



## **Low Cost Integrated Voice/Audio Module**

# **LIBRE SYNC**

### **Product Data Sheet Module: LS5BV-N11S**

**Rev: 0.2**

## 1. Introduction

Libre Wireless, LS5BV-N11S is a voice enabled network media module which includes a 580 MHz MIPS24K CPU core, 64MB of DDR2 DRAM memory and 16MB of Serial Flash, an 802.11n compliant 1T1R MAC/BBP/PA/RF, single port 10/100 Ethernet MDI interface, Voice processing DSP and a USB Host.

LS5BV-N11S provides a convenient and simple voice activated method for discovering and controlling devices, and cloud interfaces. LS5BV-N11S contains Integrated DSP for efficient voice trigger, speech recognition and high-speed audio processing. Provides Non-stationary and stationary noise reduction for both transmit and receive sides, and it supports Acoustic Echo Cancellation, Barge-in, Flexible Listening Enhancement, Voice equalizers.

The LS5BV-N11S, has very few external components required for 2.4GHz 11n wireless products. The LS5BV-N11S employs Libre Wireless's 2nd generation 11n technologies for longer range and better throughput. The embedded high performance CPU can process advanced applications effortlessly, such as Wi-Fi data processing without overloading the host processor. In addition, the LS5BV-N11S has rich hardware interfaces (SPI/ I2S/ I2C/ UART/ USB) to enable many possible applications.

LS5BV-N11S devices can be optimized for Smart Home control, Security/Surveillance, Voice Control Devices, Intercom/PA systems, Music Streaming, Outdoor/Recreational, Low Power Applications.

Libre solutions enables Brands/ODM's to take advantage of DDMS and unique Libre capabilities while delivering voice control, IoT device control, media streaming, communication and cloud connectivity features to the connected Consumer & Home.

## 2. Module Feature Summary

### Network Media Features

- LS5BV-N11S is the small size and low power module for IEEE 802.11b/g/n wireless LAN.
- Embedded 1T1R 2.4G CMOS RF
- Embedded 802.11n 1T1R MAC/BBP w/MLD enhancement
- Support for both PCB connector and Notched SMT pad option
- 72.2 Mbps PHY data rate
- 20Mhz channel width
- Legacy and high throughput modes
- Compressed block ACK

- WEP64/128, WPA, WPA2, WAPI engines
- QOS - WMM, WMM Power Save
- Hardware frame aggregation
- Supports 802.11h TPC
- MIPS 24KEc 580 MHz with 64 KB I-cache/32 KB D-cache
- 16-bit DDR2 64Mbytes
- Serial Flash 16Mbytes
- 3x UART
- 1x USB 2.0 HOST
- Single port 10/100 Mbps Fast Ethernet MDI interface
- Slow speed I/O: GPIO, SPI, I2C, I2S, UART, and JTAG
- I2S interface supports 24-bit/192kHz (slave mode)
- I/O: 3.3 V

### **Voice Features**

- Two Integrated DSP cores; that comprise: power-efficient voice trigger (VT) subsystem, high-speed audio processor (APR) subsystem.
- Noise Reduction
  - Supports Narrowband and wideband voice communications
  - Provides Non-stationary and stationary noise reduction for both transmit and receive sides.
  - Provides High voice quality in various handheld phone positions.
- Acoustic Echo Cancellation: Reduces the effects of echo in both single-talk (half-duplex) and double-talk (full-duplex) use cases.
- Automatic Gain Control: maintains the voice signal at desired level for both transmit and receive voice.

- Flexible Listening Enhancement: Improves the intelligibility of received voice in noisy environment.
- Voice equalizers: Enable frequency response modifications of voice and audio for better performance.
- Customized noise reduction for ASR: Maximizes ASR rates.

### 3. Block Diagram

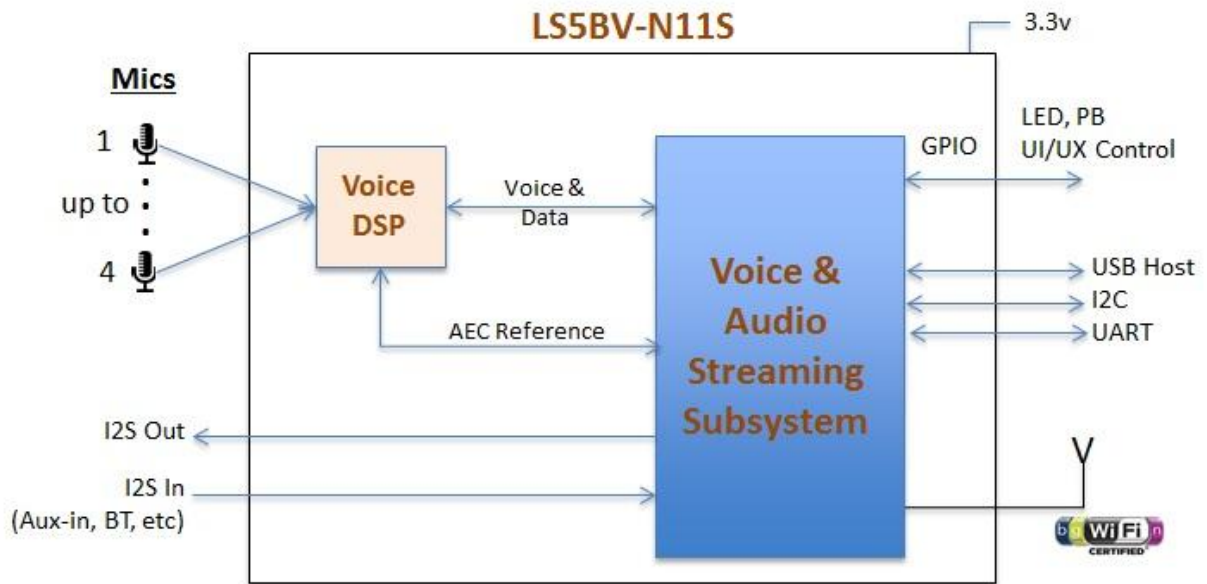


Figure 3-1: LS5BV Block Diagram

## 4. Specifications

### 4.1. Generic Specification Table

| Type                  | Description for LS5BV-N11S                                                                                                                                                                                                                           |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model                 | LS5BV-N11S                                                                                                                                                                                                                                           |
| Product Name          | Voice Enabled Network Media Module                                                                                                                                                                                                                   |
| Major Chipset         | MT7688A + DBMD5                                                                                                                                                                                                                                      |
| Standard              | IEEE802.11b / g /n                                                                                                                                                                                                                                   |
| Data Transfer Rate    | 1, 2, 5.5, 6, 11, 12, 18, 22, 24, 30, 48, 54, 65 and maximum Physical Layer rate of 72.2 Mbps                                                                                                                                                        |
| Frequency Band        | 2.4 GHz                                                                                                                                                                                                                                              |
| Control Bus Interface | UART                                                                                                                                                                                                                                                 |
| Data Bus Interface    | USB / Ethernet / I2S                                                                                                                                                                                                                                 |
| I2S Sampling Rate     | Maximum of 192 KHz, 24 Bits                                                                                                                                                                                                                          |
| Operating Voltage     | 3.3 V +/- 5%                                                                                                                                                                                                                                         |
| Ripple Requirement    | 20-30 mv peak-to-peak                                                                                                                                                                                                                                |
| Operating Temperature | -20°C to +60°C                                                                                                                                                                                                                                       |
| Storage Temperature   | TBG                                                                                                                                                                                                                                                  |
| Dimension (L x W x H) | 52mm x 26mm x 5.8 mm (approx.) ± 0.2mm<br> <b>Note:</b> The dimension mentioned are subject to change. Please check with Libre team before finalising the design. |

## 4.2. RF Characteristics

| Items             | IEEE802.11b<br>(11 Mbps mode unless otherwise specified) | IEEE802.11g<br>(54 Mbps mode unless otherwise specified) | IEEE802.11n<br>(MCS7 mode unless otherwise specified) |
|-------------------|----------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------|
| Mode              | DSSS / CCK 11 Mbps                                       | OFDM 54 Mbps                                             | OFDM 135 Mbps                                         |
| Channel Frequency | 2412 ~ 2462 MHz                                          | 2412 ~ 2462 MHz                                          | 2412 ~ 2462 MHz                                       |
| RX                | -83dbm                                                   | -70dbm                                                   | -65dbm                                                |
| TX EVM            | -27db                                                    | -30db                                                    | -31db                                                 |
| Normal Conditions | Temperature: 25°C<br>VDD: 3.3 V                          | Temperature: 25°C<br>VDD: 3.3 V                          | Temperature: 25°C<br>VDD: 3.3 V                       |

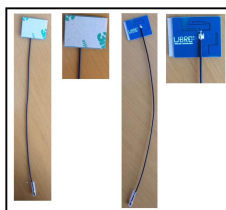
## 4.3. DC Characteristics

| Module     | Voltage | Ripple Requirement    | Current Consumption (linking) |
|------------|---------|-----------------------|-------------------------------|
| LS5BV-N11S | 3.3 V   | 20-30 mv peak-to-peak | TBD                           |

## 4.4. Antenna Specification

|                         |                                     |
|-------------------------|-------------------------------------|
| Antenna Module          | LSANT-1A-180                        |
| Antenna Gain            | ≤ 1.5dBi                            |
| Manufacturer of Antenna | Golden Smart International Co., Ltd |

Antenna Images



## 5. Mechanical, Connectors and Interfaces

### 5.1. Physical Module

**Note:** The dimension mentioned are subject to change. Please check with Libre team before finalising the design.

Module Dimension is 52mm x 26.0mm x 5.8mm (L x W x H)

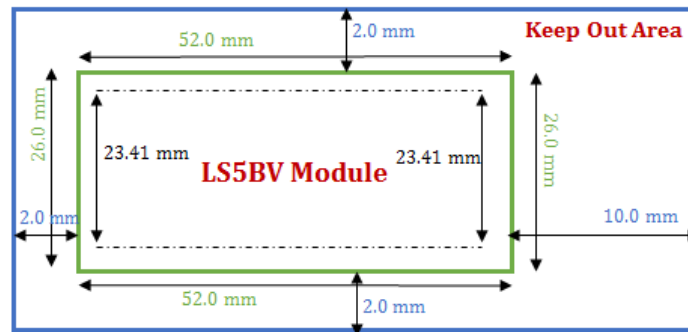


Figure 6-1: Keep Out Area Details

TBG

Figure 5-1: LS5BV-N11S Module Bottom

TBG

Figure 5-2: LS5BV-N11S Module Top

### 5.2. Connector Pin Out

| Pin | Description | Function | Pin | Function       | Description |
|-----|-------------|----------|-----|----------------|-------------|
| 1   | 3.3VD       | 3.3VD    | 31  | 3.3VD          | 3.3VD       |
| 2   | Ground      | GND      | 32  | 3.3VD          | 3.3VD       |
| 3   | I2C_Clock   | I2C_SCK  | 33  | Ground         | GND         |
| 4   | I2C_Data    | I2C_SDA  | 34  | SPI_SPCK/GPIO4 | SPCK        |
| 5   | NC          | NC       | 35  | SPI_MOSI/GPIO5 | MOSI        |

| Pin | Description            | Function          | Pin | Function       | Description                 |
|-----|------------------------|-------------------|-----|----------------|-----------------------------|
| 6   | POWER ON RESET I/P     | PORST_N           | 36  | SPI_MISO/GPIO6 | MISO                        |
| 7   | UART_TXD               | UART_TXD1         | 37  | SPI_CS1/GPIO37 | SPI-CS1                     |
| 8   | UART_RXD               | UART_RXD1         | 38  | APR GPIO11     | APR GPIO11                  |
| 9   | UART CTS               | UART_CTS1         | 39  | GND            | Ground                      |
| 10  | UART RTS               | UART_RTS1         | 40  | EPHY_RXP_P4    | Port4 RX+                   |
| 11  | DEBUG-UART Lite TXD    | UART_TXD2         | 41  | EPHY_RXN_P4    | Port4 RX+-                  |
| 12  | DEBUG-UART Lite RXD    | UART_RXD2         | 42  | EPHY_TXP_P4    | Port4 TX+                   |
| 13  | Ground                 | GND               | 43  | EPHY_TXN_P4    | Port4 TX-                   |
| 14  | MCLK_INPUT (12.288MHz) | MCLK_INPUT        | 44  | GND            | Grond                       |
| 15  | I2S_RXD                | I2SDI             | 45  | NC             | NC                          |
| 16  | I2S_TXD                | I2SWDO            | 46  | NC             | NC                          |
| 17  | I2S_LRCLK              | I2SWS             | 47  | NC             | NC                          |
| 18  | I2S BIT CLOCK          | I2SCLK            | 48  | NC             | NC                          |
| 19  | Ground                 | GND               | 49  | NC             | NC                          |
| 20  | APR GPIO8              | APR GPIO8         | 50  | NC             | NC                          |
| 21  | NW Indication LED      | NW Indication LED | 51  | MIC ON_LED     | MIC ON_LED                  |
| 22  |                        | MIC_ON_OFF        | 52  | MIC_OFF_LED    | MIC_OFF_LED                 |
| 23  | APR GPIO9              | APR GPIO9         | 53  | GND            | Ground                      |
| 24  | Ground                 | GND               | 54  | SETUP          | WAC / factory default reset |
| 25  | USB_DM                 | USB_D-            | 55  | DDMS LED       | DDMS LED                    |

| Pin | Description | Function  | Pin | Function   | Description |
|-----|-------------|-----------|-----|------------|-------------|
| 26  | USB_DP      | USB_D+    | 56  |            |             |
| 27  | Ground      | GND       | 57  | APR GPIO10 | APR GPIO10  |
| 28  | RED LED     | RED LED   | 58  | APR GPIO12 | APR GPIO12  |
| 29  | BLUE LED    | BLUE LED  | 59  | GND        | Ground      |
| 30  | GREEN LED   | GREEN LED | 60  | NC         | NC          |

## 6. Ordering Guide

| Product Number | Mic Configuration |
|----------------|-------------------|
| LS5BV-N11S     | TBD               |

## 7. Environmental

### 7.1. Operating

- Operating Temperature: TBG
- Relative Humidity: TBG

### 7.2. Storage

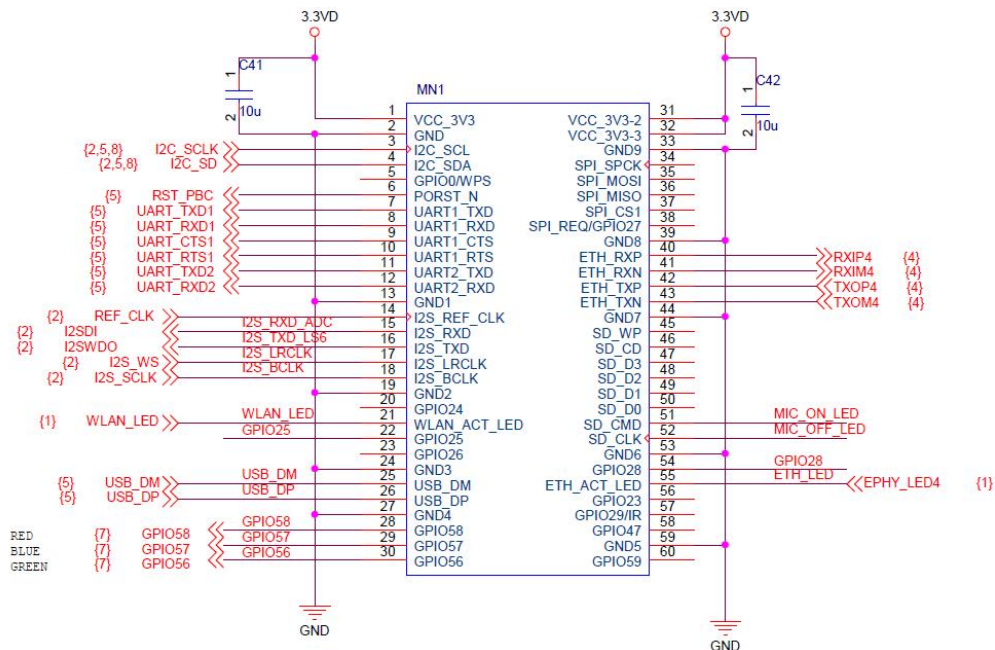
- Temperature: TBG
- Relevant Humidity: TBG

## 8. Reference Schematics

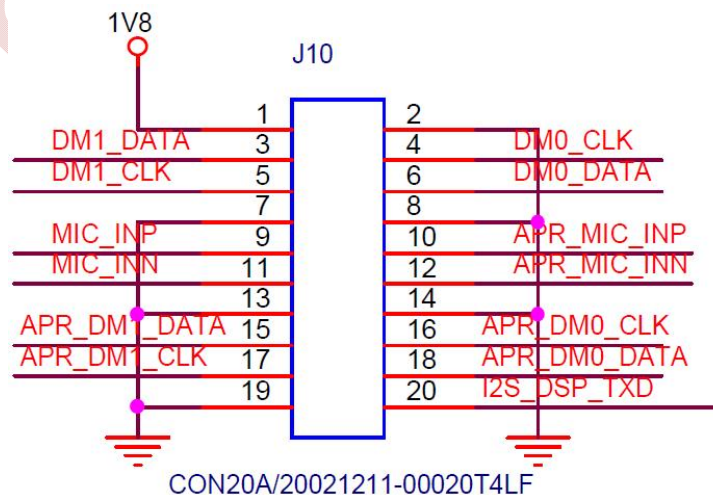
**Note:**

For latest and detailed reference schematic, Contact Libre team.

### 8.1. LS5BV-N11S Connector

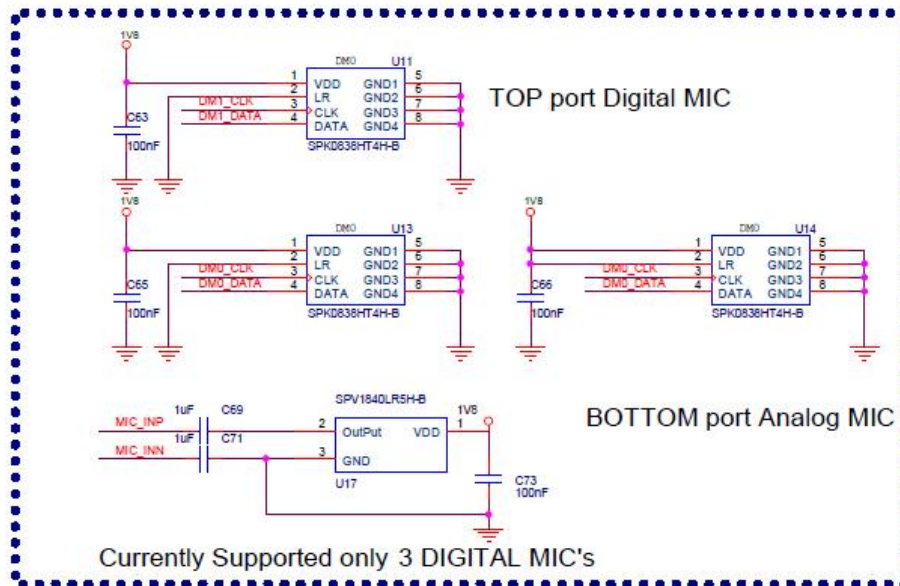


### 8.2. J10 Connector

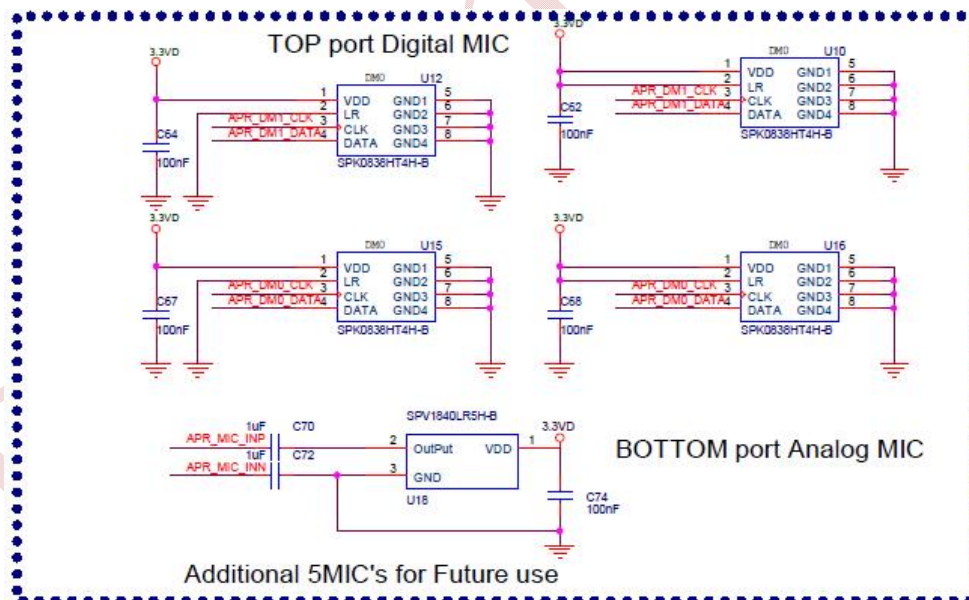


## 8.3. External MIC I/F

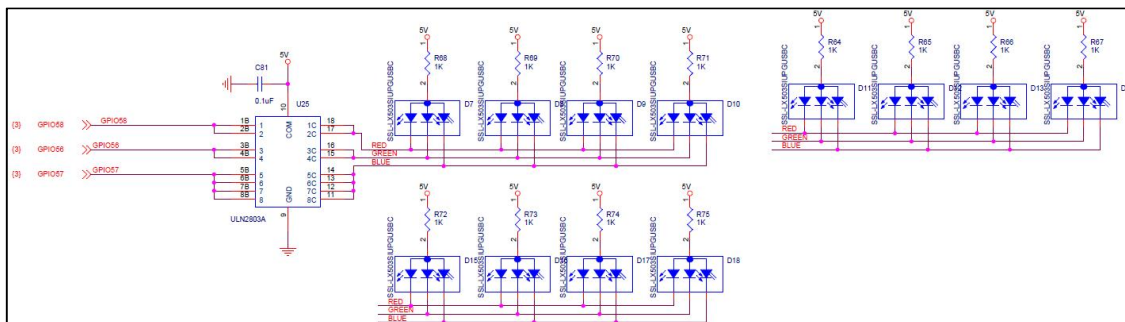
### 3 MIC Configuration – Currently Used



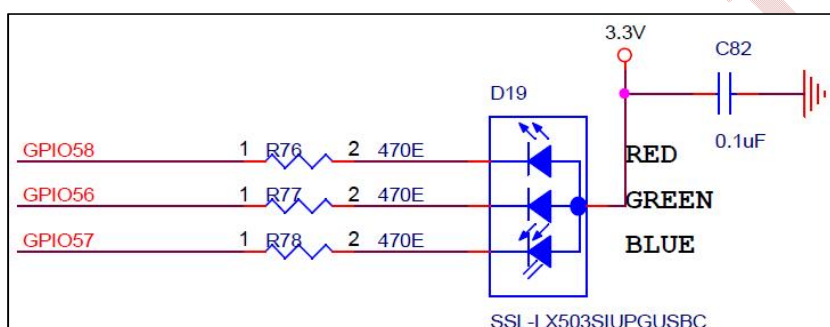
### 5 MIC Configuration – For Future Use



## 8.4. Alexa UI with Multiple RGB LED on the Ring



## 8.5. Alexa UI with Single RGB LED



For detailed specifications, refer to **LS5BV-N11S** schematic file available in Libre Portal.

## 9. Disclaimer

THE MATERIALS AND INFORMATION ARE PROVIDED “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT.

We use reasonable efforts to include accurate and up-to-date information in this document. It does not however, make any representations as its accuracy or completeness of information. Use of this document is at your own risk. Libre Wireless Technologies, its suppliers, and other parties involved in creating and delivering this document's contents shall not be liable for any special, indirect, incidental, or consequential damages, including without limitation, lost revenues or lost profits.

## 10. Appendix

### 10.1. Revision History

| Revision | Date              | Description of change |
|----------|-------------------|-----------------------|
| 0.1      | February 21, 2017 | Draft                 |
| 0.2      | February 22, 2017 | Content restructure   |

Preliminary

### **FCC Statement**

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.

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

The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device .

### **FCC Radiation Exposure Statement**

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: 2ADBM-LS5BVD-N11S Or Contains FCC ID: 2ADBM-LS5BVD-N11S"

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. 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.  
(2) This device must accept any interference received, including interference that may cause undesired operation.

2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with limit modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C : 15.247 and 15.209 requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 requirement , then the host can be sold legally.