116W-WiSeConnect 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 C: Sample AT command sequences** 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.

RS9116W-WiSeConnect supports following host interfaces in AT Command mode:

- UART
- USB-CDC

The following protocols are supporting in AT Command mode

- WLAN
- BT/BLE

## 5 WLAN Commands

The following sections explain RS9116-WiSeConnect commands, their parameters, their responses and relevance in AT mode.

### 5.1 Set Operating Mode

#### Description:

This is the first command that needs to be sent from host after receiving card ready frame from RS9116W 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_feature_bit_map>,<
bt_feature_bit_map>,<ext_tcp_ip_feature_bit_map>,<ble_feature_bit_map>,<ble_coustom_ext_feature_bit_map>,<config_feature_bit_map>\r\n
```

#### 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_custom_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_custom_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_custom_feature_bit_map>,<bt_feature_bit_map>,<ext_tcp_ip_feature_bit_map>,<ble_feature_bit_map>\r\n
```

- ble\_custom\_ext\_feature\_bit\_map gets enable when BIT(31) is set to 1 in ble\_custom\_feature\_bit\_map

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

- config\_feature\_bit\_map gets enabled when BIT(31) is set to '1' in both tcp\_ip\_feature\_bit\_map and ext\_tcp\_ip\_feature\_bit\_map

```
at+rsi_opermode=<oper_mode>,<feature_bit_map>,<tcp_ip_feature_bit_map>,<custom_feature_bitmap>,<ext_custom_feature_bit_map>,<bt_feature_bit_map>,<ext_tcp_ip_feature_bit_map>,<ble_feature_bit_map>,<ble_coustom_ext_feature_bit_map>,<config_feature_bit_map>\r\n
```

#### Oper\_mode:

Sets the mode of operation. oper\_mode contains two parts <wifi\_oper\_mode, coex\_mode>. Lower two bytes represents wifi\_oper\_mode and higher two bytes represents 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.
- 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 an AP and can create AP simultaneously.

#### Note:

In concurrent mode,

1. AP MAC address's last byte will differ, and it will be one plus the station mode MAC last byte.
2. Maximum of 4 Station devices can be connected to Concurrent AP.
3. In TCP/IP non bypass mode, Broadcast / Multicast packet goes to first created interface (e.g. if Station mode connects first, the broadcast / multicast packet goes to the network that belongs to station mode).
4. IPV6 support is not supported in the current release.
5. Aggregation is not supported.

### Possible coex modes:

| 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*       |

**Note:**

1. Coex modes are **supported only in 384K memory** configuration
2. For WLAN Coex mode, AP mode scan is not allowed.
3. ZigBee is not currently supported. Will be supported in future releases.

If coex mode is enabled in opermode command, then BT / BLE 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 **RS9116W BT Classic AT Command Programming Reference Manual.pdf** (available at <https://docs.silabs.com/rs9116>) and BLE card ready frame is described in **RS9116W BLE AT Command Programming Reference Manual.pdf** (available at <https://docs.silabs.com/rs9116>).

To select coex mode, please refer to **RS9116\_TCP\_IP\_Feature\_Selection\_vx.x.x.xlsx** given in "Docs" folder of the release package.

**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 handshake                          | Disable      | Enable       |                           |
| feature_bit_map[4]    | ULP GPIO handshake                         | Disable      | Enable       |                           |
| feature_bit_map[5]    | Reserved                                   | Reserved     | Reserved     |                           |
| feature_bit_map[6]    | Reserved                                   | Reserved     | Reserved     |                           |
| 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        | Functionality                                                                                     | Bit set to 0 | Bit set to 1 | Note and Info                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------|---------------------------------------------------------------------------------------------------|--------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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[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.<br><br>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.<br><br>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     | Functionality                                      | Bit set to 0 | Bit set to 1 | Note and Info |
|----------------------------|----------------------------------------------------|--------------|--------------|---------------|
| tcp_ip_feature_bit_map[27] | SSL certificate on to the RAM                      | Disable      | Enable       |               |
| tcp_ip_feature_bit_map[28] | TCP-IP data packet Dump on UART2                   | Disable      | Enable       |               |
| 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 release package. WiSeConnect device supports the selected features combination only if it is feasible as per **WiSeConnect\_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 specialized use cases and not in normal AP functionality. The default value of this bit is '0'. |              |              |                                                                                                                                                                |
| custom_feature_bit_map[4]  | To run NWP (Network Processor) at Higher clock frequency(160MHZ)                                                                                                                                                                                                                                                                                                                                                                                                        | Disable      | Enable       | Need to set pll_mode to 1 in feature frame command.                                                                                                            |
| 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       | it's mandatory to set region before scanning DFS channel.                                                                                                      |
| 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] | Bypass AP Blacklist in client mode                                                                                                                                                                                                                                                                                                                                                                                                                                      | Disable      | Enable       | By default, client maintains AP blacklist internally to avoid some access points. To bypass AP blacklist feature in client mode during roaming or rejoin, this |

| custom_feature_bit_map     | Functionality                                                                                                                                                                                                                                        | Bit set to 0 | Bit set to 1 | Note and Info                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            |                                                                                                                                                                                                                                                      |              |              | feature should be enabled.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 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 de-auth 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      | Enable       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| custom_feature_bit_map[24] | To run NWP at Higher clock frequency(120MHZ)                                                                                                                                                                                                         | Disable      | Enable       | Need to set pll_mode to 1 in feature frame command                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 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><b>When BIT[26] is zero:</b><br/>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><b>When BIT[26] is set:</b><br/>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                                                            | Functionality                   | Bit set to 0 | Bit set to 1 | Note and Info |
|-----------------------------------------------------------------------------------|---------------------------------|--------------|--------------|---------------|
| 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       |               |
| 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.

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                                           | Enable                                                     |                                                                                                                                                                           |
| ext_custom_feature_bit_map[1] | 4096-bit RSA key support                                                                                                                                         | Disable                                           | Enable                                                     | 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 enabled, then connected client who is in power save may miss the packet.                                                                                   |

| ext_custom_feature_bit_map        | Functionality                                                                                                                                                                                                                        | Bit set to 0 | Bit set to 1 | Note and Info                                                                                                                            |     |   |   |  |  |  |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------|-----|---|---|--|--|--|
| ext_custom_feature_bit_map[5]     | Pre authentication Support.                                                                                                                                                                                                          | Disable      | Enable       |                                                                                                                                          |     |   |   |  |  |  |
| ext_custom_feature_bit_map[6]     | 40MHZ Support                                                                                                                                                                                                                        | Disable      | Enable       | 11J AP don't support 40MHZ<br><div>Note:<br/>40MHz is not supported.</div>                                                               |     |   |   |  |  |  |
| ext_custom_feature_bit_map[9]     | EXT_HTTP_SKIP_DEFAULT_LEADING_CHARACTER<br><br>To skip default leading character ("\"") in resource name                                                                                                                             |              |              |                                                                                                                                          |     |   |   |  |  |  |
| ext_custom_feature_bit_map[11]    | 802.11R Over the Air Roaming Support                                                                                                                                                                                                 | Disable      | Enable       | 1.Resource Request Support is not Present.<br><br>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 enabled, 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 enabled, 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.<br><br>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><tr><th>MODE(KB)</th><th>BIT[20]</th><th>BIT[21]</th></tr><tr><td>192</td><td>0</td><td>0</td></tr></table> | MODE(KB)     | BIT[20]      | BIT[21]                                                                                                                                  | 192 | 0 | 0 |  |  |  |
| MODE(KB)                          | BIT[20]                                                                                                                                                                                                                              | BIT[21]      |              |                                                                                                                                          |     |   |   |  |  |  |
| 192                               | 0                                                                                                                                                                                                                                    | 0            |              |                                                                                                                                          |     |   |   |  |  |  |

| ext_custom_feature_bit_map                    | Functionality                                                                                                                                                                                                                                                                                                                                                                        |         |   | Bit set to 0                            | Bit set to 1                                                                                | Note and Info                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---|-----------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---|---|-----------------------------------------------|---|---|---------------------------------------|---|---|---------------------------------------|---|---|--|--|--|
|                                               | 256                                                                                                                                                                                                                                                                                                                                                                                  | 0       | 1 |                                         |                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
|                                               | 320                                                                                                                                                                                                                                                                                                                                                                                  | 1       | 0 |                                         |                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
|                                               | 384                                                                                                                                                                                                                                                                                                                                                                                  | 1       | 1 |                                         |                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
| ext_custom_feature_bit_map[22:23]             | To configure Sleep clock source selection<br>To select sleep clock for TA (Thread Arc processor), either crystal clock or RC clock                                                                                                                                                                                                                                                   |         |   |                                         |                                                                                             | If BIT[23] is set '1' and BIT[22] is set to '0' in ext_custom_feature_bit_map, then user has to use UULP_GPIO_0 for sleep indication to host.                                                                                                                                                                                                                                                                                                                                                                                              |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
|                                               | <table><tr><th>SELECTION</th><th>BIT[23]</th><th>BIT[22]</th></tr><tr><td>Use RC clock as sleep clock</td><td>0</td><td>0</td></tr><tr><td>Use 32KHz clock from external XTAL OSCILLATOR</td><td>0</td><td>1</td></tr><tr><td>Use 32KHz bypass clock on UULP_GPIO_3</td><td>1</td><td>0</td></tr><tr><td>Use 32KHz bypass clock on UULP_GPIO_4</td><td>1</td><td>1</td></tr></table> |         |   | SELECTION                               | BIT[23]                                                                                     | BIT[22]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Use RC clock as sleep clock | 0 | 0 | Use 32KHz clock from external XTAL OSCILLATOR | 0 | 1 | Use 32KHz bypass clock on UULP_GPIO_3 | 1 | 0 | Use 32KHz bypass clock on UULP_GPIO_4 | 1 | 1 |  |  |  |
| SELECTION                                     | BIT[23]                                                                                                                                                                                                                                                                                                                                                                              | BIT[22] |   |                                         |                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
| Use RC clock as sleep clock                   | 0                                                                                                                                                                                                                                                                                                                                                                                    | 0       |   |                                         |                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
| Use 32KHz clock from external XTAL OSCILLATOR | 0                                                                                                                                                                                                                                                                                                                                                                                    | 1       |   |                                         |                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
| Use 32KHz bypass clock on UULP_GPIO_3         | 1                                                                                                                                                                                                                                                                                                                                                                                    | 0       |   |                                         |                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
| Use 32KHz bypass clock on UULP_GPIO_4         | 1                                                                                                                                                                                                                                                                                                                                                                                    | 1       |   |                                         |                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
| ext_custom_feature_bit_map[24]                | Reserved                                                                                                                                                                                                                                                                                                                                                                             |         |   |                                         |                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
| ext_custom_feature_bit_map[25]                | To enable 1.8v supply for TA                                                                                                                                                                                                                                                                                                                                                         |         |   | Disable                                 | Enable                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
| ext_custom_feature_bit_map[26]                | To enable 3.3v supply for TA                                                                                                                                                                                                                                                                                                                                                         |         |   | Disable                                 | Enable                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
| ext_custom_feature_bit_map[27]                | To select UART port for NWP (Network Processor) debug prints                                                                                                                                                                                                                                                                                                                         |         |   | Disable (Enable debug prints on UART 2) | Enable (Enable debug prints on UART 1 and is applicable only if Host Interface is not UART) | By default, all the debug prints from NWP will be coming on UART2 if this bit is not enabled.<br><br>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 in WiSeMCU mode 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.<br><br>UART 1 - TX: GPIO_9<br>RX: GPIO_8<br>UART 2 - TX: GPIO_6<br>RX: GPIO_10<br><br>There is no functionality on rx pins for debug prints. |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |
| ext_custom_feature_bit_map[28]                | UART debug prints from NWP                                                                                                                                                                                                                                                                                                                                                           |         |   | Disable (Enable debug prints)           | Enable (Disable debug prints)                                                               | By default, this bit value is zero.<br><br>When BIT[26] is zero: For a LTCP socket when                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                             |   |   |                                               |   |   |                                       |   |   |                                       |   |   |  |  |  |

| ext_custom_feature_bit_map        | Functionality                       | Bit set to 0 | Bit set to 1                      | Note and Info                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------|-------------------------------------|--------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                   |                                     |              | prints on either UART1 or UART2 ) | <p>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_custom_feature_bit_map[29:30] | Reserved                            |              |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| ext_custom_feature_bit_map[31]    | BT and BLE feature_bit_map validity | Disable      | Enable                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

#### 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      | Enable       |                                                                                |
| ext_tcp_ip_feature_bit_map[2] | HTTP server root path bypass                                             | Disable      | Enable       |                                                                                |
| ext_tcp_ip_feature_bit_map[3] | Correcting the ACK sequence number in the TCP packet retransmission path | Disable      | Enable       | Need to enable this bit if user wants to run the bi-directional data transfer. |
| 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[6] | Support for SSL 16K record size                                          | Disable      | Enable       |                                                                                |
| ext_tcp_ip_feature_bit_map[7] | To enable DNS_CLIENT_BYPASS by host                                      | Disable      | Enable       |                                                                                |

| ext_tcp_ip_feature_bit_map        | Functionality                                                                 | Bit set to 0 | Bit set to 1 | Note and Info                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------|-------------------------------------------------------------------------------|--------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ext_tcp_ip_feature_bit_map[8]     | To enable TCP window scaling feature                                          | Disable      | Enable       | If user wants to use more than 64Kb window size.<br><b>tcp_rx_window_size_cap</b> in socket config command is used to increase the window size.                                                                                                                                                                                                                                                      |
| ext_tcp_ip_feature_bit_map[9]     | To enable Dual Mode feature                                                   | Disable      | Enable       | Enabling this feature allows to use both bypass and non-bypass modes simultaneously.                                                                                                                                                                                                                                                                                                                 |
| ext_tcp_ip_feature_bit_map[10]    | To enable Ethernet Wi-Fi bridge feature                                       | Disable      | Enable       |                                                                                                                                                                                                                                                                                                                                                                                                      |
| ext_tcp_ip_feature_bit_map[11]    | To enable the dynamic coex memory                                             | Disable      | Enable       | To enable or disable the coex and update TCP RX window accordingly.                                                                                                                                                                                                                                                                                                                                  |
| ext_tcp_ip_feature_bit_map[12:15] | To select the no of selects                                                   | Disable      | Enable       |                                                                                                                                                                                                                                                                                                                                                                                                      |
| ext_tcp_ip_feature_bit_map[16]    | To enable socket wait close                                                   | Disable      | Enable       | If it is set socket will not be closed until the shutdown is called from host.<br><br><b>Note:</b><br>Refer to 'rsi_shutdown()' API in <a href="https://docs.silabs.com/rs9116/">RS9116W SAPI Programming Reference Manual</a> at <a href="https://docs.silabs.com/rs9116/">https://docs.silabs.com/rs9116/</a><br><br><b>Note:</b><br>It is recommended to enable this bit, when using TCP sockets. |
| ext_tcp_ip_feature_bit_map[17]    | To enable MQTT feature                                                        | Disable      | Enable       | If user wants to use AT command for MQTT, should be enable this bit in the Opermode Command                                                                                                                                                                                                                                                                                                          |
| ext_tcp_ip_feature_bit_map[18]    | To enable HTTP OTAF Feature                                                   | Disable      | Enable       | To do firmware upgrade with http this bit should be enabled                                                                                                                                                                                                                                                                                                                                          |
| ext_tcp_ip_feature_bit_map[19:29] | Reserved                                                                      |              |              |                                                                                                                                                                                                                                                                                                                                                                                                      |
| ext_tcp_ip_feature_bit_map[30]    | To configure additional memory for SSL connection typically to a cloud server | Disable      | Enable       | If user connects to a cloud server using two SSL connections, then it is required to set this bit to avoid 0xD2 error                                                                                                                                                                                                                                                                                |
| ext_tcp_ip_feature_bit_map[31]    | config_feature_bit_map validity                                               | Disable      | Enable       |                                                                                                                                                                                                                                                                                                                                                                                                      |

**Note:**

- 1.Set BIT(31) in tcp\_ip\_feature\_bit\_map & BIT(29) in ext\_tcp\_ip\_feature\_bit\_map to open 3 SSL sockets.
2. Three SSL Feature is supported only in Opermode WLAN Only Mode.

**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,<br>Please refer <b>NOTE</b> given below for more info.                                                                                                                                                                                                                                                                              |
| ble_feature_bit_map[8:11]  | BLE Nbr of GATT services                                                            |              |              | maximum no services - 10<br>Please refer <b>NOTE</b> given below for more info.                                                                                                                                                                                                                                                                                        |
| ble_feature_bit_map[12:15] | BLE Nbr of slaves                                                                   |              |              | Maximum No of Ble slaves = 8<br>Please refer <b>NOTE</b> given below for more info.                                                                                                                                                                                                                                                                                    |
| ble_feature_bit_map[16:23] | BLE tx power index                                                                  |              |              | Give 31 as ble tx power index (e.g. 31<<16).<br><br>This variable is used to select the ble tx power index value. The following are the possible values.<br><br>Default Value for BLE Tx Power Index is 31<br>Range for the BLE Tx Power Index is 1 to 75 (0, 32 indices are invalid)<br><br>1 - 31 BLE -0DBM Mode<br>33 - 63 BLE- 10DBM Mode<br>64- 75 BLE - HP Mode. |
| ble_feature_bit_map[24:26] | BLE powersave options<br>BLE_DUTY_CYCLING<br>BIT(24)<br>BLR_DUTY_CYCLING<br>BIT(25) |              |              |                                                                                                                                                                                                                                                                                                                                                                        |

| ble_feature_bit_map        | Functionality                       | Bit set to 0 | Bit set to 1 | Note and Info |
|----------------------------|-------------------------------------|--------------|--------------|---------------|
|                            | BLE_4X_PWR_SAVE_MODE<br>BIT(26)     |              |              |               |
| ble_feature_bit_map[27:29] | Reserved                            |              |              |               |
| ble_feature_bit_map[30]    | RS9113 - RS9116 compatible features | Disable      | Enable       |               |
| ble_feature_bit_map[31]    | Reserved                            |              |              |               |

#### ble\_custom\_ext\_feature\_bit\_map:

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

| ble_coustom_ext_feature_bit_map       | Functionality                       | Bit set to 0 | Bit set to 1 | Note and Info                                       |
|---------------------------------------|-------------------------------------|--------------|--------------|-----------------------------------------------------|
| ble_coustom_ext_feature_bit_map[0:4]  | BLE nbr of Connection Events        |              |              |                                                     |
| ble_coustom_ext_feature_bit_map[5:12] | BLE nbr of record size in bytes (n) |              |              | E.g.: n*16:(n=60, default 1024 bytes(1K))           |
| ble_coustom_ext_feature_bit_map[13]   | GATT INIT                           |              |              | 0 - GATTt Init in Firmware<br>1 - GATT Init in Host |

#### 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 up to 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 up to 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 up to 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 up to 10 attributes.

#### config\_feature\_bit\_map:

This bitmap is valid only if BIT[31] of ext\_tcp\_ip\_feature\_bit\_map is set.

| config_feature_bit_map    | Functionality                        | Bit set to 0 | Bit set to 1 | Note and Info |
|---------------------------|--------------------------------------|--------------|--------------|---------------|
| config_feature_bit_map[0] | To select wakeup indication to host. | Disable      | Enable       |               |

| config_feature_bit_map      | Functionality                                                                                                                                            |                |                |                |                   |                      | Bit set to 0                                                                                                                                                                                                                         | Bit set to 1 | Note and Info                                     |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|----------------|-------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------------------------|
|                             | <p>If it is disabled UULP_GPIO_3 is used as a wakeup indication to host.</p> <p>If it is enabled UULP_GPIO_0 is used as a wakeup indication to host.</p> |                |                |                |                   |                      |                                                                                                                                                                                                                                      |              |                                                   |
| config_feature_bit_map[5:2] | <b>BIT (5)</b>                                                                                                                                           | <b>BIT (4)</b> | <b>BIT (3)</b> | <b>BIT (2)</b> | <b>BT Voltage</b> | <b>Wi-Fi Voltage</b> | <b>Description</b>                                                                                                                                                                                                                   |              | These bits are used for dynamic voltage selection |
|                             | 0                                                                                                                                                        | 0              | 0              | 0              |                   |                      | Default configuration. Voltages are based on BIT(25) in ext_custom_feature_bit_map, if this bit is set to 1 means 1.8v selected else 3.3v selected                                                                                   |              |                                                   |
|                             | 0                                                                                                                                                        | 0              | 0              | 1              | 3.1 V             | 3.1V                 | Fixed voltage operation 3.1V for BT and Wi-Fi.                                                                                                                                                                                       |              |                                                   |
|                             | 0                                                                                                                                                        | 0              | 1              | 0              | 1.85 V            | 1.85V                | Fixed voltage operation 1.85V for BT and Wi-Fi.                                                                                                                                                                                      |              |                                                   |
|                             | 0                                                                                                                                                        | 0              | 1              | 1              | 1.85 V            | 3.1V                 | Protocol based PA Voltage switching between BT and Wi-Fi – Option1                                                                                                                                                                   |              |                                                   |
|                             | 0                                                                                                                                                        | 1              | 0              | 0              | 1.55 V            | 3.1V                 | Protocol based PA Voltage switching between BT and Wi-Fi – Option2                                                                                                                                                                   |              |                                                   |
|                             | 0                                                                                                                                                        | 1              | 0              | 1              | 1.55 V/1.85V      | 1.85V /3.1V          | <p>NOTE: It's not supported Yet.</p> <p>Adaptive PA voltage switching based on Protocol and Wireless channel conditions</p> <p>BT 1.85V when far from headset – otherwise 1.55V</p> <p>Wi-Fi 1.85V when near AP – otherwise 3.1V</p> |              |                                                   |

| config_feature_bit_map        | Functionality |         |         |         |                                                                                                                                  | Bit set to 0 | Bit set to 1 | Note and Info                                                                                                                                                                                                               |
|-------------------------------|---------------|---------|---------|---------|----------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| config_feature_bit_map[9:6]   | BIT (6)       | BIT (7) | BIT (8) | BIT (9) | Description                                                                                                                      |              |              | These bits are used to select external PMU good time.<br><br>1 to 15 means 100usec to 1500usec (in100usec granularity)                                                                                                      |
|                               | 0             | 0       | 0       | 0       | 0 means INTERNAL_PMU                                                                                                             |              |              |                                                                                                                                                                                                                             |
|                               | 0             | 0       | 0       | 1       | EXTERNAL_PMU_GOOD_TIME_100USEC                                                                                                   |              |              |                                                                                                                                                                                                                             |
|                               | 0             | 0       | 1       | 0       | EXTERNAL_PMU_GOOD_TIME_200USEC                                                                                                   |              |              |                                                                                                                                                                                                                             |
|                               | 0             | 0       | 1       | 1       | EXTERNAL_PMU_GOOD_TIME_300USEC                                                                                                   |              |              |                                                                                                                                                                                                                             |
|                               | 0             | 1       | 0       | 0       | EXTERNAL_PMU_GOOD_TIME_400USEC                                                                                                   |              |              |                                                                                                                                                                                                                             |
|                               | 0             | 1       | 0       | 1       | EXTERNAL_PMU_GOOD_TIME_500USEC                                                                                                   |              |              |                                                                                                                                                                                                                             |
|                               | 0             | 1       | 1       | 0       | EXTERNAL_PMU_GOOD_TIME_600USEC                                                                                                   |              |              |                                                                                                                                                                                                                             |
|                               | 0             | 1       | 1       | 1       | EXTERNAL_PMU_GOOD_TIME_700USEC                                                                                                   |              |              |                                                                                                                                                                                                                             |
|                               | 1             | 0       | 0       | 0       | EXTERNAL_PMU_GOOD_TIME_800USEC                                                                                                   |              |              |                                                                                                                                                                                                                             |
|                               | 1             | 0       | 0       | 1       | EXTERNAL_PMU_GOOD_TIME_900USEC                                                                                                   |              |              |                                                                                                                                                                                                                             |
|                               | 1             | 0       | 1       | 0       | EXTERNAL_PMU_GOOD_TIME_1000USEC                                                                                                  |              |              |                                                                                                                                                                                                                             |
|                               | 1             | 0       | 1       | 1       | EXTERNAL_PMU_GOOD_TIME_1100USEC                                                                                                  |              |              |                                                                                                                                                                                                                             |
|                               | 1             | 1       | 0       | 0       | EXTERNAL_PMU_GOOD_TIME_1200USEC                                                                                                  |              |              |                                                                                                                                                                                                                             |
|                               | 1             | 1       | 0       | 1       | EXTERNAL_PMU_GOOD_TIME_1300USEC                                                                                                  |              |              |                                                                                                                                                                                                                             |
|                               | 1             | 1       | 1       | 0       | EXTERNAL_PMU_GOOD_TIME_1400USEC                                                                                                  |              |              |                                                                                                                                                                                                                             |
|                               | 1             | 1       | 1       | 1       | EXTERNAL_PMU_GOOD_TIME_1500USEC                                                                                                  |              |              |                                                                                                                                                                                                                             |
| config_feature_bit_map[11:10] | BIT(11)       |         | BIT(10) |         | Description                                                                                                                      |              |              | These bits are used for External LDO selection<br><br><b>External PMU:</b><br><br>1.In case of External PMU, User has to set EXTERNAL_P MU_GOOD_TIME_CONFIGURATION value to external PMU good time, if this is zero then it |
|                               | 0             |         | 1       |         | if this set External LDO Enable                                                                                                  |              |              |                                                                                                                                                                                                                             |
|                               | 1             |         | 1       |         | If this set External LDO is 1.0v, Else External LDO is 1.1v (This field valid only if External LDO is enabled i.e. 10bit is set) |              |              |                                                                                                                                                                                                                             |
|                               |               |         |         |         |                                                                                                                                  |              |              |                                                                                                                                                                                                                             |

| config_feature_bit_map        | Functionality                                                                                                                                                                                                                                        | Bit set to 0 | Bit set to 1 | Note and Info                                                                                                                                                         |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               |                                                                                                                                                                                                                                                      |              |              | indicates using Internal PMU.<br><br>2. In case of External PMU 1.0v or 1.05v, User has to set both the bits config_feature_bit_map[11] & config_feature_bit_map[10]. |
| config_feature_bit_map[13:12] | <b>BIT(13)</b>                                                                                                                                                                                                                                       |              |              | If these bits are not set, then by default UULP_GPIO_0 will be used.                                                                                                  |
|                               | <b>BIT(12)</b>                                                                                                                                                                                                                                       |              |              |                                                                                                                                                                       |
|                               | <b>Description</b>                                                                                                                                                                                                                                   |              |              |                                                                                                                                                                       |
|                               |                                                                                                                                                                                                                                                      |              |              |                                                                                                                                                                       |
|                               | 0                                                                                                                                                                                                                                                    | 0            |              | UULP_GPIO_0 as sleep indication to host.                                                                                                                              |
|                               | 0                                                                                                                                                                                                                                                    | 1            |              | UULP_GPIO_6 as sleep indication to host.                                                                                                                              |
|                               | 1                                                                                                                                                                                                                                                    | 1            |              | UULP_GPIO_5 as sleep indication to host                                                                                                                               |
| config_feature_bit_map[14]    | To select TLS 1.0 version                                                                                                                                                                                                                            |              | Disable      | Enable                                                                                                                                                                |
| config_feature_bit_map[15]    | To select TLS 1.2 version                                                                                                                                                                                                                            |              | Disable      | Enable                                                                                                                                                                |
| config_feature_bit_map[16]    | Active high or low interrupt mode selection for wake on wireless operation<br><br>If it is disabled active low interrupt is used in wake on wireless operation.<br><br>If it is enabled active high interrupt is used in wake on wireless operation. |              | Disable      | Enable                                                                                                                                                                |
| config_feature_bit_map[31:17] | Reserved                                                                                                                                                                                                                                             |              |              |                                                                                                                                                                       |

### **Note:**

#### **32KHz external clock connection and power save pins**

As per Silicon lab's datasheet update in May 2019, the 32KHz external clock and the power save pins connections have changed. To keep SW compatibility between initial design (i.e. first EVKs developed by Silicon labs) as well as new designs, there are currently 2 options for connecting the 32KHz external clock and the power save pins:

#### **Option 1:**

External 32KHz clock connection pins : XTAL\_32KHZ\_P & XTAL\_32KHZ\_N

Power Save connection pins : HOST\_BYP\_ULP\_WAKEUP & UULP\_VBAT\_GPIO\_3

#### **Option 2:**

External 32KHz clock connection pin : UULP\_VBAT\_GPIO\_3

Power Save connection pins : HOST\_BYP\_ULP\_WAKEUP & UULP\_VBAT\_GPIO\_0

As per Silicon's labs datasheet updated in May'2019, Option 2 must be used for External 32KHz external clock and Power save connections in new designs.

**Response:**

**AT Mode:**

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

**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.

**Note:**

Enabling Aggregation bit (feature\_bit\_map[2]) and Low power mode bit (ext\_custom\_feature\_bit\_map[19]) in Opermode will result in Wi-Fi data not working. So, they cannot be enabled at the same time.

## 5.2 Band

**Description:**

This command configures the band in which the module must be configured. This command must be issued after opermode command.

**Command Format:**

**AT Mode:**

```
at+rsi_band=< bandVal >\r\n
```

**Command Parameters:**

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

**bandVal(1 byte):**

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

**Note:**

1. Dual band is supported in station 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                             |

**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\_band=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

## 5.3 WLAN Config

**Description:**

This command configures WLAN parameters.

**Command Format:**

**AT Mode:**

at+rsi\_config=< config\_type >,< config\_val >\r\n

**Command Parameters:**

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

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

Config\_type[2 bytes]: 1 - To configure RTS threshold value

Config\_value[2 bytes]: [256-2346] - Range of rts threshold value

**Note:**

Only RTS\_THRESHOLD is supported.

**Note:**

rsi\_config command must be given after rsi\_init command.

**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 0x0063, 0x0064.

**Relevance:**

This command is relevant in all operating modes.

**Example:**

**AT Mode:**

```
at+rsi_config=1,256\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x63 0x6F 0x6E 0x66 0x69
0x67 0x3D 0x31 0x2C 0x32 0x35 0x36 0x0D 0x0A
```

**Response:**

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

## 5.4 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
```

**Command Parameters:**

**macAddr[6 bytes]** – 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                             |

**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
```

## 5.5 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

#### Command Parameters:

No parameters

### Response:

#### AT Mode:

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

### Response Parameters:

macAddress[6 byte]: 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                                           |

### Response Parameters:

macAddress[6 bytes]: 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
```

## 5.6 User Configurable Gain Table

### Description:

This command is used to configure gain table to the module from user. This method is used for overwriting default gain tables that are present in firmware. This command has to be issued immediate to init command. Customer can load all the three gain tables (i.e., 2.4GHz-20Mhz, 5GHz-20Mhz) one after other by changing band and bandwidth values.

#### Note:

This frame has to be used by customers who has done FCC/ETSI/KCC certification with their own antenna. All other customers should not use this. Inappropriate use of this frame may result in violation of FCC/ETSI/KCC or any certifications and Silicon labs is not liable for that.

### Command:

#### AT Mode:

```
at+rsi_gain_table=<Band>,<Bandwidth>,<payload_len>,<payload>\r\n
```

### Command Parameters:

#### Band[1 byte]:

| Mode | Functionality |
|------|---------------|
| 1    | 2.4 GHz       |
| 2    | 5 GHz         |

#### Bandwidth:

| Mode | Functionality |
|------|---------------|
| 0    | 20 MHz        |
| 1    | 40 MHz        |

#### Note:

40MHz is not supported.

### Payload\_len:

- 1) Max table size in 2.4Ghz is 128 bytes
- 2) Max table size in 5Ghz is 64bytes.

**Payload:** pass channel gain values for different regions in the mentioned format.

### Gain Table Payload Format:

1. Gain table Format for 2.4G Band: (Each entry of the table is 1 byte)

```
<TABLE NAME>[] = {
<NO.of Regions>,
<REGION NAME 1>, <CHANNEL_CODE_2G>,
<CHANNEL NUMBER 1>, <MAX POWER FOR b RATE>, <MAX POWER FOR g RATE>, <MAX POWER
FOR n RATE>,
<CHANNEL NUMBER 2>, <MAX POWER FOR b RATE>, <MAX POWER FOR g RATE>, <MAX POWER
```

```

FOR n RATE>,
.
.
<CHANNEL NUMBER m-1>, <MAX POWER FOR b RATE>, <MAX POWER FOR g RATE>, <MAX POWER
FOR n RATE>,
<CHANNEL NUMBER m>, <MAX POWER FOR b RATE>, <MAX POWER FOR g RATE>, <MAX POWER
FOR n RATE>,
<REGION NAME 2>, <CHANNEL_CODE_2G>,
<CHANNEL NUMBER 1>, <MAX POWER FOR b RATE>, <MAX POWER FOR g RATE>, <MAX POWER
FOR n RATE>,
<CHANNEL NUMBER 2>, <MAX POWER FOR b RATE>, <MAX POWER FOR g RATE>, <MAX POWER
FOR n RATE>,
.
.
<CHANNEL NUMBER m-1>, <MAX POWER FOR b RATE>, <MAX POWER FOR g RATE>, <MAX POWER
FOR n RATE>,
<CHANNEL NUMBER m>, <MAX POWER FOR b RATE>, <MAX POWER FOR g RATE>, <MAX POWER
FOR n RATE>,
<REGION NAME 3>, <CHANNEL_CODE_2G>,
.
.
<REGION NAME y>, <CHANNEL_CODE_2G>,
};

```

## 2. Gain table Format for 5G Band: (Each entry of the table is 1 byte)

```

<TABLE NAME>[] = {
<NO.of Regions>,
<REGION NAME 1>, <CHANNEL_CODE_5G>,
<CHANNEL NUMBER IN BAND 1 IF ANY>, <MAX POWER FOR g RATE>, <MAX POWER FOR n RATE>,
<BAND_NUMBER 1>, <MAX POWER FOR g RATE>, <MAX POWER FOR n RATE>,
<CHANNEL NUMBER IN BAND 2 IF ANY>, <MAX POWER FOR g RATE>, <MAX POWER FOR n RATE>,
<BAND_NUMBER 2>, <MAX POWER FOR g RATE>, <MAX POWER FOR n RATE>,
<CHANNEL NUMBER IN BAND 3 IF ANY>, <MAX POWER FOR g RATE>, <MAX POWER FOR n RATE>,
<BAND_NUMBER 3>, <MAX POWER FOR g RATE>, <MAX POWER FOR n RATE>,
<CHANNEL NUMBER IN BAND 4 IF ANY>, <MAX POWER FOR g RATE>, <MAX POWER FOR n RATE>,
<BAND_NUMBER 4>, <MAX POWER FOR g RATE>, <MAX POWER FOR n RATE>,
.
.
.
<REGION NAME y>, <CHANNEL_CODE_5G>,
};

```

## 3. Supported Region names

The following are the regions and their values to be passed instead of macros in the example.

| Region | Macro Value |
|--------|-------------|
| FCC    | 0           |
| ETSI   | 1           |
| TELEC  | 2           |
| KCC    | 4           |

## 4. <CHANNEL\_CODE\_2G> is a 8 bit value which is encoded as

If Tx powers of all the channels are same, then use CHANNEL\_CODE\_2G as 17. In this case, mention channel number as 255.

If Tx power is not same for all channels, then indicate CHANNEL\_CODE\_2G as no-of channels. And specify tx power values for all the channels indicated.

5. <CHANNEL\_CODE\_5G> is a 8 bit value encoded as number of rows in a region for 5G band.
  - a. 5G is divided into 4 sub bands:
    - band 1: channel number <= 48
    - band 2: channel number > 48 and channel number <= 64
    - band 3: channel number > 64 and channel number <= 144
    - band 4: channel number > 144
  - b. If any channel in a band has different set of power values, specify the channel number followed by power values.
  - c. If all the channels in a band 1 has same power values, specify the band number as 1 followed by power value.
  - d. If all the channels in a band 2 has same power values, specify the band number as 2 followed by power value.
  - e. If all the channels in a band 3 has same power values, specify the band number as 3 followed by power value.
  - f. If all the channels in a band 4 has same power values, specify the band number as 4 followed by power value.

**Note:**

Length of the payload should match with payload\_len parameter value.

**Response:**

**AT Mode:**

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

**Possible error codes:**

Possible error codes are 0x0021, 0x003E.

**Relevance:**

This command is relevant in wlan operating modes.

**Example:**

**AT Mode:**

at+rsi\_gain\_table=0,1,128,<payload>\r\n

**Example payload formats:**

Examples:

For 2.4Ghz Band in 20Mhz bandwidth:

```
{3, //NUM_OF_REGIONS
  FCC, 13, //NUM_OF_CHANNELS
  // rate, 11b, 11g, 11n
  1, 17, 10, 10,
  2, 17, 14, 14,
  3, 17, 16, 16,
  4, 17, 18, 18,
  5, 17, 19, 19,
  6, 17, 20, 20,
  7, 17, 19, 19,
  8, 17, 18, 18,
  9, 17, 16, 16,
  10, 17, 16, 16,
```

```

    11, 17, 12, 12,
    12, 17, 8, 12,
    13, 17, 6, 6,
    TELEC, 17,
    255, 10, 8, 8,
    KCC, 17,
    255, 13, 10, 10,
}; //}}}

```

For 5Ghz band in 20Mhz bandwidth:

```

{2,
FCC, 6,
    1, 9, 10, //band 1
    2, 8, 9, //band 2
    100, 4, 4, //band 3
    3, 6, 8, //band 3
    149, 3, 3, //band 4
    4, 6, 7, //band 4
TELEC, 4,
    1, 9, 10, //band 1
    2, 8, 10, //band 2
    3, 6, 8, //band 3
    4, 6, 7, //band 4
};

```

Customers using Certified MARS antenna should use the below mentioned gain table structures

```

/*****2GHZ-20MHZ*****/
{3, //NUM_OF_REGIONS
    FCC, 0xD, //NUM_OF_CHANNELS
    // rate, 11b, 11g, 11n
    1, 14, 16, 15,
    2, 14, 16, 15,
    3, 14, 16, 15,
    4, 15, 14, 17,
    5, 15, 14, 17,
    6, 15, 14, 17,
    7, 15, 14, 17,
    8, 15, 14, 17,
    9, 14, 15, 15,
    10, 14, 15, 15,
    11, 14, 15, 15,
    12, 14, 15, 15,
    13, 14, 15, 15,
    TELEC, 0x11, //NA
    255, 10, 8, 8,
    KCC, 0x11 //NA,
    255, 13, 10, 10
};

```

```

/*****5GHZ-20MHZ*****/
{2,
FCC, 0x6,
    1, 12, 12, //band 1
    2, 11, 11, //band 2
    100, 10, 12, //band 3
    3, 13, 13, //band 3
    140, 10, 11, //band 4
    4, 13, 13, //band 4
TELEC, 0x4, //NA
    1, 9, 10, //band 1
    2, 8, 10, //band 2
    3, 6, 8, //band 3
    4, 6, 7, //band 4

```

```
};
```

### Response:

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

### Note:

In AT command mode, User configurable gain table command will simply return OK as a response irrespective of payload content.

## 5.7 PER Mode

### Description:

This command configures the PER (Packet Error Rate) Mode in RS9116-WiSeConnect. This command should be issued after *Init* command.

### 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
```

#### Command Parameters:

**per\_mode\_enable[2 byte]:** To enable or disable PER Mode.

0 – disable

1 – enable

**power[2 byte]:** To set Tx power in dbm.

**rate[4 byte]:** To set transmit data rate.

| Value of rate | Data Rate (Mbps) |
|---------------|------------------|
| 0             | 1                |
| 2             | 2                |
| 4             | 5.5              |
| 6             | 11               |
| 139           | 6                |
| 143           | 9                |
| 138           | 12               |
| 142           | 18               |
| 137           | 24               |
| 141           | 36               |
| 136           | 48               |
| 140           | 54               |
| 256           | MCS0             |
| 257           | MCS1             |
| 258           | MCS2             |

| Value of rate | Data Rate (Mbps) |
|---------------|------------------|
| 259           | MCS3             |
| 260           | MCS4             |
| 261           | MCS5             |
| 262           | MCS6             |
| 263           | MCS7             |

#### PER Mode Data Rates

**length[2 bytes]:** 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[2 byte]:** 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 Continuous mode with power and channel values which is intended to be used in Continuous Wave mode i.e.

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

**channel[2 bytes]:** 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                                             |
| 7                        | 2442                                             |
| 8                        | 2447                                             |
| 9                        | 2452                                             |
| 10                       | 2457                                             |
| 11                       | 2462                                             |

| Channel Numbers (2.4GHz) | Center frequencies for 20MHz channel width (MHz) |
|--------------------------|--------------------------------------------------|
| 12                       | 2467                                             |
| 13                       | 2472                                             |
| 14                       | 2484                                             |

#### 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                                             |

| Channel Numbers (5GHz) | Center Frequencies for 20MHz channel width (MHz) |
|------------------------|--------------------------------------------------|
| 165                    | 5825                                             |

#### 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[2 bytes]:** 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     |

#### Rate Flags

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

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

#### Note:

Short GI is not supported in this release.

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

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

**aggr\_enable[2 byte]:** 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[2 byte]:** 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[4 byte]:** This field is used to set the delay between the packets in burst mode. Delay should be given in microseconds. i.e. if the value is given as 'n' then a delay of 'n' microseconds 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:

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                             |

#### 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
```

The following table providing the mapping between <power> and output power in dBm.

|                                   |              |                             |        |                                                               |      |        |           |          |              |                 |            |            |            |                                    |            |            |            |
|-----------------------------------|--------------|-----------------------------|--------|---------------------------------------------------------------|------|--------|-----------|----------|--------------|-----------------|------------|------------|------------|------------------------------------|------------|------------|------------|
|                                   |              |                             |        |                                                               |      | Q<br>7 | M7D<br>B  | M4S<br>B | W3           | M15<br>SB       |            |            |            |                                    |            |            |            |
|                                   |              |                             |        | Module_Off<br>set                                             |      | 2      | 3         | 2        | 2            | 3               |            |            |            |                                    |            |            |            |
| WorldWi<br>de<br>Region           |              |                             |        |                                                               |      |        |           |          |              |                 |            |            |            |                                    |            |            |            |
| All Power<br>values are in<br>dBm |              |                             |        |                                                               |      |        |           |          |              |                 |            |            |            |                                    |            |            |            |
| 2.4GHz                            | 20M<br>Hz    |                             |        |                                                               |      |        |           |          | 5GH<br>z     | 20M<br>Hz       |            |            |            | M7DB                               |            |            |            |
|                                   |              |                             |        | Max Power @ Antenna =Max<br>Power @ Chip_out-Module<br>Offset |      |        |           |          |              | Max Power table |            |            |            | Max Power table -<br>Module Offset |            |            |            |
|                                   | Data<br>Rate | Max<br>Power<br>@<br>Chip_o | Q<br>7 | M7D<br>B                                                      | M4SB | W<br>3 | M15<br>SB |          | Data<br>Rate | BAN<br>D-1      | BAN<br>D-2 | BAN<br>D-3 | BAN<br>D-4 | BAN<br>D-1                         | BAN<br>D-2 | BAN<br>D-3 | BAN<br>D-4 |

|  |          | ut (As<br>per<br>dotc) |        |    |    |  |    |    |  |          |    |    |    |    |    |    |   |   |
|--|----------|------------------------|--------|----|----|--|----|----|--|----------|----|----|----|----|----|----|---|---|
|  | 1        | 20                     | 1<br>8 | 17 | 18 |  | 18 | 17 |  | 6        | 14 | 13 | 12 | 12 | 11 | 10 | 9 | 9 |
|  | 2        | 20                     | 1<br>8 | 17 | 18 |  | 18 | 17 |  | 9        | 14 | 13 | 12 | 12 | 11 | 10 | 9 | 9 |
|  | 5.5      | 20                     | 1<br>8 | 17 | 18 |  | 18 | 17 |  | 12       | 14 | 13 | 12 | 12 | 11 | 10 | 9 | 9 |
|  | 11       | 20                     | 1<br>8 | 17 | 18 |  | 18 | 17 |  | 18       | 14 | 13 | 12 | 12 | 11 | 10 | 9 | 9 |
|  | 6        | 21                     | 1<br>9 | 18 | 19 |  | 19 | 18 |  | 24       | 14 | 13 | 12 | 12 | 11 | 10 | 9 | 9 |
|  | 9        | 21                     | 1<br>9 | 18 | 19 |  | 19 | 18 |  | 36       | 13 | 12 | 10 | 10 | 10 | 9  | 7 | 7 |
|  | 12       | 21                     | 1<br>9 | 18 | 19 |  | 19 | 18 |  | 48       | 11 | 10 | 8  | 8  | 8  | 7  | 5 | 5 |
|  | 18       | 20                     | 1<br>8 | 17 | 18 |  | 18 | 17 |  | 54       | 9  | 8  | 7  | 6  | 6  | 5  | 4 | 3 |
|  | 24       | 19                     | 1<br>7 | 16 | 17 |  | 17 | 16 |  | MC<br>S0 | 14 | 13 | 12 | 12 | 11 | 10 | 9 | 9 |
|  | 36       | 17                     | 1<br>5 | 14 | 15 |  | 15 | 14 |  | MC<br>S1 | 14 | 13 | 12 | 12 | 11 | 10 | 9 | 9 |
|  | 48       | 16                     | 1<br>4 | 13 | 14 |  | 14 | 13 |  | MC<br>S2 | 14 | 13 | 12 | 12 | 11 | 10 | 9 | 9 |
|  | 54       | 16                     | 1<br>4 | 13 | 14 |  | 14 | 13 |  | MC<br>S3 | 13 | 13 | 12 | 12 | 10 | 10 | 9 | 9 |
|  | MCS<br>0 | 20                     | 1<br>8 | 17 | 18 |  | 18 | 17 |  | MC<br>S4 | 11 | 12 | 10 | 10 | 8  | 9  | 7 | 7 |
|  | MCS<br>1 | 20                     | 1<br>8 | 17 | 18 |  | 18 | 17 |  | MC<br>S5 | 10 | 10 | 8  | 8  | 7  | 7  | 5 | 5 |
|  | MCS<br>2 | 20                     | 1<br>8 | 17 | 18 |  | 18 | 17 |  | MC<br>S6 | 8  | 8  | 6  | 6  | 5  | 5  | 3 | 3 |
|  | MCS<br>3 | 19                     | 1<br>7 | 16 | 17 |  | 17 | 16 |  | MC<br>S7 | 7  | 6  | 5  | 3  | 4  | 3  | 2 | 0 |
|  | MCS<br>4 | 17                     | 1<br>5 | 14 | 15 |  | 15 | 14 |  |          |    |    |    |    |    |    |   |   |
|  | MCS<br>5 | 16                     | 1<br>4 | 13 | 14 |  | 14 | 13 |  |          |    |    |    |    |    |    |   |   |
|  | MCS<br>6 | 16                     | 1<br>4 | 13 | 14 |  | 14 | 13 |  |          |    |    |    |    |    |    |   |   |
|  | MCS<br>7 | 14                     | 1<br>2 | 11 | 12 |  | 12 | 11 |  |          |    |    |    |    |    |    |   |   |
|  |          |                        |        |    |    |  |    |    |  |          |    |    |    |    |    |    |   |   |
|  |          |                        |        |    |    |  |    |    |  |          |    |    |    |    |    |    |   |   |

| 2.4GHz | 40M<br>Hz    |                                   |                                                               |          |      |  |        |           | 5GH<br>z | 40M<br>Hz       |            |            |            | M7DB                               |            |            |            |            |
|--------|--------------|-----------------------------------|---------------------------------------------------------------|----------|------|--|--------|-----------|----------|-----------------|------------|------------|------------|------------------------------------|------------|------------|------------|------------|
|        |              |                                   | Max Power @ Antenna =Max<br>Power @ Chip_out-Module<br>Offset |          |      |  |        |           |          | Max Power table |            |            |            | Max Power table -<br>Module Offset |            |            |            |            |
|        | Data<br>Rate | Max<br>Power<br>@<br>Chip_o<br>ut | Q<br>7                                                        | M7D<br>B | M4SB |  | W<br>3 | M15<br>SB |          | Data<br>Rate    | BAN<br>D-1 | BAN<br>D-2 | BAN<br>D-3 | BAN<br>D-4                         | BAN<br>D-1 | BAN<br>D-2 | BAN<br>D-3 | BAN<br>D-4 |
|        | MCS<br>0     | 8                                 | 6                                                             | 5        | 6    |  | 6      | 5         |          | MC<br>S0        | 10         | 10         | 9          | 9                                  | 7          | 7          | 6          | 6          |
|        | MCS<br>1     | 8                                 | 6                                                             | 5        | 6    |  | 6      | 5         |          | MC<br>S1        | 10         | 10         | 9          | 9                                  | 7          | 7          | 6          | 6          |
|        | MCS<br>2     | 8                                 | 6                                                             | 5        | 6    |  | 6      | 5         |          | MC<br>S2        | 10         | 10         | 9          | 9                                  | 7          | 7          | 6          | 6          |
|        | MCS<br>3     | 8                                 | 6                                                             | 5        | 6    |  | 6      | 5         |          | MC<br>S3        | 10         | 10         | 9          | 9                                  | 7          | 7          | 6          | 6          |
|        | MCS<br>4     | 8                                 | 6                                                             | 5        | 6    |  | 6      | 5         |          | MC<br>S4        | 10         | 10         | 9          | 9                                  | 7          | 7          | 6          | 6          |
|        | MCS<br>5     | 8                                 | 6                                                             | 5        | 6    |  | 6      | 5         |          | MC<br>S5        | 10         | 10         | 9          | 9                                  | 7          | 7          | 6          | 6          |
|        | MCS<br>6     | 8                                 | 6                                                             | 5        | 6    |  | 6      | 5         |          | MC<br>S6        | 9          | 8          | 7          | 7                                  | 6          | 5          | 4          | 4          |
|        | MCS<br>7     | 8                                 | 6                                                             | 5        | 6    |  | 6      | 5         |          | MC<br>S7        | 8          | 6          | 5          | 5                                  | 5          | 3          | 2          | 2          |

## 5.8 Configure AP Mode

### Description

This command is used to set the configuration information for AP mode. This command must 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_keepalive_type>,<ap_keepalive_period>\r\n
```

### Parameters

**channel\_no[2 bytes]:** 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[32 bytes]:** SSID of the AP to be created

**Note:**

- To support comma (,) in SSID, user needs to give SSID with in double quotes ("<SSID>").  
Ex: "MY, NETWORK"
- Not supported double quotes (") in SSID.

**security\_type[1 byte]:** Security type.

| Mode | Functionality |
|------|---------------|
| 0    | Open          |
| 1    | WPA           |
| 2    | WPA2          |

**encryp\_mode[1 byte]:** Encryption type.

| Mode | Functionality |
|------|---------------|
| 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'.

**Note:**

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

**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. Allowed values are from 1 to 255

**ap\_keepalive\_type[1 byte]:** 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 are no wireless exchanges from station with in ap\_keepalive\_period).

**ap\_keepalive\_period[1 byte]:** 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[2 bytes]:** 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 RS9116W 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 Compatibility 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                             |

#### 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 = ap\_ssid, open mode, beacon interval = 100, DTIM count =3 and max stations support =3.

```
at+rsi_apconf=11,ap_ssid,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 0x64 0x70
0x69 0x6E 0x65 0x2C 0x30 0x2C 0x30 0x2C 0x30 0x2C 0x31 0x30 0x30 0x2C 0x33 0x2C 0x33 0x0D 0x0A
```

#### Response:

```
OK\r\n
```

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

## 5.9 WPS PIN Method

#### Description:

This command configures the WPS PIN method to be used in RS9116-WiSeConnect. This command should be issued before join command.

#### Command Format:

##### AT Mode:

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

#### Command Parameters:

**wps\_method[2 bytes]:** WPS method type Should set to '1' for PIN method.

**generate\_pin[2 bytes]:** 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[8 bytes]:** wps\_pin is of 8-digit 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 method response does not contains any payload.

#### AT Mode:

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

#### 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
```

## 5.10 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 *init* command and before *Join* command.

#### 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
```

#### Command Parameters:

**Channel[4 byte]:** 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  
BIT(0) (QUICK SCAN feature) -It is valid only if channel number and ssid is given.  
BIT(1) (SCAN RESULTS TO HOST) - when it is enabled additional scan results are given to host. After getting scan results, host has to issue another scan request by disabling this bit in scan feature bitmap before issuing join command.
4. If channel bitmap is specified, Module will scan only channels which are valid in selected region

**Table 5: Channels in 2.4 GHz Mode**

| 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                 |

**Note:**

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

**Table 6: Channels in 5GHz Mode**

| Channel Number | chan_num parameter |
|----------------|--------------------|
| All channels   | 0                  |
| 36             | 36                 |
| 40             | 40                 |

| Channel Number | chan_num parameter |
|----------------|--------------------|
| 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                |
| 144            | 144                |
| 149            | 149                |
| 153            | 153                |
| 157            | 157                |
| 161            | 161                |
| 165            | 165                |

| 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[32 byte]:** 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.

**Note:**

1. To support comma (,) in SSID, user needs to give SSID with in double quotes ("<SSID>").

Ex: "MY, NETWORK"

1. Not supported double quotes (") in SSID.

Reserved: Set to '0's.

**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.

**channel\_bit\_map\_2\_4[2 bytes]:** channel bitmap for scanning in set of selective channels in 2.4Ghz.

**Channel\_bit\_map\_5[4 bytes]:** 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.

**Table 7: Channel Number to Bitmap Mapping in 2.4GHz**

| Channel Number | Channel bit position in bitmap |
|----------------|--------------------------------|
| 1              | 0                              |
| 2              | 1                              |
| 3              | 2                              |
| 4              | 3                              |
| 5              | 4                              |
| 6              | 5                              |
| 7              | 6                              |
| 8              | 7                              |
| 9              | 8                              |
| 10             | 9                              |
| 11             | 10                             |
| 12             | 11                             |
| 13             | 12                             |
| 14             | 13                             |

**Table 8: Channel Number to Bitmap Mapping in 5GHz**

| Channel Number | chan_num parameter |
|----------------|--------------------|
| 36             | 0                  |
| 40             | 1                  |
| 44             | 2                  |
| 48             | 3                  |
| 52             | 4                  |

| Channel Number | chan_num parameter |
|----------------|--------------------|
| 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                 |
| 144            | 19                 |
| 149            | 20                 |
| 153            | 21                 |
| 157            | 22                 |
| 161            | 23                 |
| 165            | 24                 |

| Channel Number(4.9GHz) | Channel bit position in bitmap |
|------------------------|--------------------------------|
| 8                      | 0                              |
| 12                     | 1                              |
| 16                     | 2                              |
| 184                    | 3                              |
| 188                    | 4                              |
| 192                    | 5                              |
| 196                    | 6                              |

#### AT Mode:

| Result Code                                                                                                                                                                                                                                                                                                   | Description                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| OK< <a href="#">scanCount</a> >< <a href="#">padding</a> ><br>< <a href="#">rfChannel</a> >< <a href="#">securityMode</a> >< <a href="#">rssiVal</a> >< <a href="#">uNetworkType</a> >< <a href="#">ssid</a> >< <a href="#">bssid</a> ><<br><a href="#">reserved</a> > .....up to the number of scanned nodes | Successful execution of the command. |
| ERROR<Error code>                                                                                                                                                                                                                                                                                             | Failure                              |

## 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            |
| 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(32 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 "ap\_ssid\_net1" and "ap\_ssid\_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 =ap_ssid_net2> < bssid =0x00 0x23 0xA7 0x1F 0x1F 0x15> < reserved >< rfChannel =0x06> < securityMode =0x00> < rssiVal =20> < uNetworkType =0x01> < ssid =ap_ssid_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 0x64 0x70 0x69 0x6E 0x65 0x5F 0x6E 0x74 0x32 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 0x64 0x70 0x69 0x6E 0x65 0x5F 0x6E 0x74 0x31 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
```

## 5.11 Join

### Description:

This command is used for following:

1. Associate to an access point (operating mode = 0 or 2)

2. Create an Access Point (operating mode 6)
3. 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

**Note:**

1. To support comma (,) in SSID, user needs to give SSID with in double quotes ("<SSID>").
  - i. Ex: "MY, NETWORK"
2. Not supported double quotes (") in SSID.

**Command Parameters:**

reserved1: Reserved. Set to '0'

**Security\_mode[1 byte]:** 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  |

**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. WPS method is not supported in Coex mode.

**dataRate[1 byte]:** Transmission data rate. Physical rate at which data has to be transmitted.

**Table 9: Transmission Data Rates**

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

| Data Rate (Mbps) | Value of Data Rate |
|------------------|--------------------|
| 2                | 2                  |
| 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                 |

**powerLevel[1 byte]:** 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. 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.

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

**Note:**

1. To support comma (,) in SSID, user needs to give SSID with in double quotes ("<SSID>").  
Ex: "MY, NETWORK"
2. Not supported double quotes (") in SSID.

Reserved2: Reserved, set to '0'

ssid\_len: Actual length of the SSID

**join\_feature\_bitmap[1 byte]:**

| Functionality                                      | Bit set to 0 | Bit set to 1 | Note and Info                                                                                                                 |
|----------------------------------------------------|--------------|--------------|-------------------------------------------------------------------------------------------------------------------------------|
| b/g only mode in station mode                      | Disable      | Enable       |                                                                                                                               |
| listen interval from join command                  | Disable      | Enable       |                                                                                                                               |
| quick join feature                                 | Disable      | Enable       |                                                                                                                               |
| CCXV2                                              | Disable      | Enable       |                                                                                                                               |
| AP based on BSSID                                  | Disable      | Enable       |                                                                                                                               |
| Management Frame Protection Capable only (802.11W) | Disable      | Enable       |                                                                                                                               |
| 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. |
| listen interval from power save command            | Disable      | Enable       |                                                                                                                               |

**listen\_interval[4 bytes]:** 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.

**Note:**

To ensure data for module is buffered for sufficient time in access point,

1. Listen interval in association request is incremented by 6 if user configured interval is greater than 11.
2. If user configured listen interval less than or equal to 11, by default module will send listen interval 16 in association request.

But during power save module goes to sleep for user defined listen interval only.

**Vap\_id[1 byte]:** Possible values are 0 and 1.

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

When 1 – Module will create AP.

**join\_bssid[6 bytes]:** 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.

## 5.12 Request Timeout

### Description:

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

### Command Format:

#### AT Mode:

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

### Command Parameters:

**timeout\_bitmap[4 bytes]:**

| timeout_bitmap    | Functionality                                                                                                   |
|-------------------|-----------------------------------------------------------------------------------------------------------------|
| timeout_bitmap[0] | sets timeout for association and authentication request.<br>timeout_value: timeout value in ms (default 300ms). |
| timeout_bitmap[1] | Sets 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
```

## 5.13 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
```

#### Command Parameters:

**rsi\_max\_try[4 bytes]:** 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 the time interval in seconds for the subsequent retry.

**rsi\_beacon\_missed\_count[4 bytes]:** 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[4 bytes]:** 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                             |

#### 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

## 5.14 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

#### Command Parameters:

**wmm\_ps\_enable[2 bytes]:** To enable or disable WMM PS

0 - disable

1 - enable

**wmm\_ps\_type[2 bytes]:** WMM PS type

0 - Tx Based

1 - Periodic

**wmm\_ps\_wakeup\_interval[4 bytes]:** Wakeup interval in milli seconds.

**wmm\_ps\_uapsd\_bitmap[1 byte]:** Bitmap , 0 to 15 possible values.

**Note:**

Individual ACs shouldn't be configured for WMM power save. If user wants to enable UAPSD, then UAPSD bitmap should be 0xF (need to enable all AC's).

| 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: Background         |
| 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                             |

**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
```

## 5.15 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
```

**Command Parameters:**

**TimeVal[2 bytes]:** 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 command |
| ERROR<Error code> | Failure                             |

**Possible error codes:**

Possible error codes are 0x0025, 0x002C.

**Relevance:**

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

## 5.16 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. RS9116-WiSeConnect 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](#) >,<listen\_interval>\r\n

**Command Parameters:**

**powerVal[1 byte]:**

| 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[1 byte]:**

| 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[1 byte]:**

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.

**psp\_type[1 byte]:** 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[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.

### **num\_of\_dtim\_skip[1 byte]:**

This parameter is to skip the number of dtim. if its value is n then our module will wake up 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

**listen\_interval[2 bytes]:** This is valid only if BIT(7) 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 and should be less than the listen interval configured in join command.

#### **Note:**

If the User wants to change the Listen\_interval dynamically, then user needs to disable Power save and enable power save again with a new listen\_interval.

### **Response:**

#### **AT Mode:**

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

### **Possible error codes:**

Possible error codes are 0x0021, 0x0025, 0x002C, 0xFFFF8, 0x0015, 0x0026, 0x0052

### **Relevance:**

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

## **5.16.1 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.

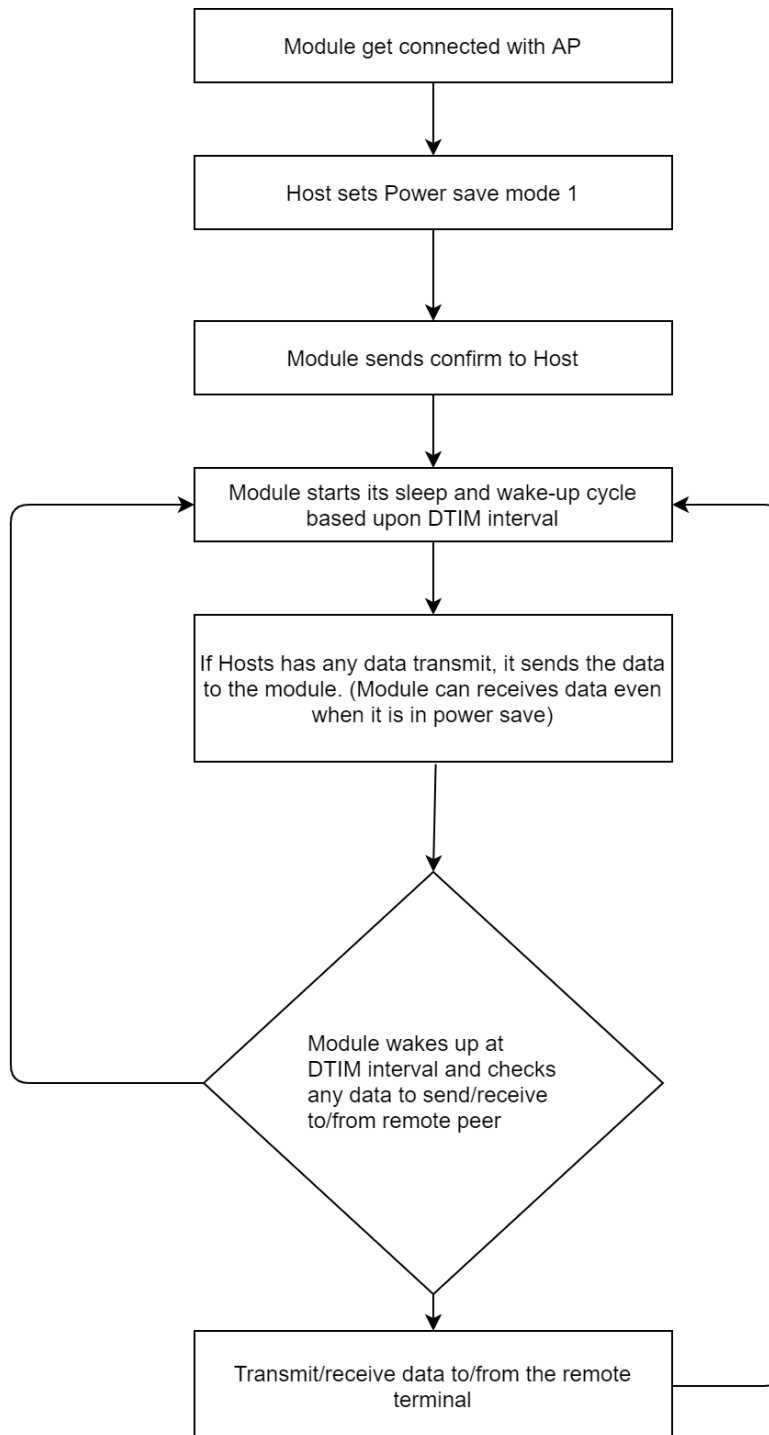
| Protocol   | Non-Connected State                                               | Connected State                                                                                                         |
|------------|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 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 lesser than the WLAN wakeup period, the module will wake up and serves BT/BLE and go back to the sleep again.

### 5.16.2 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 22: 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.

### 5.16.3 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-wake up cycle based upon the DTIM interval.

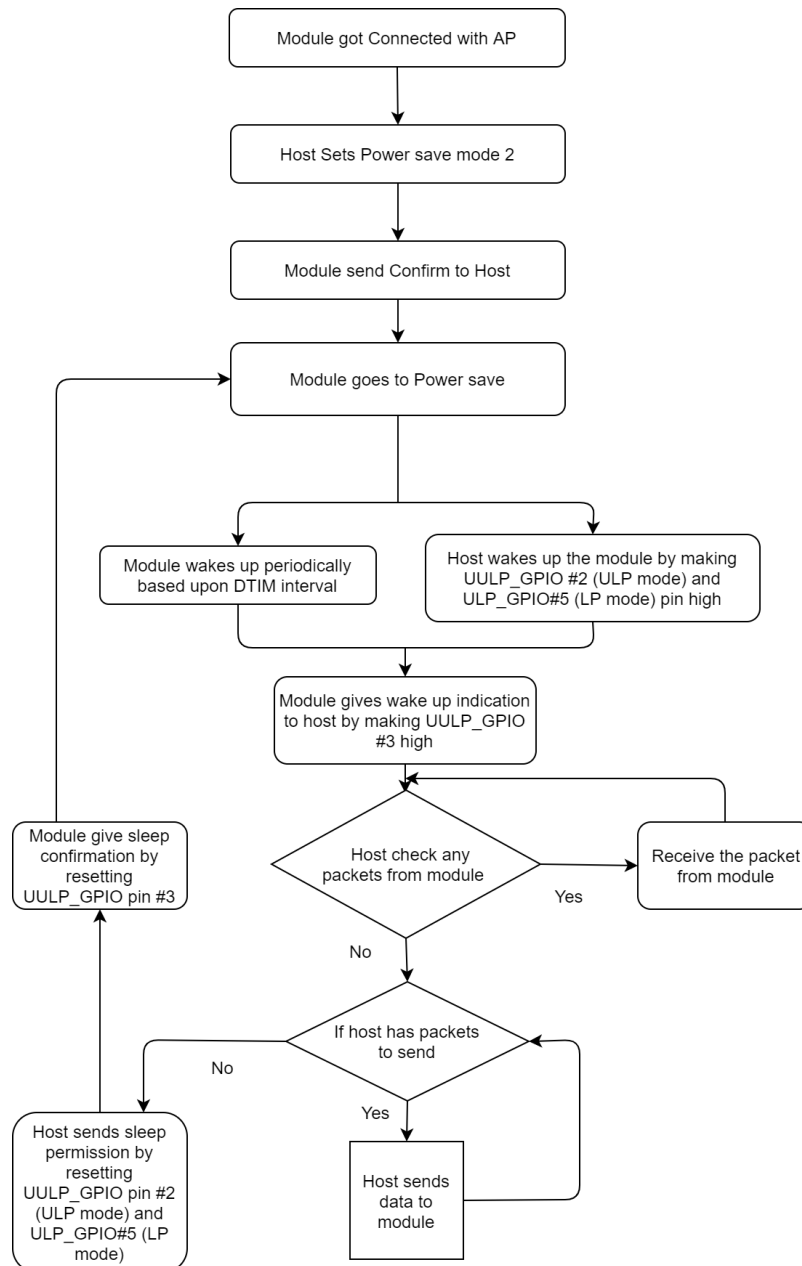
Power mode 2 is GPIO based. In ULP mode, `feature_bit_map[4]` has to be set in `opermode` command. In this mode, Whenever host want to send data to module, gives wakeup indication to module by setting `ULP_GPIO_5` high in case of LP or `UULP_GPIO_2` in case of ULP(which make module to wake up from power save). After wakeup, if the module is ready for data transfer, it sends wakeup indication to host. 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.

**Note:**

1. By default UULP\_GPIO\_3 is used for wakeup indication to host.
2. If BIT(0) is set in config\_feature\_bit\_map then UULP\_GPIO\_0 is used for wakeup indication to host.



**Figure 23: Power Save Mode 2**

#### 5.16.4 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 RS9116-WiSeConnect 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 cannot 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.

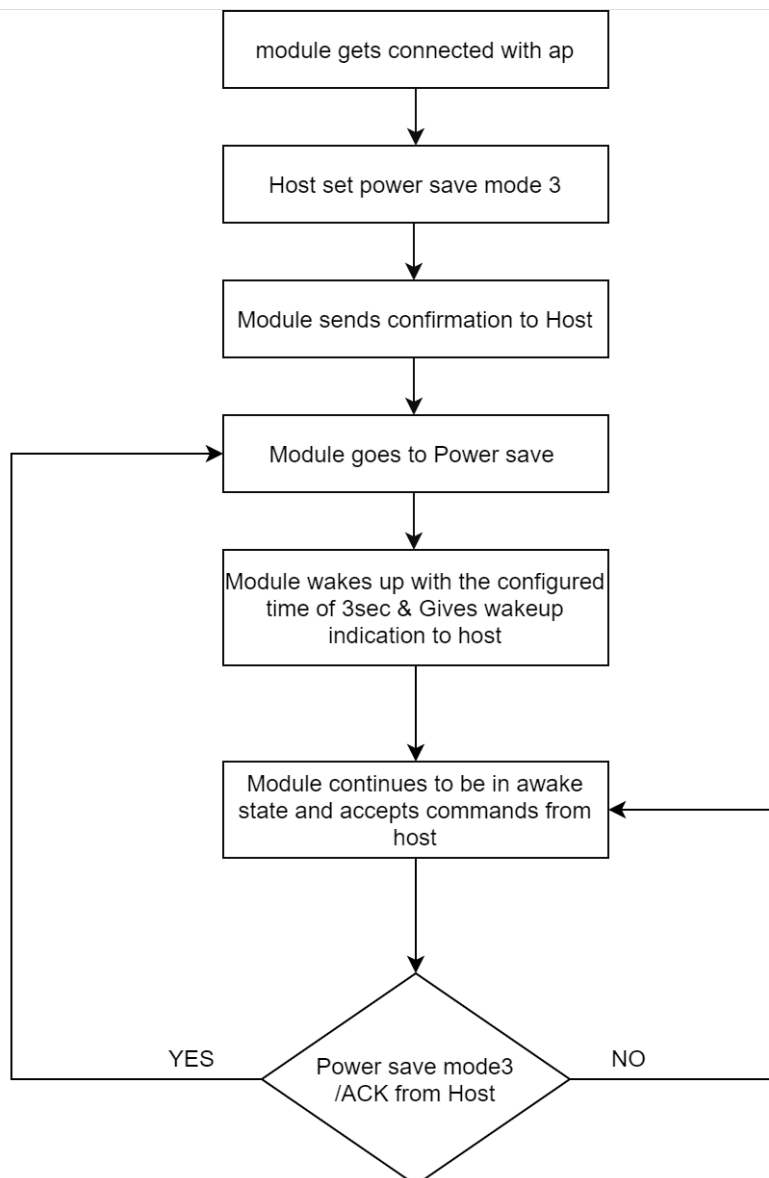
Module shall not go into complete power-save state if ack is not received from host for given sleep message. Module can send received packets or responses to host at any instant of time. No handshake is required on Rx path.

**Table 10: Message from Module in Power Save Mode**

| AT Mode |
|---------|
| "WKP"   |
| "SLP"   |

**Table 11: Message from host in Power Save Mode**

| AT Mode |
|---------|
| "ACK"   |



**Figure 24: Power Save Mode 3**

#### 5.16.5 Power Save Mode 8

This command must be issued after Init command.

In Power Mode 8 both RF and SOC of RS9116-WiSeConnect 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.

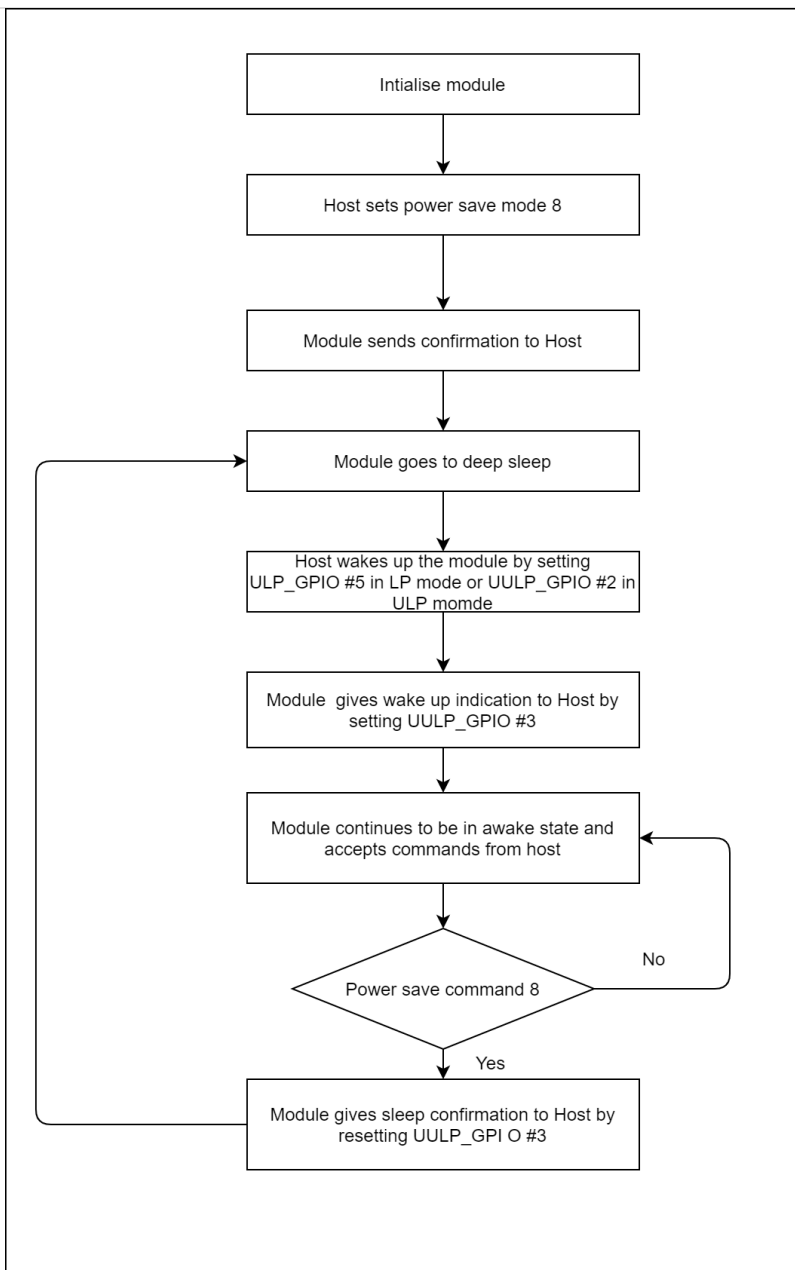
When ulp\_mode\_enable is set to '0' or '1', once the module gets wakeup it continues to be in wakeup state until it gets power mode 8 commands from host.

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.

**Table 12: Message from Module in ULP Mode 2**

**AT Mode**

"WKP FRM SLEEP"



**Figure 25: Power Save Mode 8**

### 5.16.6 Power Save Mode 9

In Power Mode 9 both Radio and SOC of RS9116-WiSeConnect 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 set 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

"WKP FRM SLEEP"

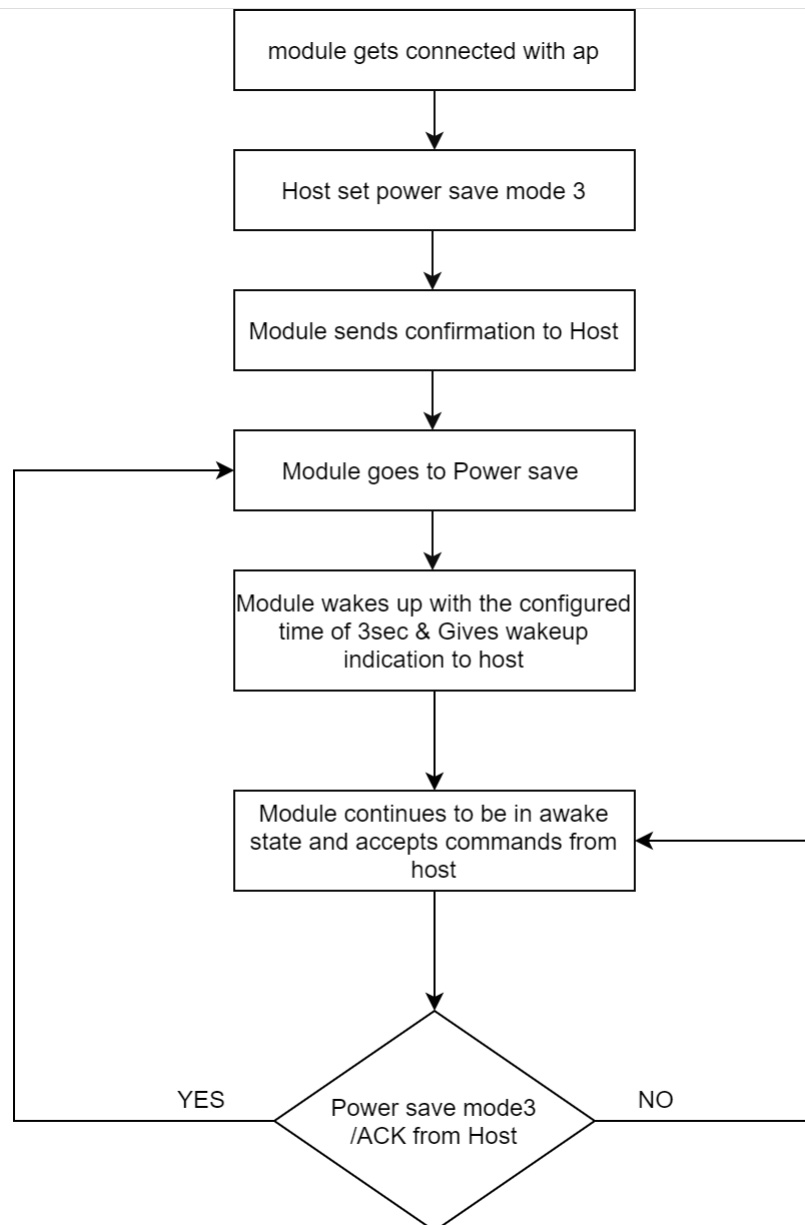


Figure 26: Power Save Mode 9

## 5.17 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 an 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

## Command Parameters:

**TYPE[1 byte]:** 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[64 bytes]:** 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 AT plus 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

ap\_ssid[32 bytes]: 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 uses 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 contain any payload.

## AT Mode:

| Result Code       | Description                                                      |
|-------------------|------------------------------------------------------------------|
| OK                | Successful execution of the command. If TYPE value is '1'or '2'. |
| OK< pmk >         | Successful execution of the command. If TYPE value is '3'.       |
| ERROR<Error code> | Failure                                                          |

### 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 .

### 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

"ABCDEFABCDEFABCDEF12345678901234ABCDEFABCDEFABCDEF12345678901234", the command is

```
at+rsi_psk=2, ABCDEFABCDEFABCDEF12345678901234ABCDEFABCDEFABCDEF12345678901234,\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
```

## 5.18 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
```

### Command Parameters:

**index[2 bytes]:** 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                             |

### 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

## 5.19 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 is 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 RS9116\_WC\_GENR\_0\_x\_x release.

**Response:**

| Result Code       | Description                                                                 |
|-------------------|-----------------------------------------------------------------------------|
| OK                | Successful execution of the command                                         |
| ERROR<Error code> | Failure,<br>Possible error codes are 0x0021, 0x0025, 0x002C, 0xFFFF8,0x002D |

**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

## 5.20 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

#### Command Parameters:

**eapMethod[32 bytes]:** Should be one of among TLS, TTLS, FAST, PEAP or LEAP. It should be ASCII character string.

**innerMethod[32 bytes]:** 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[64 bytes]:** User ID which is configured in the user configuration file of the radius sever.

**Password[128 bytes]:** Password which is configured in the user configuration file of the Radius Server for that User Identity.

**Okc[4 bytes]:** 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[82 bytes]:** 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 command |
| ERROR<Error code> | Failure,                            |

#### Possible error codes:

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

#### Relevance:

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

## 5.21 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 that loading certificate 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

### Command Parameters:

**total\_len[2 bytes]:** 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 certificate is 4088 bytes
4. 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.
5. 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:

By default, SSL certificates will be loaded onto flash. Set BIT(27) in tcp\_ip\_feature\_bit\_map to load SSL certificate onto RAM.

| cert_type[1 byte] | 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     |

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

**keyPwd(128 bytes):** Reserved.

**certificate:** This is the data of the actual certificate.

**Certificate erase:**

For erasing certificate,  
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                             |

**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 wifiuser.pem is the names of the certificate file:

```
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=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
```

## 5.22 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 that loading certificate is required to be done only once.

**Note:**

This command is used for WI-FI alone mode in case of loading 3 SSL certificates to FLASH.

**Note:**

This command should be sent only after opermode command.

**Command Format:**

**AT Mode:**

at+rsi\_cert =< [CertType](#) >,< [total\\_len](#) >,< [CertInx](#) >,< [KeyPwd](#) >,< [Certificate](#) >\r\n

**Command Parameters:**

**total\_len[2 bytes]:** 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 certificate is 4088 bytes.
4. 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.
5. 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:**

1. Set BIT(27 ) in tcp\_ip\_feature\_bit\_map to load SSI certificate onto RAM. By default, SSL certificates will be loaded onto flash.
2. Set BIT(31) in tcp\_ip\_feature\_bit\_map & BIT(29) in ext\_tcp\_ip\_feature\_bit\_map to open 3 SSL Client sockets.

| cert_type[1 byte] | Type of certificate    |
|-------------------|------------------------|
| 1                 | EAP Client certificate |
| 2                 | FAST PAC file          |
| 3                 | SSL Client Certificate |

| cert_type[1 byte] | Type of 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     |

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

**CertInx (1 byte):** 1. Module can hold two sets of SSL certificate into RAM. This field is used to provide the index of the certificates and possible values are 0 and 1.

2. Module can hold three sets of SSL certificate onto Flash. This field is used to provide the index of the certificates and possible values are 0, 1 and 2.

**Note:**

Currently RS9116 can either load certificates onto RAM or FLASH, but not both at a time.

**keyPwd(127 bytes):** Reserved.

**certificate:** This is the data of the actual certificate.

**Certificate erase:**

For erasing certificate,

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                             |

**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 name 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 0x5F 0x69 0x6E 0x78 0x3D 0x31 0x2C 0x30 0x2C 0x30
0x2C 0x30 0x2C 0x30 0x0D 0x0A
```

**Response:**

```
OK\r\n
```

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

## 5.23 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
```

**Command Parameters:**

**mode\_flag[2 bytes]:**

| 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.                                                              |

**client\_mac\_addr[6 bytes]:** 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                             |

**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:**

After issuing disconnect command, 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 0x74 0x2B 0x72 0x73 0x69 0x5F 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
```

## 5.24 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
```

### Command Parameters:

**dhcpMode[1 byte]:** 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

5 - To enable Option 71 with static IP

### 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[4 bytes]:** IP address in 4 bytes hex format. This can be 0's in the case of DHCP.

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

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

**hostname[31 bytes]:** 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[1 byte]:** 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[4 bytes]:

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                             |

#### 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
```

## 5.25 IP Change Notification

#### Description:

This notification is received when module gets a different IP 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 > |             |

**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

## 5.26 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

**Command Parameters:**

**mode[2 bytes]:**

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

0—Manual

1—DHCPv6

**prefixLength[2 bytes]:** Prefix length of the IPv6 address.

**ipaddr6[16 bytes]:** IPv6 address. This can be 0's in the case of DHCPv6.

**gateway6[16 bytes]:** 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 RS9116-WiSeConnect 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                              |

### Response Parameters:

prefixLength(2 bytes): Prefix length of IPv6 address  
ipaddr6(16 bytes): Assigned IPv6 address  
defaultgw6(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:db8:1:0:0:0:123 as the IPV6 address and with 2001:db8:1:0:0:0:100 as router IPV6 address, the command is :

```
at+rsi_ipconf6=0,64,2001:DB8:1:0:0:0:123,2001:DB8:1:0:0:0:100\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 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.

## 5.27 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 first command for using SNMP feature

### Command Format:

#### AT Mode:

```
at+rsi_snmp_enable=< snmpEnable >\r\n
```

### Command Parameters:

#### snmpEnable[1 byte]:

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                              |

### 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

## 5.28 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

**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. |

**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

[illegible]

## 5.29 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
```

### Command Parameters:

**type[1 byte]:** type of object requested.

### Table 13 SNMP Object Types and Codes

| 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        |

**value[200 bytes]:** 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 “Silicon” (length of the value is 7 bytes) then remaining 193 bytes should be filled with NULL.
2. OID should be given followed by value, without having any comma (,) separator between value and OID.
3. If sending data type SNMP\_ANS1\_COUNTER64 is more than 4bytes (1 word = 4bytes), then each word should be reversed (as it is reversed in case of counter 32) in hex form and sent. Only then expected response is received in server side. e.g.- 1122334455667788 sends it as 4433221188776655

**Response:**

**AT Mode:**

| Result Code | Description                          |
|-------------|--------------------------------------|
| OK          | Successful execution of the command. |

| Result Code       | Description |
|-------------------|-------------|
| ERROR<Error code> | Failure     |

#### 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.

To get the Data types of individual OID's, should follow the path <http://www.oid-info.com/>

Copy the OID except for last digit, paste it on **Display OID**. It gives Data type, description and information about OID's.



The list of example OIDs are:

| OID               | Data Type | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.3.6.1.2.1.1.1.0 | String    | A textual description of the entity. This value should include the full name and version identification of the system's hardware type, software operating-system, and networking software.                                                                                                                                                                                                                                                                 |
| 1.3.6.1.2.1.4.3.0 | Counter32 | The total number of input datagrams received from interfaces, including those received in error.                                                                                                                                                                                                                                                                                                                                                           |
| 1.3.6.1.2.1.4.4.0 | Counter32 | 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 | Counter32 | 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 | Counter32 | 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.                                                                     |

| OID                 | Data Type | Description                                                                                                                                                                                                                                                                                                                                                   |
|---------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.3.6.1.2.1.4.7.0   | Counter32 | The number of locally addressed datagrams received successfully but discarded because of an unknown or unsupported protocol.                                                                                                                                                                                                                                  |
| 1.3.6.1.2.1.4.9.0   | Counter32 | The total number of input datagrams successfully delivered to IP user-protocols (including ICMP).                                                                                                                                                                                                                                                             |
| 1.3.6.1.2.1.4.10.0  | Counter32 | 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  | Counter32 | 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.                               |
| 1.3.6.1.2.1.4.12.0  | Counter32 | 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.                         |
| 1.3.6.1.2.1.4.13.0  | Integer   | The maximum number of seconds that received fragments are held while they are awaiting reassembly at this entity.                                                                                                                                                                                                                                             |
| 1.3.6.1.2.1.4.14.0  | Counter32 | Number of Internet Protocol (IP) fragments received which needed to be reassembled at this entity.                                                                                                                                                                                                                                                            |
| 1.3.6.1.2.1.4.15.0  | Counter32 | Number of Internet Protocol (IP) datagrams successfully re-assembled.                                                                                                                                                                                                                                                                                         |
| 1.3.6.1.2.1.4.16.0  | Counter32 | 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 | Counter32 | Number of Internet Protocol (IP) datagrams that have been successfully fragmented at this entity.                                                                                                                                                                                                                                                             |
| 1.3.6.1.2.1.4.18.0  | Counter32 | 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  | Counter32 | 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   | Counter32 | 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   | Counter32 | 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   | Counter32 | The number of ICMP Echo (request) messages received.                                                                                                                                                                                                                                                                                                          |
| 1.3.6.1.2.1.5.9.0   | Counter32 | The number of ICMP Echo Reply messages received.                                                                                                                                                                                                                                                                                                              |
| 1.3.6.1.2.1.5.14.0  | Counter32 | 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  | Counter32 | 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  | Counter32 | The number of ICMP Echo (request) messages sent.                                                                                                                                                                                                                                                                                                              |
| 1.3.6.1.2.1.5.22.0  | Counter32 | The number of ICMP Echo Reply messages sent.                                                                                                                                                                                                                                                                                                                  |

| OID                | Data Type | Description                                                                                                                                                                                                                                                     |
|--------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.3.6.1.2.1.6.5.0  | Counter32 | 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  | Counter32 | 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  | Counter32 | 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  | Counter32 | 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 | Counter32 | 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 | Counter32 | 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 | Counter32 | 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 | Counter32 | The total number of segments received in error (e.g., bad TCP checksums).                                                                                                                                                                                       |
| 1.3.6.1.2.1.6.15.0 | Counter32 | The number of TCP segments sent containing the RST flag.                                                                                                                                                                                                        |
| 1.3.6.1.2.1.7.1.0  | Counter32 | The total number of UDP datagrams delivered to UDP users.                                                                                                                                                                                                       |
| 1.3.6.1.2.1.7.4.0  | Counter32 | The total number of UDP datagrams sent from this entity.                                                                                                                                                                                                        |
| 1.3.6.1.2.1.7.3.0  | Counter32 | 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 0x73 0x69 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 HEX 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

### 5.30 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

#### Command Parameters:

**type[1 byte]** : type of object requested.

**Table 14 SNMP Object Types and Codes**

| 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        |

**value[200 bytes]**: value passed in response corresponding to the type of object requested.

#### Note:

- Size of the value should be 200 bytes. For example, if the value is "Silicon" (length of the value is 7 bytes) then remaining 193 bytes should be filled with NULL.
- 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                              |



## Command Format:

### AT Mode:

at+rsi\_snmp\_trap=< [snmp\\_version](#) >,< [ip\\_version](#) >,< [ipv4/ipv6 address](#) >,< [community](#) >,< [trap\\_type](#) >,< [trap\\_oid](#) >,< [elapsed\\_time](#) >,< [object\\_list\\_count](#) >,< [snmp\\_buf](#) >\r\n

### Command Parameters:

**snmp\_version[4 bytes]:** snmp version (1/2/3). Currently only version 2 is supported for SNMP trap.

**ip\_version[4 bytes]:** IP version (4 or 6)

**destIPAddr.ipv4\_address[4 bytes]:** ipv4 address based upon the ip\_version 4 selected. Module ignores remaining 12 bytes in case of ip version 4.

**destIPAddr.ipv6\_address[16 bytes]:** ipv6 address based upon the ip\_version 6 selected.

**community[32 bytes]:** community name

**trap\_type[1 byte]:** type of trap

| trap_type | type of trap              |
|-----------|---------------------------|
| 0         | (coldStart)               |
| 1         | (warmStart)               |
| 2         | (linkDown)                |
| 3         | (linkUp)                  |
| 4         | (authenticationFailure)   |
| 5         | (egpNeighborLoss)         |
| 6         | (User specific trap type) |

**trap\_oid[51 bytes]:** trap oid of the user specific trap .elapsed time: Total device time elapsed .

**obj\_list\_count[1 byte]:** Obeject variables list count

**snmp\_buf[1024 bytes]:** snmp buf contains the array of snmp trap object variable structures(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 octet 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                              |

### 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:**

1. Command usage for Integer Object data type:

[illegible]

- ## 2. Command usage for Octect string object adata type:

```
at+rsi_snmp_trap=2,4,192.168.0.178,public,1,,1234,1,1.4.4.4.4.3\000\000\000\000\000\n\000\000\000\016\32
0\334G\001\000\000\000x\350\360G\n\000\000\000\004", '\000' <repeats 11 times>, "\004\000\000\000\270\r\001
\000\000\001\000\000\000\000\000#\001\000\000\031\000\000\000Sample SNMP Trap String!!, '\000' <repeats
111 times>,\r\n
0x61 0x74 0x2b 0x72 0x73 0x69 0x5f 0x73 0x6e 0x6d 0x70 0x5f 0x74 0x72 0x61 0x70 0x3d 0x32 0x2c 0x34 0x2c
0x31 0x39 0x32 0x2e 0x31 0x36 0x38 0x2e 0x00 0x2e 0x31 0x37 0x38 0x2c 0x70 0x75 0x62 0x6c 0x69 0x63
0x2c 0x31 0x2c 0x2c 0x31 0x32 0x33 0x34 0x2c 0x31 0x2c 0x31 0x2e 0x34 0x2e 0x34 0x2e 0x34 0x2e 0x34
0x2e 0x34 0x2e 0x34 0x2e 0x33 0x00 0x00 0x00 0x00 0x00 0x0a 0x00 0x00 0x00 0x0e 0xd0 0xdc 0x47 0x01
0x00 0x00 0x00 0x78 0xe8 0xf0 0x47 0x0a 0x00 0x00 0x00 0x04 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x00 0x04 0x00 0x00 0x00 0xb8 0x0d 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x23
0x01 0x00 0x00 0x19 0x00 0x00 0x00 0x53 0x61 0x6d 0x70 0x6c 0x65 0x20 0x53 0x4e 0x4d 0x50 0x20 0x54
0x72 0x61 0x70 0x20 0x53 0x74 0x72 0x69 0x6e 0x67 0x21 0x21 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x000x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x000x00 0x00 0x00 0x00 0x00 0x00 0x00 0x000x00
0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x000x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x000x00 0x00
0x00 0x00 0x00 0x00 0x00 0x00 0x000x00 0x00 0x00 0x00 0x00 0x00 0x00 0x000x00 0x00 0x00 0x00 0x00
0x00 0x00 0x000x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x0D 0x0A
```

3. For ipv6:

```
at+rsi_snmp_trap=2,6,2001:db8:1:0:0:0:123,public,1,,1234,1,1.4.4.4.4.4.3\000\000\000\000\000\n\000\000\000
0\016\320\334G\001\000\000\000x\350\360G\n\000\000\000\004", '\000' <repeats 11 times>,
"\004\000\000\000\0270\r\001 \000\000\001\000\000\000\000\000\000#\001\000\000\031\000\000\000Sample SNMP
Trap String!!, '\000' <repeats 111 times>,\r\n
0x61 0x74 0x2b 0x72 0x73 0x69 0x5f 0x73 0x6e 0x6d 0x70 0x5f 0x74 0x72 0x61 0x70 0x3d 0x32 0x2c 0x36 0x2c
0x32 0x30 0x30 0x30 0x31 0x3a 0x44 0x42 0x38 0x3a 0x31 0x3a 0x31 0x32 0x33 0x2c 0x2c 0x70 0x75 0x62
0x6c 0x69 0x63 0x2c 0x31 0x2c 0x2c 0x31 0x32 0x33 0x34 0x2c 0x31 0x2c 0x31 0x2e 0x34 0x2e 0x34 0x2e
0x34 0x2e 0x34 0x2e 0x34 0x2e 0x34 0x2e 0x33 0x00 0x00 0x00 0x00 0x00 0x0a 0x00 0x00 0x00 0x0e 0xd0
0xdc 0x47 0x01 0x00 0x00 0x00 0x78 0xe8 0xf0 0x47 0x0a 0x00 0x00 0x00 0x04 0x00 0x0d 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00
0x00 0x00 0x00 0x23 0x01 0x00 0x00 0x19 0x00 0x00 0x00 0x53 0x61 0x6d 0x70 0x6c 0x65 0x20 0x53 0x4e 0x4d
0x50 0x20 0x54 0x72 0x61 0x70 0x20 0x53 0x74 0x72 0x69 0x6e 0x67 0x21 0x21 0x00 0x00 0x00 0x00 0x00
```

```

0x00 0x00 0x00 0x00 0x000x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x000x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x000x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x000x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x000x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x000x00

0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x000x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x000x00 0x00 0x00
0x00 0x00 0x00 0x00 0x00 0x000x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x0D 0x0A

```

**Response:**

OK\r\n0x4F 0x4B 0x0D 0x0A

### 5.32 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. After MQTT connection, the maximum LTCP can support is only 9.
5. Each SSL/Web socket will occupy one TCP socket. SSL is supported only in Wi-Fi Client mode
6. If SSL is enabled, module uses same SSL version until module reboots.
7. If SSL is enabled, module uses 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).

If BIT(27) (SSL certificate on to the RAM feature) is set in tcp\_ip\_feature\_bit\_map, module only supports 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 idx>\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_ltp6=<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

It is recommended to enable BIT(16) in '[ext\\_tcp\\_ip\\_feature\\_bit\\_map](#)' in 'at+rsi\_opermode' when using TCP sockets.

#### Command Parameters:

**moduleSocket (2 bytes):** Port number of the socket in the module. Value ranges from 1024 to 49151.

##### Note:

User can give any Port number from the above range except 30000, as that port number is reserved for specific feature.

**destSocket (2 bytes):** destination port. Value ranges from 1024 to 49151. Ignored when TCP server or Listening UDP sockets are to be opened.

##### Note:

User can give any Port number from the above range except 30000, as that port number is reserved for specific feature.

**destIPaddr.ipv4\_address (4 bytes):** 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 (16 bytes):** 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 (2 bytes):** Maximum number of clients which can be connected in case of LTCP.

##### Note:

1. Module supports 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.
2. This field '**max\_count**' can be ignored if the socket type is other than 2 (TCP server).

**tos (4 bytes):** type of service field. Possible values are 0-7.

**Table 15 TOS Values**

| 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    |

| TOS Value | Description |
|-----------|-------------|
| 6         | Internet    |
| 7         | Network     |

**ssl\_bitmap (1 byte):** 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):** 1-byte bitmap used to select the various cipher modes. This field is optional, and the possible values are listed below:

| Bit Position | Value | Name                            |
|--------------|-------|---------------------------------|
| BIT(1)       | 2     | TLS_RSA_WITH_AES_256_CBC_SHA256 |
| BIT(2)       | 4     | TLS_RSA_WITH_AES_128_CBC_SHA256 |
| BIT(3)       | 8     | TLS_RSA_WITH_AES_256_CBC_SHA    |
| BIT(4)       | 16    | TLS_RSA_WITH_AES_128_CBC_SHA    |
| BIT(5)       | 32    | TLS_RSA_WITH_AES_128_CCM_8      |
| BIT(6)       | 64    | TLS_RSA_WITH_AES_256_CCM_8      |

These values can be OR'ed together to select multiple ciphers. To select all the ciphers, either all bits can be set or alternatively, 0 can be passed.

Other than SSL bitmap cipher modes few default cipher modes are also supported.

Default cipher modes:

TLS\_ECDHE\_ECDSA\_WITH\_3DES\_EDE\_CBC\_SHA  
 TLS\_ECDHE\_RSA\_WITH\_3DES\_EDE\_CBC\_SHA  
 TLS\_DHE\_RSA\_WITH\_3DES\_EDE\_CBC\_SHA  
 TLS\_ECDHE\_ECDSA\_WITH\_AES\_256\_CBC\_SHA  
 TLS\_DHE\_RSA\_WITH\_AES\_128\_CBC\_SHA  
 TLS\_DHE\_RSA\_WITH\_AES\_256\_CBC\_SHA  
 TLS\_ECDHE\_RSA\_WITH\_AES\_128\_CBC\_SHA  
 TLS\_ECDHE\_RSA\_WITH\_AES\_256\_CBC\_SHA  
 TLS\_ECDHE\_ECDSA\_WITH\_AES\_128\_CBC\_SHA256  
 TLS\_ECDHE\_ECDSA\_WITH\_AES\_256\_CBC\_SHA384  
 TLS\_ECDHE\_RSA\_WITH\_AES\_128\_CBC\_SHA256  
 TLS\_ECDHE\_RSA\_WITH\_AES\_256\_CBC\_SHA384  
 TLS\_DHE\_RSA\_WITH\_AES\_128\_CBC\_SHA256  
 TLS\_DHE\_RSA\_WITH\_AES\_256\_CBC\_SHA256

Curve IDs supported:

| Curve Id | Description     | Support |
|----------|-----------------|---------|
| 15       | secp160k1       | Yes     |
| 16       | secp160r1       | Yes     |
| 17       | secp160r2       | Yes     |
| 18       | secp192k1       | Yes     |
| 19       | secp192r1       | Yes     |
| 20       | secp224k1       | Yes     |
| 21       | secp224r1       | Yes     |
| 22       | secp256k1       | Yes     |
| 23       | secp256r1       | Yes     |
| 24       | secp384r1       | Yes     |
| 25       | secp521r1       | Yes     |
| 26       | brainpoolP256r1 | Yes     |
| 27       | brainpoolP384r1 | Yes     |
| 28       | brainpoolP512r1 | Yes     |

**webs\_resource\_name (51 bytes):** 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 (1 byte):** To configure tcp retransmissions count

**socket\_bitmap (1 byte):** To configure socket bit map

| socket_bitmap    | Functionality                                                                                                                                                                                                                                                        |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| socket_bitmap[0] | synchronous data read<br><br><b>Info:</b><br>Module sends data to host only after receiving data read request from host.                                                                                                                                             |
| socket_bitmap[1] | TCP socket<br><br><b>Info:</b><br>To open a listening TCP socket and to accept client connection, host need to provide accept command.                                                                                                                               |
| socket_bitmap[2] | TCP ACK indication<br><br><b>Info:</b><br>When this bit is enabled module gives an TCP ACK indication(Frame type 0xAB) to host after receiving TCP ACK from remote peer.<br>Host has to send next data packet to module only after receiving this TCP ACK indication |
| socket_bitmap[3] | If this bit is set module handles small sized received packets effectively.<br><br><b>Info:</b><br>Recommended to set for the sockets which receive small size packets                                                                                               |
| socket_bitmap[4] | TCP RX window size<br><br><b>Info:</b><br>When this bit is enabled, module opens socket with RX window size based on the value provided in <code>rx_window_size</code> field                                                                                         |

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 (1 byte):** 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.

**tcp\_keepalive\_timeout (2 bytes):** This field is used to configure TCP keep alive initial timeout in seconds.

**cert\_inx (1 byte):** 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 ><br>< 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                              |

## 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 0x00>\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 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= 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x53 0x01 0x00 0x00 > < mss
=0xB4 0x05>< window_size =0x00 0x00 0x01 0x00>\r\n
0x4F 0x4B 0x06 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 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 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 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 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
```

### 5.33 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

**Command Parameters:**

N/A

**Response:**

**AT Mode:**

| Result Code                                                                                                                                                                                                                                      | Description                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| AT+RSI_LTCP_CONNECT=< <a href="#">ip_version</a> >< <a href="#">socket</a> >,< <a href="#">fromPortNum</a> >,< <a href="#">ipv4_address / ipv6_address</a> >< <a href="#">mss</a> >< <a href="#">window_size</a> >< <a href="#">SrcPortNum</a> > | Asynchronous message from module to host on tcp connection establishment . |

**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.

### 5.34 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

**Response:**

**AT Mode:**

| Result Code                                                                                                                                     | Description                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| OK< <a href="#">socketDescriptor</a> >< <a href="#">ip_version</a> >< <a href="#">ipv4_address / ipv6_address</a> >< <a href="#">destPort</a> > | Successful Execution of Command. |

| Result Code   | Description |
|---------------|-------------|
| ERROR <Error> | Failure     |

#### 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 with '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
```

## 5.35 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
```

#### Parameters:

**socketDescriptor (2 bytes):** Socket descriptor of the socket to be closed.

**port\_number (2 bytes):** This field is valid only for LTCPU socket.

When this field is mentioned module closes all LTCPU 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 LTCPU 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 closes exchanges, module gives remote terminate indication to host.

#### Response:

##### AT Mode:

| Result Code                  | Description                     |
|------------------------------|---------------------------------|
| OK< socketDsc >< bytesSent > | Successful execution of command |

| Result Code       | Description |
|-------------------|-------------|
| 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.

**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

## 5.36 Send Data

This section explains how to send data from the host to the module.

### 5.36.1 Send Data in AT mode

**Description:**

This command is used to send data from the host to the module, which is transmitted over a wireless media in AT mode.

**Note:**

1. Maximum data that can be sent over TCP/LTCP socket is 1460 Bytes
2. Maximum data that can be sent over LUDP socket is 1472 Bytes
3. Maximum data that can be sent over Web socket is 1450 Bytes
4. Maximum data that can be sent over TCP-SSL/LTCP-SSL is 1370 Bytes
5. Maximum data that can be sent over Web socket over SSL is 1362 Bytes
6. Maximum data that can be sent over TCP/LTCP socket is 1440 Bytes in IPv6 mode.
7. Maximum data that can be sent over LUDP socket is 1452 Bytes in IPv6 mode

**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 (2 byte):** Socket handle of the socket over which data is to be sent.

**sendBufLen (4 bytes):** Length of the data that is getting transmitted. Wrong parameter may cause module to hang in some cases. In case of Web socket correct length is mandatory.

**destIPAddr (4 bytes):** Destination IPv4/IPv6 Address. Should be '0' in case of data transmitting on a TCP/LTCP/SSL socket.

**destPort (2 bytes):** 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.<br>1: Final frame web socket message. |

**sendDataBuf (1400 bytes):** Actual data to be sent to the specified socket.

### Response:

| Result Code                                  | Description                                                                                                                                                                                                                      |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OK<length><br>(or)<br>OK<socket id ><length> | 2 bytes length (2 bytes hex), length of data sent.<br><br>1-byte socket id, 2 bytes length (2 bytes hex), length of data sent.                                                                                                   |
| ERROR<Error code>                            | Failure<br>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.<br>Possible error codes are 0x0030,0xFFFE,0xFF7E,0xFFF8,0x003F,0xFFF7. |

When enabled the socket BIT(2) (opensocket)

#### Note:

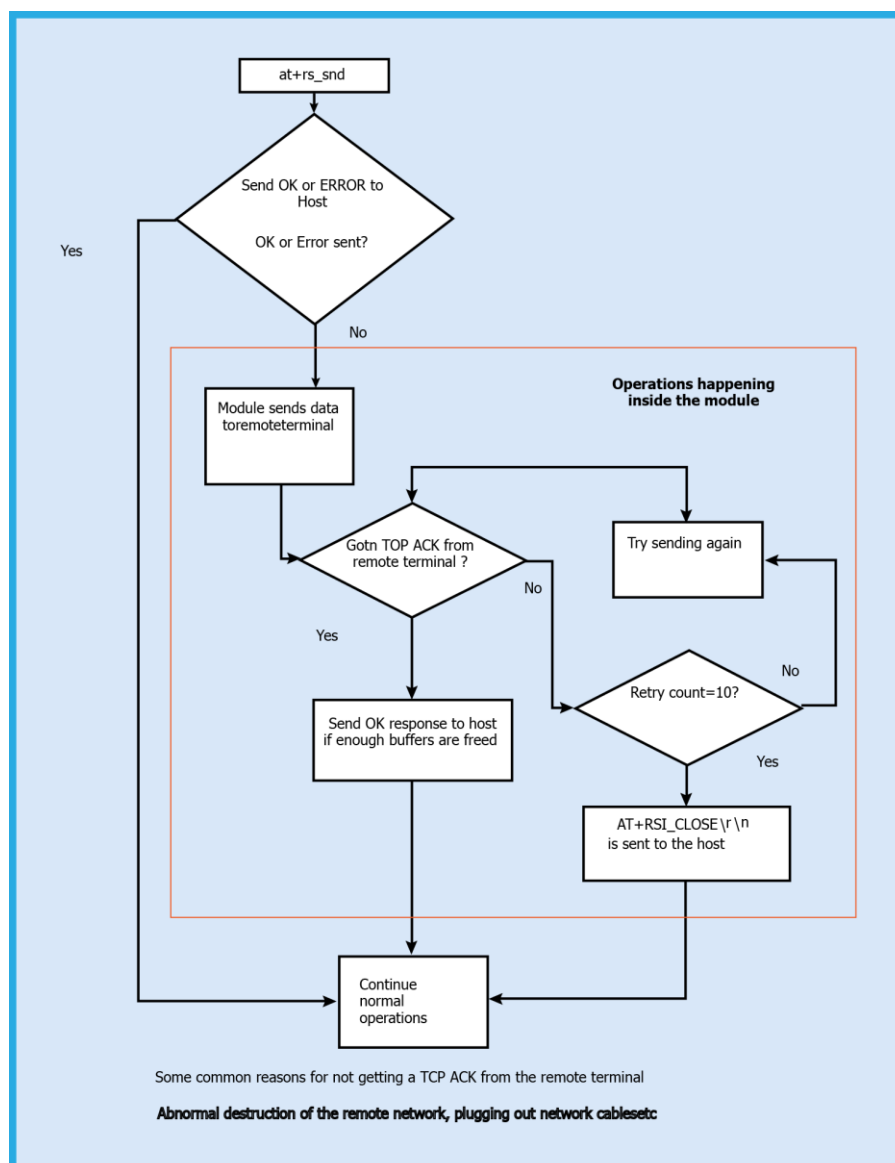
1. When enabled the socket bit map(2) (open socket), the send response gives 3bytes. User needs to consider the following for "snd" command if TCP\_ACK(bit[2]) is enabled. User will get an immediate "OK<socket id ><length>\r\n" response for "snd" command. This indicates the "snd" command transaction 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 ASCII 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.



## 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.

## Example: Data Stuffing

### 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

**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.

## 5.37 Read Data

This section explains how to read socket data from the module to host.

**Note:**

To use this feature, BIT(0) should be set in socketbitmap while opening a socket.

### 5.37.1 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 (1 byte):** Socket handle of the socket over which data is to be received.

**no of bytes (4 bytes):** Length of the data that has to be read from the module.

**time out in ms (2 bytes):** Read timeout in milliseconds to configure read data time out.

**Response:**

| Result Code                                                                                                                                                                                                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT+RSI_READ< <a href="#">ip_version</a> ><br>< <a href="#">recvSocket</a> >< <a href="#">recvBufLen</a> >< <a href="#">ipv4_address / ipv6_address</a> > < <a href="#">src_port</a> >< <a href="#">recvDataBuf</a> > | <b>ip_version (2 bytes, hex):</b><br>IP version of the data received.<br>4 – for IPv4<br>6 – for IPv6<br><br><b>recvSocket (2 bytes, hex):</b><br>socket handle of the socket over which the data is received.<br>The least significant byte is returned first. If Web socket has been enabled, upper byte holds the web socket info.<br>Seventh bit indicates the FIN packet and bit 3:0 gives the opcode information from web socket header. |

| Result Code | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | <p><b>recvBufLen (2 bytes, hex):</b><br/>Number of bytes received.<br/>The least significant byte is sent first. For example, 900 bytes (0x0384) would be sent as &lt;0x84&gt; &lt;0x03&gt;</p> <p><b>ipv4_address / ipv6_address (16 bytes, hex):</b><br/>Source IPv4/IPv6 address. i.e. IP address from which data is received.<br/>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><b>src_port (2 bytes, hex):</b><br/>Source port. i.e. port number from which data is received.<br/>This field is not present in the message if the data is received over a TCP socket.</p> <p><b>recvDataBuf:</b><br/>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.<br/>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).

### 5.37.2 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.

### 5.37.3 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< <a href="#">ip_version</a> ><br>< <a href="#">recvSocket</a> >< <a href="#">recvBufLen</a> >< <a href="#">ipv4_address /<br/>ipv6_address</a> > < <a href="#">src_port</a> >< <a href="#">recvDataBuf</a> > | <p><b>ip_version (2 bytes, hex):</b><br/>IP version of the data received.<br/>4 – for IPv4<br/>6 – for IPv6</p> <p><b>recvSocket (2 bytes, hex):</b><br/>socket handle of the socket over which the data is received.<br/>The least significant byte is returned first. If Web socket has been enabled, upper byte holds the web socket info.<br/>Seventh bit indicates the FIN packet and bit 3:0 gives the opcode information from web socket header.</p> <p><b>recvBufLen (2 bytes, hex):</b><br/>Number of bytes received.<br/>The least significant byte is sent first. For example, 900 bytes (0x0384) would be sent as &lt;0x84&gt; &lt;0x03&gt;</p> <p><b>ipv4_address / ipv6_address (16 bytes, hex):</b><br/>Source IPv4/IPv6 address. i.e IP address from which data is received.<br/>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><b>src_port (2 bytes, hex):</b><br/>Source port. i.e port number from which data is received.<br/>This field is not present in the message if the data is received over a TCP socket.</p> <p><b>recvDataBuf:</b><br/>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.<br/>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 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).

## 5.38 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) to host. Upon receiving this message, host must send wireless firmware upgrade request message if upgrade is required. Host can ignore if upgrade is not required.

**Command Format:**

**AT Mode:**

```
at+rsi_fwupok\r\n
```

**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.

**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.

## 5.39 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, RS9116 WiSeConnect 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 >,< rsi\_tolerance\_threshold >,< bgscan\_periodicity >,< active\_scan\_duration >,< passive\_scan\_duration >,< multi\_probe >\r\n
```

**Command Parameters:**
**bgscan\_enable (2 bytes):**

To enable/Disable bgscan

0 – Disable

1 - Enable

**enable\_instant\_bgscan (2 bytes):**

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 (2 bytes):**

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.

**rsi\_tolerance\_threshold (2 bytes):**

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 rsi\_tolerance\_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) the given bgscan\_threshold.

**active\_scan\_duration (2 bytes):**

This is active scan duration per channel in milli seconds.

**passive\_scan\_duration (2 bytes):**

This is passive scan duration per DFS channel in 5GHz in milli seconds.

**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).

**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 `bq enable` is disabled:

OK\r\n

If instant `bq enable` is enabled:

| Result Code                                                                                                                                                                                                                                                                                             | Description                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| OK< <a href="#">scanCount</a> >< <a href="#">padding</a> > < <a href="#">rfChannel</a> >< <a href="#">securityMode</a> >< <a href="#">rssiVal</a> >< <a href="#">uNetworkType</a> >< <a href="#">ssid</a> >< <a href="#">bssid</a> >< <a href="#">reserved</a> > .....up to the number of scanned nodes | Successful execution of the command. |
| ERROR<Error code>                                                                                                                                                                                                                                                                                       | Failure                              |

### 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

**rssi\_val(1 byte):** RSSI of the scanned Access Point

**uNetworkType(1 byte):**

Network type of the scanned Access Point

1- Infrastructure mode

**ssid(32 bytes):** SSID of the scanned Access Point

**Bssid(6 bytes):** MAC address of the scanned Access Point

**Reserved2(2 byte):** Reserved bytes.

### Possible error codes:

Possible error codes are 0x0021, 0x0025, 0x002C, 0x004A

**Relevance:**

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

**Note:**

If host does not provide channel bit map and scan channel number in scan command, module will scan all channels in 2.4 GHz and all non-DFS channels in 5GHz.

**Example:**

**AT Mode:**

When instant bgscan is enabled, host will get OK response followed by the response of BG scan. Module will do back ground scanning in the configured channel given in the channel bit map or scan all channels if bitmap is not provided (all non DFS channels in 5GHz)and send the scanned result to host.

```
at+rsi bqscan=1,1,10,4,10,15,20,1\r\n
```

```
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x62 0x67 0x73 0x63 0x61 0x6E 0x3D 0x31 0x2C 0x31 0x2C 0x31 0x30 0x2C
0x34 0x2C 0x31 0x30 0x2C 0x31 0x35 0x2C 0x32 0x30 0x2C 0x31 0x0D 0x0A
```

**Response:**

If two networks are found with the SSID "ap\_ssid\_net1" and "ap\_ssid\_net2", in channels 6 and 11, 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 =ap_ssid_net2> < bssid =0x00 0x23 0xA7 0x1F 0x1F 0x15> < reserved > < rfChannel =0x06> < securityMode =0x00> < rssiVal =20> < uNetworkType =0x01> < ssid =ap_ssid_net1> < bssid =0x00 0x23 0xA7 0x1F 0x1F 0x14> < reserved > \r\n
```

[illegible]

When instant bgscan is disabled and When connected AP RSSI falls below -10dBm (e.g. -15, -12 etc) then bgscan will be triggered after 10 seconds period get over. But host will get only OK message here.  
at+rsi\_bgscan=1,0,10,4,10,15,20,1\r\n  
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x62 0x67 0x73 0x63 0x61 0x6E 0x3D 0x31 0x2C 0x31 0x2C 0x31 0x30 0x2C 0x34 0x2C 0x31 0x30 0x2C 0x31 0x35 0x2C 0x32 0x30 0x2C 0x31 0x0D 0x0A

**Response:**

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

## 5.40 Roam Parameters

**Description:**

This command is used to enable roaming and set roaming parameters. This command can be issued any time after init command, but this command will come into action only after bgscan.

**Command Format:**

**AT Mode:**

at+rsi\_roam\_params= < [roam\\_enable](#) >,< [roam\\_threshold](#) >,< [roam\\_hysteresis](#) >\r\n

**Command Parameters:**

**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.

**Response:**

**AT Mode:**

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

**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

**Note:**

WLAN - RS9116 support Wi-Fi L2 roaming.

## 5.41 HT Caps

### Description:

This command is used to enable HT (high throughput) Caps (capabilities) in module when operating in AP mode. This command must be issued after ap configuration parameters command.

### Command Format:

#### AT Mode:

```
at+rsi_ht_caps=< mode_11n_enable > ,< ht_caps_bitmap >\r\n
```

### Command Parameters:

#### mode\_11n\_enable (2 bytes):

Enable/Disable 11n capabilities in AP Mode.

1 - Enable

0 - Disable

#### ht\_caps\_bit\_map (2 bytes):

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]     | Rx STBC support            | Disable                                       | Enable                                      |               |
| 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]     | Channel Width Support      | Disable(Channel Width Support disabled)       | Enable(Channel Width Support enabled)       |               |
| ht_caps_bit_map[0]     | Set to '0'                 |                                               |                                             |               |

### Response:

#### AT Mode:

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

### 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
```

## 5.42 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
```

### Command Parameters:

#### DNSMode (8 bytes):

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 ( 4 bytes):

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 (32 bytes):

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 (4 bytes):

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 (32 bytes):

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.                         |

### 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, 0xFFFF8,0xFF74,0xBBA8,0xBBB2,0xBBAF,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 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:db8:1:0:0:0:0:2>< secondary v6 address = 2001:db8:1:0:0:0:0:3>\r\n
0x4F 0x4B 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x02 0x00 0x00 0x00 0xB8 0x0D 0x01
0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x00 0x03 0x00 0x00 0x00 0x0D 0x0A
```

**Command:**

```
at+rsi_dnsserver6=0,2001:DB8:1:0:0:0:0:5,0\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 0x30 0x3A 0x35 0x2C 0x30
0x0D 0x0A
```

**Response:**

```
OK< primary v6 address = 2001:DB8:1:0:0:0:0:5 ><secondary v6 address=0>\r\n
0x4F 0x4B 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x05 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x0D 0x0A
```

## 5.43 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
```

**Command Parameters:**

**aDomainName (90 bytes):**

This is the domain name of the target website. A maximum of 90 characters is allowed.

**uDNSServerNumber (2 bytes):**

Reserved.

**Response:**

**AT Mode:**

**For IPv4:**

| Result Code                                                                | Description                     |
|----------------------------------------------------------------------------|---------------------------------|
| OK< ip_version >< ulPCount >< alPAddr.ipv4_address >..repeats for 10 times | Successful execution of command |
| ERROR<Error code>                                                          | Failure.                        |

#### For IPv6:

| Result Code                                                                                                                | Description                     |
|----------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| OK< <a href="#">ip_version</a> >< <a href="#">ulPCount</a> >< <a href="#">alPAddr.ipv6_address</a> >..repeats for 10 times | Successful execution of command |
| ERROR<Error code>                                                                                                          | Failure.                        |

#### Response Parameters:

##### ip\_version(2 bytes):

IP version used , either 4 or 6.

##### ulPCount(2 bytes):

Number of IP addresses resolved alPAddr.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.

##### alPAddr.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.silabs.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 0x64
0x70 0x69 0x6E 0x65 0x73 0x69 0x67 0x6E 0x61 0x6C 0x73 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 0x0D
0x0A
```

##### For IPv6:

```
at+rsi_dnsget6=www.silabs.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
0x64 0x70 0x69 0x6E 0x65 0x73 0x69 0x67 0x6E 0x61 0x6C 0x73 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 0x0D
0x0A
```

## 5.44 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 ).

##### 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:

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                         |

#### Command Parameters:

##### 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,silabs,1,53 \r\n

#### Response:

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

## 5.45 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

#### Command Parameters:

##### 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(5) to enable http\_post data feature

Set BIT(6) to enable HTTP version 1.1.

Set BIT(7) to enable user defined http\_content type in Flags.

#### http\_port:

HTTP server port number.

If this is not mentioned, default port numbers will be used.

#### User\_name:

User\_name for HTTP/HTTPS server authentication. Default user name is 'admin'.

#### Password:

Password for HTTP/HTTPS server authentication. Default password is 'admin'.

#### Host\_name:

Host name of the HTTP/HTTPS server.

#### Ip\_address:

IPv4/IPv6 address of HTTP/HTTPS server.

url: requested URL.

#### Extended\_header:

The Purpose of this is to append user configurable header fields to the default HTTP/HTTPS header. To write extended header through 'at' command, user must use 'Data stuffing' mentioned separately in this document as well mentioning here also in context of extended header. extended header can have multiple header fields each ended by \r\n(0xd 0xa) but here \r\n is our delimiter for whole 'at' command so use data stuffing and replace all \r\n(0xd 0xa) by 0xdb 0xdc besides delimiter(\r\n).follow example given below.

default http header contains the following:

#### Default http header include:

1.Content - Type: It describes about the type of the file which user want to send like html, txt, gif etc..

2.Content - Length: It tells about the length of the text which User is using.

The above two mentioned fields are created in the header by the firmware.

**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: **html**ÜÜ

**Response:**

Module may give http response in multiple chunks for a single HTTP GET request.

**AT Mode:**

| Result Code                                                                                                                                             | Description                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT+RSI_HTTPRSP=< <a href="#">more</a><br>>< <a href="#">status_code</a> >< <a href="#">offset</a> >< <a href="#">data_len</a> >< <a href="#">data</a> > | After the module sends out the HTTP GET request to the remote server, it may take some time for the response to come back.<br>The response from the remote server is sent out to the Host from the module in the following form:<br><br>AT+RSI_HTTPRSP=<More><Status_Code><Data Offset><Data Length><Data><br><br>The string AT+RSI_HTTPRSP is in uppercase ASCII. |
| ERROR<Error_code>                                                                                                                                       | Failure                                                                                                                                                                                                                                                                                                                                                            |

**Response Parameters:**

**More(2 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.

**Status code(2 bytes):**

Provided the HTTP status code as received in the response packet such as 200, 201, 404 etc. A status\_code equal to 0 indicates that there was no HTTP header in the received packet, probably a continuation of the frame body received in the previous chunk.

**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](http://www.google.com)  
IP Address: 192.168.40.86  
URL: /index.html  
Extended HTTP Header: ContentType: **html**  
the below command is used  
at+rsi\_httpget=0,80,username,password,hostname,192.168.40.86,/index.html,ContentType: **html**

#### For IPv6:

Https\_enable : = 0, to disable https  
Http\_port :8080  
Username : username  
Password : password  
Hostname : [www.google.com](http://www.google.com)  
IP Address: 2001:DB8:1:0:0:0:0:4  
URL: /index.html  
Extended HTTP Header: ContentType:**html**  
the below command is used  
at+rsi\_httpget6=0,8080,username,password,hostname,2001:DB8:1:0:0:0:0:4,/index.html,ContentType: **html**

## 5.46 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

#### Command Parameters:

##### 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.

Set BIT(7) to enable user defined http\_content type in Flags.

**http\_port:**

HTTP server port number.

If this is not mentioned default port numbers will be used.

**User\_name:** User\_name for HTTP/HTTPS server authentication. Default user name is 'redpine'.

**Password:** Password for HTTP/HTTPS server authentication. Default password is 'admin'.

**Host\_name:** Host name of the HTTP/HTTPS server.

**Ip\_address:** IPv4/IPv6 address of HTTP/HTTPS server.

**url:** requested URL.

**Extended\_header:** The purpose of this is to append user configurable header fields to the default HTTP/HTTPS header. To write extended header through 'at' command, user must use 'Data stuffing' mentioned separately in this document as well as in context of extended header mentioned here. Extended header can have multiple header fields each ended by \r\n(0xd 0xa). But here \r\n is our delimiter for whole 'at' command, so use data stuffing and replace all \r\n(0xd 0xa) by 0xdb 0xdc besides delimiter(\r\n)

**Data:** Post data to be sent.

**Data/Data\_length:** Post data to be sent/ 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](http://www.google.com)

IP = 192.168.40.50

URL=/index.html

Extended HTTP Header = ContentType:htmlÜÜ

Data=<data>

**Example 2 (Set BIT(5) in https\_enable field ):**

Https\_enable = 32

Http\_port = 80

Username = username

Password = password

Hostname = [posttestserver.com](http://posttestserver.com)

IP = 64.90.48.15

URL=/post.php

Extended HTTP Header = ContentType: htmlÜÜ

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=< <a href="#">more</a> >< <a href="#">status_code</a> >< <a href="#">offset</a> >< <a href="#">data_len</a> >< <a href="#">data</a> > | After the module sends out the HTTP POST request to the remote server, it might take some time to receive the response. The response from the remote server is sent out to the Host from the module in the following form:<br>AT+RSI_HTTPRSP=< <a href="#">more</a> >< <a href="#">status_code</a> >< <a href="#">offset</a> >< <a href="#">data_len</a> >< <a href="#">data</a> ><br>The string AT+RSI_HTTPRSP is in uppercase ASCII. |
| ERROR<Error_code>                                                                                                                                    | Failure                                                                                                                                                                                                                                                                                                                                                                                                                                |

#### Response Parameters:

**More(2 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.

#### Status code(2 bytes):

Provided the HTTP status code as received in the response packet such as 200, 201, 404 etc. A status\_code equal to 0 indicates that there was no HTTP header in the received packet, probably a continuation of the frame body received in the previous chunk.

**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:html  ,<data=abcd>\r\n
```

##### For IPv6:

```
at+rsi_httppost6=0,443,username,password,hostname,2001:DB8:1:0:0:0:4,/index.html,
ContentType:html  ,<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: html  , 100\r\n
```

```
at+rsi_httppost=65,443,username,password,posttestserver.com,64.90.48.15,/index.html,
ContentType: html  , 100\r\n
```

```
at+rsi_httppost=97,443,username,password,posttestserver.com,64.90.48.15,/index.html,
ContentType: html  , 100\r\n
```

##### For IPv6:

```
at+rsi_httppost6=32,80,username,password,hostname,2001:DB8:1:0:0:0:4,/index.html,
ContentType: html  , 100\r\n
```

```
at+rsi_httppost6=65,443,username,password,hostname,2001:DB8:1:0:0:0:4,/index.html,
ContentType: html  , 100\r\n
```

```
at+rsi_httppost6=97,443,username,password,hostname,2001:DB8:1:0:0:0:4,/index.html,
ContentType: html  , 100\r\n
```

## 5.47 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 when 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.

### Response:

Module may give http response in multiple chunks for a single HTTP POST request.

#### AT Mode:

| Result Code                                                                                                                                                     | Description                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT+RSI_HTTPPOSTRSP=<br>< <a href="#">more</a> >< <a href="#">status_code</a> >< <a href="#">offset</a> ><<br><a href="#">data_len</a> >< <a href="#">data</a> > | <p>After the module sends out the HTTP POST request to the remote server, it might take some time to receive the response.</p> <p>The response from the remote server is sent out to the Host from the module in the following form:<br/>AT+RSI_HTTPRSP=&lt;More&gt;&lt;Status_Code&gt;&lt;Data Offset&gt;&lt;Data Length&gt;&lt;Data&gt;</p> <p>The string AT+RSI_HTTPRSP is in uppercase ASCII.</p> |
| ERROR<Error_code>                                                                                                                                               | Failure                                                                                                                                                                                                                                                                                                                                                                                               |

### Response Parameters:

**More(2 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.

#### Status code(2 bytes):

Provided the HTTP status code as received in the response packet such as 200, 201, 404 etc. A status\_code equal to 0 indicates that there was no HTTP header in the received packet, probalby a continuation of the frame body received in the previous chunk.

**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, 0BBEF, 0xBB3E, 0xBB38, 0BBE7.

#### Relevance:

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

## 5.48 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                                                                                                    |
|-------------------|----------------------------------------------------------------------------------------------------------------|
| <b>PUT_CREATE</b> | Creates HTTP client thread and HTTP client socket. This should be the first command to use the HTTP client PUT |
| <b>PUT_START</b>  | Connects to the specified HTTP server and creates the specified resource.                                      |
| <b>PUT_PACKET</b> | To send the resource data packet                                                                               |
| <b>PUT_DELETE</b> | 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 change accordingly.

at+rsi\_httpput=<command\_type>,<remaining parameters>\r\n

Following are available command types.

| HTTP PUT command  | Command Type | Command Format                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PUT create</b> | <b>1</b>     | at+rsi_httpput=1\r\n                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>PUT start</b>  | <b>2</b>     | at+rsi_httpput=2,< <a href="#">ip version</a> >,< <a href="#">https enable</a> >,< <a href="#">port number</a> >,< <a href="#">total contentlength</a> >,< <a href="#">http buffer</a> >\r\n<br><br>Ip_version: IP version to use.<br>4 – For IPv4<br>6 – For IPv6<br><b>ip_address:</b> Ipv4/Ipv6 address of the HTTP server.<br><b>port number:</b> HTTP server port number<br><b>total_length:</b> Total content length of the HTTP PUT data<br><b>http_buffer:</b> http buffer contains the username, password, host name, ip address, URL address, extended http header. |
| <b>PUT PACKET</b> | <b>3</b>     | at+rsi_httpput=3,< <a href="#">current length</a> >,< <a href="#">http buffer</a> >\r\n<br><b>current length :</b> length of the current http put content chunk<br><b>http_buffer:</b> http buffer contains the put data                                                                                                                                                                                                                                                                                                                                                      |
| <b>PUT DELETE</b> | <b>4</b>     | at+rsi_httpput=4\r\n                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

### 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.

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 uses SSL TLS 1.0 and TLS 1.2 versions.

BIT(2) and BIT(3) are valid only when HTTPS is enabled.

**Note:**

If SSL is enabled, module uses same SSL version until module reboots.

Set BIT(5) to enable http\_post data feature

Set BIT(6) to enable HTTP version 1.1.

Set BIT(7) to enable user defined http\_content\_type in flags.

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. Default user name is 'redpine'.

**Password:** Password for HTTP/HTTPS server authentication. Default password is 'admin'.

**Host\_name:** Host name of the HTTP/HTTPS server.

**Ip\_address:** IPv4/IPv6 address of HTTP/HTTPS server.

**url:** requested URL.

**Extended\_header:** The purpose of this is to append user configurable header fields to the default HTTP/HTTPS header. To write extended header through 'at' command, user must use 'Data stuffing' mentioned separately in this document as well as in context of extended header mentioned here. Extended header can have multiple header fields each ended by \r\n(0xd 0xa). But here \r\n is our delimiter for whole 'at' command, so use data stuffing and replace all \r\n(0xd 0xa) by 0xdb 0xdc besides delimiter(\r\n)

**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 S- (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 delimiters.
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=<br>< <a href="#">command_type</a> > < <a href="#">end_of_file</a> > < <a href="#">offset</a> > < <a href="#">data_len</a> > < <a href="#">data</a> > | <p>After the module sends out the HTTP PUT 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:<br/>AT+RSI_HTTPRSP=&lt;command_type&gt;&lt;end_of_file &gt;&lt;Offset&gt;&lt;DataLength&gt;&lt;Data&gt;</p> <p>The string AT+RSI_HTTPRSP is in uppercase ASCII.</p> |
| ERROR<Error_code>                                                                                                                                                    | Failure                                                                                                                                                                                                                                                                                                                                                                                                     |

#### 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,/,ContentType: html    \r\n
```

```
at+rsi_httpput=3,19,<html><body></html>\r\n
```

```
at+rsi_httpput=4\r\n
```

## 5.49 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 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.

## 5.50 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

### Response:

#### AT Mode:

| Result Code         | Description                                                       |
|---------------------|-------------------------------------------------------------------|
| OK< fwversion ><\0> | Successful execution of command.<br>All values returned in ASCII. |
| ERROR<Error code>   | Failure.                                                          |

### 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\0\r\n

0x4F 0x4B 0x31 0x2E 0x31 0x2E 0x30 0X00 0x0D 0x0A

### Note:

The Format of Firmware version response will be changed from RS9116.NB0.WC.GENR.OSI.2.x releases.

### Response:

OK1610.1.2.24.0014 or OK1610.2.0.0.0014 (for 2.x)

## 5.51 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

### Response:

#### AT Mode:

| Result Code       | Description                     |
|-------------------|---------------------------------|
| OK< rssiVal >     | Successful execution of command |
| ERROR<Error code> | Failure.                        |

### 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 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

## 5.52 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

**Response:**

**For None Concurrent Mode:**

**AT Mode:**

| Result Code       | Description                      |
|-------------------|----------------------------------|
| OK< macAddress >  | Successful execution of command. |
| ERROR<Error code> | Failure.                         |

**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.                         |

#### 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
```

## 5.53 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
```

##### Response:

##### AT Mode:

| Result Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Description                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| OK< <a href="#">wlan_state</a> >< <a href="#">Chn_no</a> >< <a href="#">psk</a> >< <a href="#">mac_addr</a> >< <a href="#">ssid</a> >< <a href="#">connType</a> >< <a href="#">sec_type</a> >< <a href="#">dhcpMode</a> >< <a href="#">ipaddr</a> >< <a href="#">subnetMask</a> >< <a href="#">gateway</a> >< <a href="#">num_open_socks</a> >< <a href="#">prefix_length</a> >< <a href="#">ipv6addr</a> >< <a href="#">defaultgw6</a> >< <a href="#">tcp_stack_used</a> >[< <a href="#">sock_id</a> >< <a href="#">socket_type</a> >< <a href="#">sPort</a> >< <a href="#">dPort</a> >< <a href="#">destIPAddr.ipv4_address</a> / <a href="#">destIPAddr.ipv6_address</a> >] upto Max sockets supported. | Successful execution of command |
| ERROR<Error Code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Failure.                        |

#### 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(32 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>]<repeats 11 times > 0x0D 0x0A.
```

## 5.54 Soft Reset

**Description:**

This command acts as a hard 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 Auto Baud Rate Detection (ABRD) for device detection and issuing the first command "Set Operating Mode". This command is valid only in case of UART and USB-CDC interface.

**Note:**

No response comes for this command. All the frame exchanges will follow as in a normal bootup sequence.

**Command Format:**

**AT Mode:**

```
at+rsi_reset\r\n
```

**Command Parameters:**

N/A

**Response:**

None

**Response Parameters:**

N/A

**Possible error codes:**

N/A

**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:**

None

## 5.55 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

### 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.<br>Possible values are as follows,<br><ol style="list-style-type: none"> <li>1. RSI_MULTICAST_MAC_ADD_BIT (To set particular bit in multicast bitmap)</li> <li>2. RSI_MULTICAST_MAC_CLEAR_BIT (To reset particular bit in multicast bitmap)</li> <li>3. RSI_MULTICAST_MAC_CLEAR_ALL (To clear all the bits in multicast bitmap)</li> <li>4. RSI_MULTICAST_MAC_SET_ALL (To set all the bits in multicast bitmap)</li> </ol> |
| 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.<br>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.                         |

### 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.

## 5.56 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

## Command Parameters:

### [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.                         |

## 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 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 0x30 0x3A 0x31 0x0D 0x0A

**Response:**

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

**Note:**

if MDNS feature is enabled, multicast group is not supported.

## 5.57 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\\_ms](#) >\r\n

**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< <a href="#">ip_version</a> >< <a href="#">ping_size</a> ><br>< <a href="#">ping_address.ipv4_address/ ping_address.ipv6_address</a> > | Successful execution of command |
| ERROR<Error code>                                                                                                                         | Failure                         |

**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\_ms:**

ping request command response timeout in milli seconds.

**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
```

**Response:**

```
0x4F 0x4B 0x04 0x00 0x0A 0x00 0xC0 0xA8 0x01 0x64 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x00 0x0D 0x0A
```

**For IPv6:**

```
at+rsi_ping=6,2001.db8.1.0.0.0.123,10\r\n
0x61 0x74 0x2B 0x72 0x73 0x69 0x5F 0x70 0x69 0x6E 0x67 0x3D 0x36 0x2C 0x32 0x30 0x30 0x31 0x2E 0x64 0x62
0x38 0x2E 0x31 0x2E 0x30 0x2E 0x30 0x2E 0x30 0x2E 0x30 0x2E 0x31 0x32 0x33 0x2C 0x31 0x30 0x0D 0x0A
```

**Response:**

```
0x4F 0x4B 0x06 0x00 0x0A 0x00 0xB8 0x0D 0x01 0x20 0x00 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x23 0x01 0x00
0x00 0x0D 0x0A
```

## 5.58 Loading the Webpage

RS9116W 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. This JSON data can be stored, retrieved and updated independently. The Webpages can fetch this data and dynamically fill form fields. These fields can be modified from the host side or the browser.

The host can store up to 10 Webpages, each up to 4K in size. The size of a page can exceed the 4K limitation, but this will result in lesser number of files that can be stored. For example, user could store one 12K file, and seven 4K files. Similarly, there can be 10 JSON data objects with each NOT exceeding 512 Bytes in any circumstances. These objects can only be stored if they have an associated webpage

### 5.58.1 Loading the static webpage

**Description:**

This command is used to load a static webpage, to store a static webpage and to overwrite an existing static webpage. This command should be issued before join command.

If webpage total length is more than MAX\_WEBPAGE\_SEND\_SIZE, then host has to send webpage in multiple chunks.

**Command Format:**

**AT Mode:**

```
at+rsi_webpage= < filename >,< total\_len >,< current\_len >,< has\_json\_data >,< webpage >\r\n
```

**Command Parameters:**

**filename:**

name of the file to load the webpage.

**total\_len:**

Total Length of the webpage

**current\_len:**

Length of the current webpage chunk has\_json\_data

1 - if file has associated json data

0 - if no associated data. In this case webpage is static page.

**webpage:**

The HTML content chunk.

**Response:**

**AT Mode:**

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

### 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 up to the 4K chunk boundary. Precisely, if an old file used 2 chunks of 4K (i.e. up to 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
```

## 5.58.2 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
```

### 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.    |

### 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

## 5.59 Clearing the Webpage

These commands are used to erase the webpage and information related to webpage from the flash.

### 5.59.1 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

**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.                         |

**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

### 5.59.2 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

#### Command Parameters:

##### filename:

name of the webpage file of which JSON data must be erased.

#### Response:

##### AT Mode:

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

#### 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
```

### 5.59.3 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
```

#### Command Parameters:

##### clear:

set '1' to clear files.

#### Response:

##### AT Mode:

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

#### 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
```

## 5.60 Loading of Store Configuration Page

RS9116W 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.**

## 5.61 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.

### url\_length(1 byte):

This is the number of characters in the requested URL.

### url\_name (40 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

### Command Parameters:

#### total\_len(4 bytes):

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(1 byte):

'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(1400 bytes):

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.                         |

### 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
```

## 5.62 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
```

### Command Parameters:

#### setregion\_code\_from\_user\_cmd(1 byte):

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. For world mode domain, setting the region information from beacon is not supported.

### Region\_code(1 byte):

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.             |

**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 Silicon 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 Silicon module.

**Table 16 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             | 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           | 4                  | 144          | 23                   | Passive   |
| 6       | 5GHz   | 149           | 5                  | 165          | 29                   | Active    |

**Table 17 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             | 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 18 Regulations followed for Japan 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   |

**Note:**

Though the transmit power levels w.r.t to region are greater than 20dBm, Silicon 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

## 5.63 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

**Command Parameters:**

**setregion\_code\_from\_user\_cmd(1 byte):**

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:**

Country code: Country code is of 3 bytes. Country code is case sensitive and should be in *Upper case*. If the first parameter is 1, the second parameter should be one of the these 'US', 'EU', 'JP' country codes.

**Note:**

If the country code is of 2 characters, 3<sup>rd</sup> character should be <space>.

**Note:**

The below parameters are considered only if the first parameter is 1.

**Number of rules(4 byte):**

Number of rules for the given domain

**First channel(1 byte):**

Start channel for the nth rule

**Number of channels(1 byte):**

number of channels holding the same rule from the start channel

**Maximum transmit power(1 byte):**

Maximum transmit power used in that set of channels.

**Response:**

**AT Mode:**

| Result Code | Description          |
|-------------|----------------------|
| OK          | Successful execution |
| ERROR       | Failure.             |

**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, Silicon 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 Silicon module

## 5.64 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

### Command Parameters:

#### per\_stats\_enable(2 bytes):

Enable /disable per status feature

0 – Enable

1 – Disable

#### per\_stats\_channel(2 bytes):

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=< <a href="#">tx_pkts</a> >,< <a href="#">reserved_1</a> >,< <a href="#">tx_retries</a> >,< <a href="#">crc_pass</a> >,< <a href="#">crc_fail</a> >,< <a href="#">cca_stk</a> >,< <a href="#">cca_not_stk</a> >,< <a href="#">pkt_abort</a> >,< <a href="#">fls_rx_start</a> >,< <a href="#">cca_idle</a> >,< <a href="#">reserved_2</a> >,< <a href="#">rx_retries</a> >,< <a href="#">reserved_3</a> >,< <a href="#">cal_rssi</a> >,< <a href="#">reserved_4</a> >,< <a href="#">xretries</a> >,< <a href="#">max_cons_pkts_dropped</a> >,< <a href="#">reserved_5</a> >,< <a href="#">bss_broadcast_pkts</a> >,< <a href="#">bss_multicast_pkts</a> >,< <a href="#">bss_filter_matched_multicast_pkts</a> >,<eof_pkt_drop_count>,<mask_pkt_drop_count>,<no_of_acks_sent>,<pkt_rcvd_with_48M>,<pkt_rcvd_with_24M>,<pkt_rcvd_with_12M>,<pkt_rcvd_with_6M>,<pkt_rcvd_with_54M>,<pkt_rcvd_with_36M>,<pkt_rcvd_with_18M>,<pkt_rcvd_with_9M>,<pkt_rcvd_with_11M>,<pkt_rcvd_with_5M>,<pkt_rcvd_with_2M>,<pkt_rcvd_with_1M>,<pkt_rcvd_with_mcs0>,<pkt_rcvd_with_mcs1>,<pkt_rcvd_with_mcs2>,<pkt_rcvd_with_mcs3>,<pkt_rcvd_with_mcs4>,<pkt_rcvd_with_mcs5>,<pkt_rcvd_with_mcs6>,<pkt_rcvd_with_mcs7> |             |

### 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 received 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 paramters 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.

## 5.65 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

**Response Parameter:**

**socketDsc(2 bytes):**

Socket descriptor of the socket which is closed.

**bytesSent(2 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.

## 5.66 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

**Command Parameters:**

sock\_handle: socket handle on which number of bytes have been successfully transmitted.

**Response:**

**AT Mode:**

|                                |          |
|--------------------------------|----------|
| OK<sock_handle><SentBytescnt > | Success. |
| ERROR                          | Failure. |

**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.

## 5.67 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.

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

#### Command Parameters:

##### assertion\_type(4 byte):

Possible values are 0 to 15.

##### assertion\_level(4 byte):

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 assertion level as 0.
2. Baud rate for UART 2 on host application side should be 460800.

#### Response:

##### AT Mode:

|       |                      |
|-------|----------------------|
| OK    | Successful execution |
| ERROR | Failure.             |

#### Possible Error Codes:

Possible error codes for this command are 0x0021, 0x0025, 0x002C, 0xFFFF8

#### Relevance:

This command can be given at any time.

## 5.68 Asynchronous Message for Connection State Notification

#### Description:

Asynchronous message are used to indicate module state to host. These message are enabled by setting 10<sup>th</sup> 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<br>>,<StateCode>,<reason_code>,<<br>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<br>>,<StateCode>,<reason_code>,<<br>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<br>>,<StateCode>,<reason_code>,<<br>rsi_channel>,<rsi_rssi>,<rsi_bssid>\r\n | Once the association or disassociation is done, module will give final state asynchronous message                               |

#### 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 contains two parts (upper nibble/lower nibble).

Upper nibble represents 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.

## 5.69 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(6 bytes):**

MAC address of receiver

**payload(100 bytes):**

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 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

## 5.70 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=<br>< MAC_address > | MAC address of station connected |
|-----------------------------------------------------|----------------------------------|

|                                                        |                                     |
|--------------------------------------------------------|-------------------------------------|
| AT+RSI_CLIENT_STATION_DISCONNECTED=<br>< MAC_address > | MAC address of station disconnected |
|--------------------------------------------------------|-------------------------------------|

#### 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

## 5.71 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

#### 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):TLS

varies from 1 to 65534(should be greater than gap time)

##### Escape Time(in milliseconds):

Varies from 2 to 65535(should be greater than 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

- 2- TLS\_RSA\_WITH\_AES\_256\_CBC\_SHA256
- 4 - TLS\_RSA\_WITH\_AES\_128\_CBC\_SHA256
- 8 - TLS\_RSA\_WITH\_AES\_256\_CBC\_SHA
- 16 - TLS\_RSA\_WITH\_AES\_128\_CBC\_SHA
- 32 - TLS\_RSA\_WITH\_AES\_128\_CCM\_8
- 64 - 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 parameters.                  |
| 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,0xFFFF8.    |

**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.

## 5.72 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\\_pinset](#)>\r\n

This command has been deprecated.

**or**

at+rsi\_hfc=<[uart\\_hw\\_flowcontrol\\_enable\\_pinset](#)>\r\n

**Note:**

This command is only valid in AT mode using UART interface. User can use any of the two commands, but it is recommended to use

at+rsi\_hfc=<[uart\\_hw\\_flowcontrol\\_enable\\_pinset](#)>\r\n for enabling hardware flow control.

**Command Parameters:**

**uart\_hw\_flowcontrol\_enable(1 byte):**

Enable or Disable UART hardware flow control.

1/2 -Enable and Pin set to be used to for RTS/CTS purpose.

0 - Disable

If uart\_hw\_flowcontrol\_enable parameter is 0, uart flow control is disabled. If the parameter is given as 1 or 2, it means uart hardware flow control is enabled and Pin set to be used

If parameter is given as 1: Pin set used for RTS/CTS functionality will be

UART\_CTS : GPIO - 11

UART\_RTS : GPIO - 7

If parameter is given as 2: Pin set used for RTS/CTS functionality will be

UART\_CTS : GPIO - 15

UART\_RTS : GPIO - 12

**Response:**

**AT Mode:**

|       |                      |
|-------|----------------------|
| OK    | Successful execution |
| ERROR | Failure              |

**Response Parameters:**

uart\_hw\_flow\_control\_enabled(1 byte) : If uart flow control is enabled, then response parameter will 1 else 0.

**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.

## 5.73 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

**Command Parameters:**

**total\_sockets(1 byte):**

Desired total number of sockets to open.

**total\_tcp\_sockets(1 byte):**

Desired total number of TCP sockets to open.

**total\_udp\_sockets(1 byte):**

Desired total number of UDP sockets to open.

**tcp\_tx\_only\_sockets(1 byte):**

Desired total number of TCP sockets to open which are used only for data transmission.

**tcp\_rx\_only\_sockets(1 byte):**

Desired total number of TCP sockets to open which are used only for data reception.

**udp\_tx\_only\_sockets(1 byte):**

Desired total number of UDP sockets to open which are used only for data transmission.

**udp\_rx\_only\_sockets(1 byte):**

Desired total number of UDP sockets to open which are used only for data reception.

**tcp\_rx\_high\_performance\_sockets(1 byte):**

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(1 byte):**

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(1 byte):**

In case of high latency networks in order to give TCP ACK with respective to the window size. Default value is 2.

Possible values: 2 - tcp\_rx\_window\_size\_cap

**Response:**
**AT Mode:**

|       |                      |
|-------|----------------------|
| OK    | Successful execution |
| ERROR | Failure.             |

**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
```

## 5.74 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
```

**Command Parameters:**
**rf\_rx\_curr\_mode(1 byte):**

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(1 byte):**

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(2 byte):**

This two bytes are reserved. Set to '0'.

**Response:**

**AT Mode:**

|       |                      |
|-------|----------------------|
| OK    | Successful execution |
| ERROR | Failure.             |

**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.

## 5.75 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

**Response:**

**AT Mode:**

|       |                      |
|-------|----------------------|
| None  | Successful execution |
| ERROR | Failure.             |

**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. 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.

## 5.76 HTTP Abort

### Description:

This command is used to abort the HTTP/HTTPS GET/POST

### Pre-Condition:

This command should be given only after Ipconf command.

### Command Format:

#### AT Mode:

at+rsi\_http\_abort\r\n

### Response:

#### AT Mode:

|       |                      |
|-------|----------------------|
| OK    | Successful execution |
| ERROR | Failure.             |

### 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.

## 5.77 HTTP Server Credentials from Host

### Description:

This command is used to set the HTTP Server Credentials.

### Pre-Condition:

This command should be given only after Opermode command.

### Command Format:

#### AT Mode:

at+rsi\_credentials=<username>,<password>\r\n

**username(31 byte):** Username for HTTP Server. Default user name is 'redpine'.

**password(31 byte):** Password for HTTP Server. Default password is 'admin'.

### Response:

#### AT Mode:

|       |                      |
|-------|----------------------|
| OK    | Successful execution |
| ERROR | Failure.             |

### 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.

## 5.78 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                                                                                                                           |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Create</b>                   | Creates FTP objects. This should be the first command for accessing FTP.                                                              |
| <b>Connect</b>                  | Connects to FTP server.                                                                                                               |
| <b>Make Directory</b>           | Creates directory in a specified path.                                                                                                |
| <b>Delete Directory</b>         | Deletes directory in a specified path                                                                                                 |
| <b>Change Working Directory</b> | Changes working directory to a specified path.                                                                                        |
| <b>Directory List</b>           | Lists directory contents in a specified path.                                                                                         |
| <b>File Read</b>                | Reads the file                                                                                                                        |
| <b>File Write</b>               | Open file to write                                                                                                                    |
| <b>File Write Content</b>       | Writes content into file which is opened using File Write command. File content can be written in multiple chunks using this command. |
| <b>File Delete</b>              | Deleted file                                                                                                                          |
| <b>File Rename</b>              | Renames file                                                                                                                          |
| <b>Disconnect</b>               | Disconnects from FTP server.<br>Once disconnect is done user can connect again using connect command.                                 |
| <b>Destroy</b>                  | Destroys FTP objects.<br>Once destroy is given user can't 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 can't 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                                                                                       |
|----------------|--------------|------------------------------------------------------------------------------------------------------|
| <b>Create</b>  | <b>1</b>     | at+rsi_ftp=1\r\n                                                                                     |
| <b>Connect</b> | <b>2</b>     | at+rsi_ftp=2,<ip_version>,<IPaddress>,<username>,<password>,<server_port>\r\n<br>ip_version(1 byte): |

| FTP command              | Command Type | Command Format                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          |              | <p>IP version to use.<br/>4 – For IPv4<br/>6 – For IPv6</p> <p><b>IP address(IPv4 : 4 byte,IPv6 : 16 byte):</b><br/>IPv4/IPv6 address for FTP server to connect.</p> <p><b>username(31 byte):</b><br/>username of FTP server</p> <p><b>password(31 byte):</b><br/>password of FTP server</p> <p><b>server_port(4 byte):</b><br/>FTP server port number</p>                                        |
| Make Directory           | 3            | <p>at+rsi_ftp=3,&lt;<a href="#">Directory_path</a>&gt;\r\n</p> <p><b>Directory_path(51 byte):</b><br/>Path of the directory to make.</p>                                                                                                                                                                                                                                                          |
| Delete Directory         | 4            | <p>at+rsi_ftp=4,&lt;<a href="#">Directory_path</a>&gt;\r\n</p> <p><b>Directory_path(51 byte):</b><br/>Path of the directory to delete.</p>                                                                                                                                                                                                                                                        |
| Change Working Directory | 5            | <p>at+rsi_ftp=5,&lt;<a href="#">Directory_path</a>&gt;\r\n</p> <p><b>Directory_path(51 byte):</b><br/>Change of directory path.</p>                                                                                                                                                                                                                                                               |
| Directory List           | 6            | <p>at+rsi_ftp=6,&lt;<a href="#">Directory_path</a>&gt;\r\n</p> <p><b>Directory_path(51 byte):</b><br/>path of the directory for list.</p>                                                                                                                                                                                                                                                         |
| File Read                | 7            | <p>at+rsi_ftp=7,&lt;<a href="#">file_name</a>&gt;\r\n</p> <p><b>file_name(51 byte):</b><br/>name of the file to read.</p>                                                                                                                                                                                                                                                                         |
| File Write               | 8            | <p>at+rsi_ftp=8,&lt;<a href="#">file_name</a>&gt;\r\n</p> <p><b>file_name(51 byte):</b><br/>name of the file to write.</p>                                                                                                                                                                                                                                                                        |
| File Write content       | 9            | <p>at+rsi_ftp_file_content=&lt;<a href="#">end_of_file</a>&gt;,&lt;<a href="#">file_content</a>&gt;\r\n</p> <p><b>end_of_file(1 byte):</b><br/>Represents whether end of file is reached or not.<br/>0 – More data is coming to write into file.<br/>1 – Current chunk is the last chunk and no more data is coming.</p> <p><b>File_content(1400 byte):</b><br/>Content of the file to write.</p> |
| File Delete              | 10           | <p>at+rsi_ftp=10,&lt;file_name&gt;\r\n</p> <p><b>file_name(51 byte):</b><br/>Name of the file to delete.</p>                                                                                                                                                                                                                                                                                      |
| File Rename              | 11           | <p>at+rsi_ftp=11,&lt;<a href="#">file_name</a>&gt;,&lt;<a href="#">new_file_name</a>&gt;\r\n</p> <p><b>file_name(51 byte):</b><br/>Old name of the file.</p> <p><b>new_file_name(51 byte):</b><br/>New file name.</p>                                                                                                                                                                             |
| 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                                                                                                                                                                                                                                                                                                                                                                                 |

**command\_type(1 byte):**

Type of the FTP command.

This parameter is valid for all commands.

## Remaining parameters:

### ip\_version(1 byte):

IP version to use. This parameter is valid for **connect** command.

4 – For IPv4

6 – For IPv6

### server\_ip\_address.ipv4\_address(4 byte):

IPv4 address of the FTP server. This parameter is valid for **connect** command.

### server\_ip\_address.ipv6\_address(16 byte):

IPv6 address of the FTP server. This parameter is valid for **connect** command.

### username(31 byte):

username for the FTP server. This parameter is valid for **connect** command.

### password(31 byte):

Password for the FTP server. This parameter is valid for **connect** command.

### server\_port(4 byte):

FTP server port number. This parameter is valid for **connect** command.

### path(51 byte):

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(51 byte):

New file name.

This parameter is valid for **File Rename** command.

### end\_of\_file(1 byte):

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 | <p>AT+RSI_FTP_DIR_LIST=&lt;<a href="#">command_type</a>&gt;&lt;<a href="#">more</a>&gt;&lt;<a href="#">length</a>&gt;&lt;<a href="#">data</a>&gt;\r\n</p> <p><b>command_type(1 byte):</b><br/>This field contains value '6'.</p> <p><b>More(1 byte):</b><br/>Represents whether more response is pending from module or not.<br/>1 – More response is pending<br/>0 – End of response</p> <p><b>Length(2 bytes):</b><br/>Length of current chunk response</p> <p><b>Data(variable bytes):</b><br/>Content of the directory list</p> |
| File Read      | <p>AT+RSI_FTP_FILE=&lt;<a href="#">command_type</a>&gt;&lt;<a href="#">more</a>&gt;&lt;<a href="#">length</a>&gt;&lt;<a href="#">data</a>&gt;\r\n</p> <p><b>command_type(1 byte):</b><br/>This field contains value '7'.</p> <p><b>More(1 byte):</b><br/>Represents whether more response is pending from module or not.<br/>1 – More response is pending<br/>0 – End of response</p> <p><b>Length(2 bytes):</b><br/>Length of current chunk response</p>                                                                           |

| FTP command            | Command Response                                                                                   |
|------------------------|----------------------------------------------------------------------------------------------------|
|                        | <b>Data(Variable bytes):</b><br>Content of the file                                                |
| For all other commands | OK< <a href="#">command type</a> >\r\n<br><b>command_type(1 byte):</b><br>Type of the FTP command. |

#### Response Parameters:

**command\_type(1 byte):** Type of the FTP command.

**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):** 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
```

## 5.79 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                                                                                     |
|---------------------------|-------------------------------------------------------------------------------------------------|
| <b>Create</b>             | Creates SNTP objects. This should be the first command to get time updates from the SNTP server |
| <b>Get Time</b>           | To Get the Current time in seconds                                                              |
| <b>Get Time-Date</b>      | To Get the Current time in Time-Date format                                                     |
| <b>Get Server Address</b> | To Get the SNTP server Details.                                                                 |
| <b>Get Server Info</b>    | To Get the SNTP server Details.                                                                 |

| SNTP Command | Description                |
|--------------|----------------------------|
| 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<br><b>ip_version(1 byte):</b><br>IP version to use.<br>4 – For IPv4<br>6 – For IPv6<br><b>IP address(IPv4 : 4 byte /IPv6 : 16 byte):</b><br>IPv4/IPv6 address for SNTP server to connect.<br><b>sntp_method(1 byte):</b> SNTP method to use.<br>1 – For BroadCast Method<br>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                                                                                                                                                                                                                                                                                                                                          |
| Get Server info    | 6            | at+rsi_sntp=6\r\n                                                                                                                                                                                                                                                                                                                                          |

#### command\_type(1 byte):

Type of the SNTP command. This parameter is valid for all commands.

#### ip\_version(1 byte):

IP version to use. This parameter is valid for **create** command.

4 – For IPv4

6 – For IPv6

#### server\_ip\_address.ipv4\_address(4 byte):

IPv4 address of the SNTP server. This parameter is valid for **create** command.

#### server\_ip\_address.ipv6\_address(16 byte):

IPv6 address of the SNTP server. This parameter is valid for **create** command.

#### sntp\_method(1 byte):

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        |

| SNTP command                        | Command Response                                                                                                                                                                                                                                           |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Get Time</b>                     | OK<Time in seconds>\r\n                                                                                                                                                                                                                                    |
| <b>Get Time Date</b>                | OK<Time in Ddat-Time format>\r\n                                                                                                                                                                                                                           |
| <b>Get Server Address</b>           | OK<Ip version><Ip address><sntp method>\r\n<br>Ip_version(1 byte): Ip version of the SNTP server.<br>Ip_address(IPv4 : 4 byte /IPv6 : 16 byte): Ip address of the SNTP server.<br>sntp_method(1 byte): sntp method of the server.                          |
| <b>Invalid SNTP server response</b> | AT+RSI_INVALID_SNTP_SERVER=<ip_version><ip_address><sntp_method>\r\n<br>Ip_version(1 byte): Ip version of the SNTP server.<br>Ip_address(IPv4 : 4 byte /IPv6 : 16 byte): Ip address of the SNTP server.<br>sntp_method(1 byte): sntp method of the server. |
| <b>For remaining commands</b>       | OK<Command_type>\r\n<br>Command_type: 1byte. Type of the SNTP command                                                                                                                                                                                      |

#### Response Parameters:

**Command\_type(1 byte):** Type of the SNTP command.

**ip\_version(1 byte):** IP version of the SNTP server.

**server\_ip\_address(IPv4 : 4 byte /IPv6 : 16 byte):** IP address of the SNTP server.

**sntp method(1 byte):** 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
```

## 5.80 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                                                          |
|-------------------------|--------------|----------------------------------------------------------------------|
| <b>Init</b>             | 1            | Creates MDNS Daemon. This should be the first command to initialize. |
| <b>Register Service</b> | 3            | To add a service/start service discovery.                            |
| <b>Deinit</b>           | 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Init</b>             | <b>1</b>     | at+rsi_mdns=1,<ip_version>,<tll>,<buffer>\r\n<br>ip_version(1 byte): IP version to use.<br>4 – For IPv4<br>6 – For IPv6<br>tll(2 byte): Time To Live, Time in seconds for which service should be active.<br>buffer(1000 byte): Host name which is to used as host name in Type-A record.                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Register Service</b> | <b>3</b>     | at+rsi_mdns=3,<port_number>,<tll>,<more>,<buffer>\r\n<br>port_number(2 byte): Port number on which service which should be added.<br>tll(2 byte): Time To Live, Time in seconds for which service should be active.<br>more(1 byte): This byte should be set to '1' when there are more services to add.<br>0 – This is last service, starts MDNS service.<br>1 – Still more services will be added.<br>buffer(1000 byte): This field contains strings separated by null character(ascii : 0x00(Hex))<br>Buffer contains 3 string fields separated by NULL, fields are<br>1. Name to be added in Type-PTR record<br>2. Name to be added in Type-SRV record(Service name)<br>3. Text field to be added in Type-TXT record. |
| <b>Deinit</b>           | <b>6</b>     | at+rsi_mdns=6\r\n                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

**command\_type(1 byte):**

Type of the MDNSD command.

This parameter is valid for all commands.

**ip\_version(1 byte):**

IP version to use.

This parameter is valid for **Init** command.

4 – For IPv4

6 – For IPv6

**tll(2 byte):**

Time To Live, this field is valid for Init command(type - 1), register service command(type - 3).

**more(1 byte):**

This field is only valid for Register service command.

**Response:**

**AT Mode:**

| MDNS command            | Command Response     |
|-------------------------|----------------------|
| <b>Any MDNS Command</b> | OK<Command Type>\r\n |

**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_obe._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

## 5.81 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                                                                              |
|---------------|------------------------------------------------------------------------------------------|
| <b>Create</b> | Creates SMTP related thread, this should be the first command to use the SMTP client     |
| <b>Init</b>   | To initialize the SMTP client with username, password, from mail address and domain name |
| <b>Send</b>   | To send the mail to recipient                                                            |
| <b>Deinit</b> | 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Create</b>    | <b>1</b>     | at+rsi_smtp=1\r\n<br>Creates the SMTP client                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Init</b>      | <b>2</b>     | at+rsi_smtp=2,<ip_version>,<ip address>,<auth_type>,<server port>,<smtp buffer>\r\n<br>ip_version(1 byte): IP version to use.<br>4 – For IPv4<br>6 – For IPv6<br>ip_address(IPv4 : 4 byte /IPv6 : 16 byte): Ipv4/Ipv6 address of the SMTP server agent.<br>auth_type(1 byte): Authentication type of the SMTP server.<br><br>1. For Auth-Login type<br>2. For Auth_plain type<br><br>server_port(4 byte): SMTP server agent port number<br>smtp_buffer(1024 byte):smtp buffer contains server's username, password, from mail address, smtp server local domain name. |
| <b>Mail send</b> | <b>3</b>     | at+rsi_smtp=3,<smtp_feature>,<mail body_length>,<smtp buffer>\r\n<br>smtp_feature(1 byte): smtp feature bitmap<br>BIT(0): Low priority mail<br>BIT(1): Normal priority mail                                                                                                                                                                                                                                                                                                                                                                                           |

| SMTP command | Command Type | Command Format                                                                                                                                                                                                                                             |
|--------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |              | BIT(2): High priority mail<br>BIT(3): Smtplib extended header feature<br>smtp_mail_body_length(2 byte):Length of the mail body<br>smtp_buffer(1024 byte): smtp buffer contains recipient mail address, mail subject line, mail body, smtp extended header. |
| Deinit       | 4            | at+rsi_smtp=4\r\n<br>To delete the smtp client                                                                                                                                                                                                             |

**command\_type(1 byte):** Type of the SMTP command. This parameter is valid for all commands.

**ip\_version(1 byte):**

IP version to use. This parameter is valid for **Init** command.

4 – For IPv4

6 – For IPv6

**ipv4\_address(4 byte) :**

IPv4 address of the SMTP agent.

**ipv6\_address(16 byte):**

IPv6 address of the SMTP agent.

**auth\_type(1 byte):**

Authentication method used by the SMTP server agent.

1 for AUTH\_PLAIN

3 for AUTH\_LOGIN

**server\_port(4 byte):**

SMTP server agent port number.

**smtp\_feature(1 byte):**

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(2 byte):**

Length of the SMTP client mail body.

**smtp\_buffer(1024 byte):**

smtp\_buffer contains remaining parameters based on command type.

**Note:**

1. Maximum supported length for username, password, domain name, recipient mail address, from mail address is 100 bytes each excluding NULL character
2. Maximum supported length for recipient 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, 0xBBB2, 0x003E, 0xBBA5, 0xBBA3, 0xBA0, 0xBBA1, 0xBBA2, 0xBBA4, 0xBBA6, 0xBBA7, 0xBBA8, 0xBBA9, 0xBBAA, 0xBBAB, 0xBBAC, 0xBBAD, 0xBBAE, 0xBBAF, 0xBBB0, 0xBBB1, 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 Silicon1@Siliconlabs.comNULLmail.Siliconlabs.comNULL\r\n
```

```
at+rsi_smtp=3,3,4,Silicon2@Siliconlabs.comNULLsubjectlineNULLbody\r\n
```

```
at+rsi_smtp=4\r\n
```

## 5.82 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                                                                                                                                                                                           |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Session Create</b>    | 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. |
| <b>Get mail stats</b>    | To get the total number of mails count and size                                                                                                                                                       |
| <b>Get mail list</b>     | To get the size of the mail for the passed index                                                                                                                                                      |
| <b>Retrieve mail</b>     | To retrieve the mail content for the passed mail index                                                                                                                                                |
| <b>Mark mail</b>         | To mark a mail as deleted for the passed mail index                                                                                                                                                   |
| <b>Unamark mail</b>      | To unmark(reset) all the marked(deleted) mails in the current session.                                                                                                                                |
| <b>get server status</b> | To get the pop3 server status                                                                                                                                                                         |
| <b>session delete</b>    | 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 a 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Session Create</b> | <b>1</b>     | at+rsi_pop3=1,<ip_version>,>,<ipaddress>,<serverport>,<auth_type>,<username>,<password>\r\n<br>ip_version(1 byte): IP version to use.<br>4 – For IPv4<br>6 – For IPv6<br>ip_address(IPv4 : 4 byte /IPv6 : 16 byte): Ipv4/Ipv6 address of the POP3 server.<br>server_port(2 byte): POP3 server port number<br>auth_type(1 byte): Authentication type of the POP3 server.<br>For Auth-Login type<br>For Auth_plain type<br>username(101 byte): username for POP3 server authentication.<br>password(101 byte): password for POP3 server authentication. |
| <b>Mail stats</b>     | <b>2</b>     | at+rsi_pop3=2\r\n<br>To get the mail stats from the POP3 server.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Mail list</b>      | <b>3</b>     | at+rsi_pop3=3,<mail index>\r\n<br>mail index(2 byte) : Index of the particular mail which is used to get the size of the mail.                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Retrieve mail</b>  | <b>4</b>     | at+rsi_pop3=4,<mail index>\r\n<br>mail index(2 byte) : Index of the particular mail which is used in the mail list command.                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Mark mail</b>      | <b>5</b>     | at+rsi_pop3=5,<mail index>\r\n<br>mail index(2 byte) : Index of the particular mail which is used for deletion by passing the index                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Unmark mail</b>    | <b>6</b>     | at+rsi_pop3=6\r\n<br>To reset all the marked mails in the current session                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>server status</b>  | <b>7</b>     | at+rsi_pop3=7\r\n<br>To get the POP3 server status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>session delete</b> | <b>8</b>     | at+rsi_pop3=8\r\n<br>To delete the POP3 client session                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

command\_type: Type of the POP3 command. This parameter is valid for all commands.

ip\_version(1 byte): IP version to use. This parameter is valid for **session create** command.

4 – For IPv4

6 – For IPv6

ipv4\_address(4 bytes):

Ipv4 address of the POP3 server.

ipv6\_address(16 bytes):

Ipv6 address of the POP3 server.

**auth\_type(1 byte):**

Authentication method used by the SMTP server agent.

**server\_port\_number(2 byte):**

POP3 server agent port number.

**username(101 byte):**

username for POP3 server authentication

**password(101 byte):**

password for POP3 server authentication

**pop3\_client\_mail\_index(2 byte):**

POP3 mail index number

**Command\_type(1 byte):**

Type of the POP3 command.

**mail\_count(2 byte):**

Total mails count/ mail index

**size(4 byte):**

Total size of the mails/ size of the particular mail

**more(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(2 byte):**

Length of the current pop3 mail content chunk

**data(1000 byte):**

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
```

## 5.83 IAP Init

**Description:**

This command initializes the interface between RS9116W and IAP(iPod Accesory protocol) co processor before starting the Apple Authentication process.

**Command:****AT Mode:**

N/A

**Command Parameters:**

No parameters

**Response:****AT Mode:**

N/A

**Relevance:**

This command is relevant in AP mode and Station mode

**Note:**

This command is required only if IAP co-processor is mounted on RS9116W chip with I2C interface. This command is not required if IAP chip is mounted on the host MCU. For more information, contact Silicon Labs.

## 5.84 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

**Command Parameters:**

**ie\_len(1 byte):** Length of the MFI information element need to be loaded in the beacon of RS9116W Accesory.

**ie(200 byte):** array of MFI information element.

**Response:****AT Mode:**

N/A

**Relevance:**

This command is relevant in AP mode

**Possible Error Codes:**

Possible Error codes for this command are 0x0021, 0x0015, 0x002C.

## 5.85 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(1 byte):** IP version used, either 4 or 6.

**destIPAddr(IPv4 : 4 bytes /IPv6 : 16 bytes):**

IP Address of the target server.

**server\_port(4 bytes):**

destination port. Value ranges from 1024 to 49151.

**Note:**

User can give any Port number from the above range except 30000,as that port number is reserved for specific feature.

**chunk\_number(2 bytes):**

chunk number of the firmware to be upgraded. Initially keep it as 1.

**rx\_timeout(2 bytes):**

To configure timeout.

**tcp\_retry\_count(2 bytes):**

To configure 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
```

**Note:**

It is recommended to finish pending transactions (like data transfers and disconnect sockets if any) and disable power save before starting firmware upgrade process.

## 5.86 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

**Response:****AT Mode:**

N/A

**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 RS9116W with I2C interface. This command is not required if IAP chip is mounted on the host MCU. For more information, contact Silicon Labs.

## 5.87 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

### Command Parameters:

digest\_length(4 byte): Input Digest length from the host.

digest(40 byte): Digest to give to the IAP co-processor.

### Response:

#### AT Mode:

N/A

### Response Parameters:

signature\_length(2 byte): Length of signature generated for the given digest.

Signature (100 byte): 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 RS9116W with I2C interface. This command is not required if IAP chip is mounted on the host MCU. For more information, contact Silicons Labs.

## 5.88 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.

### 5.88.1 Storing Configuration Parameters in Client mode

### 5.88.2 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

#### AT Mode:

|    |                      |
|----|----------------------|
| OK | Successful execution |
|----|----------------------|

|       |          |
|-------|----------|
| ERROR | Failure. |
|-------|----------|

**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.

### 5.88.3 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

**Command Parameters:**

cfg\_enable(1 byte):

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 <b>Store configuration structure parameters</b> . |
| ERROR | Failure.                                                                                                            |

**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.

### 5.88.4 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?

**Response:**

**AT Mode:**

|                      |                                                                                                                          |
|----------------------|--------------------------------------------------------------------------------------------------------------------------|
| OK<response payload> | For response payload parameters description, refer to section <a href="#">Store configuration structure parameters</a> . |
| ERROR                | Failure.                                                                                                                 |

**Note:**

Transparent mode parameters are only valid in UART interface in AT command mode only,

**Note:**

After firmware upgradation, previous saved configuration may be lost due to checksum fail.

**Response Parameters:**

For response payload parameters description, refer section [Store configuration structure parameters.](#)

**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.

### 5.88.5 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

**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.             |

**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.

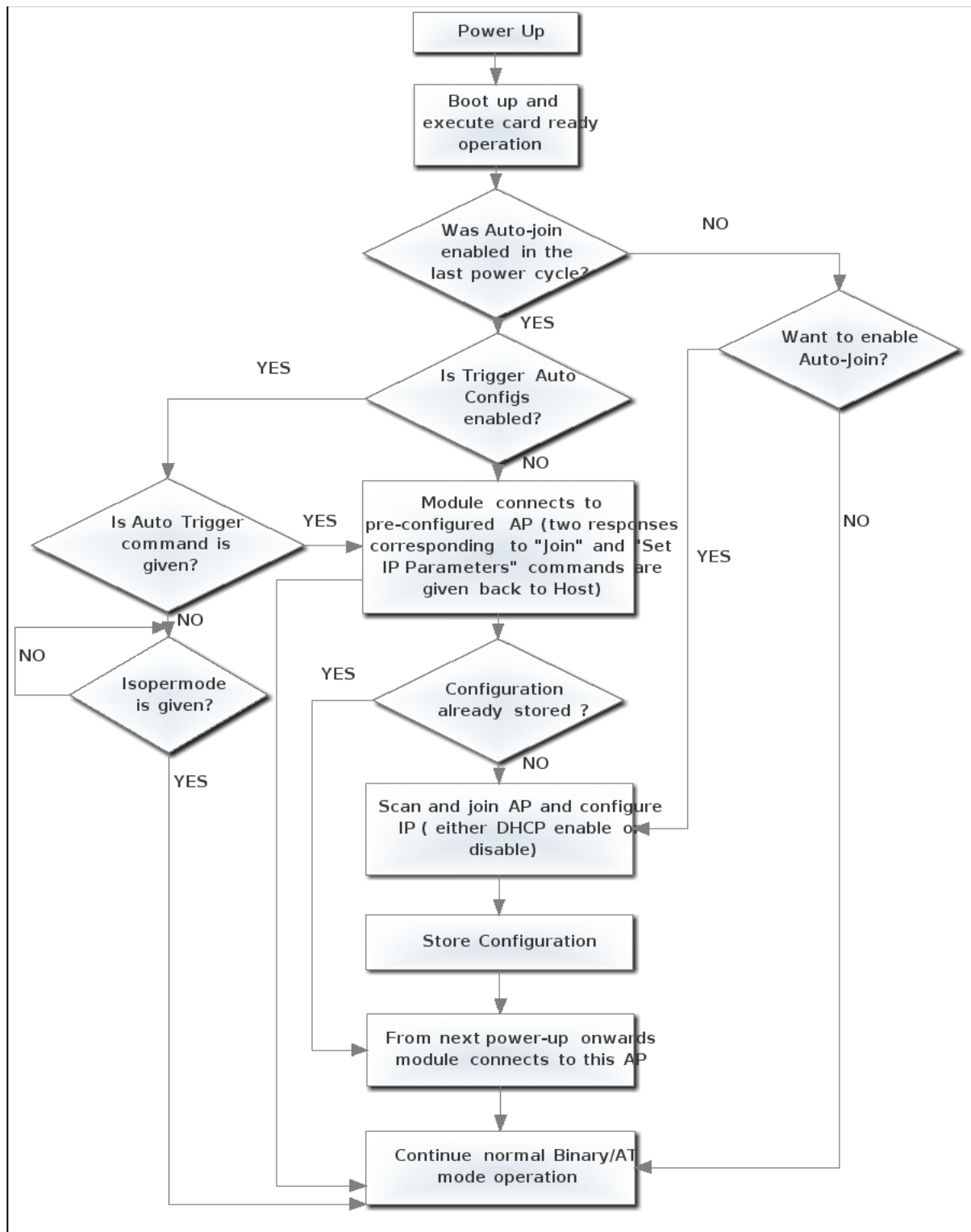
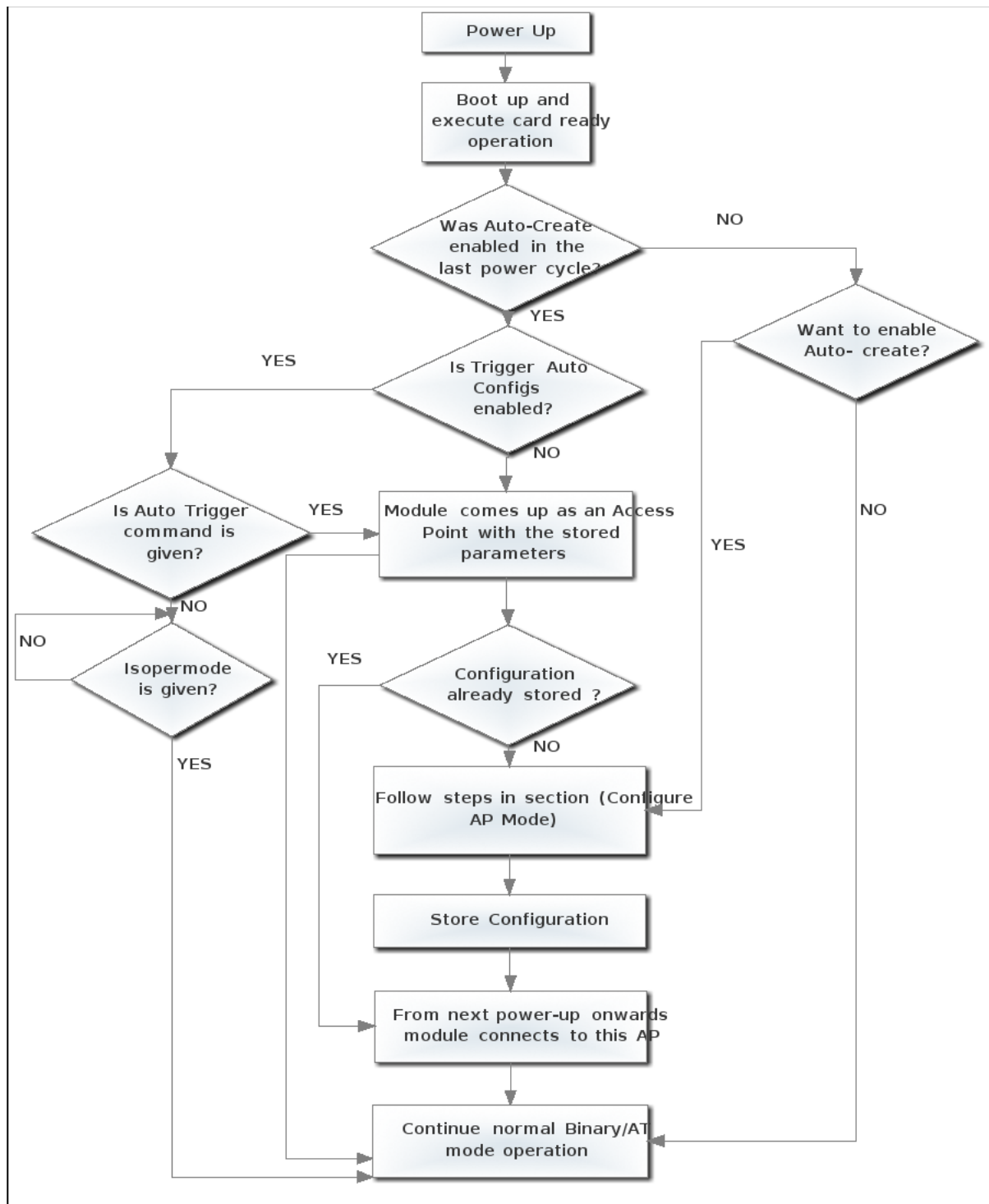


Figure 27: Connecting to Pre-configured AP



**Figure 28: Creating Preconfigured AP**

## 5.89 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.

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.

$\text{oper\_mode} = ((\text{wifi\_oper\_mode}) | (\text{coex\_mode} \ll 16))$

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.

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 (currently not supported)

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:

**Table 19 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    |

**Note:**

ZigBee is not supported currently.

**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 Wi-Fi 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[28]- To enable TCP-IP data packet Dump on UART2

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 extension

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 Wake on 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. Possible values are 1 to 16 in AP mode.

**Note:**

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.

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 (32 bytes):

SSID of the AP configured in auto-join or in auto-create mode. If the actual length is not 32 bytes, 0x00 filler bytes are appended to make the length 32 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 Silicon 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 DUT in auto create mode.This variable is used to define the security mode of the Access point to which module is supposed to connect.

BIT[7]:To enable/disable listen interval from power save command

1 - To enable listen interval.

0 - To disable listen interval.

#### Possible values:

0 – Open mode

1 – WPA security

2 – WPA2 Security

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 (32 bytes): SSID of the AP to be scanned in auto-join. If the actual length is not 32 bytes, 0x00 filler bytes are appended to make the length 32 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.

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(32 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. RS9116-WiSeConnect 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 rss\_i\_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(4 bytes): channel bitmap for scanning in set of selective channels in 2.4 GHz band

scan\_chan\_bitmap\_stored\_5\_GHz(4 bytes): 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 attempts 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 IE)

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.

Trans\_mode\_enable(2 bytes): If transparent mode magic word (0x5C5C) is given transparent mode is enabled, after successful 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 on 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 needs 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(1): 2: TLS\_RSA\_WITH\_AES\_256\_CBC\_SHA256

BIT(2): 4: TLS\_RSA\_WITH\_AES\_128\_CBC\_SHA256

BIT(3): 8: TLS\_RSA\_WITH\_AES\_256\_CBC\_SHA

BIT(4): 16: TLS\_RSA\_WITH\_AES\_128\_CBC\_SHA

BIT(5): 32: TLS\_RSA\_WITH\_AES\_128\_CCM\_8

BIT(6): 64: 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 represents 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 is used 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.

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

BIT[6] - Support for SSL 16K record size

- 1 – To enable
- 0 - To disable

BIT[7] - To enable DNS\_CLIENT\_BYPASS by host

- 1 – To enable
- 0 - To disable

BIT[8] - To enable TCP window scaling feature. If user wants to use more than 64Kb window size. **tcp\_rx\_window\_size\_cap** in socket config command is used to increase the window size.

- 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.

## 5.90 WLAN Statistics

**Note:**

This command is supported only in WI-FI alone mode.

**Description:**

This command is used to query for WLAN statistics of the module. If this command is issued immediately after opermode command, all the stats will be empty. It should be issued after WLAN connection.

**Command Format:**

at+rsi\_get\_wlan\_stats?\r\n

### Command Parameters:

**Operatingmode:** Module is configured in client mode.

**Dtim\_period:** *DTIM* stands for Delivery traffic indication map or message. The *DTIM interval* (1-255) means the period of time to wake up wireless clients from Sleep Mode.

**Ideal Beacon info:** The number of beacons without multicast and broadcast indication in TIM field.

**Busy Beacon info:** The number of beacons with multicast and broadcast indication in TIM field.

**Beacon interval:** Beacon Broadcast interval is the time lag between each of the beacons sent by your router or access points.

### Response

| Result            | Description                      |
|-------------------|----------------------------------|
| Ok<Wi-fi stats>   | Successful execution of command. |
| ERROR<Error code> | Failure                          |

### Possible error codes:

Possible error codes are 0x0021, 0xFF82.

### Relevance:

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

### Example:

#### AT Mode:

```
at+rsi_wlan_stats?\r\n
```

### Response:

```
OK\0x00\0x01\0x0b\0x00\0x0c\0x00\0xc8\0x00
```

```
4f 4b 00 01 0b 00 0c 00 c8 00 0d 0a
```

## 5.91 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 needs to set BIT[28] of custom feature bitmap through opermode command.

### Command Format:

```
at+rsi_host_rtc_time=<second>,<minute>,<hour>,<day>,<month>,<year><weekday>\r\n
```

### 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.

**weekday:** This is current real time clock weekday, 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                             |

**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 6  
at+rsi\_host\_rtc\_time=10,10,10,2,3,2018,6\r\n

**Response:**

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

## 5.92 Get RTC Time

**Description:**

This command is used to get the real time clock of the module from the host.

**Command Format:**

at+rsi\_get\_rtc\_time?

**Response:**

**AT Mode:**

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

**Possible error codes:**

Possible error codes are 0x0021, 0x0025

**Relevance:**

This command is relevant in all modes.

**Example:**

**AT Mode:**

Below example get the configured module rtc time.  
at+rsi\_get\_rtc\_time?

**Response:**

OK< tm\_sec>< tm\_min>< tm\_hour>< tm\_mday >< tm\_mon >< tm\_year ><tm\_wday>\r\n

**Response parameters:**

**second:** This is current real time clock seconds.

**minute:** This is current real time clock minute.

**hour:** This is current real time clock hour.

**day:** This is current real time clock day.

**month:** This is current real time clock month.

**year:** This is current real time clock year.

**weekday:** This is current real time clock weekday, which needs to be set for module.

## 5.93 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

**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

## 5.94 Get RAM Dump

**Description:**

This command is used to get ram dump of the module for a given address and offset.

**Command Format:**

at+rsi\_get\_ram\_dump=<address><length>/r/n

**ADDR (4 bytes):**

Address in RS9116 module

**LENGTH (4 bytes):**

Chunk length to read from RS9116 module

**Response:****AT Mode:**

Result Code Description

OK Successful execution of the command

ERROR<Error code> Failure

**Possible error codes:**

Possible error codes are 0x0021, 0x003e

**Relevance:**

This command is relevant in all modes.

**Example:****AT Mode:**

at+rsi\_get\_ram\_dump=0,4096\r\n

**Response:**

OK\r\n

0x4F 0x4B 0x0D 0x0A

**Note:**

This command should be sent only after opermode command.

## 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 (2 bytes)**

LMAC beacon drop threshold(ms): The amount of time that FW waits to receive full beacon.

Default value is 5000ms.

**FILTER BROADCAST IN TIM (1 byte)**

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 (1 byte)

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

## 5.95 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 value.

**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

## 5.96 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

### Command Parameters:

#### AntennaVal:

- 0 – RF\_OUT\_2/Internal Antenna is selected
- 1 – RF\_OUT\_1/uFL connector is selected.

For RS9116W single band modules BOO and Q7, 'AntennaVal' should be 0.

For RS9116W dual band modules like CC0, appropriate 'AntennaVal' should be configured based on Wi-Fi band being used. If using 2.4GHz band, 'AntennaVal' should be 0 and if using 5GHz band, 'AntennaVal' should be 1. In the later case, antenna should be mounted on uFL connector.

When using RS9116W modules/EVKs for PER testiing, 'AntennaVal' should be set to 0 in order to use uFL connector.

### Note:

rsi\_antenna command must be given after rsi\_init command.

### Note:

Currently Gain\_2g, Gain\_5g, antenna\_path and antenna\_type parameters are supported.

### 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

## 5.97 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

### Command Parameters:

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

#### bandVal (1 byte):

| 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.

#### Note:

802.11J supports only 5 GHz bandVal

### Response:

#### AT Mode:

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

### 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\_band=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

## 5.98 MQTT Client

### Description:

This section explains different commands to use MQTT client.

This command should be given only after [Set IP Parameters](#) command.

#### Note:

- To Support this feature, enable `ext_tcp_ip_feature_bit_map[17]` in the opermode command.
- After MQTT connection, only 9 sockets can be opened.

**Note:**  
MQTT only supports STA mode in current release.

|                       |                                                                                                                                                                                                                       |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Init/Create</b>    | This command is used to Create MQTT objects. This should be the first command for accessing MQTT.<br><br>TCP level connection is established in this command. This command has to be issued after "IPCONFIG" command. |
| <b>Connect</b>        | This command is used to Connect to MQTT Server/Broker(mosquitto).<br><br>MQTT level connection is established in this command. This command has to be issued after "MQTT INIT" command.                               |
| <b>Subscribe</b>      | This command is used to send MQTT subscribe packet. This command has to be issued after "MQTT CONNECT" command.                                                                                                       |
| <b>Publish</b>        | This command is used to send MQTT publish packet. This command has to be issued after "MQTT CONNECT" command.                                                                                                         |
| <b>Unsubscribe</b>    | This Command is used to send MQTT unsubscribe packet. This command has to be issued after "MQTT CONNECT" command.                                                                                                     |
| <b>Disconnect</b>     | This command is used to Disconnect from the Socket.<br><br>MQTT and TCP level disconnection is established in this command. This command has to be issued after "MQTT CONNECT" command.                               |
| <b>Delete/Destroy</b> | This command is used to delete MQTT client's configuration and TCP level disconnection happens in this command. This command has to be issued after "MQTT INIT" command.                                              |

Following table explains list of MQTT commands and their description.

- **Init/Create** should be called as a first command to use MQTT.
- Once create is successful, **connect** should be called to connect to a MQTT Server/Broker.
- After connection is successful, host can issue remaining commands.
- After MQTT operations are done, host has to give **disconnect** command to disconnect from MQTT server/Broker.
- Once disconnect is done, host can again connect to the MQTT server using **connect** command.
- Delete command is used to delete MQTT client's configuration.

#### Command Format:

##### AT Mode:

MQTT client has different command types. Based on the command type next parameters will change.

`at+rsi_mqtt=<command_type>,<remaining parameters>\r\n`

Following are available command types.

| MQTT Command | Command Type | Command Format                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Init         | 1            | <p>at+rsi_mqtt=1,&lt;ip_version&gt;,&lt;server_ip&gt;,&lt;server_port&gt;,&lt;client_id_length&gt;,&lt;client_id&gt;,&lt;keepalive&gt;,&lt;username_length&gt;,&lt;username&gt;,&lt;password_length&gt;,&lt;password&gt;,&lt;clean_session&gt;,&lt;encrypt&gt;,&lt;client_port&gt;\r\n</p> <ul style="list-style-type: none"> <li>• &lt;ip_version&gt; ip version used (IPv4-4, IPv6-6)</li> </ul> <p><b>Note:</b><br/>IPv6 is not supported.</p> <ul style="list-style-type: none"> <li>• &lt;server_port&gt; MQTT server port number</li> <li>• &lt;server_ip&gt; MQTT Server/Broker IP address</li> <li>• &lt;client_id_length&gt; length of the client id (Not valid if 0 or more than 60)</li> </ul> <p><b>Note:</b><br/>Client id length and length of the client id should be a match. Undefined behavior may be observed if these fields are mismatched.</p> <ul style="list-style-type: none"> <li>• &lt;client_id&gt; client ID</li> </ul> <p><b>Note:</b><br/>ClientID should be unique and should not match with others</p> <ul style="list-style-type: none"> <li>• &lt;keepalive&gt; keep alive interval (in seconds)</li> <li>• &lt;username_length &gt; length of the username</li> <li>• &lt;username&gt; username to be used to authenticate with MQTT broker</li> </ul> <p><b>Note:</b></p> <ul style="list-style-type: none"> <li>• Maximum supported length for username is 60 bytes.</li> <li>• Username length and length of the Username should be a match. Undefined behavior may be observed if these fields are mismatched.</li> </ul> <ul style="list-style-type: none"> <li>• &lt;password_length &gt; length of the password</li> <li>• &lt;password&gt; user name to be used to authenticate with MQTT broker</li> </ul> <p><b>Note:</b></p> <ul style="list-style-type: none"> <li>• Maximum supported length for Password is 60 bytes.</li> <li>• Password length and length of the Username should be a match. Undefined behavior may be observed if these fields are mismatched.</li> </ul> |

| MQTT Command | Command Type | Command Format                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |              | <ul style="list-style-type: none"> <li>• &lt;clean_session&gt; clean session(0-1) (Clears historical data if set). Clean session 0 is not supported. It should always be 1.</li> <li>• &lt;encrypt&gt; Type of MQTT socket connection. 0 : Disable SSL, 1 : Enable SSL</li> <li>• &lt;client_port&gt; Client port to be used. If this parameter is not given,1883 is used as client port number</li> </ul>                                                                                                                                                                                                                                                                                                                              |
| Connect      | 2            | at+rsi_mqtt=2,<usr_flag>,<pwd_flag>,<will_flag>,<will_retain>,<will_qos>,<will_topic_length>,<will_topic>,<will_msg_length>,<will_msg>\r\n <ul style="list-style-type: none"> <li>• &lt;usr_flag&gt; Enable username (0-1) to authenticate with MQTT server. 1- Enable username, 0 - Disable username</li> <li>• &lt;pwd_flag&gt; Enable password (0-1) to authenticate with MQTT server. 1 - Enable password, 0 - Disable password</li> <li>• &lt;will_flag&gt; Reserved</li> <li>• &lt;will_retain&gt; Reserved</li> <li>• &lt;will_qos&gt; Reserved</li> <li>• &lt;will_topic_length&gt; Reserved</li> <li>• &lt;will_topic&gt; Reserved</li> <li>• &lt;will_msg_length&gt; Reserved</li> <li>• &lt;will_msg&gt; Reserved</li> </ul> |
| Subscribe    | 3            | at+rsi_mqtt=3,<topic_length>,<topic>,<qos>\r\n <topic_length> topic length <div style="background-color: #ffffcc; padding: 10px; margin-top: 10px;"> <p><b>Note:</b></p> <ul style="list-style-type: none"> <li>• Maximum supported length for TOPIC is 60 bytes.</li> <li>• TOPIC length and length of the TOPIC should be a match. Undefined behavior may be observed if these fields are mismatched.</li> </ul> </div> <ul style="list-style-type: none"> <li>• &lt;topic&gt; topic to subscribe</li> <li>• &lt;qos&gt; message Qos, can be 0, 1, or 2 .</li> </ul> <div style="background-color: #ffffcc; padding: 10px; margin-top: 10px;"> <p><b>Note:</b><br/>QOS2 is not supported</p> </div>                                   |
| Publish      | 4            | at+rsi_mqtt=4,<topic_length>,<topic>,<qos>,<retained>,<dup>,<message_length>,<message>\r\n <ul style="list-style-type: none"> <li>• &lt;topic_length&gt; topic length</li> </ul> <div style="background-color: #ffffcc; padding: 10px; margin-top: 10px;"> <p><b>Note:</b></p> <ul style="list-style-type: none"> <li>• Maximum supported length for TOPIC is 60 bytes.</li> </ul> </div>                                                                                                                                                                                                                                                                                                                                               |

| MQTT Command | Command Type | Command Format                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |              | <ul style="list-style-type: none"> <li>• TOPIC length and length of the TOPIC should be match. Undefined behavior may be observed if these fields are mismatched.</li> <li>• &lt;topic&gt; topic of subscribe message.</li> <li>• &lt;qos&gt; Publish message Qos, can be 0, 1, or 2.</li> </ul> <p><b>Note:</b><br/>QOS2 is not supported.</p> <ul style="list-style-type: none"> <li>• &lt;retained&gt; retained flag, can be 0 or 1.</li> </ul> <p><b>Note:</b><br/>If the RETAIN flag is set to 1 in a PUBLISH Packet sent by a Client to a Server, the Server must store the Application Message and its QoS, so that it can be delivered to future subscribers whose subscriptions match its topic name.</p> <ul style="list-style-type: none"> <li>• &lt;dup&gt; duplicate flag, can be 0 or 1.</li> </ul> <p><b>Note:</b><br/>The DUP flag MUST be set to 1 by the Client or Server when it attempts to re-deliver a PUBLISH Packet.<br/>The DUP flag MUST be set to 0 for all QoS 0 messages.</p> <ul style="list-style-type: none"> <li>• &lt;message_len&gt; length of publish message.</li> </ul> <p><b>Note:</b><br/>a) The message length is dependent on TOPIC length, total length should not exceed 1460 bytes, if connection is not SSL secured (MQTT Header+Topic + Publish data).<br/>b) SSL Maximum supported message_len should not exceed 1370 bytes (MQTT Header+Publish data).</p> <ul style="list-style-type: none"> <li>• &lt;message&gt; Publish message</li> </ul> |
| Unsubscribe  | 5            | at+rsi_mqtt=5,<topic_length>,<topic>>\r\n <ul style="list-style-type: none"> <li>• &lt;topic_len&gt; topic length</li> </ul> <p><b>Note:</b></p> <ul style="list-style-type: none"> <li>• Maximum supported length for TOPIC is 60 bytes.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

| MQTT Command   | Command Type | Command Format                                                                                                                                                                                                          |
|----------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                |              | <ul style="list-style-type: none"> <li>• TOPIC length and length of the TOPIC should be match.Behavior may be undefined if these fields are mismatched</li> <li>• &lt;topic&gt; topic of unsubscribe message</li> </ul> |
| Disconnect     | 8            | at+rsi_mqtt=8\r\n                                                                                                                                                                                                       |
| Delete/Destroy | 9            | at+rsi_mqtt=9\r\n                                                                                                                                                                                                       |

Response:  
AT Mode:

| MQTT Command | Command Response                                                                                                                                                                                                                        |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Create/Init  | 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 (or)Error Code (failure case). |
| Connect      | OK/Error Code                                                                                                                                                                                                                           |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |
|              |                                                                                                                                                                                                                                         |

| MQTT Command          | Command                            | Response                                                                                               |
|-----------------------|------------------------------------|--------------------------------------------------------------------------------------------------------|
|                       | 4                                  | 0x04 Connection Refused, bad username or password<br>The data in the username or password is malformed |
|                       | 5                                  | 0x05 Connection Refused, not authorized<br>The Client is not authorized to connect                     |
| <b>Subscribe</b>      | OK/Error Code                      |                                                                                                        |
| <b>Publish</b>        | OK/Error Code                      |                                                                                                        |
| <b>Unsubscribe</b>    | OK/Error Code                      |                                                                                                        |
| <b>Destroy/Delete</b> | OK/Error Code<br>ERROR<ERROR-CODE> |                                                                                                        |

**Note:**

DUT sends received data on published topic to host asynchronously.

**Format:**

AT+RSI\_MQTT\_READ\_DATA<mqtt\_flags><current\_chunk\_length><topic\_length><topic><message>\r\n

**Asynchronous Responses:**
**AT Mode:**

| Response            | Description                                                                                                                                         | Response format                                                                           | Parameters Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Terminate    | This message is posted to the host when remote terminate /socket closure from peer is received                                                      | ERROR<ERROR-CODE>\r\n                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Keep Alive Time out | This message is posted to host when Keepalive( MQTT Ping) response is not received in given time period when keep alive request is sent from module | AT+RSI_MQTT_KA_TIMEOUT\r\n                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Publish Message     | This message is received when publish message is received from MQTT Broker                                                                          | AT+RSI_MQTT_READ_DATA<mqtt_flags><current_chunk_length><topic_length><topic><message>\r\n | <p>mqtt_flags : 2 bytes : Has the info regarding MQTT publish message. BIT(0) - Retain flag BIT(1) &amp; BIT(2) - QOS level BIT(3) - DUP flag BIT(4) - More data BIT(5) : BIT(15) - Reserved for future use. This bit is set if more chunks/ Data is coming for same publish.</p> <p>message topic_length: 2 bytes - length of the topic</p> <p>current_chunk_length: 2 bytes - message length in current chunk topic: publish topic- This field is valid only if topic length is non-zero value</p> |

|  |  |  |                                                                                                                                                                                                                                                                                                                         |
|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | <p>message: publish message : This field is valid only if current_chunk_length field is non-zero</p> <div> <p><b>Note:</b><br/>&lt;topic&gt; and &lt;message&gt; are variable fields. These fields are dependent on &lt;topic_length&gt; and &lt;current_chunk_length&gt;. Rest of the parameters are fixed.</p> </div> |
|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Example:

#### AT Mode:

```
at+rsi_opermode=0,0,2147484676,2147483648,3145728,0,131072,0,0,0
at+rsi_band=0
at+rsi_init
at+rsi_scan=0,ap_ssid_OP_TESTING
at+rsi_psk=1,12345678
at+rsi_join=ap_ssid_OP_TESTING,0,2,2
at+rsi_ipconf=1

//MQTT init and connect
at+rsi_mqtt=1,4,139.196.135.135,1883,38,6789|securemode=3,signmethod=hmacsha1|,200,19,Device1&a1BLKg93h0r,40,EB9558F74EF496E72C129B5EDF66427683488246,1,0
at+rsi_mqtt=2,1,1,0,0,0,0,0
//Subscribe
at+rsi_mqtt=3,7,redpine,1,1
//Publish to cloud
at+rsi_mqtt=4,7,redpine,0,0,0,40,{"state":{"desired":{"toggle":1}}}}
//Unsubscribe
at+rsi_mqtt=5,7,redpine
//Disconnect
at+rsi_mqtt=8
//Destroy
at+rsi_mqtt=9
```

#### Note:

For SSL connectivity, user needs to configure SSL certificate prior to the above sequence of steps.

### Reference Links:

<http://docs.oasis-open.org/mqtt/mqtt/v3.1.1/mqtt-v3.1.1.html>

<https://www.oasis-open.org/news/announcements/mqtt-version-3-1-1-becomes-an-oasis-standard>

## 6 WLAN Error Codes

### Error Codes

This section lists and describes error codes for different commands.

**Table 20 Error Codes**

| Error Codes<br>(in hexadecimal<br>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 dissociated state                                                              |
| 0x0008                                    | De-authentication received from AP                                                                           |
| 0x0009                                    | Failed to associate to Access Point during "Join"                                                            |
| 0x000A                                    | Invalid channel                                                                                              |
| 0x000E                                    | 1. Authentication failure during "Join"<br>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                                    | 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<br>2. Rejoin failure                                                               |
| 0x001A                                    | Frequency not supported                                                                                      |
| 0x001B                                    | Invalid Opermode                                                                                             |
| 0x001C                                    | EAP configuration failed                                                                                     |
| 0x001F                                    | Disconnect in wrong state                                                                                    |
| 0x0020                                    | Unable to join                                                                                               |
| 0x0021                                    | Command given in the incorrect state                                                                         |
| 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                                                                         |

| Error Codes<br>(in hexadecimal<br>format) | Description                                                                                                                                                              |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0x0028                                    | PSK length less than 8 bytes or more than 63 bytes                                                                                                                       |
| 0x0029                                    | Failed to clear or to set the Enterprise Certificate (Set Certificate)                                                                                                   |
| 0x002B                                    | Association between nodes failed in WPS Failed due to timeout                                                                                                            |
| 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 (or) Mqtt publish data and publish data length mismatched (or) MQTT Send data packet exceeded the limit. |
| 0x0031                                    | ARP Cache entry not found                                                                                                                                                |
| 0x0032                                    | UART command timeout happened                                                                                                                                            |
| 0x0033                                    | Fixed data rate is not supported by connecting AP                                                                                                                        |
| 0x0036                                    | Maximum length exceeded of Username/password/Client_ID/Topic in MQTT.                                                                                                    |
| 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 32 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 (De-authentication due to beacon miss)                                                                                     |
| 0x0045                                    | De-authentication received from the supplicant                                                                                                                           |
| 0x0046                                    | De-authentication received from AP after channel switching                                                                                                               |
| 0x0047                                    | Synchronization missed                                                                                                                                                   |
| 0x0048                                    | Authentication timeout occurred                                                                                                                                          |
| 0x0049                                    | Association timeout                                                                                                                                                      |

| Error Codes<br>(in hexadecimal format) | Description                                                            |
|----------------------------------------|------------------------------------------------------------------------|
| 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 is not supported in current operating mode                         |
| 0x0057                                 | Concurrent AP doesn't have same channel as connected station channel   |
| 0x0058                                 | PBC session overlap error                                              |
| 0x0059                                 | BT feature bit map invalid                                             |
| 0x005A                                 | 4/4 confirmation of 4-way handshake failed                             |
| 0x005C                                 | Concurrent mode, both AP and Client should UP, to enable configuration |
| 0x005D                                 | Certificate load not allowed in flash                                  |
| 0x005E                                 | Certificate load not allowed in RAM                                    |
| 0x005F                                 | Certificate load failed due to wrong index                             |
| 0x0060                                 | AP HT caps not enabled for 40 MHz                                      |
| 0x0061                                 | Address family not supported by protocol.                              |
| 0x0062                                 | Invalid beacon interval provided.                                      |
| 0x0063                                 | Invalid range of the configuration provided                            |
| 0x0064                                 | RTS THRESHOLD Config type is invalid.                                  |
| 0x0065                                 | Error with MQTT command                                                |
| 0x0066                                 | listen interval in power save is greater than the join listen interval |
| 0x005B                                 | MAC address does 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                     |

| Error Codes<br>(in hexadecimal format) | Description                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------------------|
| 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 web-page data than the total length initially specified                      |
| 0x00C7                                 | Error in set region command                                                                |
| 0x00C8                                 | Web-page 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                                                                      |

| Error Codes<br>(in hexadecimal<br>format) | Description                                                                                                                                              |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xBB29                                    | ICMP request failed                                                                                                                                      |
| 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)                                                                    |
| 0xBB40                                    | Wrong packet info                                                                                                                                        |
| 0xBB41                                    | Invalid Length                                                                                                                                           |
| 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.<br>In the case of FTP, the user needs 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                                    | SMTP message reply error                                                                                                                                 |
| 0xBBAC                                    | SMTP data reply error                                                                                                                                    |
| 0xBBAD                                    | SMTP authentication reply error                                                                                                                          |

| Error Codes<br>(in hexadecimal format) | Description                                                                                                                      |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 0xBBAE                                 | SMTP server error reply                                                                                                          |
| 0xBBAF                                 | DNS duplicate entry.                                                                                                             |
| 0xBBB1                                 | SMTP oversize server reply                                                                                                       |
| 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<br>FTP file is not closed                                                                               |
| 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                                                                                                  |
| 0xBBF1                                 | MQTT ping time out error                                                                                                         |
| 0xBBF2                                 | MQTT command sent in incorrect state                                                                                             |
| 0xBBF3                                 | MQTT ACK time out error                                                                                                          |
| 0xBBFF                                 | POP3 error for invalid mail index                                                                                                |
| 0xFFFF                                 | Listening TCP socket in the module is not connected to the remote peer or the LTCP<br>the socket is not yet opened in the module |
| 0xFFFE                                 | Sockets not available. The error comes if the Host tries to open more than 10<br>sockets                                         |
| 0xFFFC                                 | IP configuration failed                                                                                                          |

| Error Codes<br>(in hexadecimal format) | Description                                                                                                                                                                                                                    |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xFFFFB                                | Cannot create IP in the same interface in concurrent mode                                                                                                                                                                      |
| 0xFFFFA                                | TCP socket is not connected                                                                                                                                                                                                    |
| 0xFFFF4                                | HTTP OTAF incomplete packet                                                                                                                                                                                                    |
| 0xFFFF8                                | 1. Invalid command (e.g. parameters insufficient or invalid in the command).<br><br>Invalid operation (e.g. power save command with the same mode given twice, accessing the wrong socket, creating more than allowed sockets) |
| 0xFFFF6                                | MQTT REMOTE TERMINATE ERROR                                                                                                                                                                                                    |
| 0xFFFF7                                | Byte stuffing error in AT mode                                                                                                                                                                                                 |
| 0xFFFF5                                | Store configuration profile type mismatch or Invalid profile type                                                                                                                                                              |
| 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                                                                                                                                                                            |
| 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.<br>or<br>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                                                                                                                                                                |

| Error Codes<br>(in hexadecimal<br>format) | Description                                                                                  |
|-------------------------------------------|----------------------------------------------------------------------------------------------|
| 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                                                           |
| 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.                                              |
| 0xFFE1                                    | Improper RSNIE from AP to station                                                            |

## 7 Wireless Features and Mechanisms

This document briefs about the following wireless features and mechanisms.

- Connect Application
- Firmware Upgrade Mechanism
- Power Save Modes
- Wake on Wireless

### 7.1 Connect Application

#### 7.1.1 Description

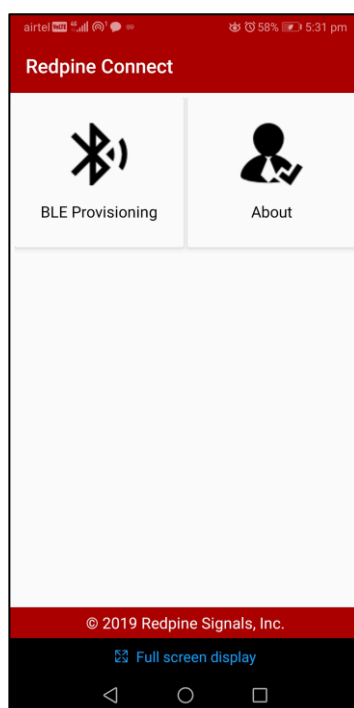
- The BLE Wi-Fi Provisioning example is designed to showcase the provisioning of Wi-Fi parameters (SSID, network key, etc.) over a BLE connection.
- Wi-Fi provisioning over BLE provides various benefits such as eliminating the need to explicitly connect to a shared network.
- Connect Application explains how to establish WLAN Connection using BLE provisioning

In this application,

- Silicon Labs Module starts advertising and with BLE Provisioning the Access Point details are fetched
- Silicon Labs device is configured as a Wi-Fi station and connects to an Access Point.

#### 7.1.2 Application Steps

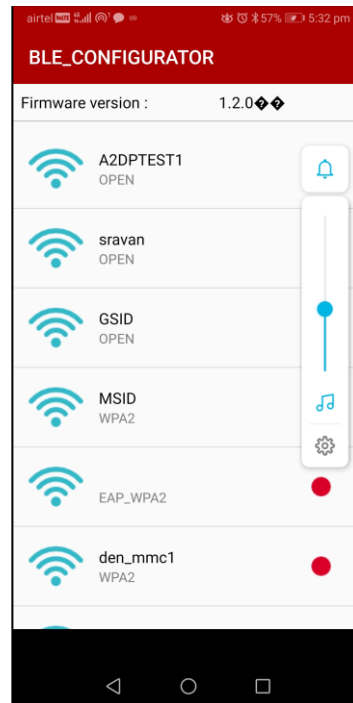
- Configure the Access point with Internet connection in OPEN/WPA-PSK/WPA2-PSK mode to connect the Silicon Labs device in STA mode.
- Connect any serial console for prints.
- Connect app is available in the release 'utils' folder. Currently, this app will be available for Android devices only. path for the application: RS9116.NB0.WC.GENR.OSI.x.x.x/utils
- Launch the Connect App.
- Click on BLE Provisioning.



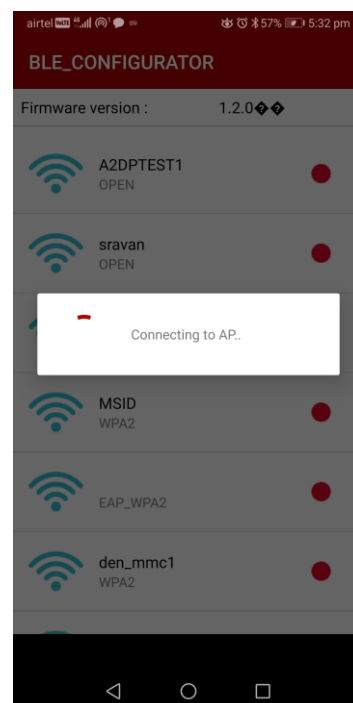
- Click on BLE\_CONFIGURATOR, Device gets connected

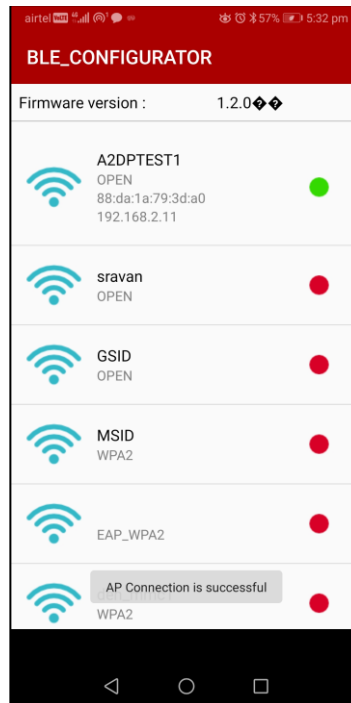


- Once the BLE gets connected, list of available Access Points gets displayed on the screen



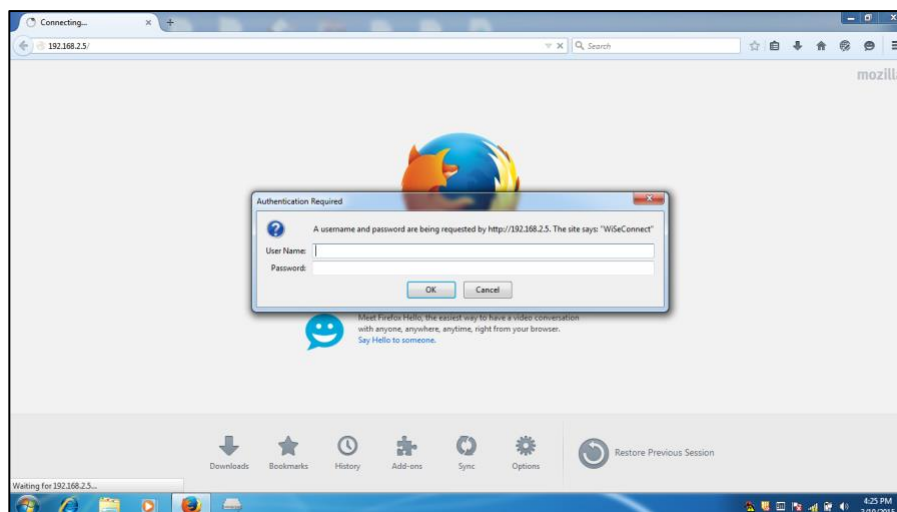
- Connect to the Access Point.





## 7.2 Firmware Upgrade Mechanisms

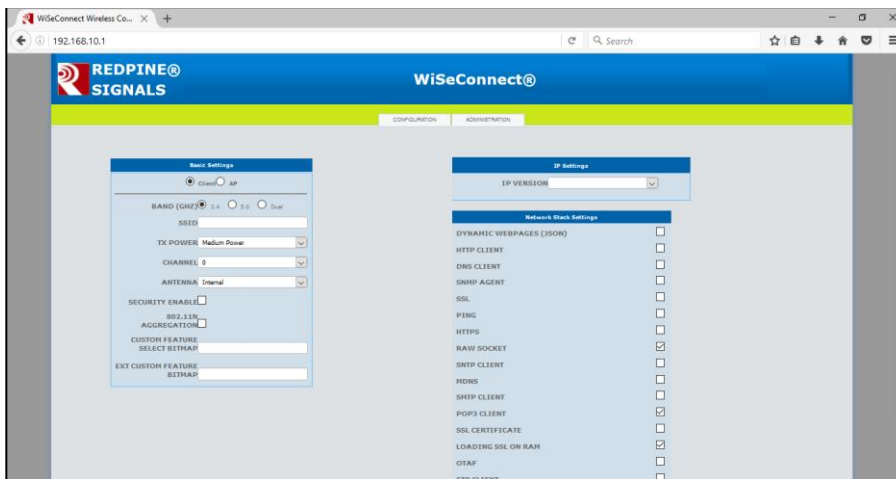
The firmware of the module can be upgraded wirelessly through web server. To upgrade the firmware wirelessly, user has to open configuration page. In the given example, module is in WLAN client mode. Module and some other host are connected to an AP. Module gets IP 192.168.2.5. When opened the module's webpage on the other host, it asks for the login credentials. To open the modules configuration page, the credentials for Username should be given as "redpine" and password should be given as "admin".



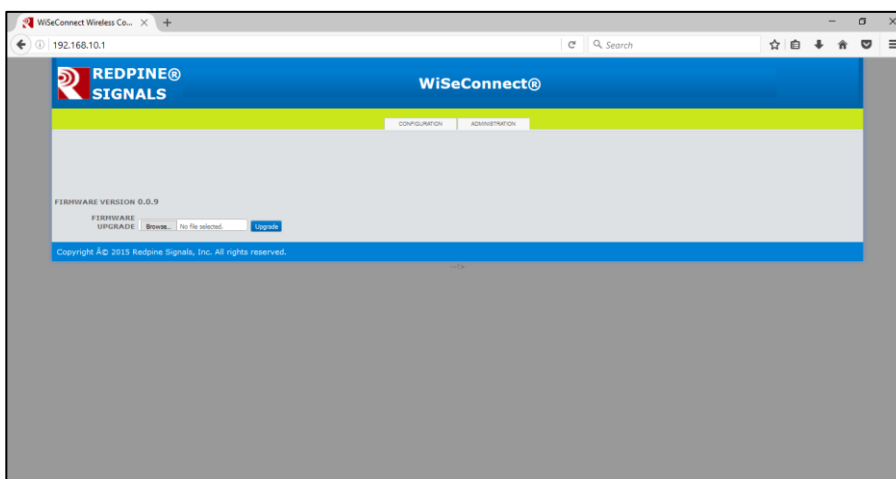
After entering the login credentials, the module's configuration page is opened as shown in the figure below.

**Note:**

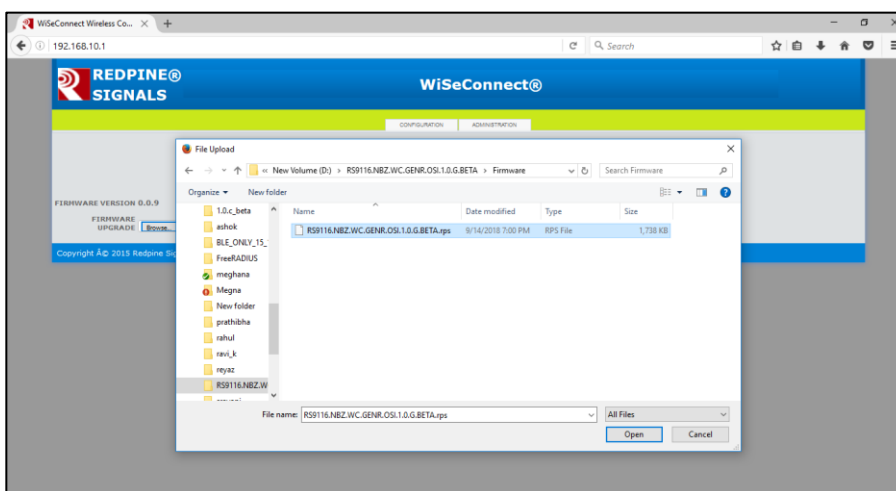
'Authentication Required' pop up window will only appear if BIT[23] in Custom feature bitmap is enabled.



Click on ADMINISTRATION button to go to the wireless firmware up-gradation page.

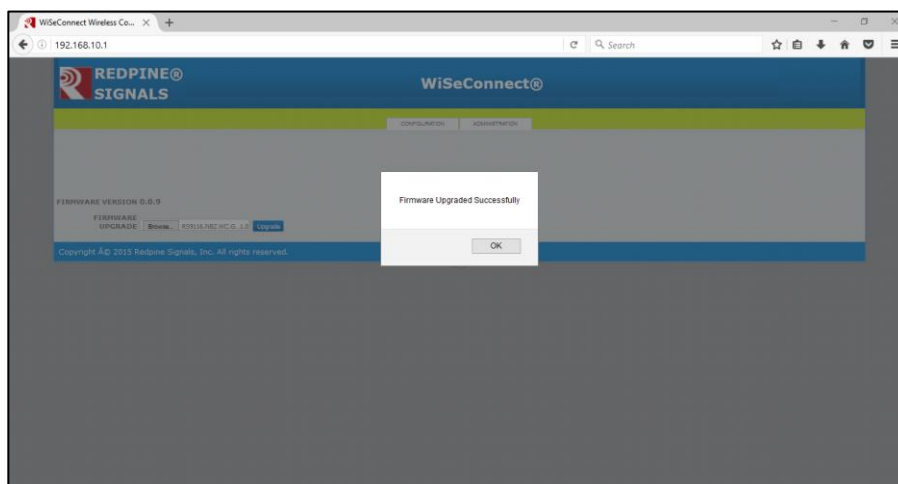


Browse for the rps file(RS9116.WC.GEN.OSI.x\_x\_x.rps ) on the host to upgrade the module firmware and click on UPGRADE, as shown in the figure below.



Once the remote peer has pressed upgrade button on the webpage, if module is connected through UART or USB-CDC interface then 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 fails to reply within the specified timeout (~20 seconds), request will expire, and upgradation process terminates.

After the firmware upgraded is successful, a popup appears 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 and upgradation starts automatically.
3. After wireless firmware upgrade, after reboot user needs to wait for few minutes (~ 1.5 minutes) for the bootloader to copy upgraded image into actual flash location.

## 7.3 Power Save Modes

### 7.3.1 Power Save

#### 7.3.1.1 Description

This feature configures the Power Save mode of the module and can be issued at any time after Opermode command. Power Save is disabled by default.

There are six different modes of Power Save.

1. Power Save mode 0
2. Power Save mode 1
3. Power Save mode 2
4. Power Save mode 3
5. Power Save mode 8
6. Power Save mode 9

#### Note

1. RS9116-WiSeConnect doesn't support power save modes while operating in AP.
2. Power Save modes 2 and 8 are not supported in USB / USB-CDC interface. Instead, they are supported in UART / SPI interfaces.
3. In SPI interface, when Power Save mode is enabled, host has to re-initialize SPI interface of the module after wakeup from sleep.

### 7.3.2 Power Save Operations

The behavior of the module differs according to the power save mode 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 to 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:

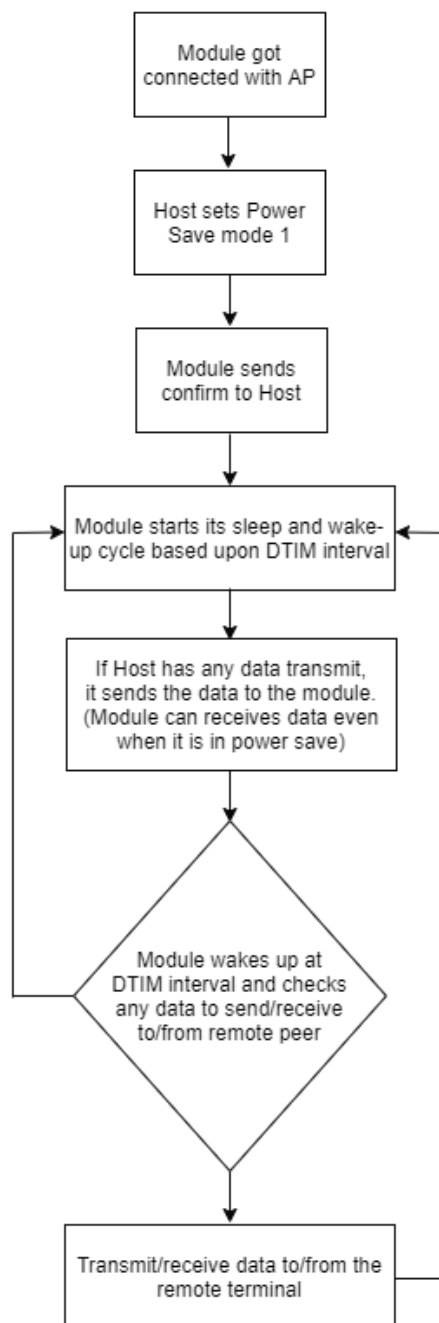
1. In case of WLAN, wake up period will be calculated based on DTIM interval.
2. In case of BT-Classic, wake up period will be calculated based on inquiry scan interval in discoverable mode, page scan interval in connectable mode and sniff interval in connected mode.
3. In case of BLE, wake up period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

### 7.3.2.1 Power Save Mode 0

In this mode, module is active, and power save is disabled. It can be configured any time, while power save is enabled with Power Save mode 2 or Power Save mode 8.

### 7.3.2.2 Power save Mode 1

Once the module is configured to power save mode 1, it wakes 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 must be given only when module is in connected state (with the AP).



**Figure 29: Setting Power Svc 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.

### 7.3.2.3 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. Power Save mode 2 can be either GPIO based or message based.

#### **GPIO based mode:**

In case of GPIO based mode, whenever host wants to send data to module, it gives wakeup indication by setting UULP GPIO #2. After wakeup, if the module is ready for data transfer, it sends wakeup indication to host by setting UULP GPIO #3. Host is required to wait until module gives wakeup indication before sending any data to the module. After the completion of data transfer, host can give sleep permission to module by resetting UULP GPIO #2. After recognizing sleep permission from host, module gives confirmation to host by resetting UULP GPIO #3 and again gets back to its sleep-wake up cycle.

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

#### **Message based mode:**

In case of message-based power save, both radio and SOC of the module are in power save mode. Module wakes up periodically upon every deep sleep duration and gives wakeup message ("WKP") to host. Module cannot 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 ("ACK") message. Host either sends ack ("ACK") or any other pending message. But once ack ("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.

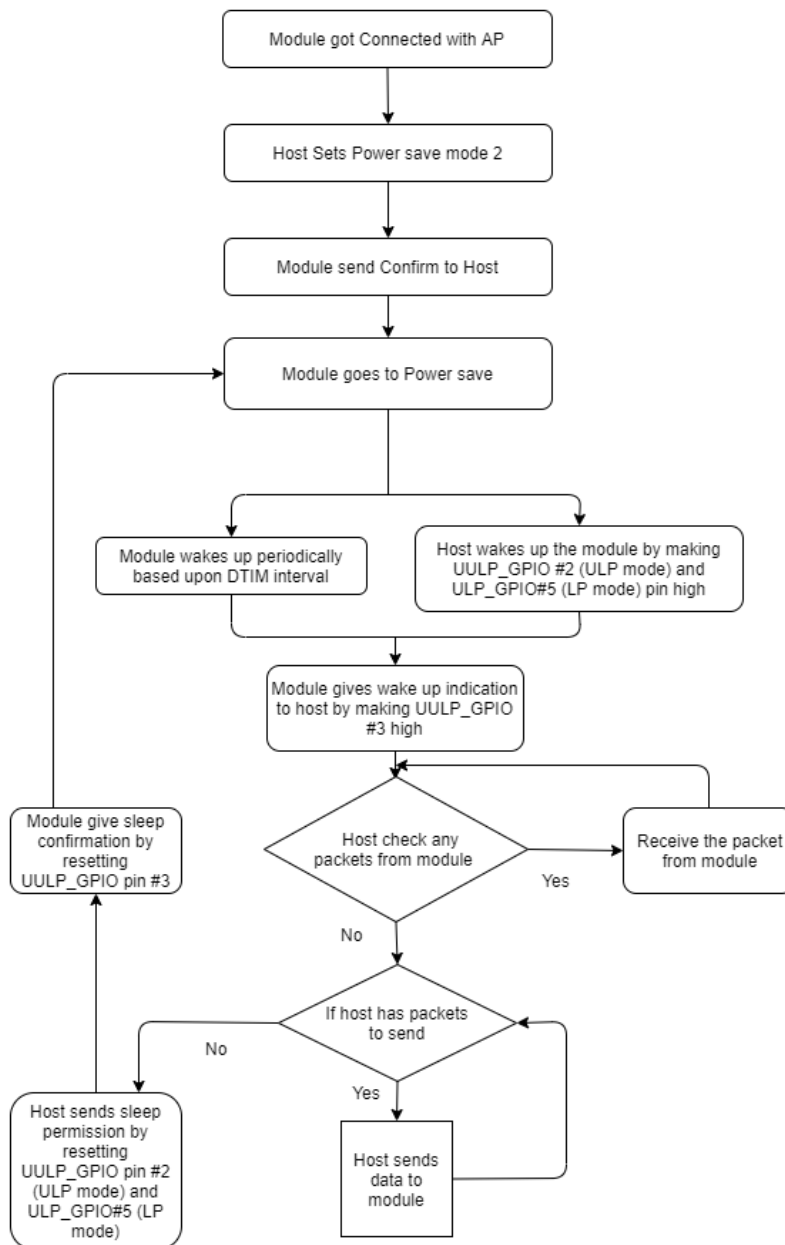


Figure 30: Power Save Mode 2

#### AT Mode

"WKP"

"SLP"

#### Messages from Module in Power Saver 2

#### AT Mode

"ACK"

#### Messages from host in Power Save mode 2

##### Usage in BT-Classic Mode:

In Classic, Power Save mode 2 can be used during Discoverable / Connectable / Connected sniff states.

- **Discoverable Mode State:** In this state, module is awake during Inquiry Scan window duration and sleeps till Inquiry Scan interval.

Default Inquiry scan window value is 11.25 msec, and Inquiry scan interval is 320 msec.

- **Connectable Mode State:** In this state, module is awake during Page Scan window duration and sleeps till Page Scan interval.

Default Page scan window value is 11.25 msec, and Page scan interval is 320 msec.

- **Connected Sniff State:** When the module is in connected state as a master or slave and configured with Power Save mode 2 with GPIO based or message based, it goes into power save mode. This works when the module and peer device support sniff feature. Module should be configured with sniff command after a successful connection, before configuring with power save command.

Module goes into power save after serving a sniff anchor point and wakes up before starting a sniff anchor point. Sniff connection anchor point may vary based on the remote device's `t_sniff` value.

#### Usage in BT-LE Mode:

In LE, Power Save mode 2 can be used during Advertise / Scan / Connected states.

- **Advertise State:** In this state, module is awake during advertising event duration and sleeps till Advertising interval.
- **Scan State:** In this state, module is awake during Scanning window and sleeps till Scanning Interval. Default scan window is 50 msec, default scan interval is 160 msec.
- **Connected state:** In this state, module wakes up for every connection interval. Default connection interval configurable is 200 msec.

#### 7.3.2.4 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 RS9116-WiSeConnect 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 cannot 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.

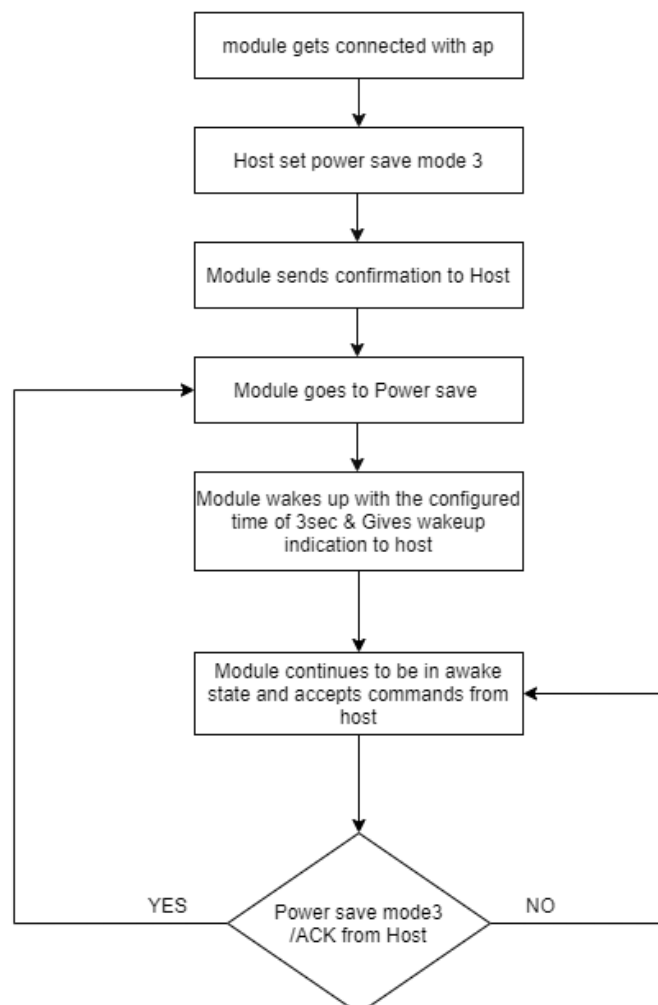


Figure 31: Power Save Mode 3

### 7.3.2.5 Power Save mode 8

In Power save mode 8, both RF and SOC of the module are in complete power save mode. This mode is significant only when module is in standby mode. Power Save mode 8 can be either GPIO based or message based.

#### GPIO based mode:

In case of GPIO based, host can wakeup the module from power save by making UULP-GPIO #2 high. Once the module wakes up, it continues to be in wakeup state until it gets power mode 8 commands from host.

#### Message based mode:

In case of message based, module goes to sleep immediately after issuing power save command and wakes up after 3sec. Upon wakeup, module sends a wakeup message "WKP" to the host and expects host to give ack "ACK" before it goes into next sleep cycle. Host can either send ack or any other messages. But once ACK is sent, no other packet should be sent before receiving next wakeup message.

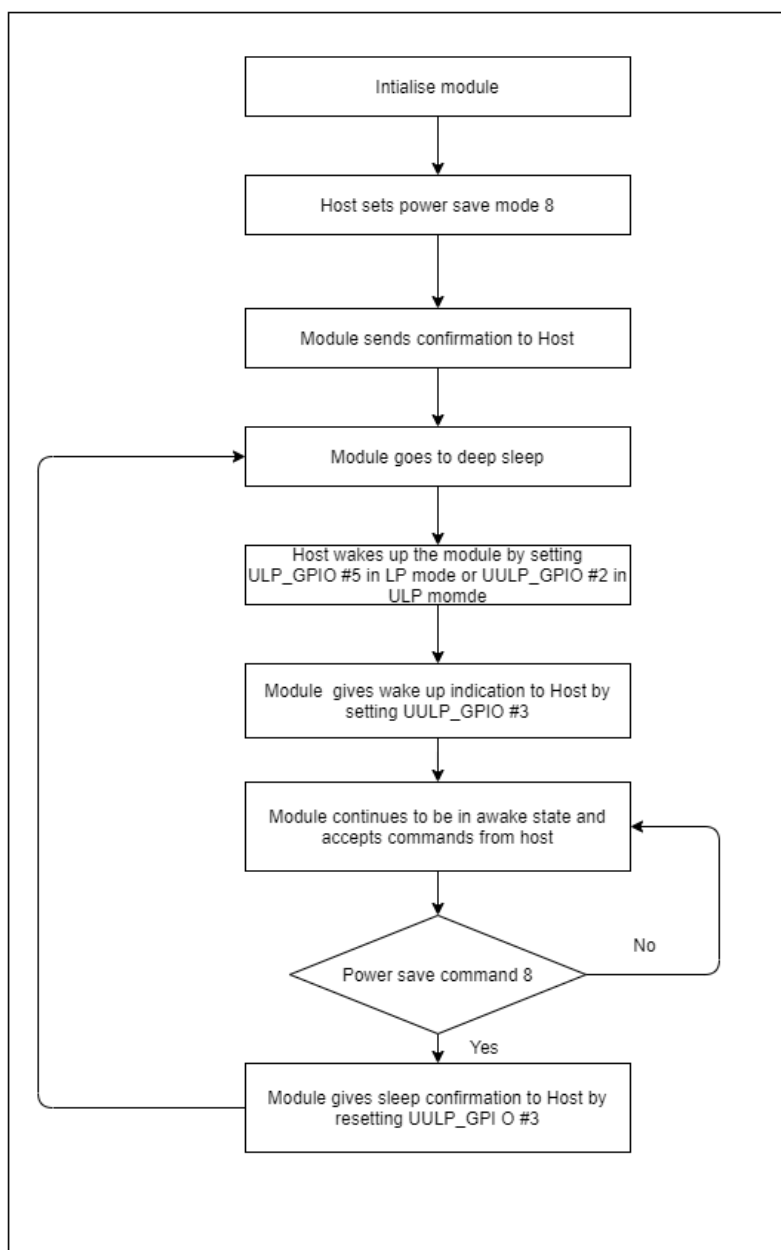


Figure 32: Power Save Mode 8

## AT Mode

"WKP"

### Messages from module in Power Save mode 8

## AT Mode

"ACK"

### Messages from host in Power Save mode 8

#### Note

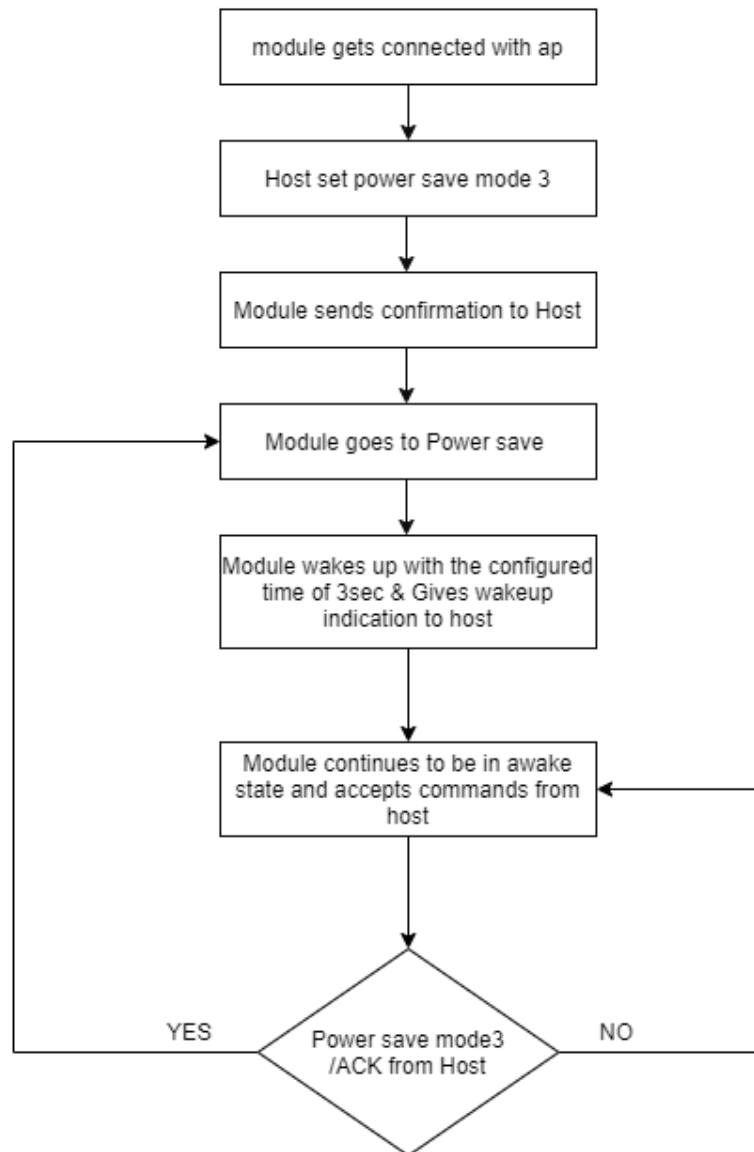
- In BT Classic/LE, Power Save mode 8 can be used in Standby (idle) state.

**Example:** Suppose if Power Save is enabled in advertising state, in order to move to Scanning state, first Power Save disable command needs to be issue before giving Scan command.

- For Page scan, Inquiry scan, sniff parameters related information, please verify Bluetooth protocol specification document.
- When the module is configured in a co-ex mode and WLAN is in INIT\_DONE state, power save mode 2 & 3 are valid after association in the WLAN. Whereas in BT & BLE alone modes, it will enter into power save mode (2&3) in all states (except in standby state).
- Power save disable command has to be given before changing the state from standby to remaining states and vise-versa.

#### 7.3.2.6 Power Save Mode 9

In Power Mode 9 both Radio and SOC of RS9116-WiSeConnect 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 using set sleep timer command. If host does not set 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.



**Figure 33: Power Save Mode 9**

## 7.4 Wake on Wireless

RS9116 Module can send packets to host in wake on wireless mode in any of the two modes listed below.

### 7.4.1 Active High Interrupt Mode

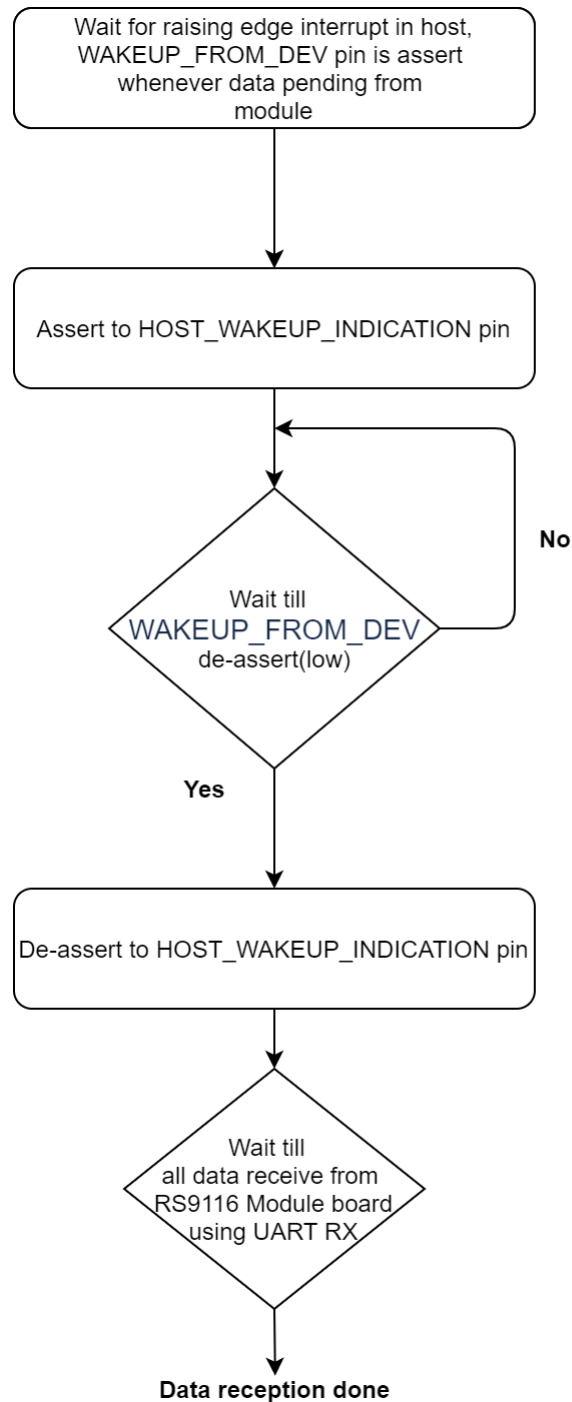
If BIT(16) of config\_feature\_bit\_map is enabled in opermode command, then active high interrupt mode is enabled.

When the RS9116 Module wants to send packets to host, it asserts WAKEUP\_FROM\_DEV pin.

The following are the sequence of steps in UART mode:

1. RS9116 Module asserts WAKEUP\_FROM\_DEV pin when data is pending from module and polls for ack (HOST\_WAKEUP\_INDICATION pin to be high) before starting the transfer.
2. After recognizing WAKEUP\_FROM\_DEV pin asserted, host should ack the request from module by asserting HOST\_WAKEUP\_INDICATION pin and poll WAKEUP\_FROM\_DEV pin for module confirmation (WAKEUP\_FROM\_DEV is low).
3. After recognizing ack (HOST\_WAKEUP\_INDICATION pin high) from host, module de-asserts WAKEUP\_FROM\_DEV pin and start transfer.
4. Once WAKEUP\_FROM\_DEV is de-asserted, host should de-assert HOST\_WAKEUP\_INDICATION pin and receive the packet from module.

The flow chart below shows how the data is received from RS9116 Module in active high interrupt mode :



**Figure 34: Active High Interrupt Mode**

#### 7.4.2 Active Low Interrupt Mode

If BIT(16) of config\_feature\_bit\_map is not enabled in opermode command, then active low interrupt mode is enabled.

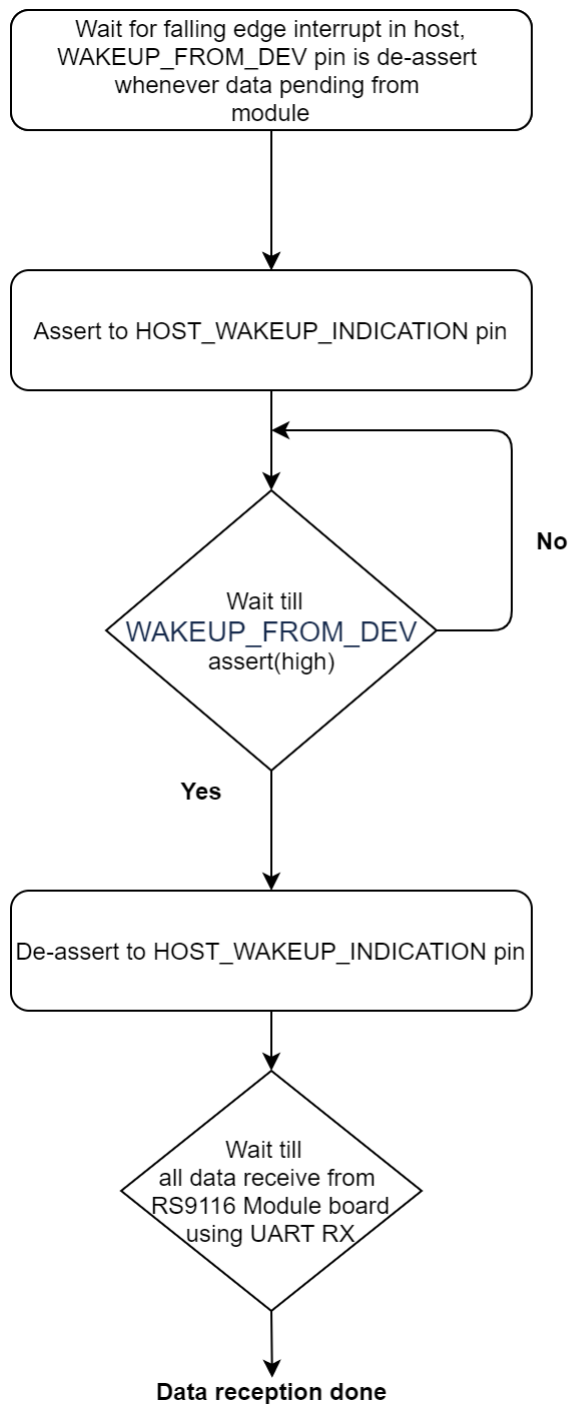
When the RS9116 Module wants to send packets to host, it de-asserts WAKEUP\_FROM\_DEV pin.

The following are the sequence of steps in UART mode:

1. RS9116 Module de-asserts WAKEUP\_FROM\_DEV pin when data is pending from module and polls for ack (HOST\_WAKEUP\_INDICATION pin to be high) before starting the transfer.

2. After recognizing WAKEUP\_FROM\_DEV pin de-asserted, host should ack the request from module by asserting HOST\_WAKEUP\_INDICATION pin and poll WAKEUP\_FROM\_DEV pin for module confirmation (WAKEUP\_FROM\_DEV pin is high).
3. After recognizing ack ( HOST\_WAKEUP\_INDICATION pin high) from host, module asserts WAKEUP\_FROM\_DEV pin and start transfer.
4. Once WAKEUP\_FROM\_DEV is asserted, host should de-assert HOST\_WAKEUP\_INDICATION pin and receive the packet from module.

The flow chart below shows how the data is received from RS9116 Module in active low interrupt mode:



**Figure 35: Active Low Interrupt Mode**

**Note:**

Since UART is asynchronous interface, Polling mechanism is suggested.

Polling for HOST\_WAKEUP\_INDICATION is valid only if BIT(11) in custom feature bit map of opermode command is enabled in UART mode.

If BIT(11) of custom\_feature\_bit\_map is not enabled in opermode command, the WOW feature in UART follows the below steps like other interfaces.

For other host interfaces like SDIO /SPI /USB /USB-CDC:

When RS9116W wants to send packets to host,

1. RS9116W drives WAKEUP\_FROM\_DEV pin low ('0').
2. Host should wake up and take the packet from RS9116W.
3. Once the packet is received by host, RS9116W drives WAKEUP\_FROM\_DEV pin high ('1').

**Note:**

BIT(11) of custom\_feature\_bit\_map is not valid in SPI/SDIO/USB/USB-CDC interfaces.

## 8 WLAN AT Command Changes/Enhancements

| S.No | Configuration/Parameter | Existing Configuration | New/Modified Configuration | Comments |
|------|-------------------------|------------------------|----------------------------|----------|
| -    | -                       | -                      | -                          | -        |

## 9 Revision History

| Revision No. | Version No. | Changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1            | 1.0         | Advance version                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 2            | 1.2         | A note to specify the usage of channel bit map.<br>Added procedure to switch from binary to AT and vice-versa.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 3            | 1.3         | Added Broadcast API in the chapter WLAN Commands                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 4            | 1.4         | Added the broadcast API, added the tcp_rx_window_size_cap parameter in the socket_config command, added the note for the TCP/IP stack and added the antenna command in the chapter WLAN Commands.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 5            | 1.5         | <ol style="list-style-type: none"> <li>Added Error code in Error codes section</li> <li>Added HTTP PUT Response structure</li> <li>Added WLAN keep alive configuration support in request_timeout command</li> <li>Added UART debug prints selection and de selection option in extended custom feature bitmap in opermode command</li> <li>0 – Selecting single socket is enabled changed as<br/>1 -Selecting single socket is enabled</li> <li>Modified the UART debug prints information</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 6            | 1.6         | <ol style="list-style-type: none"> <li>Added Setregion command and DFS channels in wireless Configuration</li> <li>Changed the PER Continuous flow and Added the preamble duty cycling bit in the feature frame command</li> <li>Added the TCP ACK division factor changes in ext_tcp_ip_feature_bitmap and socket_config command</li> <li>Added Feature frame command request and response type in Binary Command Mode</li> <li>Added changes for "at+rsi_host_rtc_time" command in WLAN Commands</li> <li>Corrected join security possible values information in WLAN Commands</li> <li>Added ext tcp ip feature bit map in WLAN Commands and certificate valid command in Binary Command Mode</li> <li>Added Bit map in ext_tcp_ip_feature_bit_map[7] for DNS_CLIENT_BYPASS</li> </ol>                                                                                                                                           |
| 7            | 1.7         | <ol style="list-style-type: none"> <li>Added information about RAW socket feature</li> <li>Added rsi_config command and possible error codes in the PRM</li> <li>Added note section in band command related to wifi direct and 11j mode</li> <li>Modified rsi_wireless_antenna api.</li> <li>Added few error codes</li> <li>Added comment in ext_custom_feature_bit_map bit 6, 40mhz not supported in 11j AP</li> <li>Edit note section in at+rsi_snmp_get_rsp, to explain counter64 "data reverse send case"</li> <li>Added gain table user configurable command information</li> <li>Added a Note in opermode for custom feature bit map</li> <li>Added precondition for Antenna selection.</li> <li>Safe upgrade in progress is mentioned for IMAGE_STORED_IN_DUMP in Bootloader for similarity with UART messages</li> <li>Added description of BIT(22) in extended custom feature bitmap as crystal clock selection</li> </ol> |
| 8            | 1.8         | Added rsl_get_ram_dump command                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

| Revision No. | Version No. | Changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9            | 1.9         | <ol style="list-style-type: none"> <li>Added config feature bitmap in opermode</li> <li>Updated soft reset command description for UART/USB-CDC</li> <li>Added no.of sockets supported in MQTT connection</li> </ol>                                                                                                                                                                                                                                                                                                                               |
| 10           | 1.10        | <ol style="list-style-type: none"> <li>Added ext_tcp_ip_feature_bit_map[16] description in ext_tcp_ip_feature_bit_map.</li> <li>Added BIT(1) SCAN RESULTS TO HOST description in scan_feature_bitmap in scan command</li> </ol>                                                                                                                                                                                                                                                                                                                    |
| 11           | 1.11        | <ol style="list-style-type: none"> <li>Added MQTT AT commands</li> <li>Added Error type for MQTT Timeout</li> <li>Added next sequence of commands for MQTT user commands</li> <li>Added Response for MQTT_INIT command and a note for possible opermode for MQTT client usage</li> <li>Removed note which says Antenna selection command is not supported</li> </ol>                                                                                                                                                                               |
| 12           | 1.12        | <ol style="list-style-type: none"> <li>Modified the parameters of "at+rsi_setregion", command by adding the third parameter- "module type".</li> <li>Removed the commands, which appeared twice in " Response ID's for Rx operation table", in binary command mode document.</li> <li>Removed the twice appeared error codes, in "WLAN error codes" table.</li> <li>Modified the note which says that UART flow control feature is required only for 926100 baudrate.</li> </ol>                                                                   |
| 13           | 1.13        | Added a Note to run the CW mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 14           | 1.14        | <ol style="list-style-type: none"> <li>Added UART CTS/RTS pin set selection from host in UART flow control command</li> <li>Updated XTAL clk and Power save GPIOs info according to latest data sheet</li> <li>Removed module_type from setregion command</li> <li>Rephrased description about AP blacklisting feature</li> </ol>                                                                                                                                                                                                                  |
| 15           | 1.15        | <ol style="list-style-type: none"> <li>Added support for additional memory for SSL connections by configuring BIT(30) in extended TCP/IP feature bitmap.</li> <li>Updated error codes</li> </ol>                                                                                                                                                                                                                                                                                                                                                   |
| 16           | 1.16        | Updated revision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 17           | 1.17        | <ol style="list-style-type: none"> <li>Updated MQTT command parameters and MQTT error codes.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 18           | 1.18        | <p>Updated MQTT Document</p> <ol style="list-style-type: none"> <li>Removed Timeout command.</li> <li>Added Prerequisites for every command.</li> <li>Added MAX length in publish command and few more changes related to MQTT.</li> </ol>                                                                                                                                                                                                                                                                                                         |
| 19           | 1.9         | Updated HTTP response with additional field for status code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 20           | 2.0         | <ol style="list-style-type: none"> <li>Added the description of BIT(7) for http_client commands, "that bit is used to enable user defined http_content_type".</li> <li>Updated MQTT commands and error codes.</li> <li>Added the weekday parameter and its description in Set and Get RTC time command.</li> <li>Added NOTE for the configuration of listen_interval in association request related to join command.</li> <li>Added NOTE in 'Open Socket' section, regarding max number of LTCP sockets supported with MQTT connection.</li> </ol> |

| Revision No. | Version No. | Changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |             | <ol style="list-style-type: none"> <li>6. Added a note specifying tcp_ip_feature_bit_map[8] has to be enabled in oper_mode in "Associate to an Access Point (with WPA2-PSK security) as a client" example and modified the oper_mode accordingly.</li> <li>7. Modified the description of ht_caps_bit_map[1], "it is used for Channel_Width_Support". Also modified ht_caps_bit_map[8].</li> <li>8. Merged 'Architecture Overview' and 'Wi-Fi Software Programming' sections.</li> <li>9. Corrected maximum length of SSID to 32 bytes from 34 bytes.</li> <li>10. Added description for 'ext_tcp_ip_feature_bit_map[31]'.</li> <li>11. Removed 'Related Resources' section.</li> <li>12. Moved 'SPI Interface', 'UART Interface', 'USB Interface' and 'SDIO Interface' sections to 'Host Interfaces'.</li> <li>13. Moved 'Command Mode Selection' section to 'Bootloader' section.</li> <li>14. Removed 'PUF Commands'.</li> <li>15. Renamed 'Using Different Wi-Fi Operation' section to 'Wi-Fi Operation Modes' and moved to Appendix A.</li> <li>16. Moved 'Wireless Configuration' to Appendix B.</li> <li>17. Removed 'Wireless Firmware Upgrade', 'Wake on Wireless' sections and 'Power save Modes' description from 'Power Mode' section.</li> <li>18. Renamed 'Appendix A: Sample flow of commands for Wi-Fi over UART' to 'Appendix C: Sample AT command sequences'.</li> <li>19. Renamed document name from 'Embedded WLAN Software Programming Reference Manual (PRM)' to 'RS9116W Wi-Fi AT Command Programming Reference Manual'.</li> <li>20. Added the description of WLAN Statistics command.</li> <li>21. Added a NOTE specifying that the User can configure listen_interval dynamically in Power Mode command.</li> <li>22. Added a NOTE point in Set Certificate with Indices saying that the user has to set BIT(31) in tcp_ip_feature_bit_map &amp; BIT(29) in ext_tcp_ip_feature_bit_map to open 3 SSL Client sockets.</li> <li>23. Provided some information about the support of 3 SSL Client certificates loaded into FLASH in 'Set Certificate with Indices' command.</li> <li>24. Added the new bit configurations supported in config_feature_bitmap of oper_mode.</li> <li>25. Added the description of Bit 5 in MODE argument of 'rsi_ipconf' command.</li> <li>26. Added description for the bit BIT(5) in 'FLAGS' parameter in all the HTTP_CLIENT related commands.</li> <li>27. Added a NOTE about the port 30000, in Open Socket command</li> <li>28. Updated Channel Bitmap for 5 GHz</li> <li>29. Removed all Binary Commands</li> <li>30. Modified the Username to "redpine" in 'Http Server Credentials from Host' command.</li> <li>31. Modified open 3 SSL socket information in WLAN PRM</li> <li>32. Added SNMP GET response in WLAN PRM</li> <li>33. Renamed the username 'ap_ssid' to 'redpine' in http section.</li> <li>34. Added note - 'maximum data that can be sent over TCP-SSL/LTCP-SSL is 1370 Bytes only'.</li> <li>35. Removed SDIO, USB, SPI from Host Interfaces section.</li> </ol> |

| Revision No. | Version No. | Changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |             | <p>36. Added 'Wireless Features and Mechanisms' section with sub sections 'Connect Application', 'Firmware Upgrade Mechanisms', 'Power Save Modes' and 'Wake on Wireless'.</p> <p>37. Added 'Changes/Enhancements in WLAN AT Commands, Configurations and Mechanisms' section.</p> <p>38. Added a note in Opermode section in WLAN AT Commands section.</p> <p>39. Added/modified description for 'WLAN Statistics' command in 'WLAN Commands' section.</p> <p>40. Added length for each AT CMD (parameters and responses.)</p> <p>41. Added bitmap for TLSv1.0 and TLSv1.2 in config_feature_bitmap.</p> <p>42. Added note for Wi-Fi stats command (only support Wi-Fi client mode).</p> <p>43. Added supported Curve IDs for Ciphers in section 'Open Socket'.</p> |

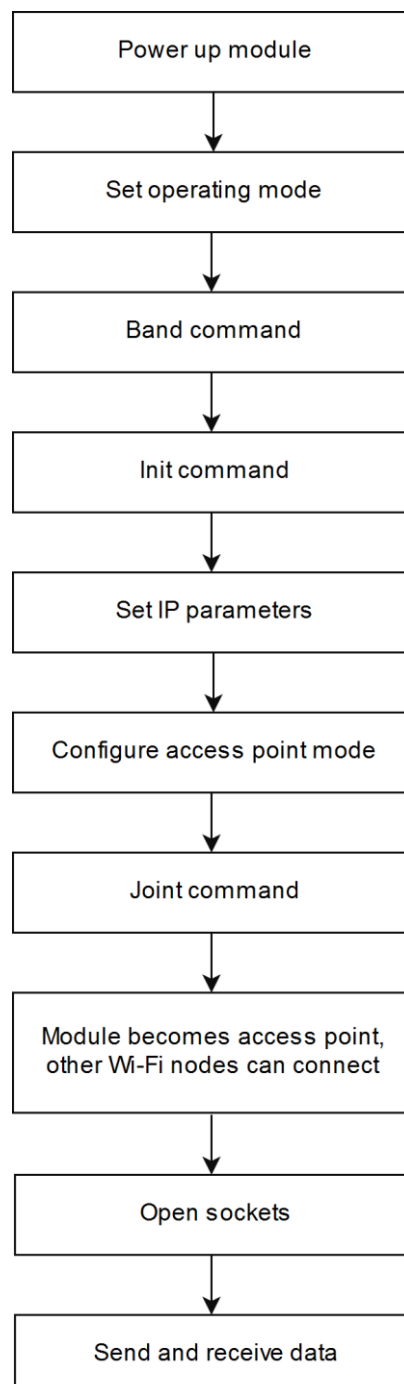
## 10 Appendix A: Wi-Fi Operation Modes

The module can be configured in the following modes:

- 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

### Access Point Mode

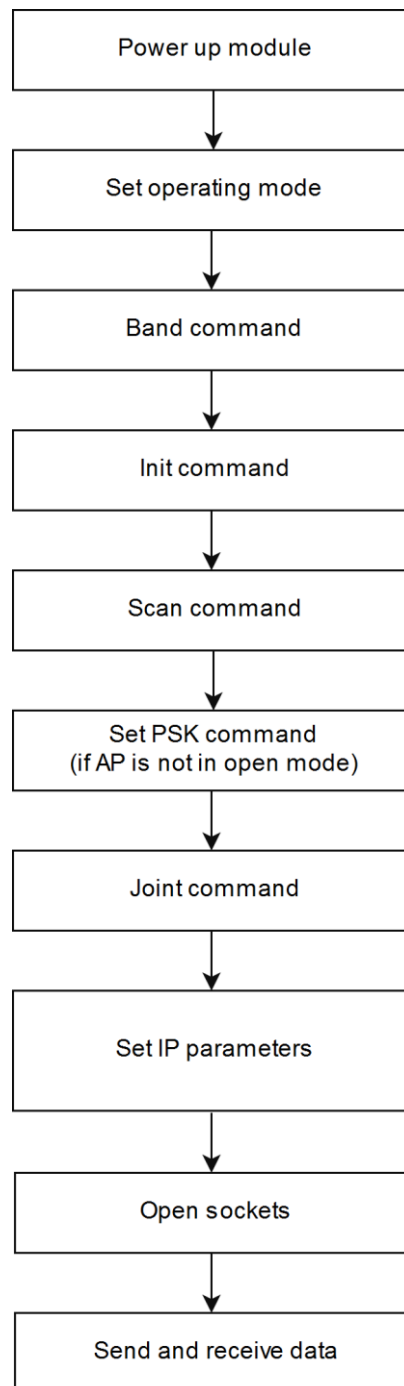
The following sequence of commands should be used to create an Access Point in the module. The module can support eight external clients when it is configured in Access Point mode. By default the module can act as a DHCP server.



**Figure 36: Access Point Mode**

### Client Mode with Personal Security

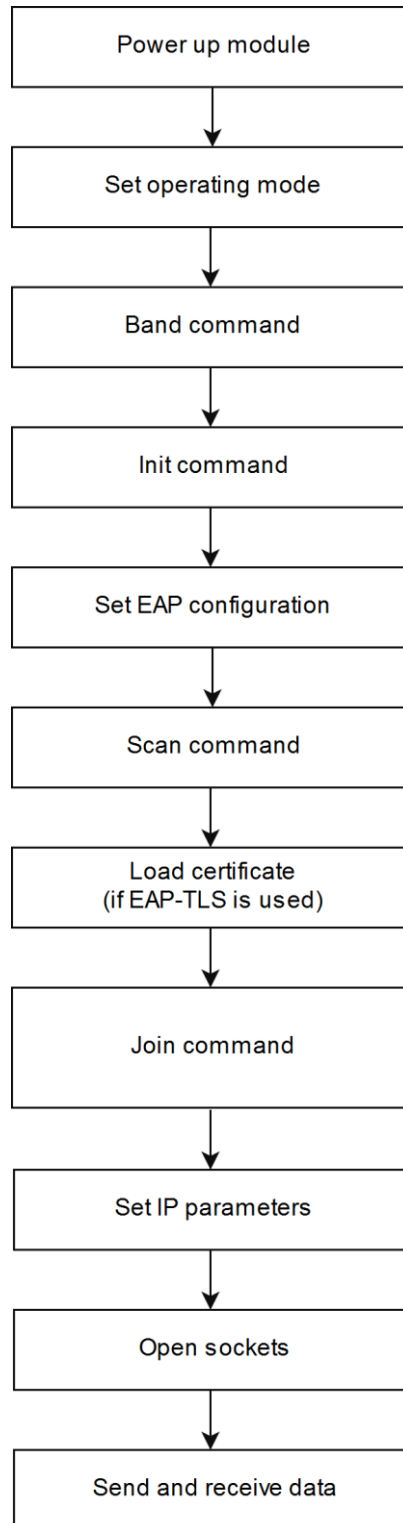
In this mode, the module works as a Wi-Fi client. It can connect to an Access Point with open mode or Personal Security.



**Figure 37: Client Mode with Personal Security**

### Client Mode with Enterprise Security

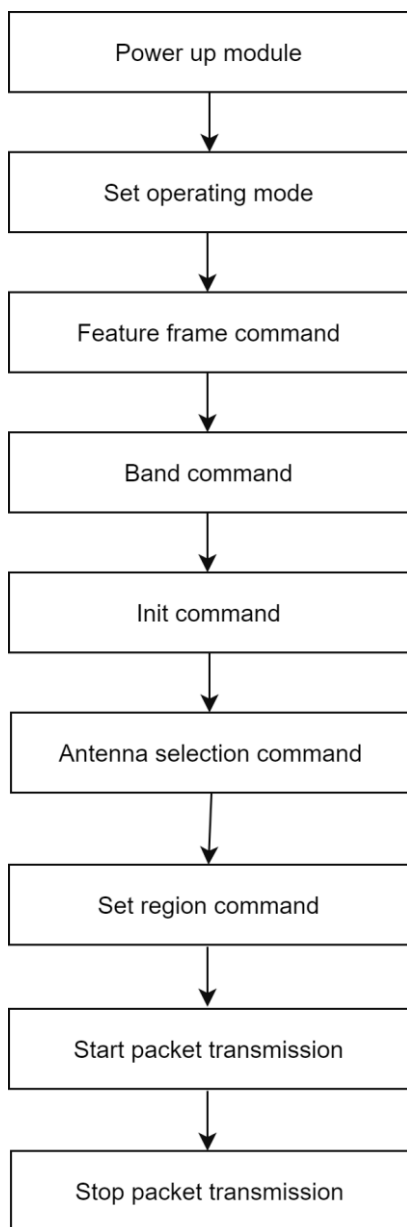
In this mode, the module works as a client to connect to an Enterprise security enabled network that Hosts a Radius Server.



**Figure 38: Client Mode with Enterprise Security**

### PER Mode

This mode is used for Packet Error Rate analysis and regulatory and compliance certification e.g. FCC/IC/CE/TELEC



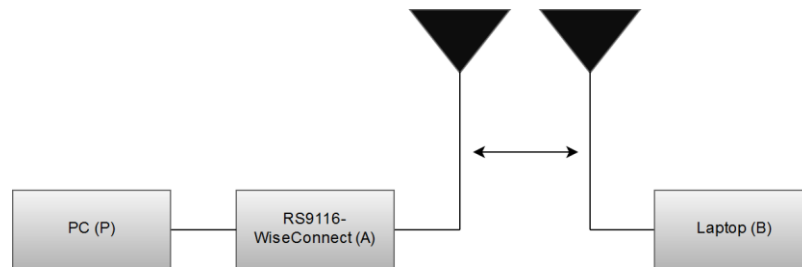
**Figure 39: PER Mode**

## 11 Appendix B: 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").

### 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 40: 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 C: Sample AT commands Sequences').
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. Set\_region : 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.

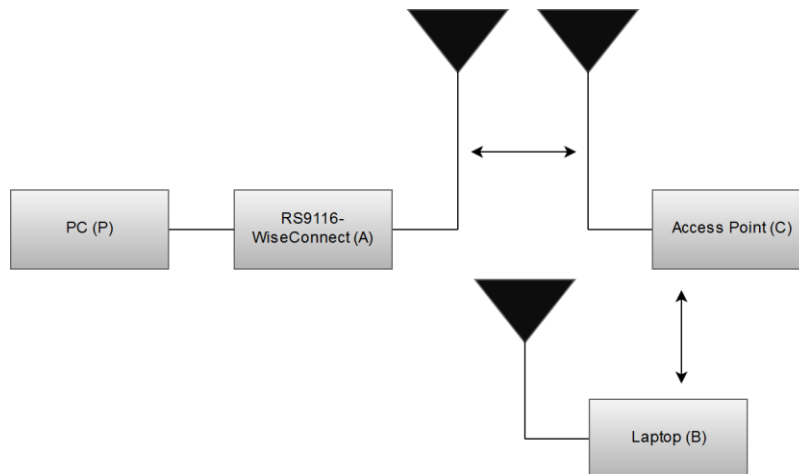
The module should now be power cycled or hard reset. It boots up and then automatically scans channels for the target AP and connects to it and gets an IP address. The module will send out two responses to the host, the first corresponds to the "Join" command and the second to the "Set IP Parameters" 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.

**Note:**

If the information sent is wrong than module will throw an error while scanning or joining. In that case user need to disable the auto configuration. User can issue the command `at+rsi_configsave=0\r\n` and power cycle 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 C: Sample AT commands Sequences').



**Figure 41: Setup for Configuration to Join a Specific AP – Flow 2**

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**".

3. 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 the configuration is over.
  - b. Band: Single Band (2.4GHz or 5GHz) or Dual Band (2.4 GHz and 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. Set-region : This is used to configure the device to operate according to the regulations of its operating country.
  - e. Security Enable: 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.

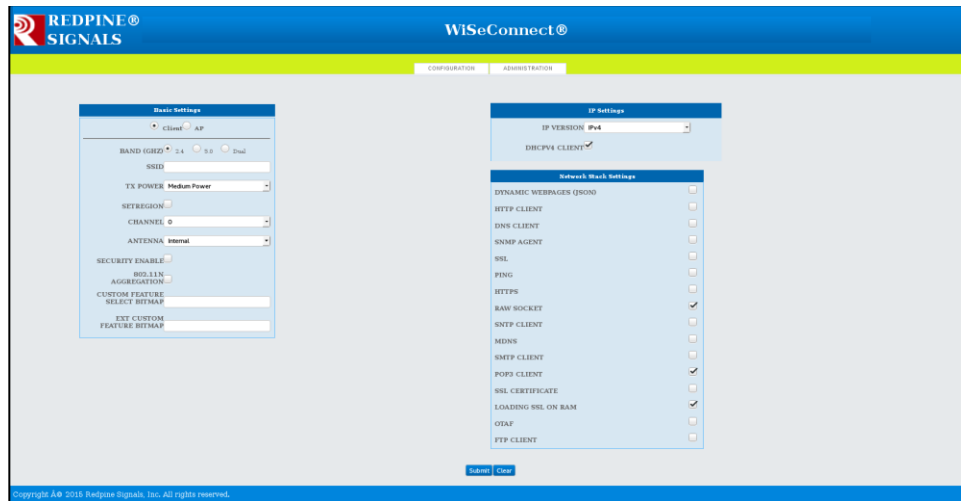


Figure 42: Webpage Screenshot

- h. Security Enable: Select if security mode is enable and fill the PSK, Security Type, encryption Type fields accordingly.
  - i. IPconfiguration: Select the IP version (IPv4/IPv6/Both) and provide static IP details or enable DHCP.
4. 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.
  5. Click on "Submit" button. The information is sent to the module and stored in its internal flash.
  6. 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.

## 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.

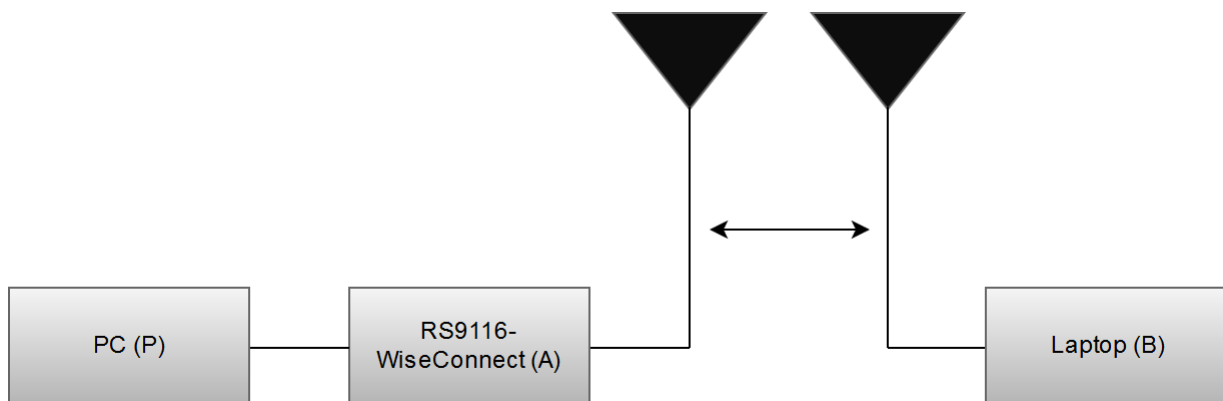


Figure 43: Setup for Configuration to Create an AP – Flow 1

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
  - 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.

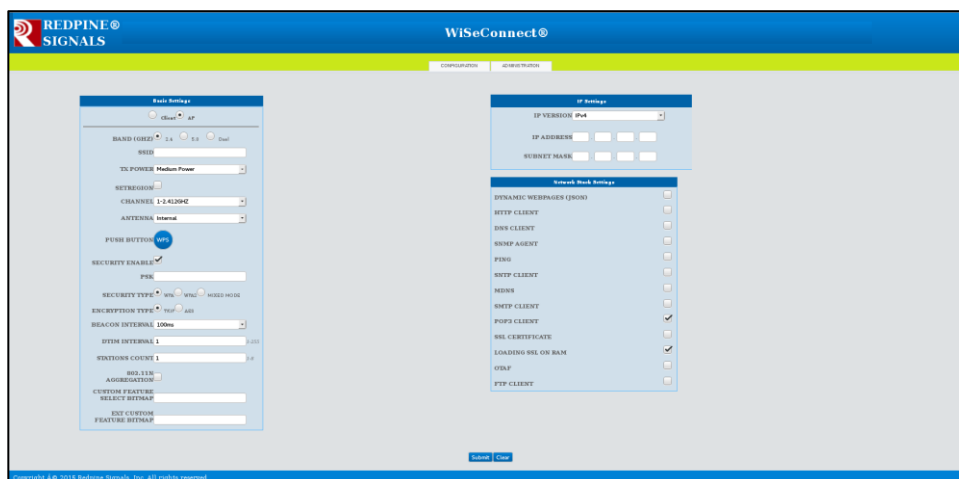
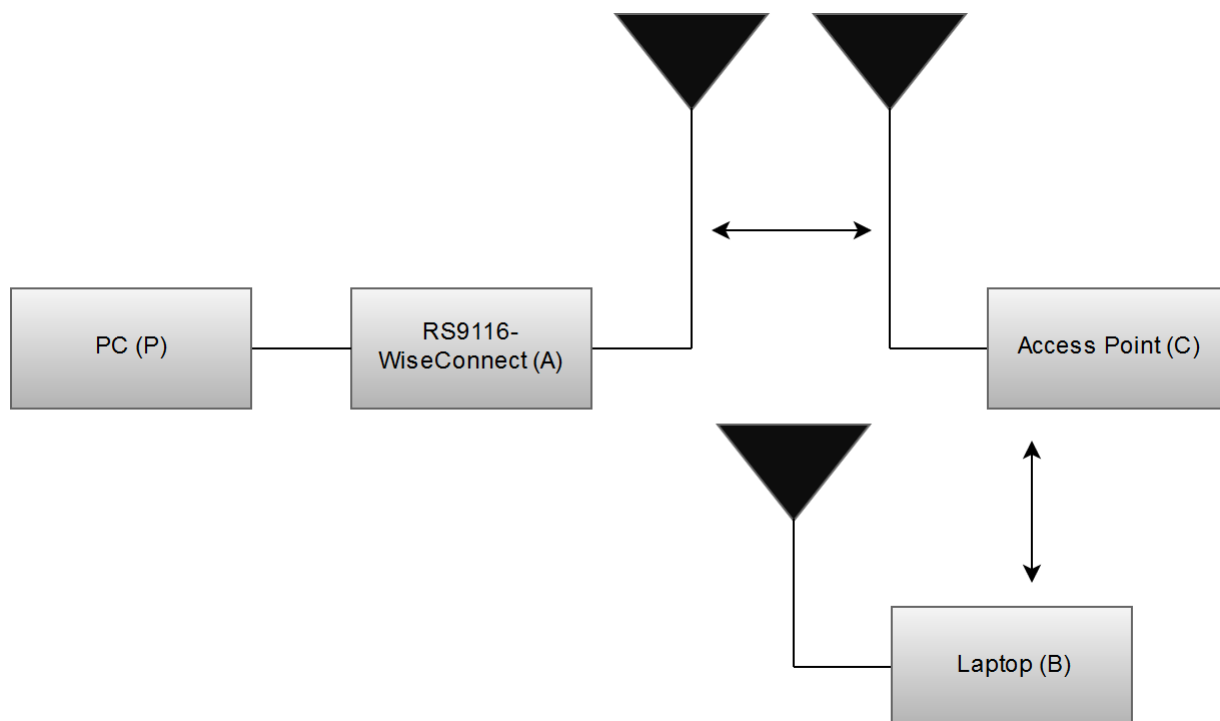


Figure 44: Webpage Screenshot

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 45: 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.

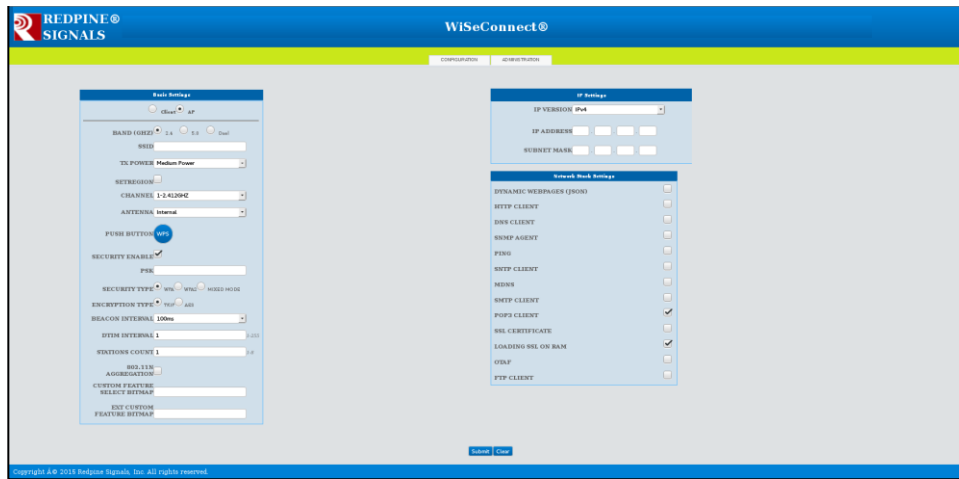


Figure 46: Webpage Screenshot

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.

### 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.

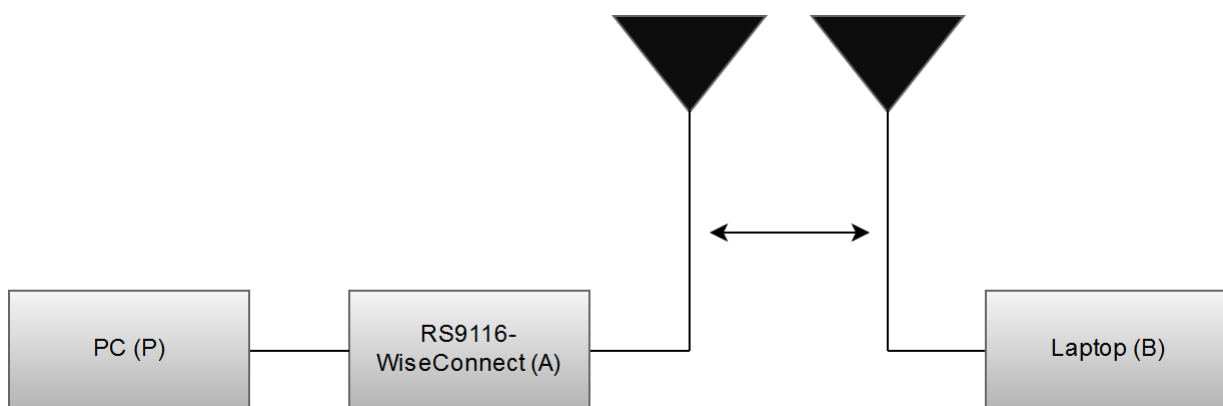


Figure 47: Setup for Configuration to Join an AP with Enterprise Security – Flow 1

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.

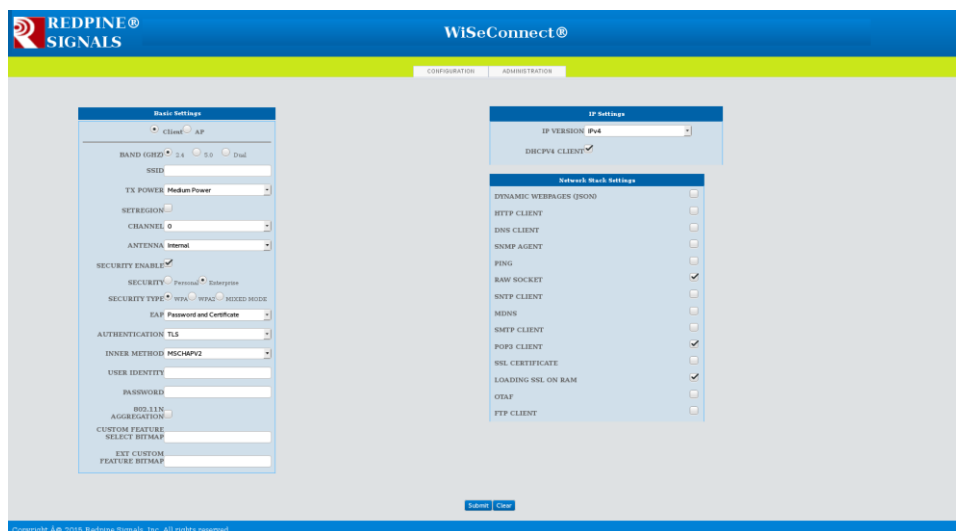
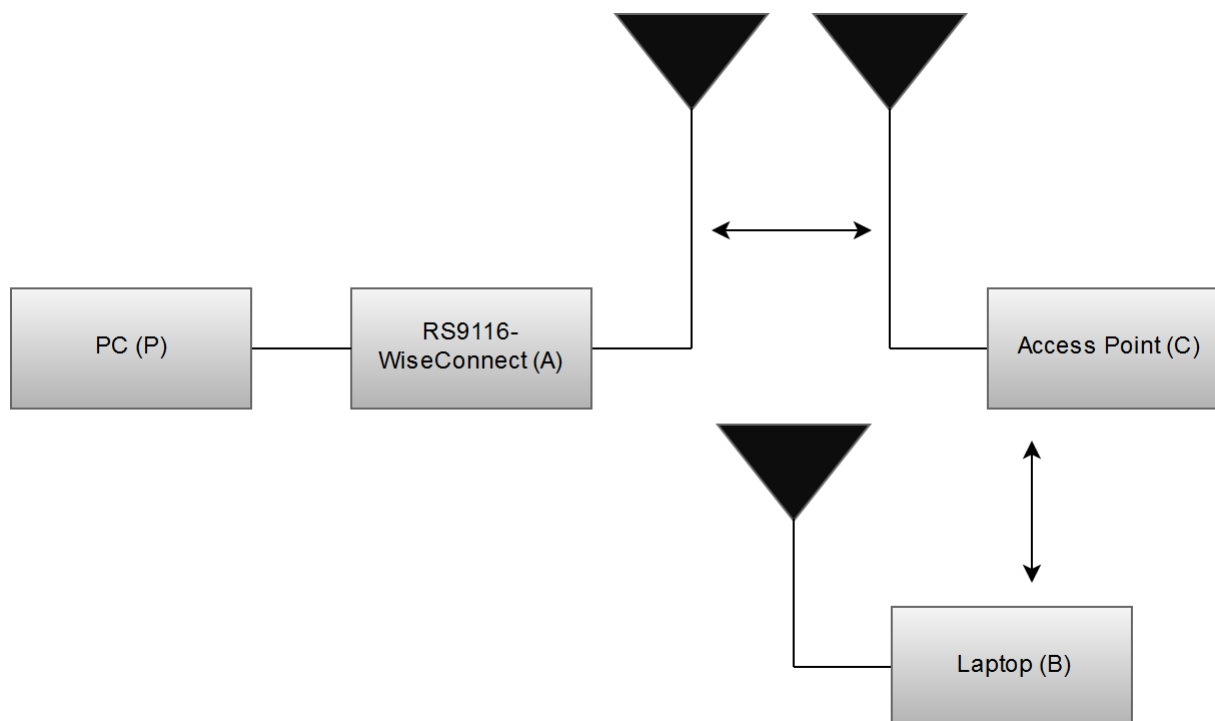


Figure 48: Webpage Screenshot

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 49: 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.

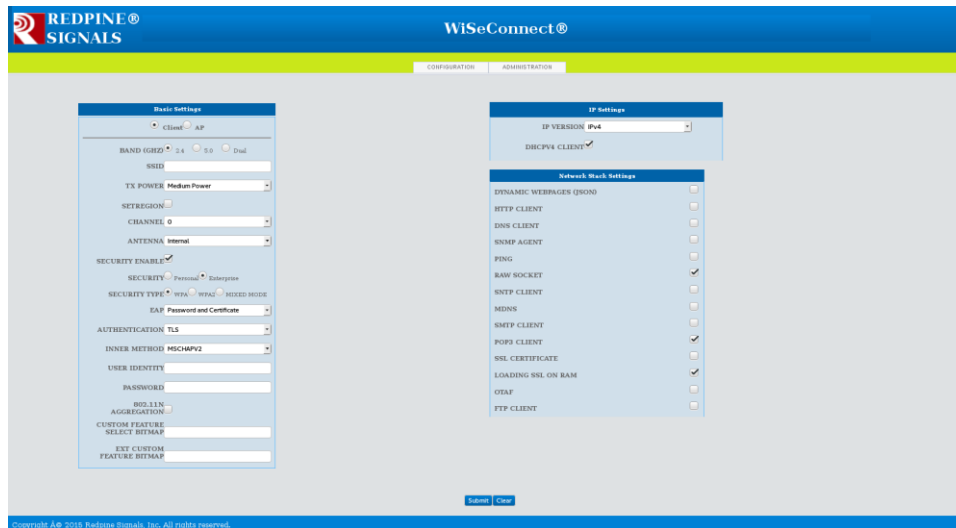


Figure 50: Webpage Screenshot

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.

## 12 Appendix C: Sample AT Command Sequences

Sample command sequences are shown below for operating the module in different modes.

### 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,AP_SSID,2,2,12345678,300,2,4\r\n`

This command will configure the SSID of the AP to "AP\_SSID" and password will be set to "12345678".

`at+rsi_join=AP_SSID,0,2\r\n`

This command will create the Access Point with SSID 'AP\_SSID' 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,This is a test\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.

### Associate to an Access Point (With WPA2-PSK Security) as Client

`at+rsi_opermode=0,1,256,0\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\_dnsserver=1,0,0\r\n*

Optional command to provide the IP address of a DNS server.

**Note:**

If the user wants to use the DNS command to get DNS server IP then the user has to enable `tcp_ip_feature_bit_map[8]` in the `oper_mode` command.

*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,This is a test\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

### Associate to an Access Point (With WEP Security) as 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,This is a test\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

### 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,This is a test\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.

### Associate to an Enterprise Security Enabled Access Point as 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,<TLS certificate>\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\_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 (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 a AT+RSI\_READ message to the Host.

### 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=0,1,0,0,1,0\r\n*

This command sets the correct RF type and path

*at+rsi\_init\r\n*

This command initializes the module.

*at+rsi\_antenna=0\r\n*

This is the command for antenna .

*at+rsi\_setregion = 1,4\r\n*

This command configures the region to worldwide

*at+rsi\_per=1,127,139,1000,0,6,0,0,0,0\r\n*

This command sends the packets in burst mode in channel number 6, with packet length 1000, with max power, with data rate 6Mbps.

*at+rsi\_per=0\r\n*

To stop transmission

### 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=0,1,0,0,1,0\r\n*

This command sets the correct RF type and path

*at+rsi\_init\r\n*

This command initializes the module.

*at+rsi\_antenna=0\r\n*

This is the command for antenna .

*at+rsi\_setregion = 1,4\r\n*

This command configures the region to worldwide

*at+rsi\_per=1,127,139,260,1,6,0,0,0,0\r\n*

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

*at+rsi\_per=0\r\n*

To stop transmission

*at+rsi\_per=1,127,0,260,2,6,0,0,0,0\r\n*

This command sends the packets in continuous Wave mode in channel number 6, with packet length 260, with max power, with data rate 1Mbps.

### Per Stats

*at+rsi\_per\_stats=0,1\r\n*

To enable the PER stats.

```
at+rsi_per_stats=1\r\n
```

To disable the PER stats.

### Per Receive

```
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=0,1,0,0,1,0\r\n
```

This command sets the correct RF type and path

```
at+rsi_init\r\n
```

This command initializes the module.

```
at+rsi_setregion = 1,4\r\n
```

This command configures the region to worldwide

```
at+rsi_per_stats=0,1\r\n
```

This command here is used to see the WLAN Receive stats.

```
at+rsi_per_stats=1\r\n
```

This command is used to stop the WLAN PER RECEIVE STATS

### Enabling BG Scan in Open Mode as 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.

### Enabling Roaming in Open Mode as 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.

## Enabling WMM PS in Open Mode as 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.

## 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.

## 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.

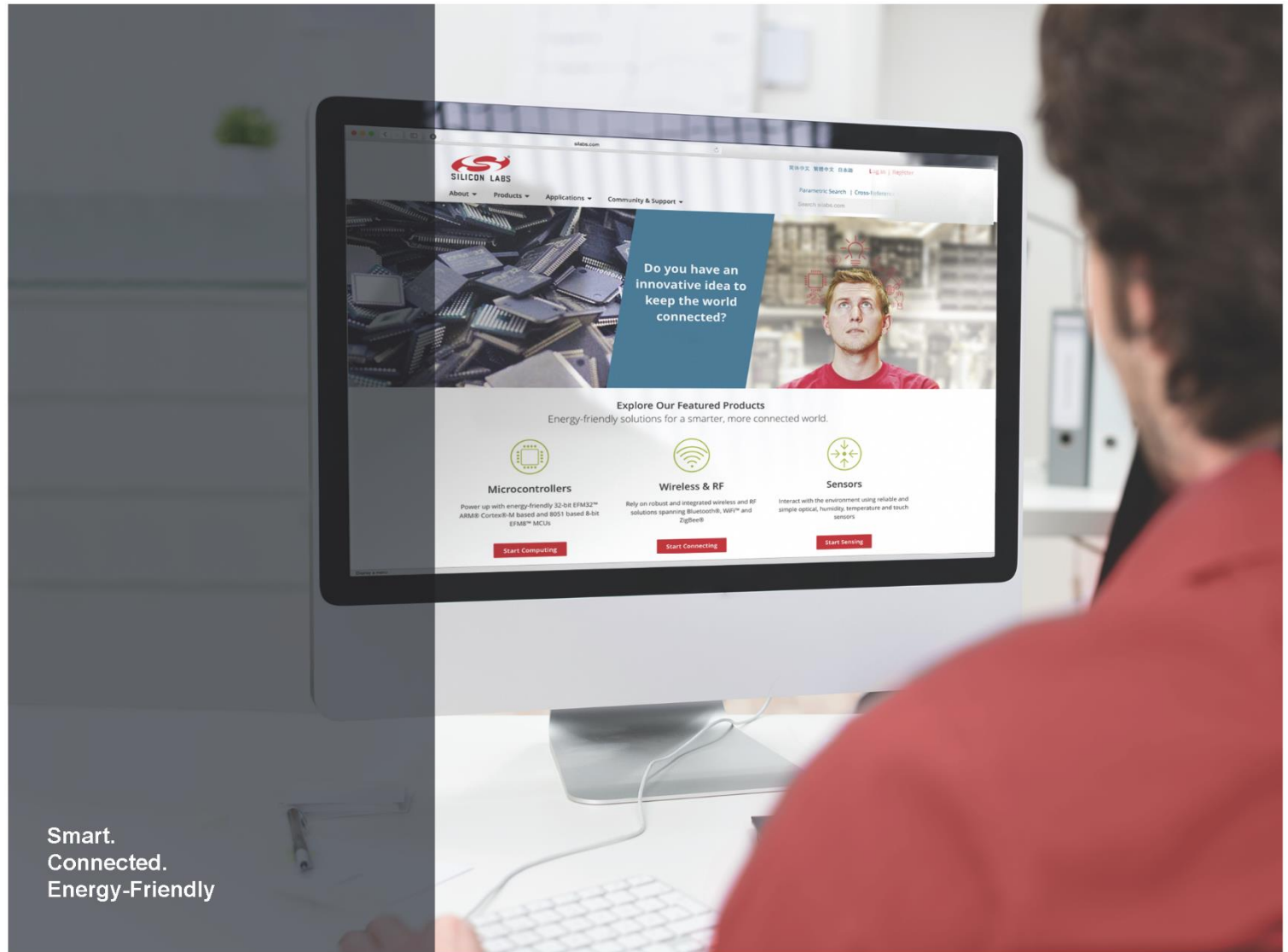
`at+rsi_ltcp=5001,2,0,1,0\r\n`

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.



Smart.  
Connected.  
Energy-Friendly



**Products**  
[www.silabs.com/products](http://www.silabs.com/products)



**Quality**  
[www.silabs.com/quality](http://www.silabs.com/quality)



**Support and Community**  
[community.silabs.com](http://community.silabs.com)

#### Disclaimer

Silicon Laboratories intends to provide customers with the latest, accurate, and in-depth documentation of all peripherals and modules available for system and software implementers using or intending to use the Silicon Laboratories products. Characterization data, available modules and peripherals, memory sizes and memory addresses refer to each specific device, and "Typical" parameters provided can and do vary in different applications. Application examples described herein are for illustrative purposes only. Silicon Laboratories reserves the right to make changes without further notice and limitation to product information, specifications, and descriptions herein, and does not give warranties as to the accuracy or completeness of the included information. Silicon Laboratories shall have no liability for the consequences of use of the information supplied herein. This document does not imply or express copyright licenses granted hereunder to design or fabricate any integrated circuits. The products must not be used within any Life Support System without the specific written consent of Silicon Laboratories. A "Life Support System" is any product or system intended to support or sustain life and/or health, which, if it fails, can be reasonably expected to result in significant personal injury or death. Silicon Laboratories products are generally not intended for military applications. Silicon Laboratories products shall under no circumstances be used in weapons of mass destruction including (but not limited to) nuclear, biological or chemical weapons, or missiles capable of delivering such weapons.

#### Trademark Information

Silicon Laboratories Inc., Silicon Laboratories, Silicon Labs, SiLabs and the Silicon Labs logo, CMEMS®, EFM, EFM32, EFR, Energy Micro, Energy Micro logo and combinations thereof, "the world's most energy friendly microcontrollers", Ember®, EZLink®, EZMac®, EZRadio®, EZRadioPRO®, DSPLL®, ISOmodem®, Precision32®, ProSLIC®, SiPHY®, USBXpress® and others are trademarks or registered trademarks of Silicon Laboratories Inc. ARM, CORTEX, Cortex-M3 and THUMB are trademarks or registered trademarks of ARM Holdings. Keil is a registered trademark of ARM Limited. All other products or brand names mentioned herein are trademarks of their respective holders.



Silicon Laboratories Inc.  
400 West Cesar Chavez  
Austin, TX 78701

<http://www.silabs.com>