| Revision Date | 20140912 |
|---|---|
| Revision No. | 0.0 |

# User Manual

# SWL - CQ51

## 802.11 b/g/n WLAN Module

WARNING

I. RF exposure warning statement - for keeping 20cm distance when installing this module.

II. Warning that this module should not be installed and operating simultaneously with other radio without additional evaluation or FCC filing.

III. Instruction for host system labeling, the host system should have proper label showing that it

"Contains FCC ID : A3LSWL-CQ51 / Contains IC ID : 649E-SWLCQ51"

# Revision History

| Revision | Date | Descriptions |
|---|---|---|
| 0.0 | 2014-09-12 | - Initial release |

# Table of Contents

# 1 General Description

## 1.1 Functional Description

SWL-CQ51 Module is a network protocol and Linux kernel based embedded wireless Full module. This module can be used for Smart appliance and a variety of applications such as standalone Wi-Fi AP or Station **( IEEE 802.11b/g/n , Main IC is QCA4531 )**

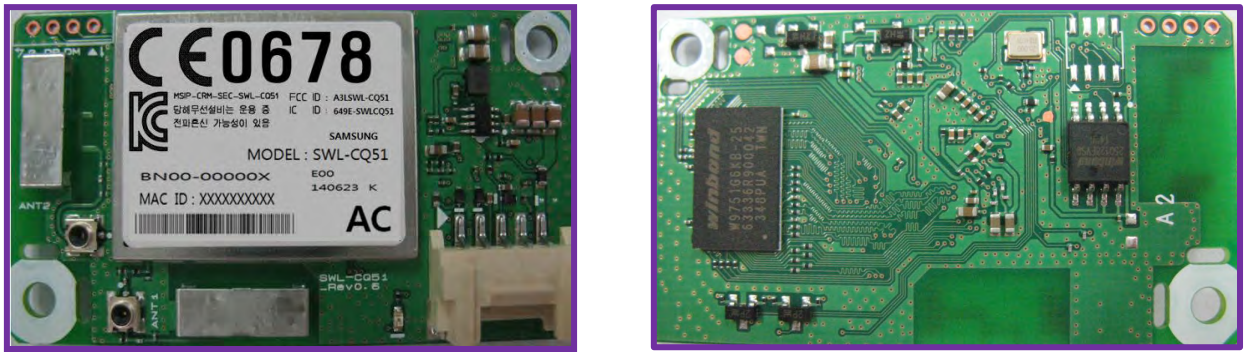


**Figure 1-1 Module Picture**

## 1.2 Features

- Consists of WiFi chipset which is QCA4531 for 2.4GHz band.
- Includes 1T2R MAC/BB/RF, high performance 550MHz MIPS R24 K CPU core
- Includes two 2.4GHz band Metal antennas (On-board)
- Compliant to IEEE 802.11b/g/n Wireless LAN Standards
- Supports standalone Wi-Fi AP or station for 2.4GHz band
- Supports 135Mbps PHY data rate for 2.4GHz band
- Supports 20MHz/40MHz channel bandwidth.
- Supports WEP 64/128, WPA, WPA2, TKIP, AES.
- Supports QOS – WMM, WMM Power Save.
- Supports UART Host Interface (12V level)
- Halogen free, RoHS Compliant.
- Manufacturing Site – SEMTHAI in Thailand

### 1.2.1 Power Management

- Supply voltage range
  VCC 5V_12V (4.75V ~ 13.2V)

- Power Consumption
  11b 2.425W (@ Continuous Tx , 1Mbps , 18dBm)
  T.B.D (@ Continuous Rx)

  11g 2.242W (@ Continuous Tx , 6Mbps , 16dBm)
  T.B.D (@ Continuous Rx)

  11n 2.183W (@ Continuous Tx , MCS0 , 6.5Mbps , 13dBm)
  T.B.D (@ Continuous Rx)

### 1.2.2 Applications

- Home appliances
  (refrigerator, air conditioner , washing machine , electric oven , air cleaner)
- smart grid system
- Home energy management system solution
- Building energy management system solution
- Web server/client based IP-USN solution for Monitoring and Control

### 1.2.3 Block Diagram

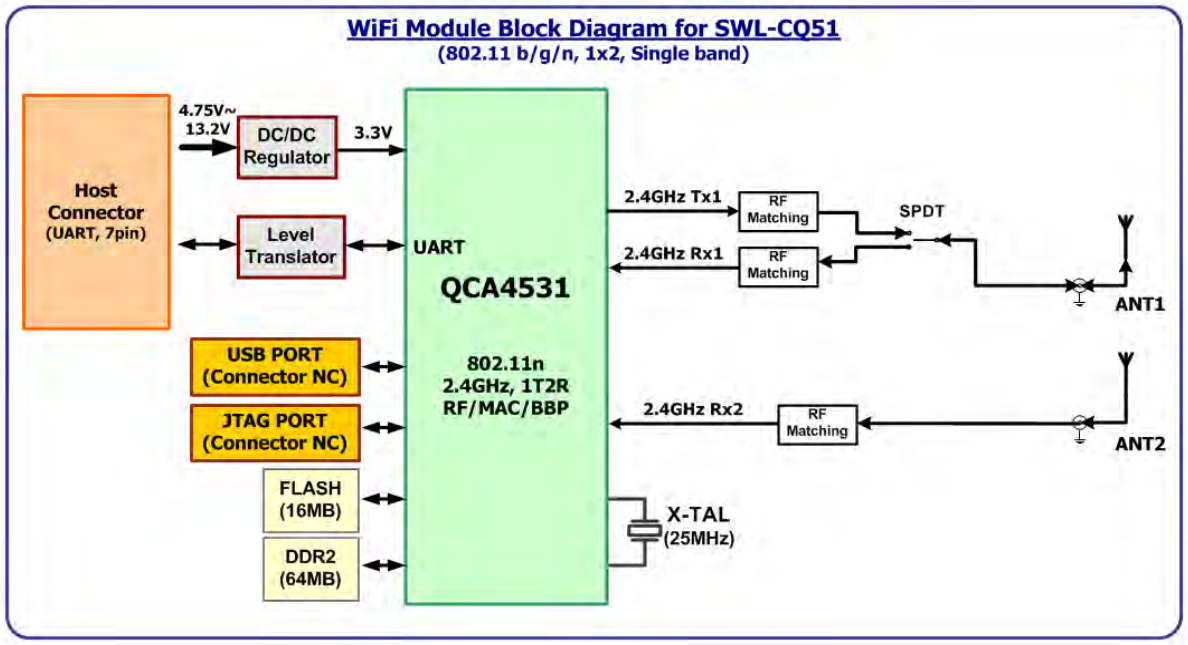


**Figure 1-2 Hardware block diagram**

# 2 Dimension , Pin Assignments , Pictures

## 2.1 Dimension

### 2.1.1 Array & Module Dimension

- Array : L X W X H = 190.0 x 72.0 x 7.34mm

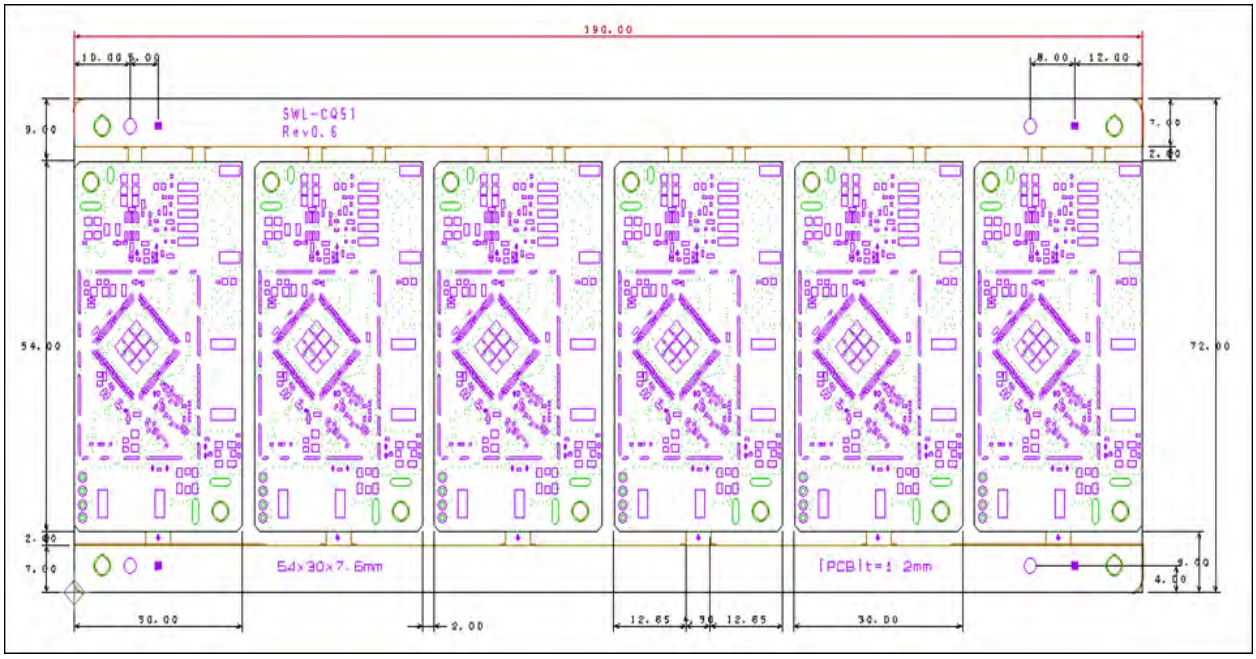


**Figure 2-1 Array & Module Dimension**

| Parameter | Conditions | Min. | Nom. | Max. | Unit |
|---|---|---|---|---|---|
| **Dimension (Array)** | | | | | |
| X | - | - | 190 | - | mm |
| Y | - | - | 72 | - | mm |
| Height | - | - | 7.34 | - | mm |
| **Dimension (Module)** | | | | | |
| X | - | - | 54 | - | mm |
| Y | - | - | 30 | - | mm |
| Height | - | - | 7.34 | - | mm |

### 2.1.2 Antenna Dimension

*** Please use only allowed PIFA antenna below. Do not use any other antenna with antenna port.**

*** Use other antenna may subject to additional testing and filing to FCC.**

ANT 1 & ANT 2 : 11.7(+/-0.3) x 4.0 (+/-0.3) x Hight Top 2.5 (+/-0.3)mm

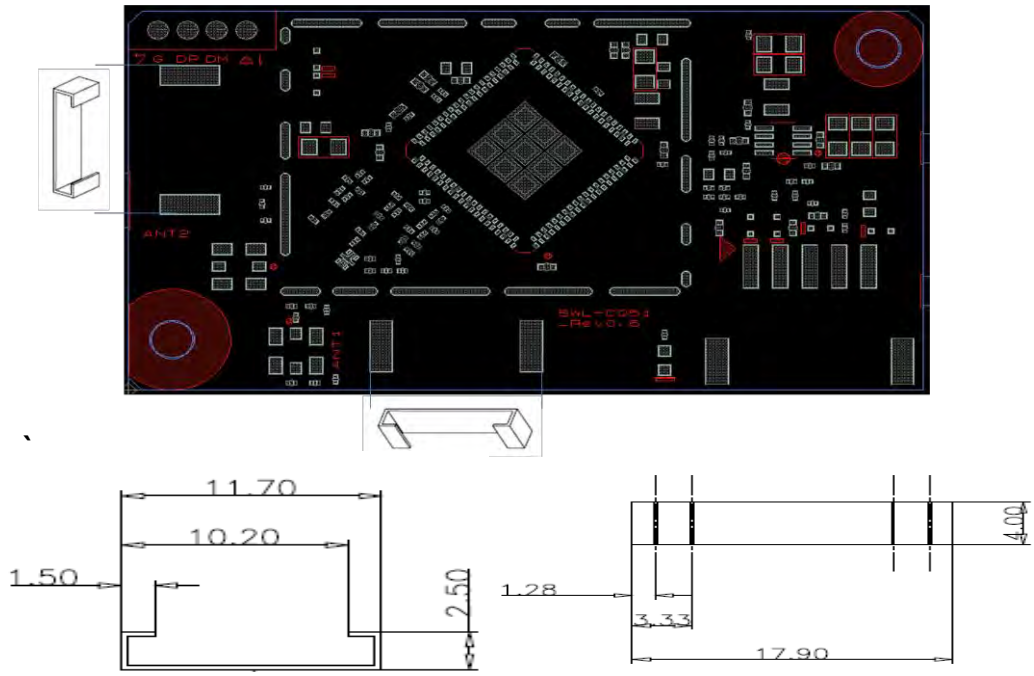


**Figure 2-2 Antenna Mechanical Dimension**

## 2.2 Pin Assignments

### 2.2.1 UART Interface

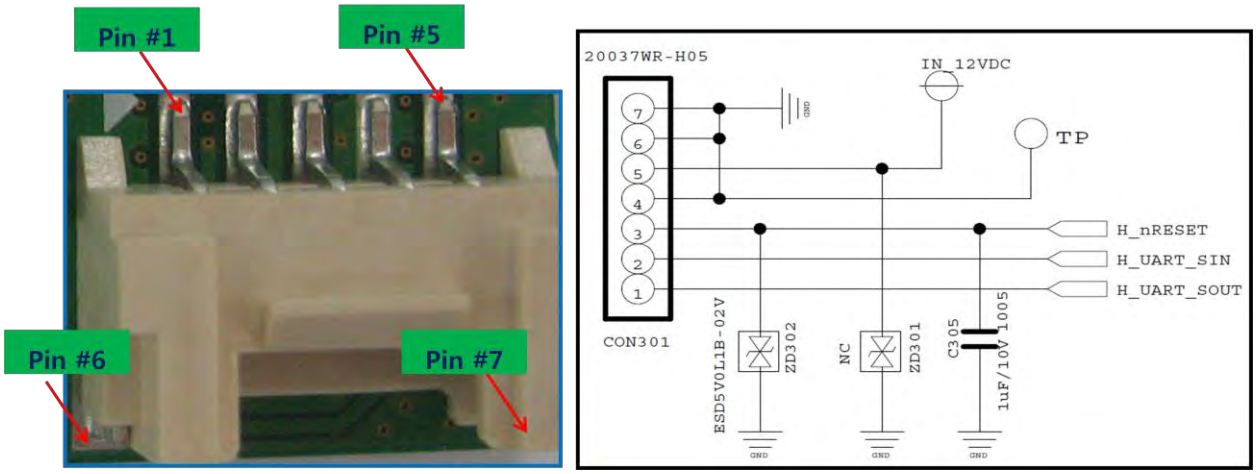


**Figure 2-3 UART Pin Assignments (Top View)**

| No. | Pin Name | Description | Type |
|---|---|---|---|
| 1 | **H_UART_SOUT** | UART OUT | O |
| 2 | **H_UART_SIN** | UART IN | I |
| 3 | **H_nRESET** | Reset | O |
| 4 | **TP** | Test Point | T |
| 5 | **IN_12VDC** | +12V Power supply for WIFI | P |
| 6 | **GND** | Ground | G |
| 7 | **GND** | Ground | G |

### 2.2.2 USB Interface

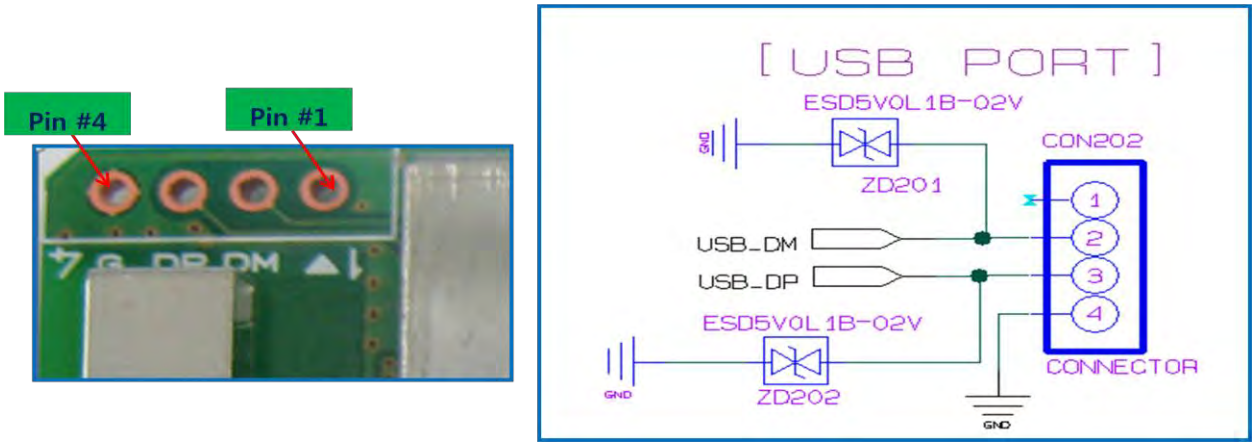


**Figure 2-4 USB Pin Assignments (Top View)**

| No. | Pin Name | Description | Type |
|---|---|---|---|
| 1 | **NC** | NC | - |
| 2 | **USB_DM** | USB 2.0 D- | I/O |
| 3 | **USB_DP** | USB 2.0 D+ | I/O |
| 4 | **GND** | Ground | G |

## 2.3 Pictures

### 2.3.1 Picture

**[Top Side]**


**[Bottom Side]**

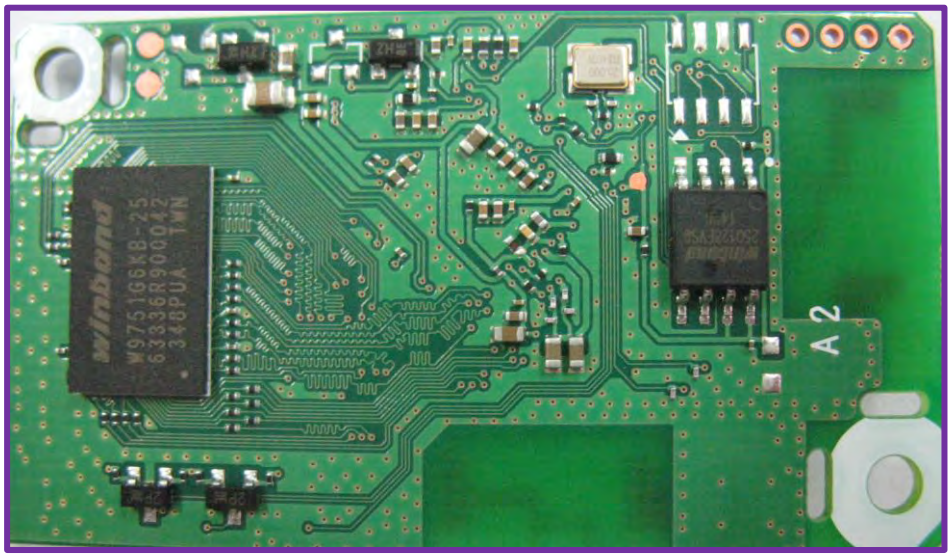


**Figure 2-5 Module Picture**

# 3 Electrical Characteristics

## 3.1 Absolute Maximum Ratings

| Symbol | Parameter | Min. | Max. | Unit |
|---|---|---|---|---|
| VDD_5V_12V | DC supply voltage | **4.75** | **+13.2** | **V** |

## 3.2 Power Consumption

| Parameter | Conditions | Min. | Nom. | Max. | Unit |
|---|---|---|---|---|---|
| **Tx mode (Max current)** | | | | | |
| 802.11b(2.4GHz) | 12V, 18dBm Tx Power, 1Mbps | | 202.137 | | mA |
| 802.11g(2.4GHz) | 12V,16dBm Tx Power, 6Mbps | | 186.903 | | |
| 802.11n(2.4GHz)_20MHz | 12V,16dBm TX Power, MCS0 | | 181.968 | | |
| 802.11n(2.4GHz)_40MHz | 12V,16dBm TX Power, MCS0 | | 178.535 | | |
| **Rx mode (Max current)** | | | | | |
| 802.11b/g/n(2.4GHz) | - | | -- | | mA |

| Parameter | Conditions | Min. | Nom. | Max. | Unit |
|---|---|---|---|---|---|
| **Tx mode (Max current)** | | | | | |
| 802.11b(2.4GHz) | 5V, 18dBm Tx Power, 1Mbps | | 467.126 | | mA |
| 802.11g(2.4GHz) | 5V,16dBm Tx Power, 6Mbps | | 480.978 | | |
| 802.11n(2.4GHz)_20MHz | 5V,16dBm TX Power, MCS0 | | 402.756 | | |
| 802.11n(2.4GHz)_40MHz | 5V,16dBm TX Power, MCS0 | | 416.917 | | |
| **Rx mode (Max current)** | | | | | |
| 802.11b/g/n(2.4GHz) | - | | -- | | mA |

## 3.3 Recommended Operating Conditions

| Symbol | Parameter | Conditions | Min. | Nom. | Max. | Unit |
|---|---|---|---|---|---|---|
| VDD_5V | DC supply voltage from HOST | - | **+4.75** | **+5 & +12** | **+13.2** | V |
| Top | Operating temperature(Ambient) | - | **0** | **-** | **+70** | °C |

## 3.4 Environmental Characteristics

| Symbol | Parameter | Conditions | Min. | Max. | Unit |
|---|---|---|---|---|---|
| ESD | Electro-static discharge voltage | HBM | -4K | +4K- | V |
| Top | Operating temperature | - | 0 | +70 | °C |
| Tstg | Storage temperature | - | -30 | +85 | °C |

# 4 RF Specifications

All measurements are made under nominal supply voltage, room temperature, and conducted conditions at each antenna port except antenna.

## 4.1 Receiver RF Specifications

| Parameter | Conditions | | Min. | Nom. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Receive input frequency** (based on center frequency of channel) | | | | | | |
| 802.11b/g/n | 2.4GHz | | 2412 | - | 2472 | MHz |
| **Receiver sensitivity** | | | | | | |
| 802.11b | 1Mbps | PER<8%, Packet size= 1,024bytes | - | - | -80* | dBm |
| | 2Mbps | | - | - | -80* | dBm |
| | 5.5Mbps | | - | - | -76* | dBm |
| | 11Mbps | | - | - | -76* | dBm |
| 802.11g | 6Mbps | PER<10%, Packet size= 1,024bytes | - | - | -82* | dBm |
| | 9Mbps | | - | - | -81* | dBm |
| | 12Mbps | | - | - | -79* | dBm |
| | 18Mbps | | - | - | -77* | dBm |
| | 24Mbps | | - | - | -74* | dBm |
| | 36Mbps | | - | - | -70* | dBm |
| | 48Mbps | | - | - | -66* | dBm |
| | 54Mbps | | - | - | -65* | dBm |
| 802.11n (HT20) | MCS0 / MCS8 | PER<10%, Packet size= 1,024bytes | - | | -82* | dBm |
| | MCS1 / MCS9 | | - | - | -79* | dBm |
| | MCS2 / MCS10 | | - | - | -77* | dBm |
| | MCS3 / MCS11 | | - | - | -74* | dBm |
| | MCS4 / MCS12 | | - | - | -70* | dBm |
| | MCS5 / MCS13 | | - | - | -66* | dBm |
| | MCS6 / MCS14 | | - | - | -65* | dBm |
| | MCS7 / MCS15 | | - | - | -64* | dBm |
| 802.11n (HT40) | MCS0 / MCS8 | PER<10%, Packet size= 1,024bytes | - | - | -79* | dBm |
| | MCS1 / MCS9 | | - | - | -76* | dBm |
| | MCS2 / MCS10 | | - | - | -74* | dBm |
| | MCS3 / MCS11 | | - | - | -71* | dBm |
| | MCS4 / MCS12 | | - | - | -67* | dBm |

| | | | | | | |
|---|---|---|---|---|---|---|
| | MCS5 / MCS13 | | - | - | -63* | dBm |
| | MCS6 / MCS14 | | - | - | -62* | dBm |
| | MCS7 / MCS15 | | - | - | -61* | dBm |

| **Maximum input level** | | | | | |
|---|---|---|---|---|---|
| 802.11b | PER<8% | -10* | - | - | dBm |
| 802.11g/n(2.4GHz) | PER<10% | -20* | - | - | dBm |

"*" Indicate IEEE spec

## 4.2 Transmitter RF Specifications

| Parameter | Conditions | Min | Nom | Max | Unit |
|---|---|---|---|---|---|
| **Transmit output frequency** (Center frequency of channel) | | | | | |
| 802.11b/g/n | 2.4GHz | 2412 | - | 2472 | MHz |
| **Transmit Channel Power*** | | | | | |
| 802.11b (2.4GHz) | 1~11Mbps | 15.5 | 18 | 20.5 | dBm |
| 802.11g (2.4GHz) | 6~24Mbps | 13.5 | 16 | 18.5 | dBm |
| | 36Mbps | 12.5 | 15 | 17.5 | dBm |
| | 48Mbps, 54Mbps | 11.5 | 14 | 16.5 | dBm |
| 802.11n (2.4GHz) (HT20) | MCS0 | 11.5 | 16 | 18.5 | dBm |
| | MCS1~MCS5 | 10.5 | 15 | 17.5 | dBm |
| | MCS6 | 11.5 | 14 | 16.5 | dBm |
| | MCS7 | 10.5 | 13 | 15.5 | dBm |
| 802.11n (2.4GHz) (HT40) | MCS0 | 13.5 | 16 | 18.5 | dBm |
| | MCS1~MCS3 | 12.5 | 15 | 17.5 | dBm |
| | MCS4,MCS5 | 11.5 | 14 | 16.5 | dBm |
| | MCS6 | 10.5 | 13 | 15.5 | dBm |
| | MCS7 | 9.5 | 12 | 14.5 | dBm |
| **Spectrum mask** | | | | | |
| 802.11b | Fc ± 11MHz to ± 22MHz | - | - | -30 | dBr |
| | Fc ± 22MHz and more | - | - | -50 | dBr |
| 802.11g | Fc ± 11MHz | - | - | -20 | dBr |
| | Fc ± 20MHz | - | - | -28 | dBr |
| | Fc ± 30MHz | - | - | -40 | dBr |
| 802.11n | Fc ± 11MHz/± 21MHz @ HT20/HT40 | - | - | -20 | dBr |
| | Fc ± 20MHz/± 40MHz @ HT20/HT40 | - | - | -28 | dBr |
| | Fc ± 30MHz/± 60MHz @ HT20/HT40 | - | - | -45 | dBr |
| **Center Frequency tolerance** | | | | | |
| 802.11b | 2.4GHz | -25 | - | +25 | ppm |

| | | | | | | |
|---|---|---|---|---|---|---|
| 802.11g | 2.4GHz | | -25 | - | +25 | ppm |
| 802.11n | 2.4GHz | | -25 | - | +25 | ppm |
| **EVM(Error Vector Magnitude)**** | | | | | | |
| 802.11b | 1Mbps | As specified in IEEE802.11b | - | - | 35 | % |
| | 2Mbps | | - | - | 35 | % |
| | 5.5Mbps | | - | - | 35 | % |
| | 11Mbps | | - | - | 35 | % |
| 802.11g | 6Mbps | Mandatory | - | - | -5 | dB |
| | 9Mbps | Optional | - | - | -8 | dB |
| | 12Mbps | Mandatory | - | - | -10 | dB |
| | 18Mbps | Optional | - | - | -13 | dB |
| | 24Mbps | Mandatory | - | - | -16 | dB |
| | 36Mbps | Optional | - | - | -19 | dB |
| | 48Mbps | Optional | - | - | -22 | dB |
| | 54Mbps | Optional | - | - | -25 | dB |
| 802.11n | MCS0 | | - | - | -5 | dB |
| | MCS1 | | - | - | -10 | dB |
| | MCS2 | | - | - | -13 | dB |
| | MCS3 | | - | - | -16 | dB |
| | MCS4 | | - | - | -19 | dB |
| | MCS5 | | - | - | -22 | dB |
| | MCS6 | | - | - | -25 | dB |
| | MCS7 | | - | - | -27 | dB |

**Remarks**

*** Transmit Channel Power :**
**Transmit channel power is limited within EIRP limit based on country regulation in operational mode.**

** EVM :
<Test condition>
. Method: composite EVM method.
. Number of symbols: 17.
. Phase correction: Symbol-by-symbol correction.
. Channel estimation: Raw channel estimate full packet.
. Symbol timing correction: on.
. Amplitude tracking: off.
. Frequency Sync: Long training symbol.

# 5. Product Label Information

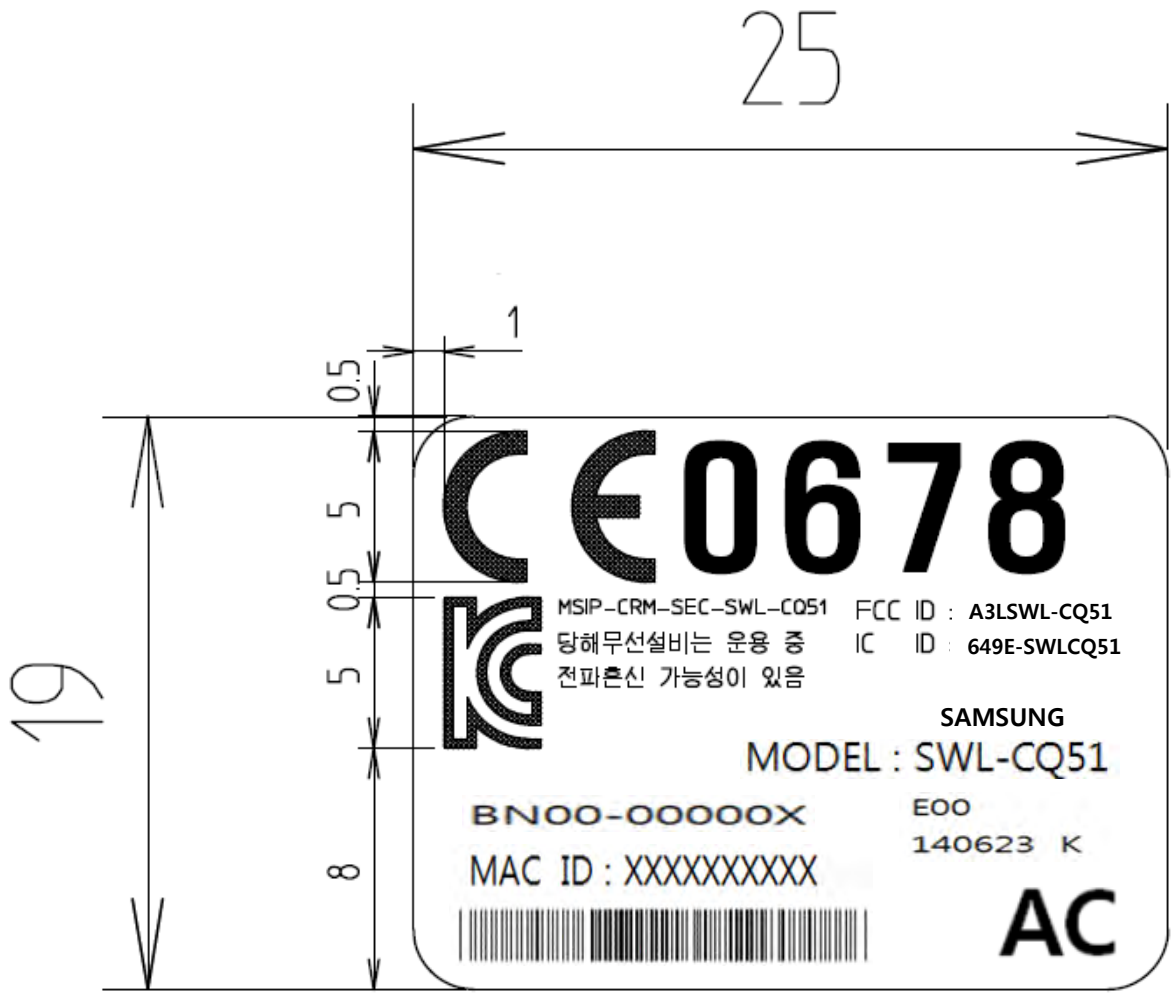


**Figure 5-1. Product Label**

## 5.1 Host system labeling instruction

We add following statement at label of each host.
"The product was mounted with a Bluetooth module (FCC ID: A3LSWL-CQ51) which was certificated by FCC Part 15 Subpart C 15.247."

## 6. Manufacturing Site

Samsung Electro-mechanics Thailand Co., Ltd. (SEMTHAI)
Wellgrow Industrial Estate, 93 Moo 5 T. Bangsamak, A.Bangpakong,
Chachoengsao 24180 THAILAND

Tel. : 66-38-562-000
Fax No. : 66-38-562-177

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.

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

This appliance and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter. A minimum separation distance of 20 ㎝ must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

This device complies with Industry Canada licence-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 that may cause undesired operation of the device.

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