

Connect-io-n™
RS9110-N-11-24
Evaluation Board User Guide
Version 3.13
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Part Number Description

Device Number	Description	TCP/IP Enabled	Option for TCP/IP Bypass
RS9110-N-11-24	Part with UART as Host Interface	Yes	No
RS9110-N-11-24-02	Part with SPI as Host Interface	Yes	Yes
RS9110-N-11-24-04	Part with UART/SPI as Host Interface	Yes	Yes

RS9110-N-11-24-04 will replace RS9110-N-11-24 and RS9110-N-11-24-02.
RS9110-N-11-24-04 is feature compatible with RS9110-N-11-24 and RS9110-N-11-24-02.

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1 Introduction

This document describes how to use the RS9110-N-11-24 EVB. It describes the sequence of commands and set-up requirements to quickly evaluate the major functions of the modules.

Chapters [Using the Evaluation Board in UART mode](#) to [Evaluating the Module in Infrastructure mode](#) describe operation using the UART interface. [Using the Evaluation Board in SPI mode](#) describes operation using the SPI interface. [Upgrading Firmware](#) describes the firmware upgrade procedure. Even if the user does not plan to use the UART interface, it is recommended to go through the UART section because all the set-ups to evaluate different functionalities of the module in UART mode are directly reusable in the SPI mode also.

2 Components on the EVBs

The RS9110-N-11-24 EVB has various switches and headers to enable the user to configure it for different scenarios¹. The figure below shows the various components. The exact EVB may differ slightly from the pictures below due to different PCB versions or minor changes.

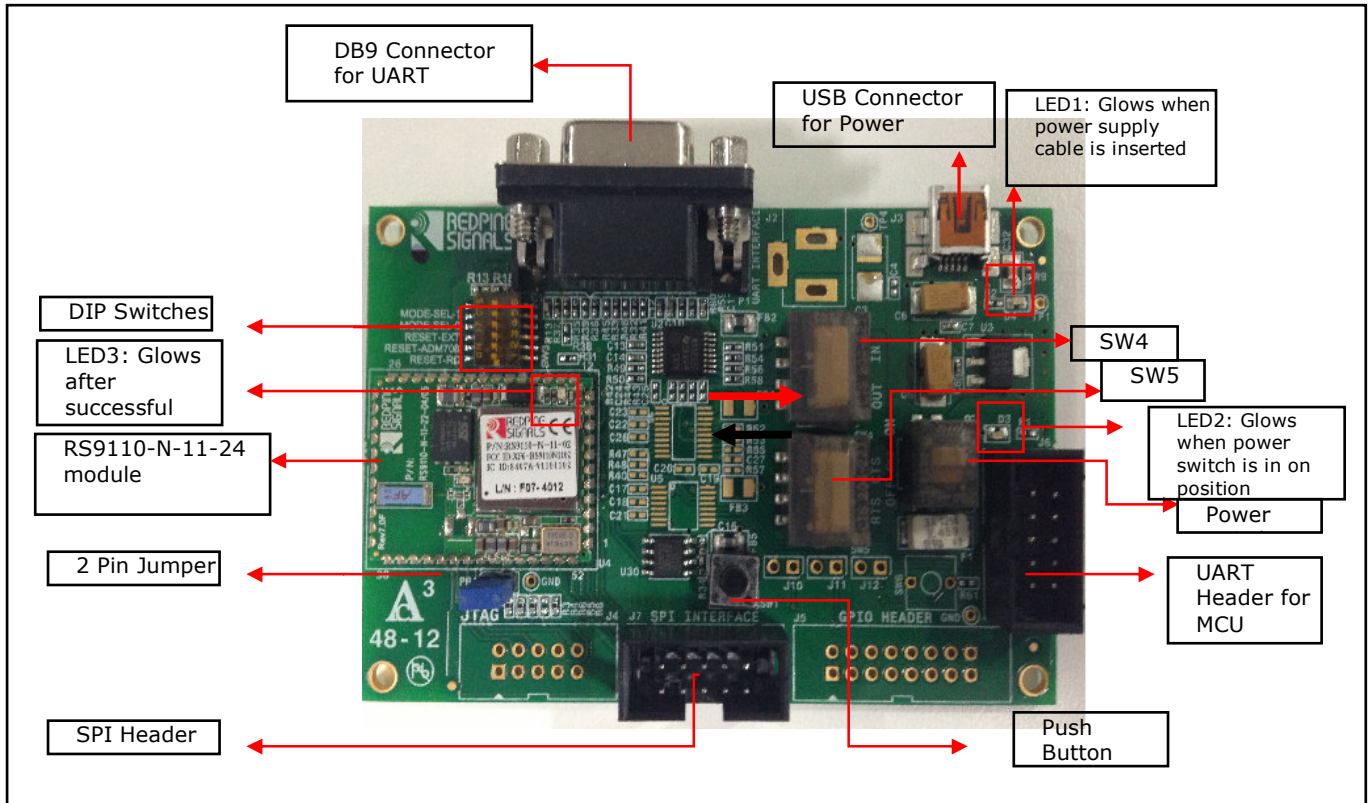


Figure 1: RS9110-N-11-24-EVB

¹ All components described in this section may not be present in different versions of the EVB PCB. General functionality will however not be affected.

USB Connector for Power

The power for the board can be supplied through this connector.

UART Header for MCU

If the EVB needs to be connected to the serial interface of an MCU platform, this header can be used. The voltage level of the UART TX and RX pins of this header is 3.3V. The Ground pin should be connected to a corresponding ground signal of the MCU board.

Pin number	Pin name	Direction	Description
1	NC	-	This pin must be left unconnected
2	NC	-	This pin must be left unconnected
3	NC	-	This pin must be left unconnected
4	UART-RX	Input	UART RX pin of the module
5	UART-TX	Output	UART TX pin of the module
6	NC	-	No connect
7	NC	-	No connect
8	GND	-	Ground
9	GND	-	Ground
10	GND	-	Ground

Table 1: UART Header Pins

SPI Header

The SPI header is used to connect the SPI interface of the module to a Host MCU. The pin configuration of this header is as follows:

Pin number	Pin name	Direction	Description
1	NC	-	No connect
2	SPI_CS	Input	SPI slave select
3	GND	-	Ground
4	VCC	-	3.3V power supply. If the USB port for power supply is not used, this pin can be used to drive power to the EVB from the Host MCU platform. The maximum current

			sourcing capacity of the Host should be 500mA. If not used, this pin should be left open
5	SPI_CLK	Input	SPI clock
6	GND	-	Ground
7	SPI_MOSI	Input	SPI data input
8	SPI_MISO	Output	SPI data output
9	INTR	Output	Interrupt output (Active high)
10	NC	-	No connect

Table 2: SPI Header Pins

DIP Switches

The DIP switches are used to select the module to work in UART or SPI mode.

Switch #	Status	Comment
1,2,3	ON, OFF, OFF	Power on reset selected
1,2,3	OFF, ON, OFF	Push button reset selected
1,2,3	OFF, OFF, ON	Reset from Host selected
4,5	ON, ON	SPI mode selected
4,5	OFF, OFF	UART mode selected
6	OFF	Keep in OFF mode

Table 3: DIP Switch Setting (6 switches)

Note: If Reset from Host selected using DIP switch settings then 14th pin of GPIO header should be connected to the host. If EVB has 4 switches DIP switch then resistor R19 should be populated with 0 ohms.

SW4 and SW5

These switches are used to select the UART DB9 connector or the "UART Header for MCU" for communicating using the UART interface. The direction shown with the thick red arrow is to select the DB9 connector. The direction shown with the thick black arrow is to select the UART Header.

2 Pin Jumper

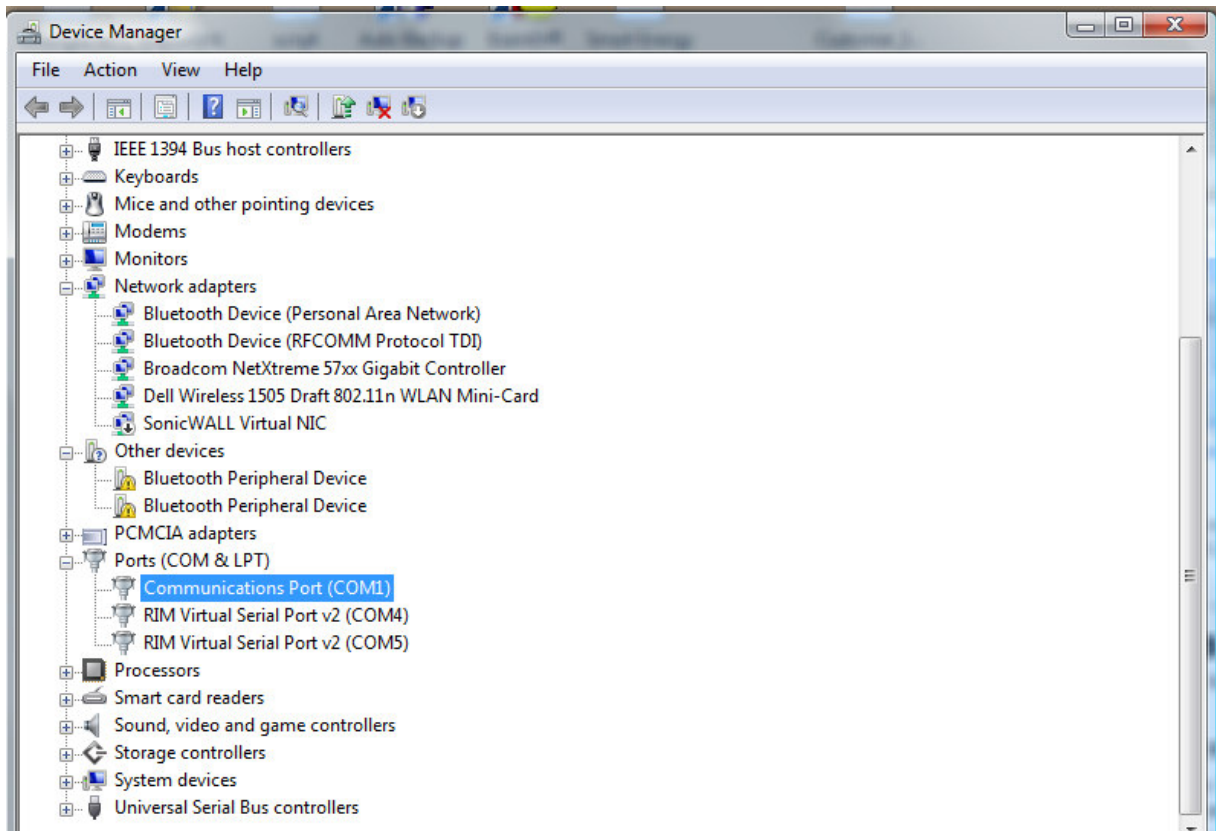
Used for Power measurements.

3 Using the Evaluation Board in UART mode

The following sections describe how to use the Evaluation Board in UART mode.

3.1 Configure Serial port in computer

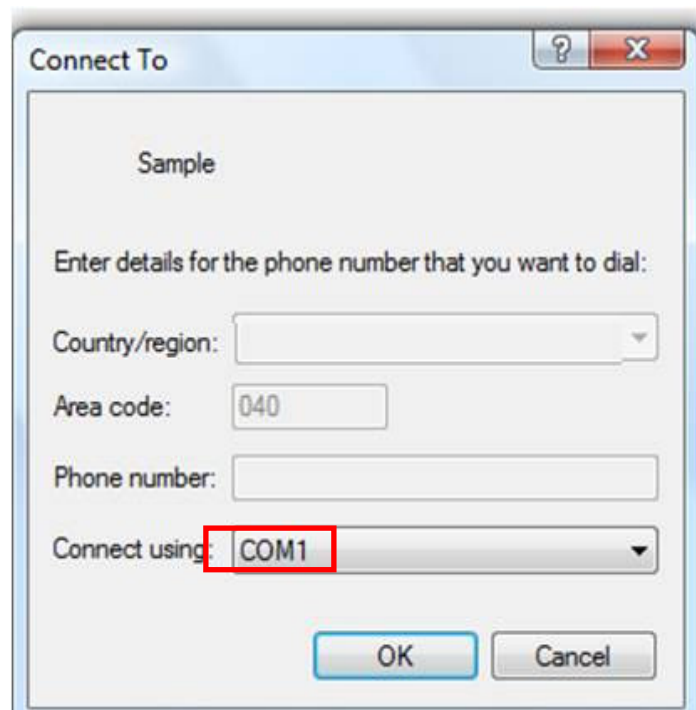
To know the COM port name, check the computer's *Device Manager* settings.



The COM port name is displayed in the window. Hyperterminal or Teraterm should be opened and configured accordingly with this COM port name.

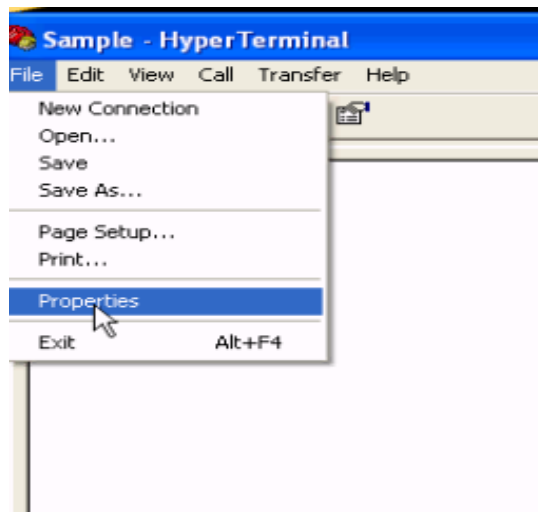
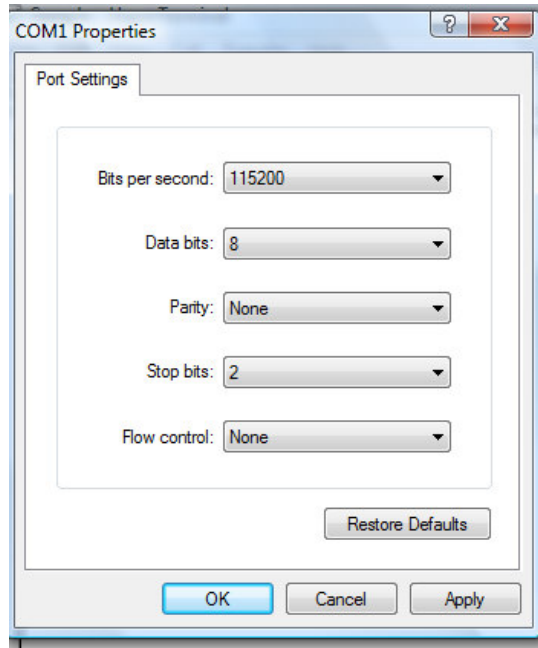
The steps for configuring HyperTerminal are shown below.

Open HyperTerminal

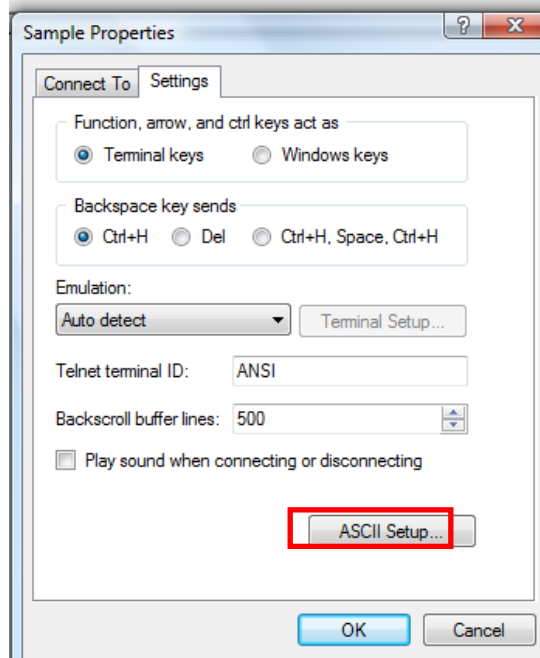


Baud Rate: 115200 bps, Data bits: 8, Parity: None, Stop bits: 2, Flow Control: None

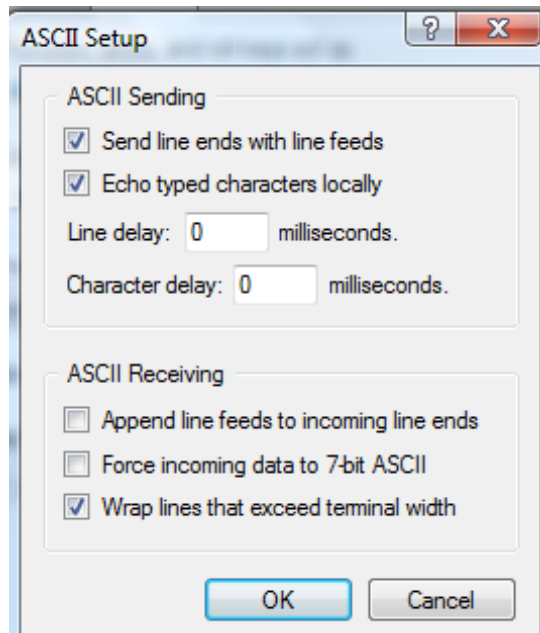
Currently other baud rates are not supported.



Click on ASCII Setup



Complete the settings as shown below and click OK.

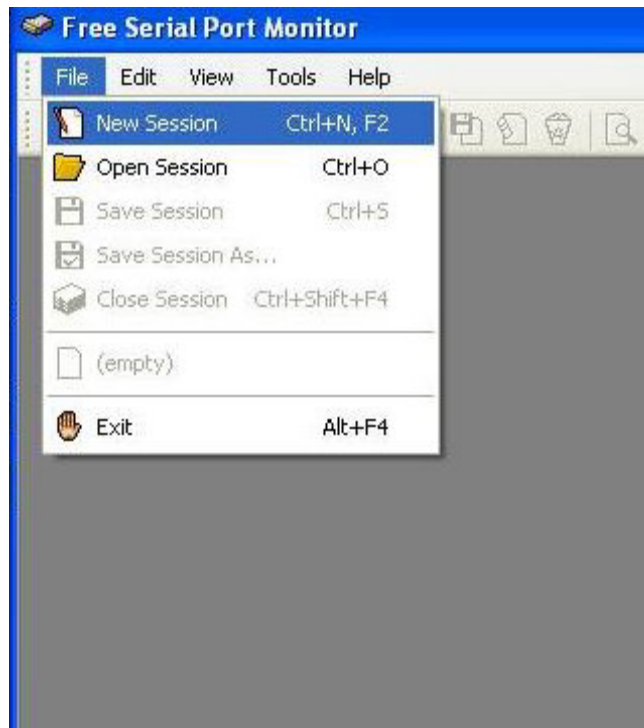


Teraterm can also be used. Similar configuration steps should be followed.

3.2 Configure Serial Port Monitor in the PC

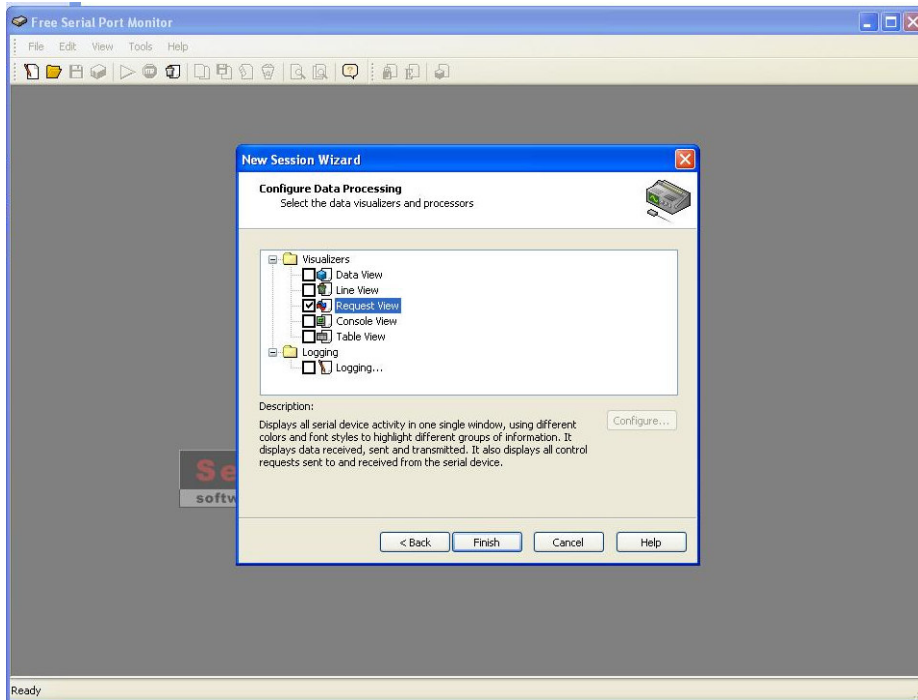
The actual bytes exchanged between the module and the Host PC may not all be readable on Hyperterminal or Teraterm because of ASCII conversion. A serial port monitor² can be used to see the actual bytes. A free package is available at <http://www.serial-port-monitor.com/>, while other similar software such as *Hterm*, *Docklight* etc. also provide good interfaces to simultaneously view ASCII and actual bytes exchanged in the UART interface. The following sections assume that HHD Free Serial Port Monitor has been installed from the above link.

Open the "HHD Free Serial Port Monitor" BEFORE opening the Hyperterminal or Teraterm. Click on File -> New Session. Select "Serial Port Monitor". Select the appropriate COM port and "Request view" for the display format.



² Redpine Signals Inc. assumes no liability for damages of any kind resulting from use of third party software.





All bytes exchanged through the UART interface will now be visible on the monitor.

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```

Device - COM1 - Free Serial Port Monitor - [Request View - Device - COM1]
File Edit View Tools Window Help
Port opened by process "hypertrm.exe" (PID: 6072)
Answer: 4/25/2013 9:59:31 AM.43564
00 0D 0A 20 57 45 4C 43 4F 4D 45 20 54 4F 20 52 ... WELCOME TO R
45 44 50 49 4E 45 20 53 49 47 4E 41 4C 53 0D 0A EDPINE SIGNALS..
20 0D 0A 20 46 69 72 6D 77 61 72 65 20 75 70 67 .. Firmware upg
72 61 64 65 20 28 79 2F 6E 29 6E 0D 0A 20 4C 6F rade (y/n).. Lo
61 64 69 6E 67 2E 2E 2E 20 0D 0A 20 4C 6F 61 64 ading... .. Load
69 6E 67 20 44 6F 6E 65 0D 0A ing Done..

Request: 4/25/2013 10:00:36 AM.71064 (+45.1930 seconds)
61 74 2B 72 73 69 5F 62 61 6E 64 3D 30 0D 0A at+rssi_band=0..

Answer: 4/25/2013 10:00:42 AM.11564 (+0.0120 seconds)
4F 4B 0D 0A OK..

Request: 4/25/2013 10:00:45 AM.40064 (+2.2850 seconds)
61 74 2B 72 73 69 5F 69 6E 69 74 0D 0A at+rssi_init..

Answer: 4/25/2013 10:00:52 AM.57964 (+0.0130 seconds)
4F 4B 0D 0A OK..

Request: 4/25/2013 10:01:32 AM.23364 (+40.6540 seconds)
61 74 2B 72 73 69 5F 73 63 61 6E 3D 31 2C 52 45 at+rssi_scan=1,RE
44 50 49 4E 45 5F 52 58 0D 0A DPINE_RX..

Answer: 4/25/2013 10:01:48 AM.55864 (+0.1190 seconds)
4F 4B 52 45 44 50 49 4E 45 5F 52 58 00 00 00 00 OKREDPINE_RX....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 02 2C 0D 0A .....,

Request: 4/25/2013 10:01:51 AM.50964 (+2.9510 seconds)
61 74 2B 72 73 69 5F 70 73 6B 3D 31 32 33 34 35 at+rssi_psk=12345
36 37 38 0D 0A 678..

Answer: 4/25/2013 10:02:01 AM.20764 (+0.0120 seconds)
4F 4B 0D 0A OK..

Request: 4/25/2013 10:02:03 AM.88964 (+1.6820 seconds)
61 74 2B 72 73 69 5F 6A 6F 69 6E 3D 52 45 44 50 at+rssi_join=REDP
49 4E 45 5F 52 58 2C 30 2C 32 0D 0A INE_RX,0,2..

Answer: 4/25/2013 10:02:21 AM.91064 (+4.5080 seconds)
4F 4B 0D 0A OK..

Request: 4/25/2013 10:02:24 AM.45264 (+2.5420 seconds)
61 74 2B 72 73 69 5F 69 70 63 6F 6E 66 3D 31 2C at+rssi_ipconf=1,
30 2C 30 2C 30 0D 0A 0,0,0..

Answer: 4/25/2013 10:02:40 AM.68664 (+6.2890 seconds)
4F 4B 00 23 A7 3B 31 0E C0 A8 01 64 FF FF FF 00 OK.#S:1.À`.dÿÿÿ.
C0 A8 01 01 0D 0A A ....
  
```

IP Address:
192.168.1.100
Subnet:
255.255.255.0
Gateway:
192.168.1.1

3.3 Evaluating the Module in Infrastructure mode

The following sections describe the steps to evaluate the modules in Infrastructure mode.

3.3.1 Configuration and Test Procedure

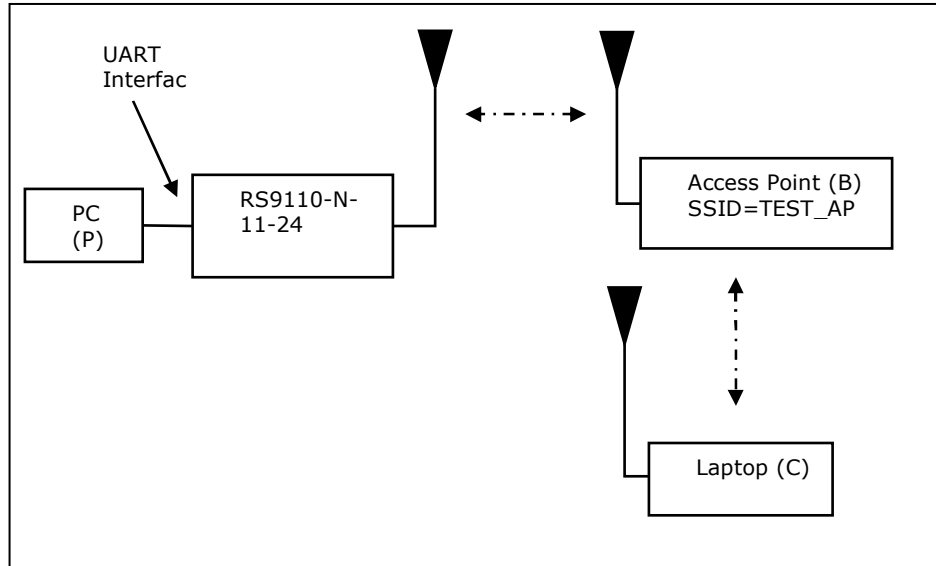


Figure 1: Evaluation Set-up³ - Infrastructure Mode

1. Configure the EVB in UART mode and connect a UART cable⁴ between the PC and the EVB. Switch SW4 and SW5 should be set to select the DB9 connector. Configure an Access Point (AP) accordingly.
2. Supply power to the EVB and put on the power switch.
3. The message "Firmware upgrade (y/n)" comes in the screen. Press 'n' and then "Enter" key immediately.
4. Once "Loading Done" message comes, the following commands should be issued.

a. at+rsi_band=0

This configures the operating band of the module to 2.4 GHz. If a RS9110-N-11-28-EVB, that is capable of operating over 5 GHz, is used, a band value of 1 can be issued to configure the module at 5 GHz.

b. at+rsi_init

This initializes the module

³ It is assumed for illustrative purposes that the IP of the AP is 192.168.50.1

⁴ USB-to-UART converter cables are found to not work consistently. It is advised to use a UART cable.

c. at+rsi_fwversion?

This returns the firmware version in the module.

d. at+rsi_scan=0

This command makes the module scan for all channels.

e. at+rsi_authmode=3

This command sets the security mode for the module to WPA2-PSK.

f. at+rsi_psk=12345678

This command configures the PSK in the module to match that in the Access Point (AP). It is assumed in this example that a WPA2-PSK enabled AP is used, with a key "12345678".

g. at+rsi_join=TEST_AP,0,2

This command is to associate to the Access Point "TEST_AP"

h. at+rsi_ipconf=0,192.168.50.10,255.255.255.0,192.168.50.1

This command configures the module's IP to 192.168.50.10 in static mode. Make sure the desired IP is in the same subnet as the Access Point. The module responds to this command by sending the configured IP address to the Host as response to the command. In Hyperterminal, this response might appear as unreadable characters because of ASCII conversion. Serial Port Monitoring software can however be used to see the exact bytes. To get the IP in DHCP mode the command is

at+rsi_ipconf=1,0,0,0

It is assumed in the following sections that an IP of 192.168.50.10 has been assigned.

i. at+rsi_ltcp=5001

This command opens a listening TCP socket in the module

5. Connect Laptop (C) to the same Access Point and execute ping from it to the module to check basic connectivity.

6. Exchanging data between the PC (P) and Laptop (C)

- a. Open a TCP socket in the Laptop (C) by typing the below command in the Windows command line interface. Make sure that any firewalls, that might prevent opening of sockets, are disabled.

TCP.exe c 2001 192.168.50.10 5001

The application is found in the path
RS.CN.xx.GENR.UT.x.x.x\Software\Applications\Windows.

- b. The command line window will display three options: 1 (Send), 2 (Receive) and 3 (Exit). Type 1 to send data to the Wi-Fi module. On being prompted "Enter the string to be Transmitted", type any

string from the Keyboard ("Data sent from Remote terminal" in this example). On pressing "Enter" key on the keyboard, the data is sent from the Laptop (C) to the module and the terminal displays it with the **AT+RSI_READ** message.

- c. To send data from the Wi-Fi module, first type Option 2 in Laptop C and then type the below command in the module

at+rsi_snd=1,0,0,0,Data sent from Module

The first parameter in the command is the *socket_handle*. It is 1 in this case. It is returned as the response of the command *at+rsi_ltcp* and can be observed in Serial Port Monitor software. Refer to the Programming Reference Manual for more details. The data sent will be displayed in the Laptop C. If the application in Laptop (C) is exited, the corresponding TCP socket closes and a message AT+RSI_CLOSE is sent by the module to the Host PC⁵.

Usage of PC applications:

TCP.exe <s for server> <lport> <dipaddr> <dport>

TCP.exe <c for client> <lport> <dipaddr> <dport>

s – to open a server TCP socket

c – to open a client TCP socket

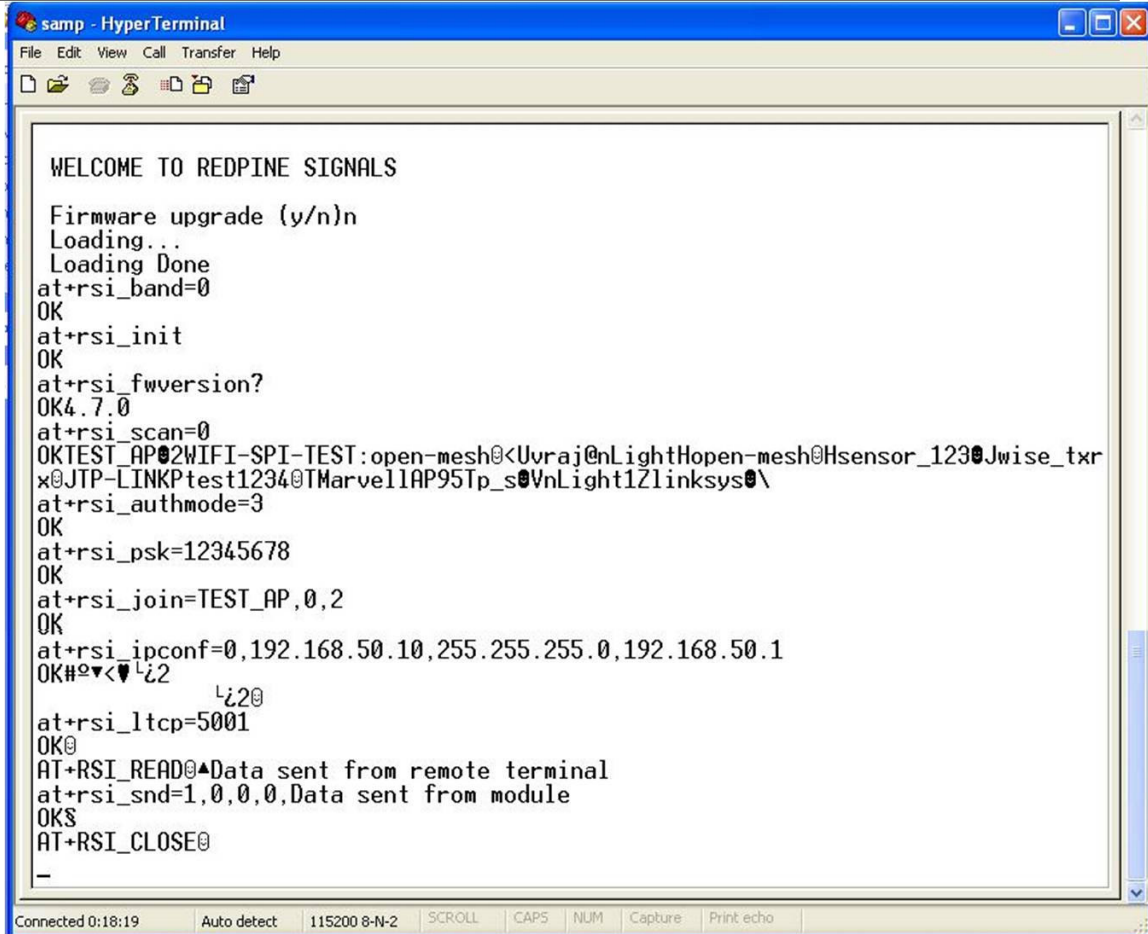
lport – Local port number

dipaddr – IP address of the destination

dport – Port number of the destination

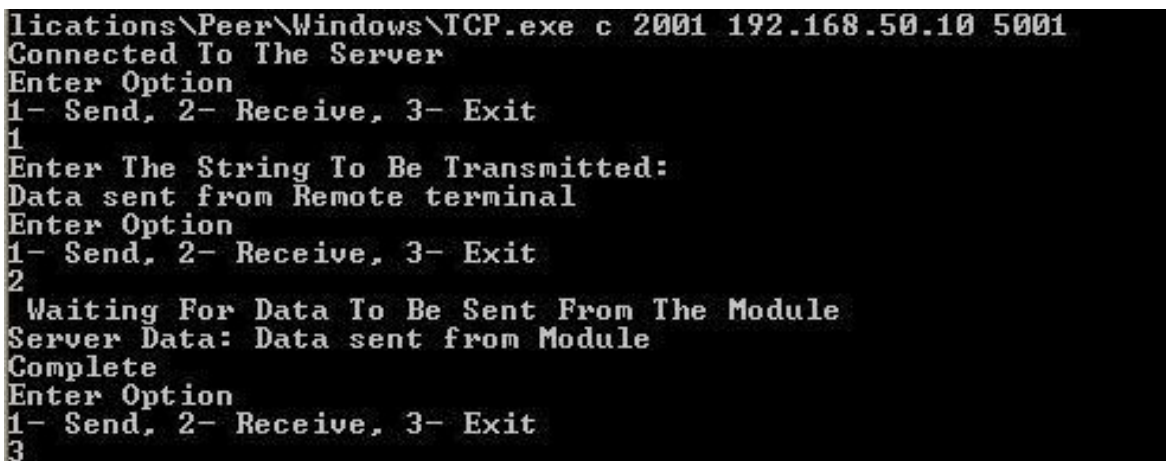
UDP.exe is also used in the same way.

⁵ Refer to the Software Programming Reference Manual for details on the commands and module behavior.



```
samp - HyperTerminal
File Edit View Call Transfer Help
WELCOME TO REDPINE SIGNALS
Firmware upgrade (y/n)n
Loading...
Loading Done
at+rsi_band=0
OK
at+rsi_init
OK
at+rsi_fwversion?
OK4.7.0
at+rsi_scan=0
OKTEST_AP@WIFI-SPI-TEST:open-mesh@Uvraj@nLightHopen-mesh@Hsensor_123@Jwise_trx@JTP-LINKPtest1234@TMarvellAP95Tp_s@VnLight1Zlinksys@
at+rsi_authmode=3
OK
at+rsi_psk=12345678
OK
at+rsi_join=TEST_AP,0,2
OK
at+rsi_ipconf=0,192.168.50.10,255.255.255.0,192.168.50.1
OK#<Lz2
Lz2@
at+rsi_ltcp=5001
OK@
AT+RSI_READ@Data sent from remote terminal
at+rsi_snd=1,0,0,0,Data sent from module
OK$
AT+RSI_CLOSE@
-
Connected 0:18:19 Auto detect 115200 8-N-2 SCROLL CAPS NUM Capture Print echo
```

Figure 2: Hyperterminal Messages



```
lications\Peer\Windows\TCP.exe c 2001 192.168.50.10 5001
Connected To The Server
Enter Option
1- Send, 2- Receive, 3- Exit
1
Enter The String To Be Transmitted:
Data sent from Remote terminal
Enter Option
1- Send, 2- Receive, 3- Exit
2
Waiting For Data To Be Sent From The Module
Server Data: Data sent from Module
Complete
Enter Option
1- Send, 2- Receive, 3- Exit
3
```

Figure 3: Messages in Laptop (C)

Note: The above sequence of command can be executed by a Python script as well. A sample Python script is provided at RS.CN.xx.GENR.UT.x.x.x\Software\Applications\Python\ . The script configures the module to associate to an Access Point with SSID "TEST_AP" and acquire an IP as a DHCP client. The user can build upon this script.

1. Power on the module. Wait for about 20 secs for the ABRD (auto baud-rate detection) process to be over.
2. Run the Python script in a Windows PC connected to the EVB through UART.

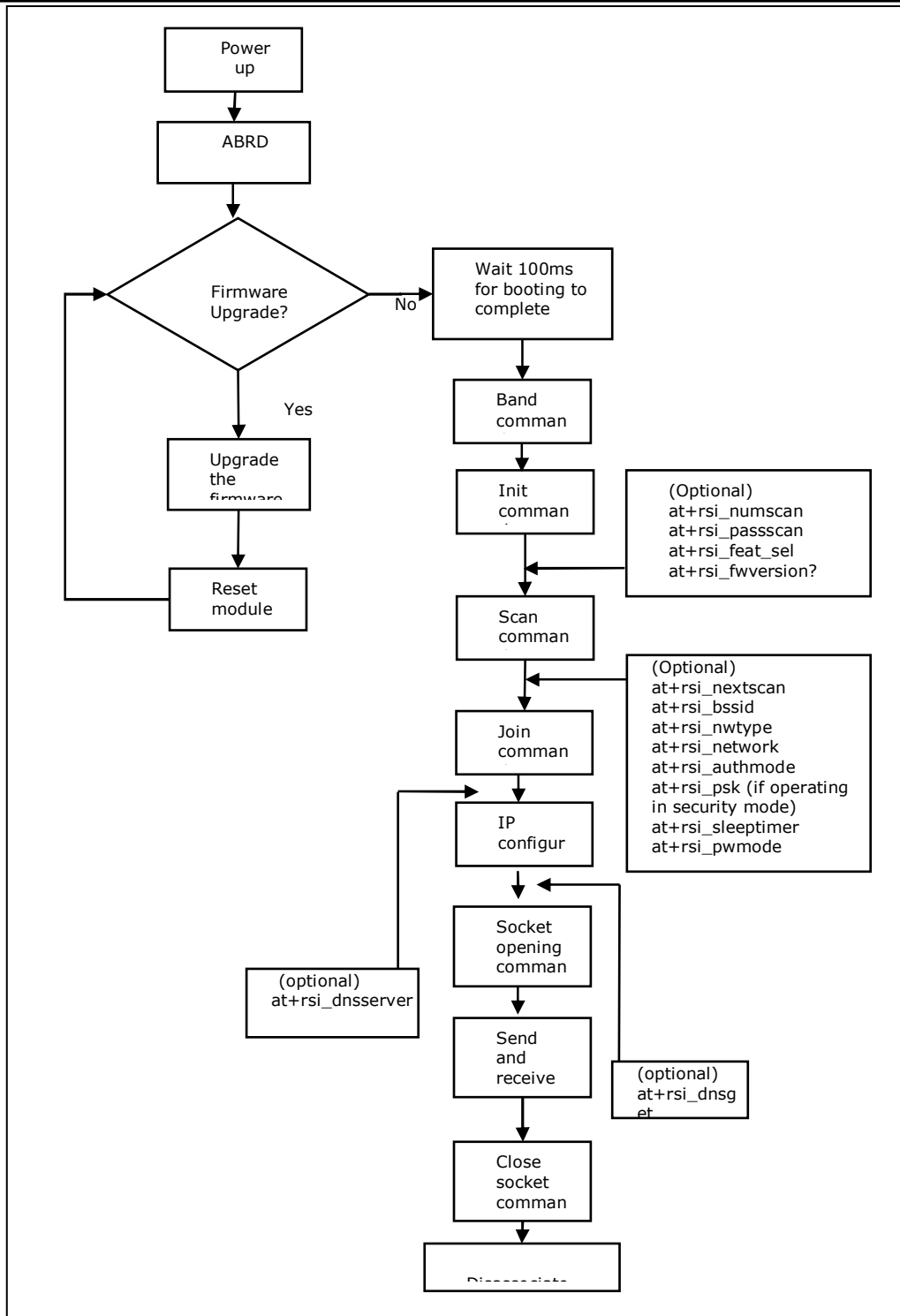


Figure 4: General Sequence of Commands

3.4 Evaluating the Modules in Ad-hoc mode

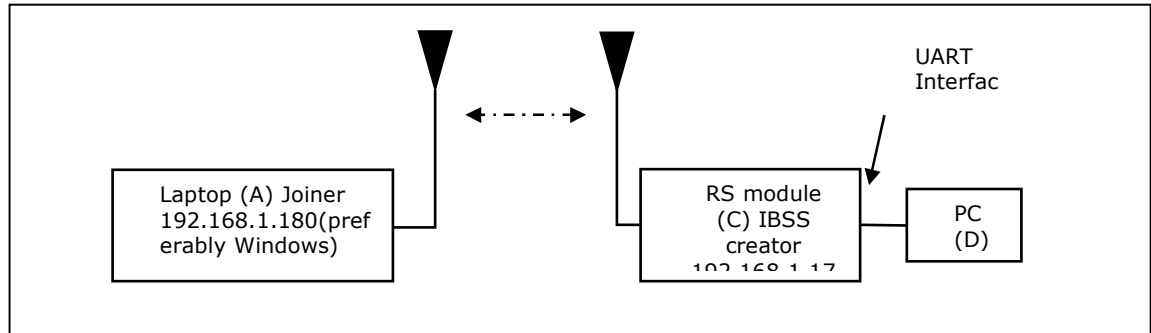


Figure 5: Evaluation Set-up – Ad-hoc Mode

1. Configure the EVB in UART mode and connect a UART cable between the PC and the EVB. Switch SW4 and SW5 should be set to select the DB9 connector. Supply power to the RS9110-N-11-24 EVB and switch on the power.
2. After powering on the module, the message "Firmware upgrade (y/n)" comes in the screen. Press 'n' and "Enter" key immediately.
3. Once "Loading Done" message comes, the following commands should be issued in PC (D).
 - a. **at+rsi_band=0**
This configures the operating band of the module.
 - b. **at+rsi_init**
This initializes the module.
 - c. **at+rsi_network=IBSS_SEC,1,6**
This is to create an Ad-hoc network in channel 6 with WEP security.
 - d. **at+rsi_psk=ABCDE12345**
This configures the PSK of the network.
 - e. **at+rsi_join=RSI_IBSS,0,2**
This creates an open IBSS network with SSID "RSI_IBSS" that other Wi-Fi devices can scan.
 - f. **at+rsi_ipconf=0,192.168.1.10,255.255.255.0,192.168.1.1**
This configures the IP address of the module.
4. Connect Laptop (A) to the Ad-hoc network and assign the static IP in same subnet e.g. 192.168.1.11. Execute ping from it to the module's IP address to check basic connectivity.

5. Exchanging data between the Wi-Fi module and Laptop (A)

- a. Open a server TCP socket in the module

a+rsi_ltcp=5001

- b. Open a TCP socket in the Laptop (A) by typing the below command in the Windows command line interface. Make sure that any firewalls, that might prevent opening of sockets, are disabled.

TCP.exe c 2001 192.168.50.10 5001

The application is found in the path
RS.CN.xx.GENR.UT.x.x.x\Software\Applications\Windows\.

- c. The command line window will display three options: 1 (Send), 2 (Receive) and 3 (Exit). Type 1 to send data to the Wi-Fi module. On being prompted "Enter the string to be Transmitted", type any string from the Keyboard. On pressing "Enter" key, the data is sent from the Laptop (A) to the module and the terminal displays it with the **AT+RSI_READ** message.
- d. To send data from the Wi-Fi module, first type Option 2 in Laptop (A) and then type the below command in the module

at+rsi_snd=1,0,0,0,Data sent from Module

The first parameter in the command is the *socket_handle*. It is 1 in this case. It is returned as the response of the command *at+rsi_ltcp* and can be observed in Serial Port Monitor software. The data sent will be displayed in the Laptop (A).

NOTE: All bytes sent by the module to the Host PC may not be readable because HyperTerminal converts some bytes into unreadable ASCII characters. There are several applications similar to HyperTerminal and available online that can be used to issue AT commands and also view the actual bytes returned by the module to the Host. Such applications may be used instead of HyperTerminal to operate the module using a PC.

3.5 Upgrading Firmware

There are two options for firmware upgrade:

- Firmware upgrade without wireless firmware upgrade feature
- Firmware upgrade with wireless firmware upgrade feature.⁶

The detailed procedure for firmware upgrade is mentioned in the below sections.

3.5.1 Firmware Upgrade Using UART Interface without wireless firmware upgrade feature

When the module is powered up, the following sequence is executed

⁶ Wireless firmware upgrade feature is not supported in RS9110-N-11-24 only

1. Auto Baud Rate Detection

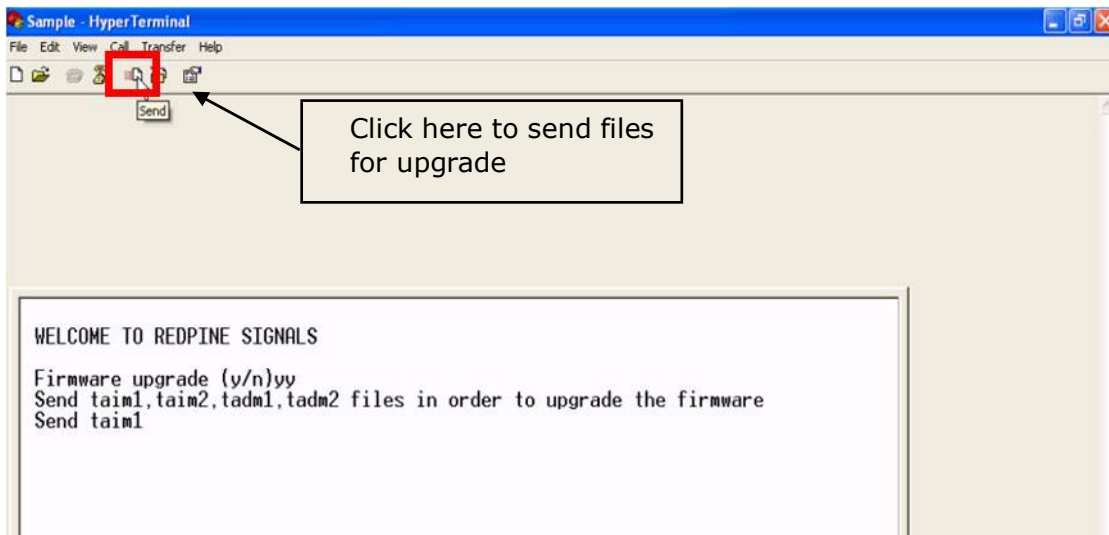
2. The module sends the message:

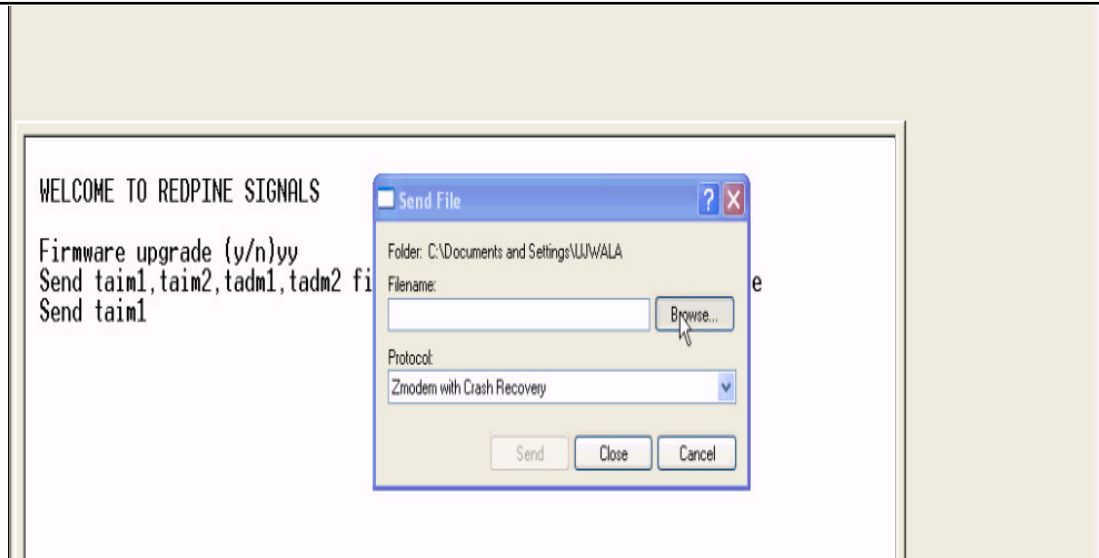
```
<space>WELCOME TO REDPINE SIGNALS\r\n<space>\r\n<space>  
Byte sequence 0x20 0x57 0x45 0x4C 0x43 0x4F 0x4D 0x45 0x20 0x54 0x4F  
0x20 0x52 0x45 0x44 0x50 0x49 0x4E 0x45 0x20 0x53 0x49 0x47 0x4E 0x41  
0x4C 0x53 0x0D 0x0A 0x20 0x0D 0x0A 0x20
```

3. The module sends the message:

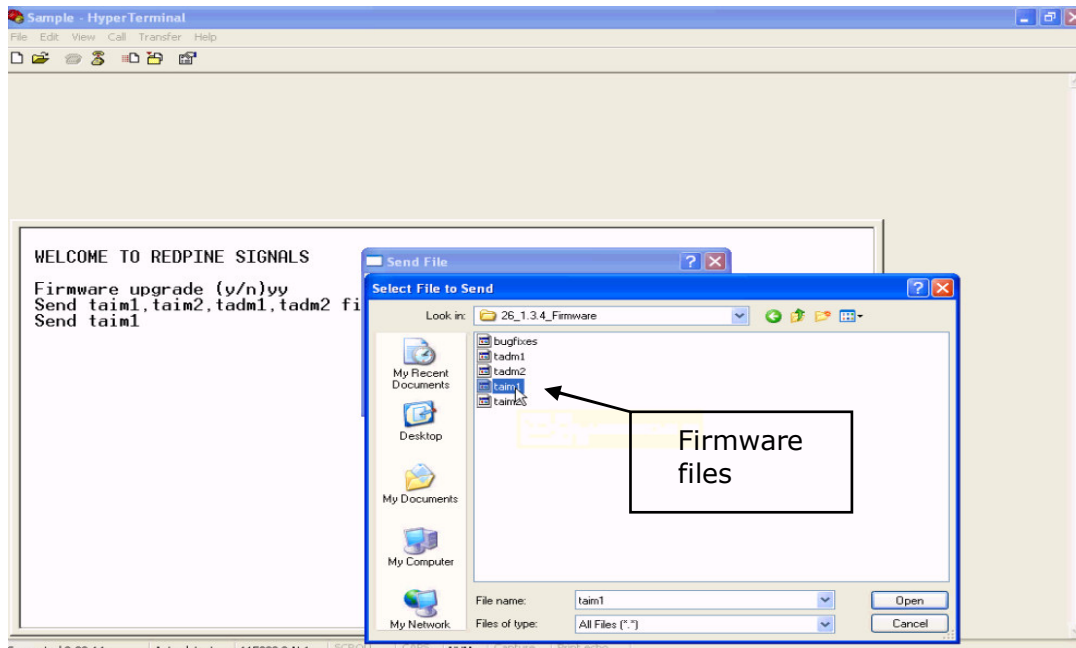
```
<space>Firmware upgrade (y/n)  
Byte sequence 0x20 0x46 0x69 0x72 0x6D 0x77 0x61 0x72 0x65 0x20 0x75  
0x70 0x67 0x72 0x61 0x64 0x65 0x20 0x28 0x79 0x2F 0x6E 0x29
```

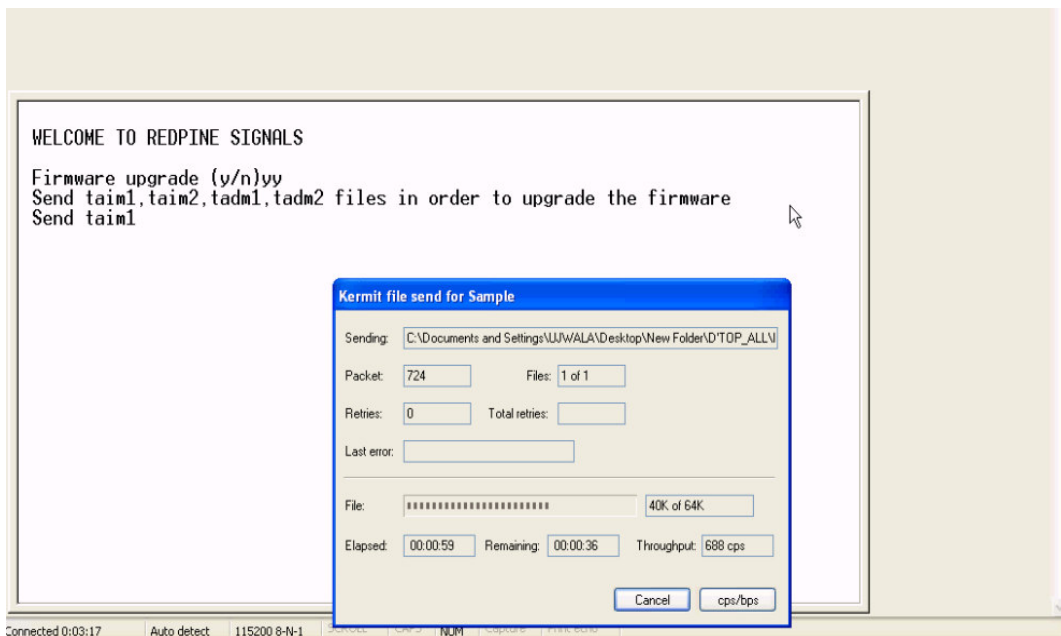
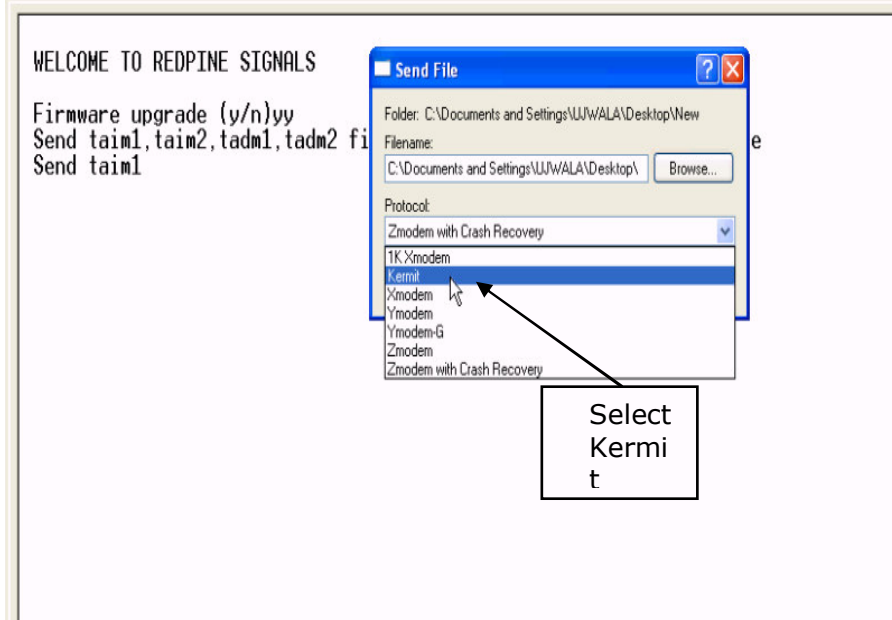
4. If the user wishes to upgrade firmware, 'y' (0x79) is sent to the module.



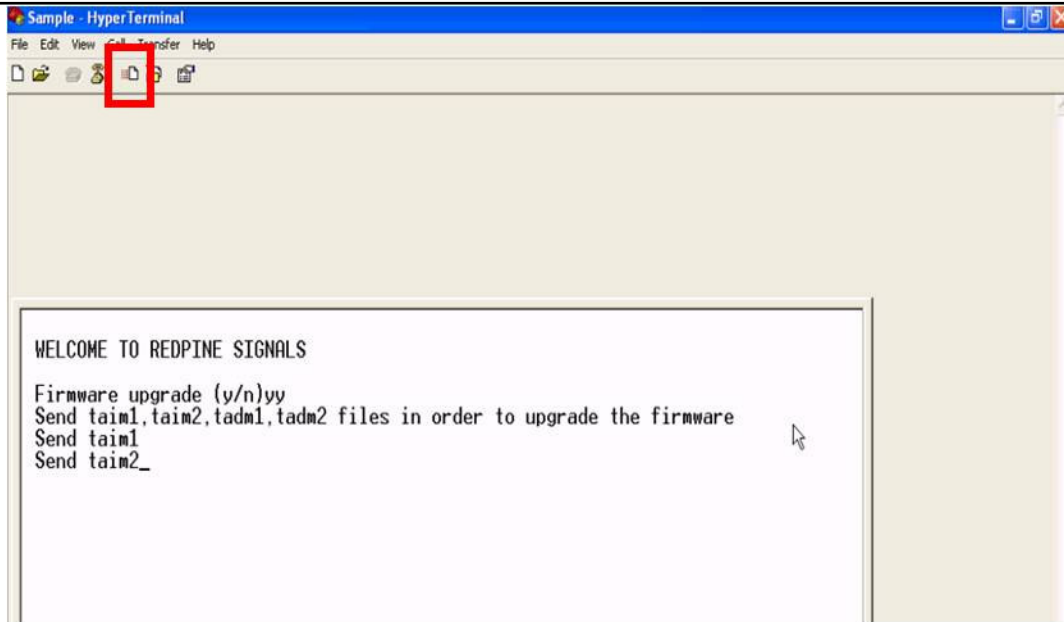


Select the firmware files from RS.CN.xx.GENR.UT.x.x.x\Software\Firmware\

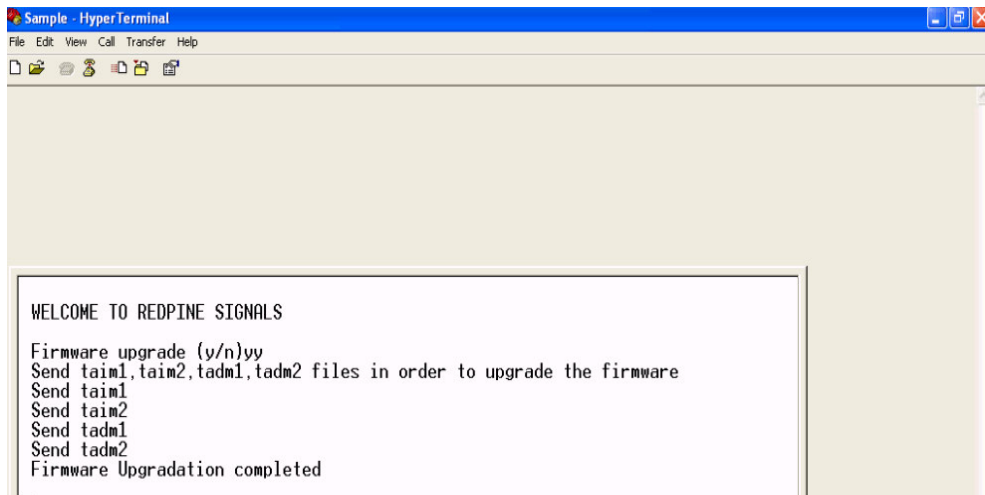




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Follow the same sequence to load all the files from RS.CN.xx.GENR.UT.4.7.x\Software\Firmware\ta*.



After all the files are loaded, the message "Firmware Upgradation completed" is sent by the module.

<space>Firmware Upgradation completed\r\n
Byte sequence 0x20 0x46 0x69 0x72 0x6D 0x77 0x61 0x72 0x65 0x20 0x55
0x70 0x67 0x72 0x61 0x64 0x61 0x74 0x69 0x6F 0x6E 0x20 0x63 0x6F 0x6D
0x70 0x6C 0x65 0x74 0x65 0x64 0x0D 0x0A

NOTE: Firmware upgrade need not be done every time the module is powered up. It is only done when a new firmware is released for the product.

5. The user can now power cycle or hard reset the module and not opt for firmware upgrade when "Firmware upgrade (y/n)" comes in the screen, by sending '\n\n' (0x6E 0x0A) to the module immediately after the message comes. In such a case, the following messages are sent from the module

```
<space>Loading...<space>\r\n  
Byte sequence 0x20 0x4C 0x6F 0x61 0x64 0x69 0x6E 0x67 0x2E 0x2E 0x2E  
0x20 0x0D 0x0A
```

```
<space>Loading Done\r\n  
Byte sequence 0x20 0x4C 0x6F 0x61 0x64 0x69 0x6E 0x67 0x20 0x44 0x6F  
0x6E 0x65 0x0D 0x0A
```

6. After this message, AT commands can be given as described

3.5.2 Firmware Upgrade Using UART Interface with wireless firmware upgrade feature^{7,8}

1. Open Hyperterminal and power up the module. The module sends the message - "Firmware upgrade (y/n)". Send 'y' to the module.
2. Send the files taim1, taim2, tadm1 and tadm2 from the location *RS.CN.xx.GENR.UT.4.7.x\Software\Wireless_Upgrade\Firstlevel_bootloader* using the Kermit protocol. Follow the same process as described in section [Firmware Upgrade from a Lower Version to 4.7.x Using UART Interface without wireless firmware upgrade feature](#) to load the file from the location *RS.CN.xx.GENR.UT.4.7.x\Software\Wireless_Upgrade\Firstlevel_bootloader*
3. Power cycle or hard reset the module. The module sends the message - "Firmware upgrade (y/n)". Send '\n\n' to the module immediately. The module displays the messages "Loading..." and then "1st level boot-loader upgradation completed"
Hex stream:

⁷ The first firmware version available for RS9110-N-11-24-04 is 4.7.1

⁸ Wireless Firmware Upgrade Feature is available from firmware version 4.7.X onwards only.

20 31 73 74 20 4C 65 76 65 6C 20 42 6F 6F 74 4C 6F 61 64 65 72 20
55 70 67 72 61 64 61 74 69 6F 6E 20 43 6F 6D 70 6C 65 74 65 64
0D 0A

4. Power cycle or hard reset the module. The module sends the message – “Firmware upgrade (y/n)”. Send ‘y’ to the module.
5. On being prompted by the module, send taim1, taim2, tadm1 and tadm2 from RS.CN.xx.GENR.UT.4.7.x\Software\Firmware\ta** to the module. The module sends the message “Firmware Upgradation completed”
6. Again power cycle or hard reset the module. The module sends the message – “Firmware upgrade (y/n)”. Send ‘u’ to the module⁹. The module prompts to send files sbim1, sbim2 and sbdm. Send these files from RS.CN.xx.GENR.UT.4.7.x\Software\Wireless_Upgrade\Secondlevel_bootloader\ in the same order, using the Kermit protocol. For each file being transferred, wait for a display on the HyperTerminal, which says “Send <nextfile>”. Note that after a file is transmitted, there is some delay in writing the data to the non-volatile memory. This might take a few seconds and the user has to wait for the prompt on the HyperTerminal to send the next file.

7. After all the files are transferred, the message is sent by the module:
“2nd Level Bootloader Upgradation completed”

Hex stream:

20 32 6E 64 20 4C 65 76 65 6C 20 42 6F 6F 74 4C 6F 61 64 65 72
20 55 70 67 72 61 64 61 74 69 6F 6E 20 63 6F 6D 70 6C 65 74 65
64 20 0D 0A

8. Power cycle or hard reset the module. The module sends the message – “Firmware upgrade (y/n)”. Send ‘s’ to the module¹⁰.
9. The module sends the message :

“Select one of the following option :

- 1.Configuration firmware upgrade:
- 2.Load configuration firmware :”

10. Enter ‘1’ immediately. Send files cfim1, cfim2 and cfdm1 from RS.CN.xx.GENR.UT.x.x.x\Software\Wireless_Upgrade\Config_firmware in the same order.

11. After the process is over, the module sends the message
“Configuration firmware upgrade completed”.

Hex stream:

⁹ Note that in the message “Firmware upgrade...”, ‘u’ is not displayed as an option.

¹⁰ Note that in the message “Firmware upgrade..”, ‘s’ is not displayed as an option

20 63 6F 6E 66 69 67 75 72 61 74 69 6F 6E 20 66 69 72 6D 77 61 72
65 20 75 70 67 72 61 64 65 20 63 6F 6D 70 6C 65 74 65 64 20 0D
0A

This completes the upgrade process.

3.5.3 Firmware Upgrade from 4.7.x to a higher version Wirelessly

The module RS9110-N-11-24-04 can be upgraded wirelessly. Also, these modules can be configured wirelessly to join specific access points. The features of wireless configuration and wireless firmware upgrade are available from firmware version 4.7.0 onwards.

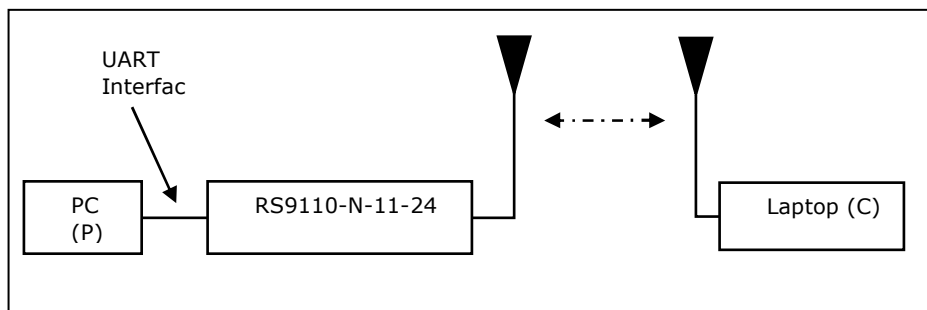


Figure 6: Wireless Firmware Upgrade Set-up

1. Power up the module. The module sends the message – "Firmware upgrade (y/n)". Send 's' to the module¹¹. The module sends two options
 - 1.Configuration Firmware upgrade
 - 2.Load Configuration FirmwarePress 2. The module now becomes an Access Point with open mode and SSID as REDPINE_<last 3 bytes of MAC ID of the module>
2. Connect Laptop (C) to the Access Point created by the module. The Laptop will acquire an IP address from the AP.
3. Open the application
RS.CN.xx.GENR.UT.x.x.x\Software\Wireless_Upgrade\
DeviceConfigGUI.jar in Laptop (C).

¹¹ Note that in the message "Firmware Upgrade...", 's' is not displayed as an option

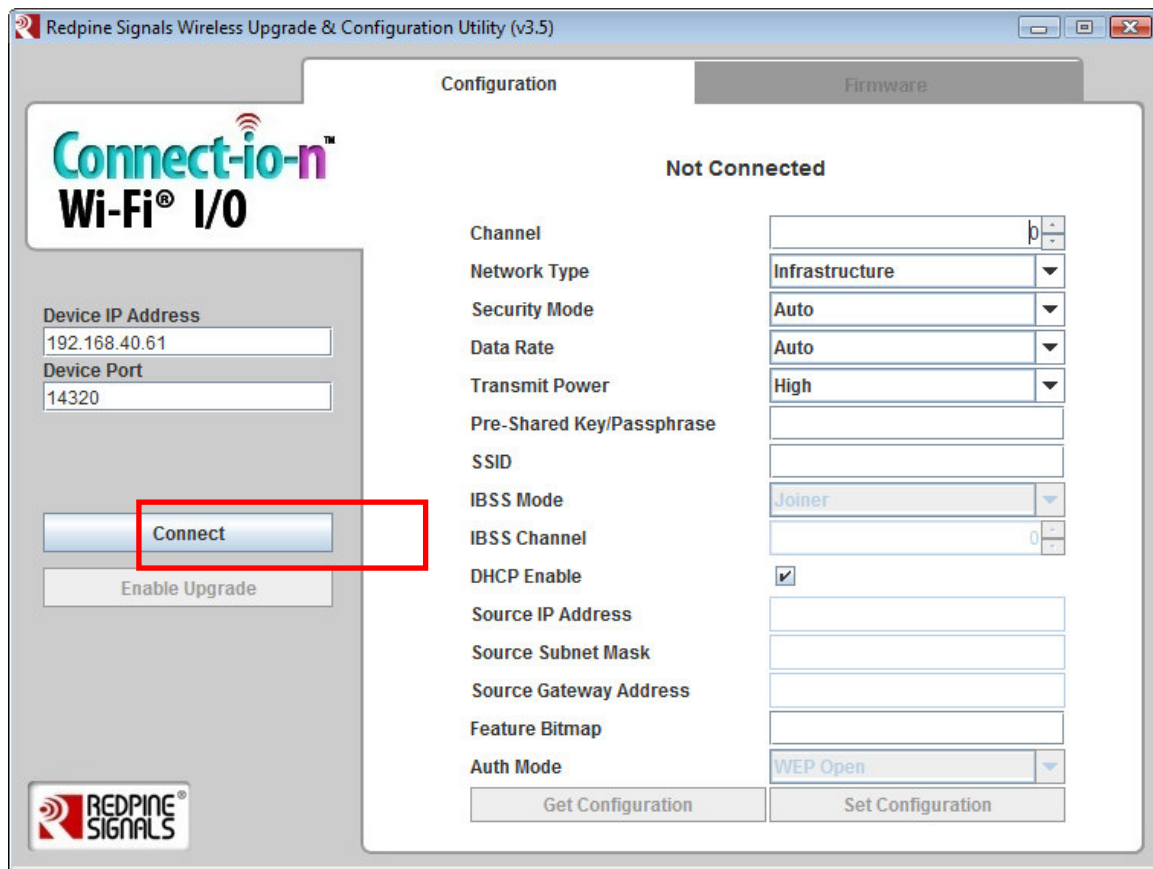
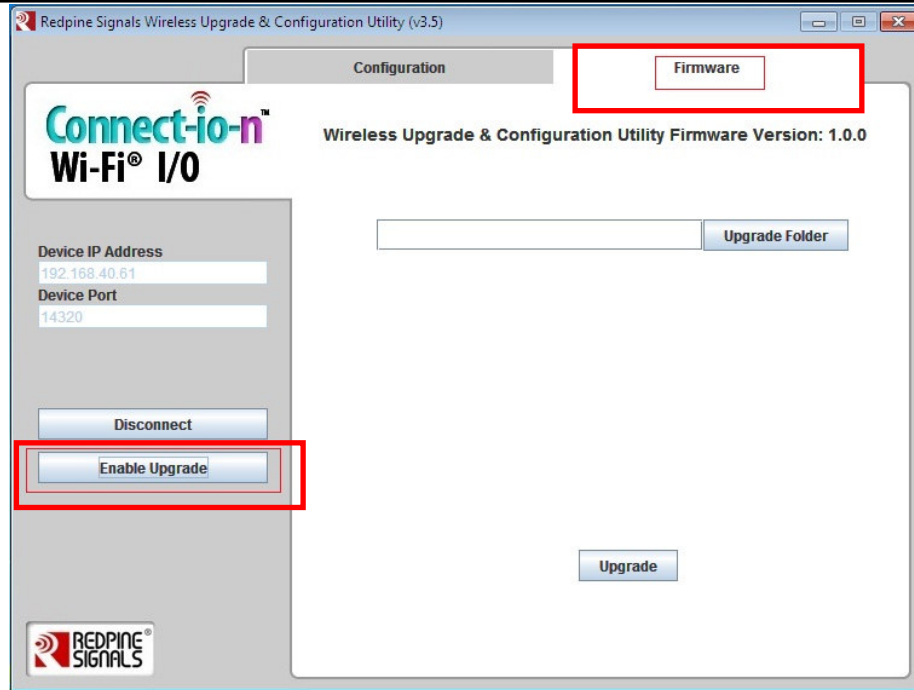


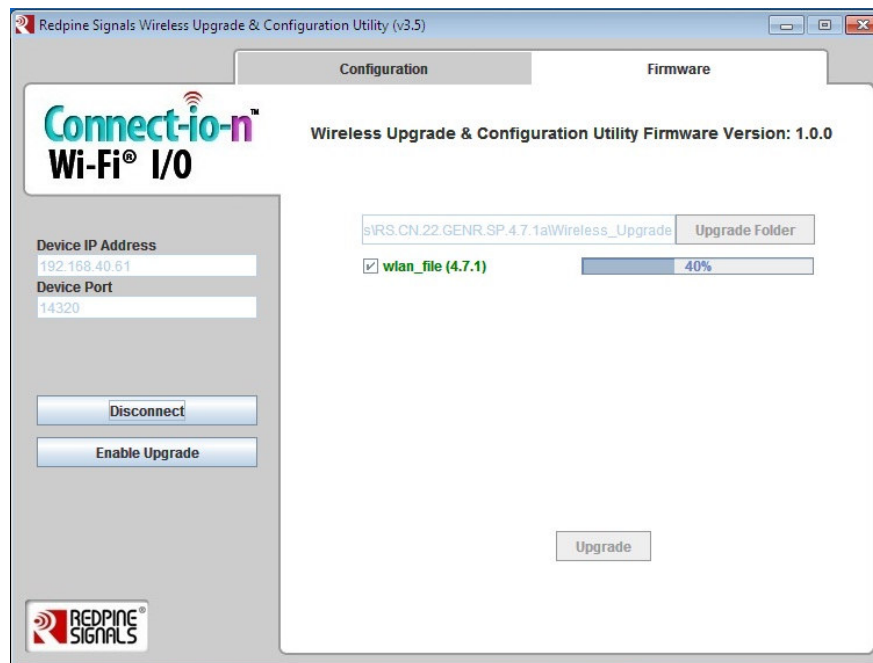
Figure 7: Configuration GUI

4. By default, the "Device IP Address" is 192.168.40.61 and "Device Port" is 14320. Keep them unchanged and click "Connect". This makes the laptop establish a TCP socket connection with the AP. The AP has an IP hardcoded into itself – 192.168.40.61. Ignore the values on the right side of the GUI.
5. Click "Enable Upgrade" button and then click on the "Firmware" tab.



6. Click on "Upgrade Folder" and select the FOLDER RS.CN.xx.GENR.UT.x.x.x\Software\Wireless_Upgrade\Functional_firmware\. Then click on the check box for the file wlan_file that appears on the GUI. Click on "Upgrade" button.

NOTE: The file RS.CN.xx.GENR.UT.x.x.x\Software\Wireless_Upgrade\Functional_firmware\wlan_file.rps has the same contents as the files RS.CN.xx.GENR.UT.x.x.x\Software\Firmware\ta**, but is formatted appropriately for wireless upgrade



7. The upgrade process starts. After successful upgrade, a message "Upgrade Complete" is shown in the GUI. At the same time, the message "AT+FWUPGRADE_DONE" is sent to the Host PC (P) from the module through the UART interface. It can be seen on Hyperterminal.
8. The module is now upgraded with the latest firmware. It can be now power cycled or hard reset and used in functional mode by providing "n\n" as an answer to the module's message "Firmware Upgrade (y/n)".

3.6 Using the Wireless Configuration Feature¹²

Using this feature, the module can be configured to

1. Join a specific Access Point
2. Join a specific ad-hoc network

3.6.1.1 Wireless Configuration in AP Mode

This section describes wireless configuration by putting the module initially into Access Point mode. The next section describes wireless configuration when the module is already connected to an AP.

¹² Wireless configuration feature is not supported in RS9110-N-11-24 only

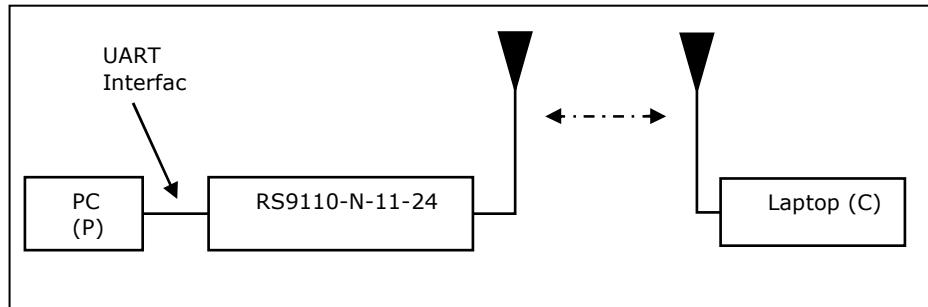


Figure 8: Wireless Configuration Set-up

1. Power up the module. The module sends the message – “Firmware upgrade (y/n)”. Send ‘s’ to the module. The module sends two options:
 - 1.Configuration Firmware upgrade
 - 2.Load Configuration Firmware
2. Press ‘2’. The module now becomes an Access Point with open mode and SSID REDPINE_<last 3 bytes of MAC ID of the module>.
3. Connect a Laptop (C) to the AP created by the module. The Laptop should be configured as a DHCP client. The Laptop will acquire the IP address from the AP.
4. Open the application
RS.CN.xx.GENR.UT.x.x.x\Software\Wireless_Upgrade\
DeviceConfigGUI.jar in Laptop (C) and click on the connect button. Leave the “Device IP Address” and “Device Port” unchanged to 192.168.40.61 and 14320 respectively. After clicking on “Connect” Button, click on the “Configuration” tab on top.

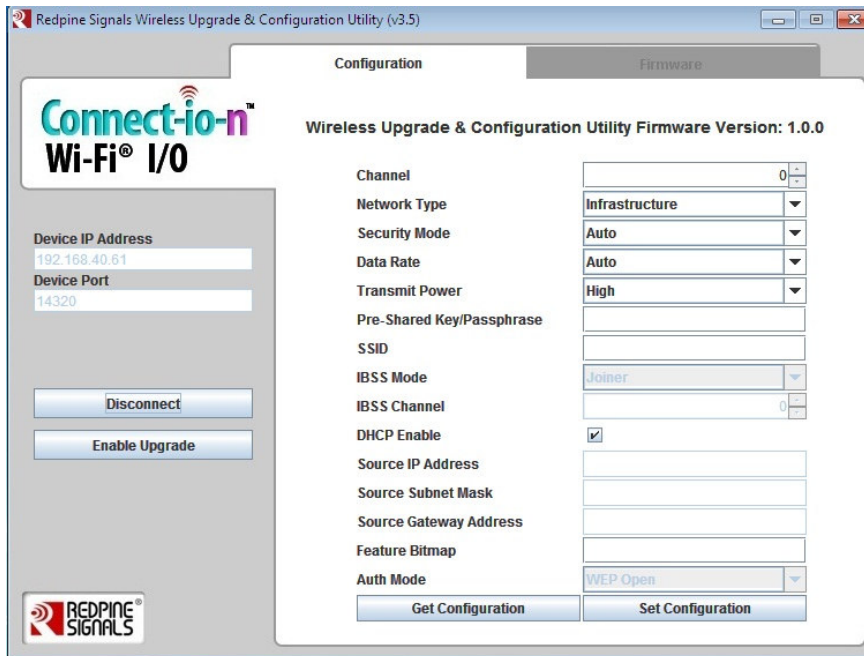


Figure 9: Configuration GUI

5. Click on the "Get Configuration" button. It displays the currently stored configuration parameters. These parameters can be ignored for now.
6. Fill the values of the parameters
 - a. Channel number of the AP or Adhoc network that the module should connect to. Refer tables below:

For 2.4 GHz

Channel Number	chan_num parameter
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

For 5 GHz

Channel Number	chan_num parameter
36	1
40	2
44	3
48	4
149	20
153	21
157	22
161	23
165	24

- b. Network Type.
- c. Security Mode- Security mode of the Access Point or Adhoc network. This field has five options.
 - Open: Joins to an open network.
 - WPA: Joins to a WPA secured network.
 - WPA2: Joins to a WPA2 secured network.
 - WEP: Joins to a WEP secured network¹⁴.
 - Auto: Joins to a network irrespective of Security type, provided the PreShared Key is correct¹⁵.
- d. Data Rate- Physical data rate to be used.

Data Rate (Mbps)	Value of Data Rate
Auto-rate	0
1	1
2	2
5.5	3

¹⁴ If the AP is in WEP shared, fill Auth mode field with "WEP Shared" else if the AP is in WEP open, leave the Auth mode field with "WEP Open".

¹⁵ This will be useful in the scenario where the user doesn't know in which Security mode the AP is, but knows the Pre-shared key/WEP keys. This option can be used when AP is Open/WEP Open/WPA/WPA2 security modes. This option cannot be used when AP is in WEP shared Security mode.

Data Rate (Mbps)	Value of Data Rate
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

- e. Transmit Power.
- f. Pre shared key- This can be left unfilled if the security mode is "Open".
- g. SSID- This is the SSID of the Access Point or Ad-hoc network to which the module should join.
- h. IBSS mode (Ad-hoc)- Set it to "Joiner" if Network Type is IBSS/IBSS Security¹⁶
- i. IBSS Channel- This field can be ignored.
- j. DHCP Enable/Disable- Used in infrastructure mode. For DHCP enable it and disable it to assign Manual IP. In IBSS/IBSS Security mode, this field would not be visible.
- k. Source IP Address, Source Subnet Mask, Source Gateway Address: If DHCP is disabled, an IP address, subnet mask and gateway address should be entered for "Source IP Address",

¹⁶ IBSS Creator is not supported

"Source Subnet Mask" and "Source Gateway" respectively.
The module will get configured with these parameters.

- I. Feature Bitmap- Set this field to '0'.
 - m. Auth mode- If "WEP" is selected in "Security Mode", then the options of "WEP Open" or "WEP Shared" should be used here.
7. Click on the button "Set Configuration". The configuration information is stored in non-volatile memory of the module and can be accessed by the Host at any time using the *at+rsi_cfgget* command.
 8. The GUI will send the message "Configure Success". The module sends the message "AT+REMOTE_CFG" to the Host¹⁷ PC (P). Once the message is received, the module can be power cycled or hard reset. The module sends the message - "Firmware upgrade (y/n)". Send "n/n" to the module. Now issue the command *at+rsi_band* to configure the correct band of operation. After this command is issued, the module will automatically join to the configured AP or Ad-hoc network depending on the parameters entered in the above steps.

3.6.1.2 Wireless Configuration When the Module is Connected to an AP

The next section describes wireless configuration when the module is already connected to an AP.

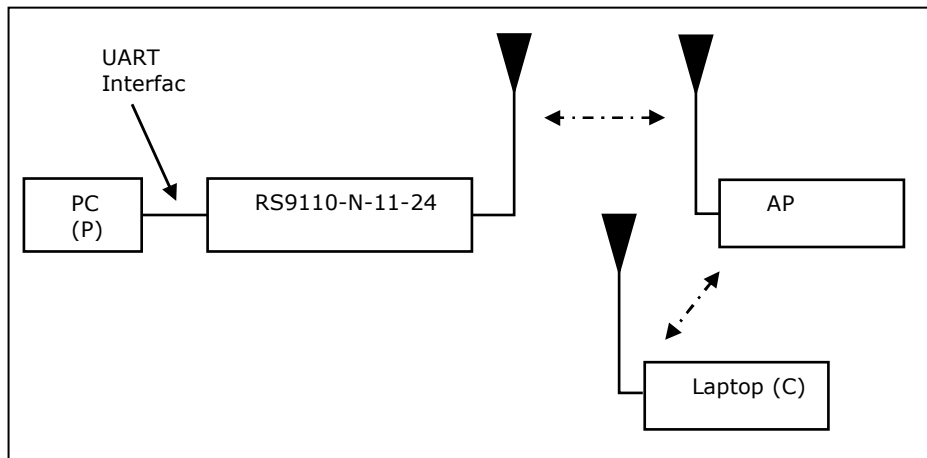


Figure 10: Wireless Configuration Set-up

1. Assuming the module is already connected to an AP through the normal functional flow, connect a Laptop to the same AP.
2. Open the application
RS.CN.xx.GENR.UT.x.x.x\Software\Wireless_Upgrade\
DeviceConfigGUI.jar in Laptop (C) and click on the connect button.

¹⁷ The message is sent in uppercase alphabets

Enter the IP address of the module in the field "Device IP Address". Keep the "Device Port" unchanged to 14320. After clicking on "Connect" Button, click on the "Configuration" tab on top.

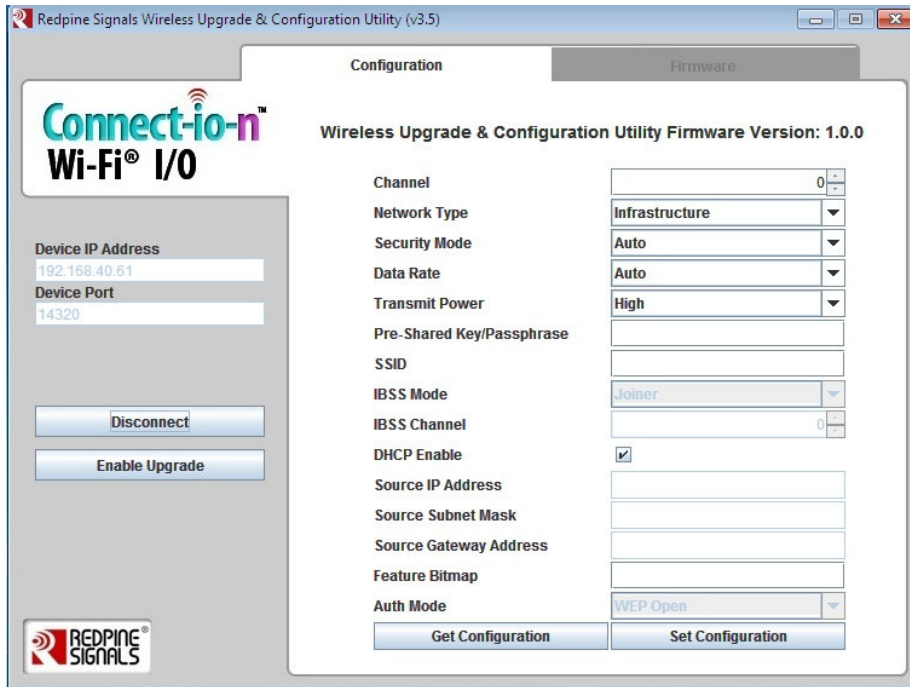


Figure 11: Configuration GUI

3. Click on the "Get Configuration" button. It displays the currently stored configuration parameters. These parameters can be ignored for now.
4. Fill the values of the parameters
 - a. Channel number of the AP or Adhoc network that the module should connect to. Refer tables below:

For 2.4 GHz

Channel Number	chan_num parameter
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

For 5 GHz

Channel Number	chan_num parameter
36	1
40	2
44	3
48	4
149	20
153	21
157	22
161	23
165	24

- b. Network Type.
- c. Security Mode- Security mode of the Access Point or Adhoc network. This field has five options.
 - Open: Joins to an open network.
 - WPA: Joins to a WPA secured network.
 - WPA2: Joins to a WPA2 secured network.
 - WEP: Joins to a WEP secured network¹⁸.
 - Auto: Joins to a network irrespective of Security type, provided the PreShared Key is correct¹⁹.
- d. Data Rate- Physical data rate to be used.

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

¹⁸ If the AP is in WEP shared, fill Auth mode field with "WEP Shared" else if the AP is in WEP open, leave the Auth mode field with "WEP Open".

¹⁹ This will be useful in the scenario where the user doesn't know in which Security mode the AP is, but knows the Pre-shared key/WEP keys. This option can be used when AP is Open/WEP Open/WPA/WPA2 security modes. This option cannot be used when AP is in WEP shared Security mode.

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

- e. Transmit Power.
- f. Pre shared key- This can be left unfilled if the security mode is "Open".
- g. SSID- This is the SSID of the Access Point or Ad-hoc network to which the module should join.
- h. IBSS mode (Ad-hoc)- Set it to "Joiner" if Network Type is IBSS/IBSS Security²⁰
- i. IBSS Channel- This field can be ignored.
- j. DHCP Enable/Disable- Used in infrastructure mode. For DHCP enable it and disable it to assign Manual IP. In IBSS/IBSS Security mode, this field would not be visible.

²⁰ IBSS Creator is not supported

-
- k. Source IP Address, Source Subnet Mask, Source Gateway Address: If DHCP is disabled, an IP address, subnet mask and gateway address should be entered for "Source IP Address", "Source Subnet Mask" and "Source Gateway" respectively. The module will get configured with these parameters.
 - l. Feature Bitmap- Set this field to '0'.
 - m. Auth mode- If "WEP" is selected in "Security Mode", then the options of "WEP Open" or "WEP Shared" should be used here.
5. Click on the button "Set Configuration". The configuration information is stored in non-volatile memory of the module and can be accessed by the Host at any time using the *at+rsi_cfgget* command.
 6. The GUI will send the message "Configure Success". The module sends the message "AT+REMOTE_CFG" to the Host²¹ PC (P). Once the message is received, the module can be power cycled or hard reset. The module sends the message - "Firmware upgrade (y/n)". Send "n/n" to the module. Now issue the command *at+rsi_band* to configure the correct band of operation. After this command is issued, the module will automatically join to the configured AP or Ad-hoc network depending on the parameters entered in the above steps.

NOTE: When the module is configured using wireless interface, the "Auto-join" feature is enabled. This makes the module join to the configured AP on the next power cycle or hard reset. If at any point of time, the user wants to disable the "Auto-join" feature, the command (*at+rsi_cfgneable=0*) should be used.

3.7 General Operation of the Modules

²¹ The message is sent in uppercase alphabets

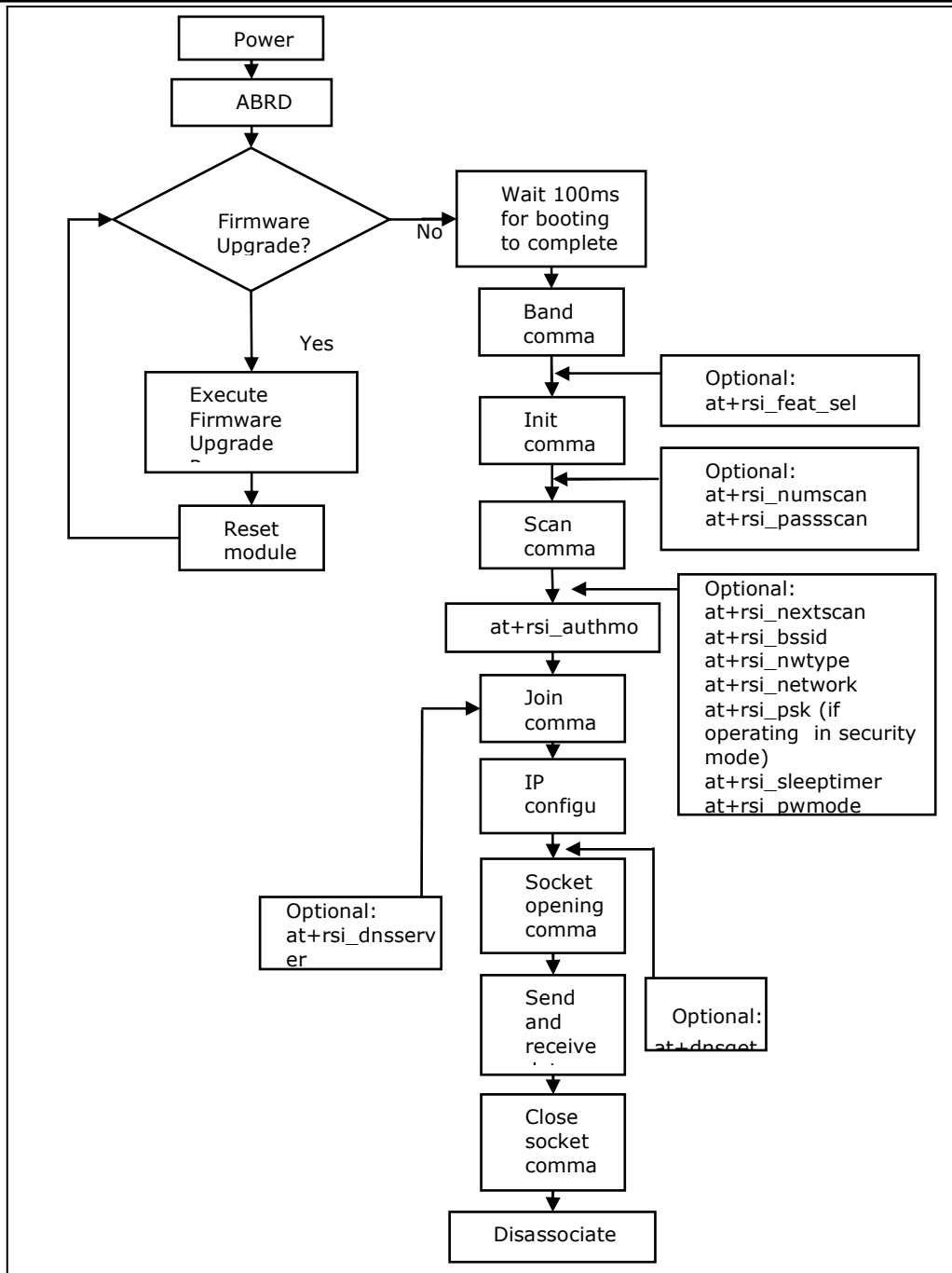


Figure 12: Firmware Upgrade and General Operation in UART modules²²

²² An AT command should be given only after receiving a response from the Host to the preceding command.

4 Using the Evaluation Board in SPI mode

To use the EVB in the SPI mode, an MCU Host platform must be interfaced with the module using the SPI interface. The firmware package for the Wi-Fi module comes with a reference driver in source code form. The reference driver can be ported to the Host MCU platform to interact and operate the Wi-Fi module. The Programming Reference Manual (PRM) is the most important document to help users to operate the module in SPI mode. For comprehensive details on all the SPI commands that can be used to configure, operate and upgrade the module, please refer to the Programming Reference Manual. The set-ups used in the previous sections in UART mode can be used in SPI mode as well.

Note: 1. There are two ways of powering the EVB: either use the USB inlet (USB adapter provided with the EVB) OR the pin #4 of the header.

2. Pin # 1 (SDIO_DATA3) should be left open.
3. Pin # 2 (SPI_CS) SPI chip Select
4. Pin # 3 VSS
5. Pin # 4 VDD
6. Pin # 5 (SPI_CLK) SPI Clock
7. Pin # 6 VSS
8. Pin # 7 SPI_DATAIN = MOSI
9. Pin # 8 SPI_DATAOUT = MISO
10. Pin # 9 The interrupt signal SPI_INTR is an active high signal.
11. Pin # 10 Not used.

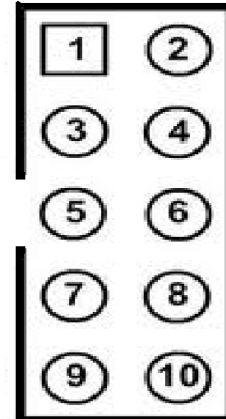


Figure 16:
Header J7
SPI TOP View

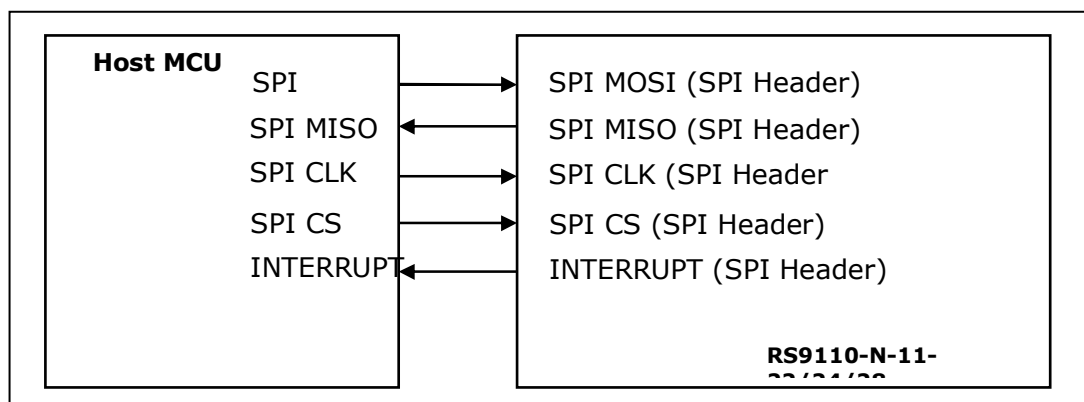


Figure 13: Connections in SPI mode

Signal Integrity Guidelines for SPI interface: Glitches in the SPI clock can potentially take the SPI interface out of synchronization. The quality and integrity of the clock line needs to be maintained. The following steps are recommended. Please note that this is not an exhaustive list of guidelines and depending on individual cases additional steps may be needed.

1. It is recommended to avoid using cables to connect the Host platform with the module's SPI interface. In case a cable is used, minimize the length of the SPI bus cable to as small as possible, preferably to within an inch or two
2. It is recommended to use a companion card with a rigid connector to the host
3. If a cable is used, increase the number of ground connections between the WiFi PCB and the MCU PCB

4.1 TCP/IP Stack Usage in RS9110-N-11-24–SPI mode

RS9110-N-11-22, RS9110-N-11-24 and RS9110-N-11-28 are Wi-Fi modules with integrated TCP/IP stack. This reduces the development effort for designers who don't want to integrate a TCP/IP stack in their Host platform. However, there are applications where the designer wants to run his own TCP/IP stack on the Host. The TCP/IP stack in the mentioned modules can be bypassed in such scenarios. This feature of bypassing the stack is available from firmware version 4.5.0 onwards.

4.1.1 Using the Wi-Fi module with TCP/IP stack enabled

The Wi-Fi module is by default in "TCP/IP stack enabled" mode.

1. The reference driver that the user should use for this mode is placed inside RS.CN.xx.GENR.SP.x.x.x/Driver/Driver_TCP
2. The API manual that should be used is placed in RS.CN.xx.GENR.SP.x.x.x/Driver/Driver_TCP/Documentation/

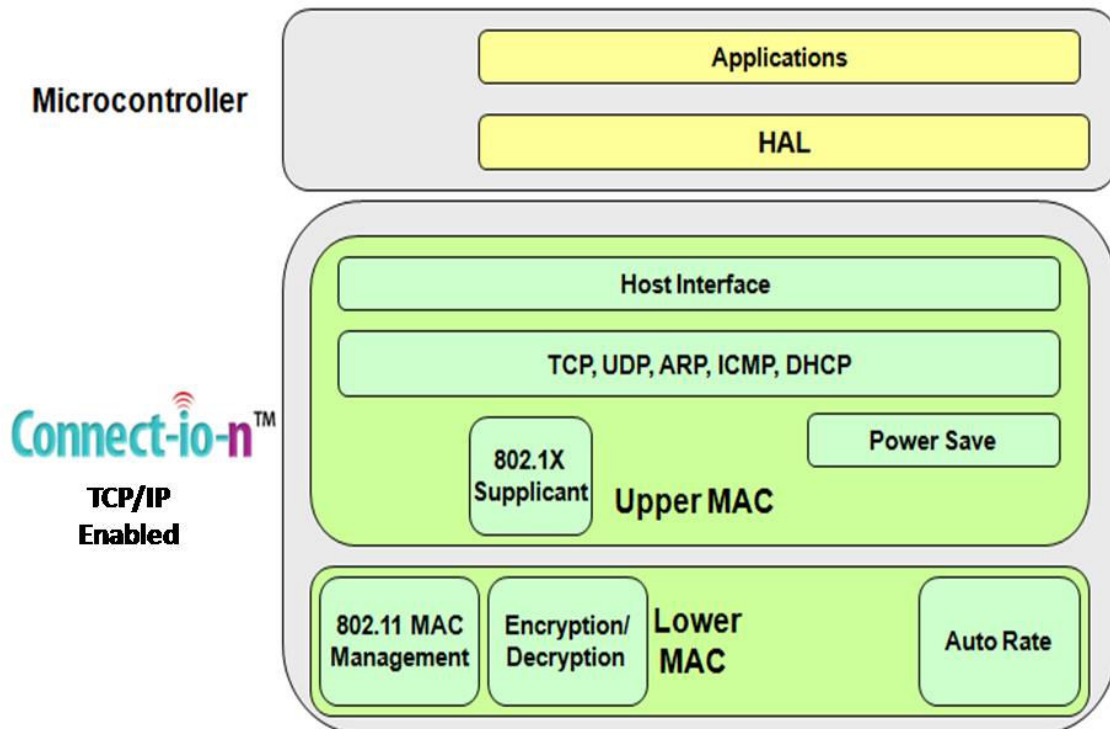


Figure 14: Architecture with TCP/IP Enabled

4.1.2 Using the Wi-Fi module with TCP/IP stack bypassed

The TCP/IP stack in the WiFi module can be bypassed by sending a software command from the Host to the module.

The "TCP bypass command" should be issued to convert the RS9110-N-11-24 from a TCP/IP enabled module to a TCP/IP bypassed module. The following should be taken care of:

1. The reference driver that the user should use for this mode is placed inside RS.CN.xx.GENR.SP.x.x.x/Driver/Driver_TCP_Bypass
2. The API manual that should be used is placed in RS.CN.xx.GENR.SP.x.x.x/Driver/Driver_TCP_Bypass/Documentation/
3. In this mode, the WiFi module presents itself as a standard network interface, which would talk to the Host TCP/IP stack through the network driver in the Host. For transmitting data to the air interface, the data should be framed by the TCP/IP stack in the Host as an Ethernet frame, and the WiFi module does only the WLAN framing on top of it. The interface is according to standard networking protocols. For example : <http://www.makelinux.com/ldd3/chp-17-sect-3> describes the structure for Linux. For successful sending and receiving of data, the MAC ID of the module should be assigned to a field inside the net_device structure

dev_addr of the network driver on the Host OS. Once this is stored after association with AP, the user can bring the wlan interface up
 In Linux, this is usually done by:
 ifconfig wlan0 <ipaddr>
 ifconfig wlan0 up
 The user can query wlan0 interface status using:
 ifconfig wlan0
 The Redpine Module's MAC address should be listed in the HW Addr (00:23:A7:xx:xx:xx)

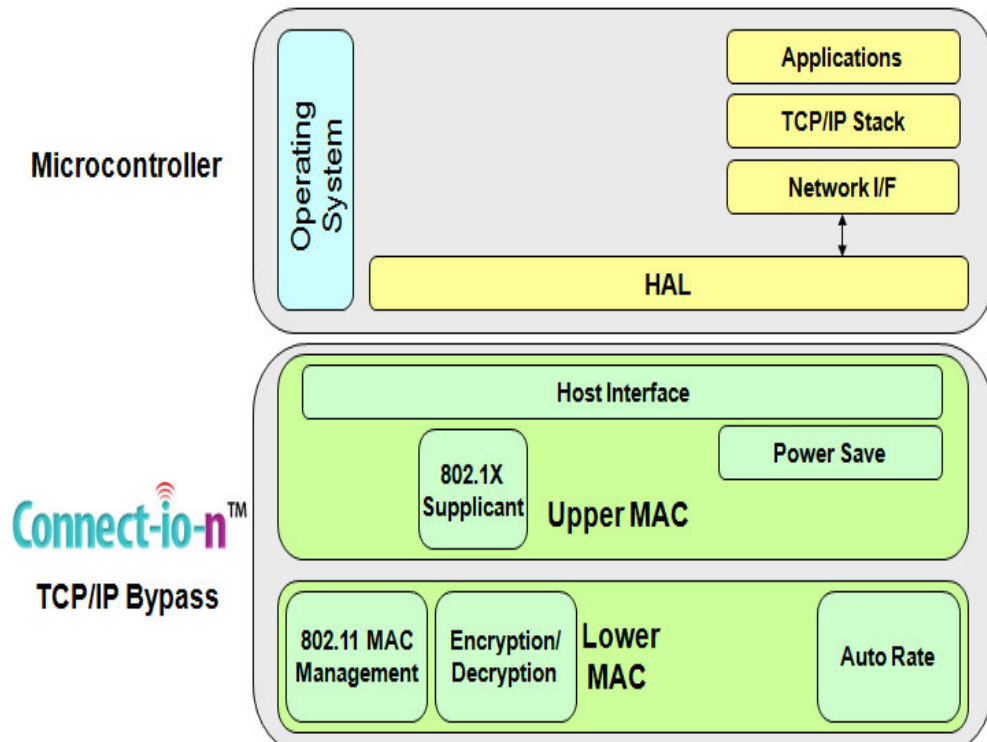
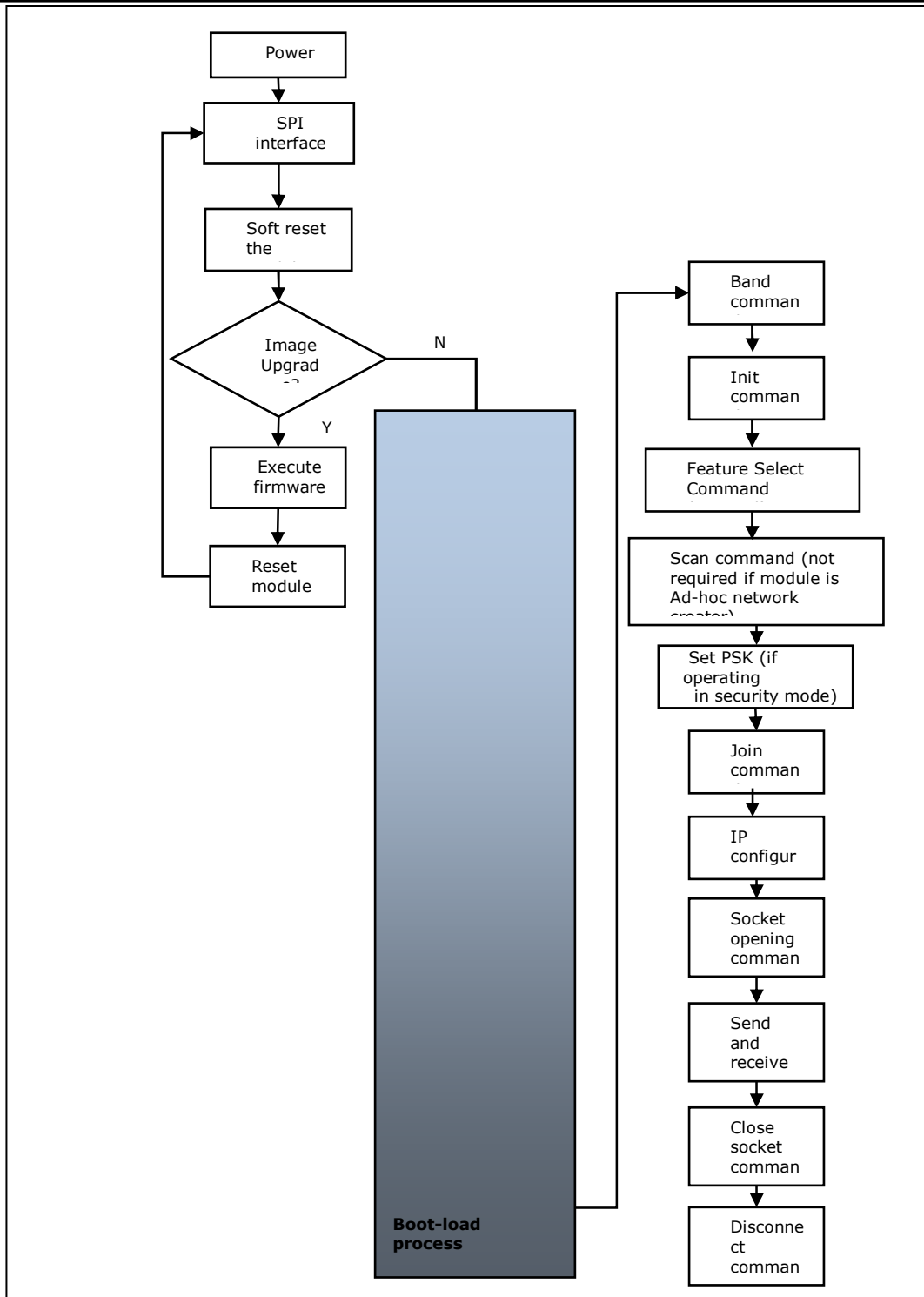


Figure 15: Architecture with TCP/IP Bypassed

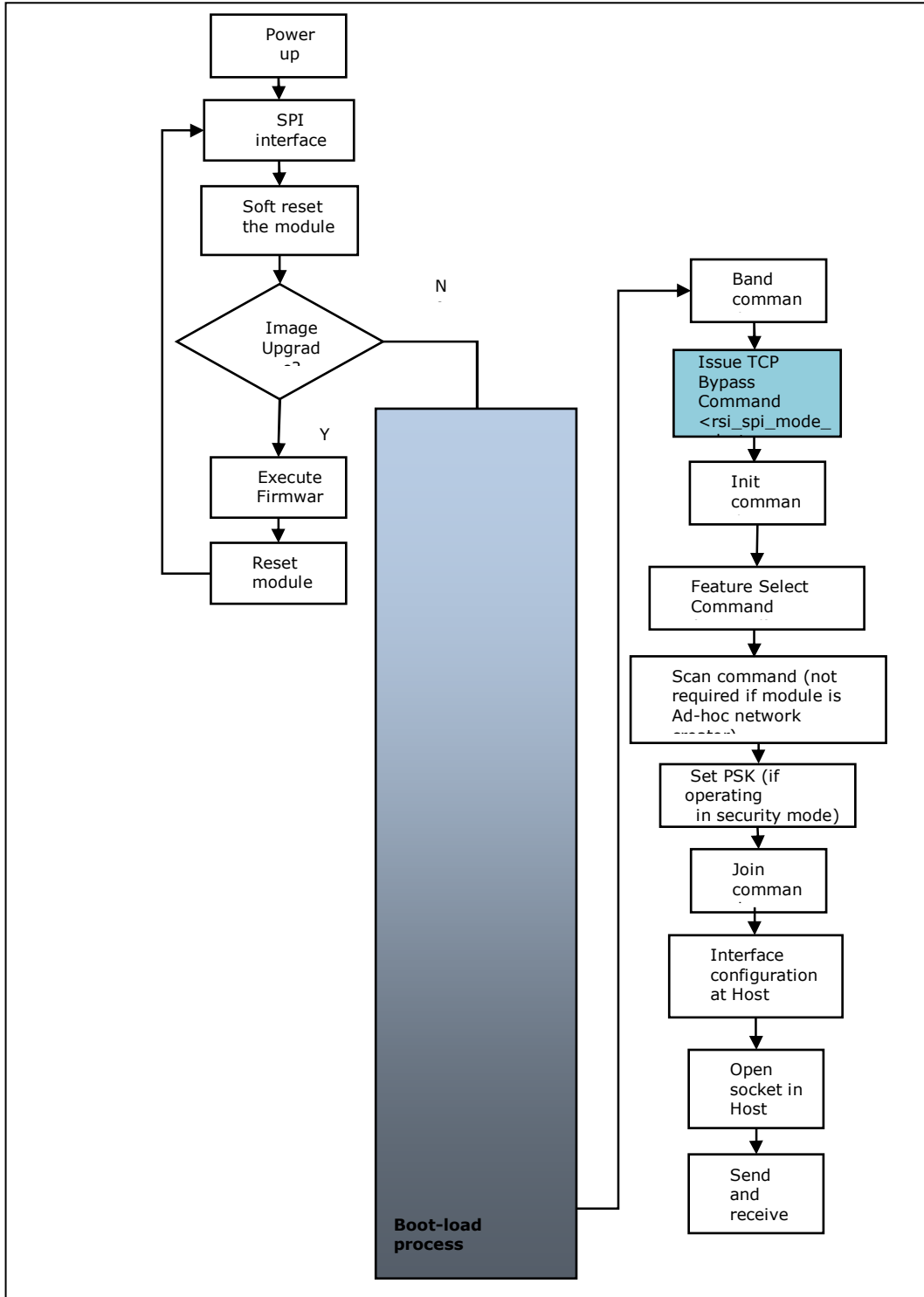
4.2 SPI Operations

The SPI operations with the TCP/IP stack enabled in the module are shown below.



Feature Select command can be issued before or after init command. To control the boot up LED Feature Select command has to be issued before init command. While for other features it can be issued after init command.

The SPI operations with the TCP/IP stack disabled in the module are shown below. In this mode, the module can be used with a Host that has its own TCP/IP stack.



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For comprehensive details on all the SPI commands that can be used to configure and operate the module, please refer to the Programming Reference Manual.

NOTE: Writing code from a scratch to execute these sequences may be time consuming. The user is **strongly** advised to use the API set, the source code of which is provided with the software package inside RS.CN.xx.GENR.SP.x.x.x/Driver/Driver_TCP<or nonTCP> , along with the PRM

5 FCC and IC Declaration

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

This device complies with Industry Canada license-exempt RSS standard(s).

Operation is subject to the Following two conditions : (1) this device may not cause interference, and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

CAUTION: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

End Product Labelling

This Module is labelled with its own FCC ID. If the FCC ID Certification Number is not visible while installed inside another device, then the device should display the label on it referring the enclosed module. In that case, the final end product must be labelled in a visible area with the following:

"Contains Transmitter Module FCC ID: XF6-RSWC201"

OR

"Contains FCC ID: XF6-RSWC201"

The OEM should not provide information to the end user regarding installation or removal of this RF module or change RF related parameters in the user manual of the end product.

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The OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

énoncé de la FCC (états-Unis seulement) Cet équipement a été testé et jugé conforme aux limites de Classe B pour un appareil numérique, en vertu de l'article 15 de la réglementation de la FCC. Ces limites ont été instaurées pour fournir une protection raisonnable contre toute interférence nuisible dans une installation résidentielle. Cet équipement génère, utilise et peut émettre de l'énergie radiofréquence. S'il n'est pas installé et utilisé conformément aux instructions, il peut provoquer des interférences sur les communications radio. Cependant, il n'est pas garanti que des interférences ne se produiront pas dans certaines installations. Si cet équipement cause des interférences à la réception radio ou télévisée (ce qui peut être vérifié en éteignant l'appareil puis en le remettant sous tension), l'utilisateur peut tenter de résoudre en suivant une ou plusieurs des mesures ci-après :

- Réorienter ou déplacer l'antenne réceptrice.
- Augmenter l'espace entre l'appareil et le récepteur. Brancher l'appareil à une prise de courant différente de celle sur laquelle le récepteur est branché. Pour obtenir de l'aide, contacter le vendeur ou un technicien radio/television expérimenté.

REMARQUE: Toute modification non autorisée expressément par le fabricant responsable de la

conformité peut annuler le droit de l'utilisateur à faire fonctionner le produit.
