

# Datasheet

## MSD45N

*Version 2.2*

---

## REVISION HISTORY

| Version | Date          | Notes                                                                                                          | Contributors | Approver    |
|---------|---------------|----------------------------------------------------------------------------------------------------------------|--------------|-------------|
| 1.0     | 25 July 2014  | Initial Release                                                                                                |              | Andrew Chen |
| 1.1     | 5 August 2014 | Added note to <a href="#">SDIO Timing Requirements</a> section regarding SDIO bus clock rate.                  |              | Andrew Chen |
| 1.2     | 06 Feb 2015   | Updated certifications; removed KC and MIC certification references                                            |              | Andrew Chen |
| 1.3     | 08 Jun 2015   | Updated the Tx power and Rx sensitivity numbers.                                                               |              | Andrew Chen |
| 1.4     | 11 Aug 2016   | Changed <i>Hardware Integration Guide</i> to <i>Datasheet</i> .                                                |              | Sue White   |
| 1.5     | 07 Sept 2016  | Added EU Declaration of Conformity                                                                             |              | Sue White   |
| 1.6     | 21 Feb 2017   | Updated FCC data to 24 non-overlapping channels                                                                |              | Jay White   |
| 1.7     | 10 Mar 2017   | Updated 5 GHz frequency bands and operating channels information                                               |              | Kris Sidle  |
| 1.8     | 19 Apr 2017   | Fixed FCC frequency range                                                                                      |              | Miles Chung |
| 1.9     | 1 May 2017    | OS Support                                                                                                     |              | Jay White   |
| 1.10    | 24 May 2017   | Updated EU DoC for new RED standards                                                                           |              | Maggie Teng |
| 1.11    | 15 June 2017  | Updated EU DoC – new style                                                                                     |              | Tom Smith   |
| 1.12    | 19 June 2017  | Updated RoHS version number. Removed incorrect CE marking information at the end of the EU regulatory section. |              | Maggie Teng |
| 1.13    | 21 June 2017  | Added <a href="#">User's Guide requirements</a> for CE.                                                        |              | Tom Smith   |
| 2.0     | 29 Mar 2018   | New template; NCC added to Certification section                                                               | Maggie Teng  | Jay White   |
| 2.1     | 16 May 2018   | Updated IC Regulatory section                                                                                  |              | Maggie Teng |
| 2.2     | 09 Jan 2019   | Added NCC and MIC regulatory information<br>Updated logos and URLs                                             |              | Maggie Teng |

## CONTENTS

|      |                                                                          |    |
|------|--------------------------------------------------------------------------|----|
| 1    | Scope.....                                                               | 4  |
| 2    | Operational Description.....                                             | 4  |
| 3    | Block Diagram .....                                                      | 5  |
| 4    | Specifications .....                                                     | 5  |
| 5    | Recommended Operating Conditions and DC Electrical Characteristics ..... | 9  |
| 5.1  | SDIO Timing Requirements.....                                            | 10 |
| 6    | Pin Definitions.....                                                     | 11 |
| 7    | MSD40NBT and MSD45N Pin Comparison Table .....                           | 14 |
| 7.1  | Integration Considerations .....                                         | 15 |
| 8    | Mechanical Specifications.....                                           | 16 |
| 8.1  | Connector Overview .....                                                 | 16 |
| 8.2  | Mounting .....                                                           | 17 |
| 9    | RF Layout Design Guidelines .....                                        | 17 |
| 10   | Regulatory.....                                                          | 18 |
| 10.1 | Certified Antennas .....                                                 | 18 |
| 10.2 | FCC and Industry Canada .....                                            | 18 |
| 10.3 | European Union .....                                                     | 22 |
| 10.4 | NCC – Taiwan .....                                                       | 25 |
| 10.5 | MIC – Japan.....                                                         | 25 |
| 11   | Appendix A: Schematic .....                                              | 26 |
| 12   | Additional Assistance .....                                              | 27 |

## 1 SCOPE

This document describes key hardware aspects of the Laird MSD45N radio module. This document is intended to assist device manufacturers and related parties with the integration of this radio into their host devices. Data in this document is drawn from a number of sources and includes information found in the Qualcomm Atheros (QCA) AR6003 data sheet issued in January 2010, along with other documents provided from Qualcomm Atheros.

The information in this document is subject to change. Please contact Laird Technologies or visit <https://connectivity.lairdtech.com/> to obtain the most recent version of this document.

## 2 OPERATIONAL DESCRIPTION

This device is a Laird MSD45N radio module which supports IEEE 802.11a/b/g/n standards via an SDIO (Secure Digital Input/Output) interface. The radio operates in unlicensed portions of the 2.4 GHz and 5 GHz radio frequency spectrum. The device is compliant with IEEE 802.11a, 802.11b, 802.11g, and 802.11n standards using Direct Sequence Spread Spectrum (DSSS) and Orthogonal Frequency Division Multiplexing (OFDM). The device supports all 802.11a, 802.11b, 802.11g, and 802.11n data rates and automatically adjusts data rates and operational modes based on various environmental factors.



When operating on channels in the UNII-2 and UNII-2 Extended bands that are in the 5GHz portion of the frequency spectrum and are subject to Dynamic Frequency Selection requirements, the MSD45N fully conforms to applicable regulatory requirements. If specified types of radar are detected by the network infrastructure, the MSD45N fully conforms to commands from the infrastructure for radar avoidance.

The MSD45N interfaces to host devices via a 60-pin connector. The device is based on the Qualcomm Atheros AR6003 chip which is an integrated device providing a Media Access Controller (MAC), a Physical Layer Controller (baseband or BB processor), and fully integrated dual-band radio transceiver. To maximize operational range, the MSD45N incorporates external 2.4 and 5 GHz power amplifiers (PA) to increase transmit power. The frequency stability for both 2.4 GHz (802.11b and 802.11g) and 5 GHz (802.11a) operation is +/- 20 ppm.

On the interface connector (Molex 60-pin connector; pin 21), an I/O voltage level configuration (either 3.3 V or 1.8 V) is required from the host platform to configure the SDIO bus signal to run at a 3.3 V or 1.8 V signal level. The MSD45N also provides the 3-wire Wi-Fi/BT coexistence signals to ensure the performance of Wi-Fi and BT system when they reside in the same platform. A cellular coexistence filter is implemented on the MSD45N to provide robust performance when implemented with a cellular system.

The MSD45N has its own RF shielding and does not require shielding provided by the host device into which it is installed in order to maintain compliance with applicable regulatory standards. As such, the device may be tested in a standalone configuration via an extender card.

The device buffers all data inputs so that it will comply with all applicable regulations even in the presence of over-modulated input from the host device. Similarly, the MSD45N incorporates power regulation to comply with all applicable regulations even when receiving excess power from the host device.

The MSD45N combines the 2.4 and 5 GHz signal path to signal U.FL type antenna connectors to support dual band transmission and receive. An antenna diversity function is **NOT** supported in this product. Supported host device antenna types include dipole and monopole antennas.

Regulatory operational requirements are included with this document and may be incorporated into the operating manual of any device into which the MSD45N is installed. The MSD45N is designed for installation into mobile devices such as vehicle mount data terminals (which typically operate at distances greater than 20 cm from the human body) and portable devices such as handheld data terminals (which typically operate at distances less than 20 cm from the human body). See "[Documentation Requirements](#)" for more information.

### 3 BLOCK DIAGRAM

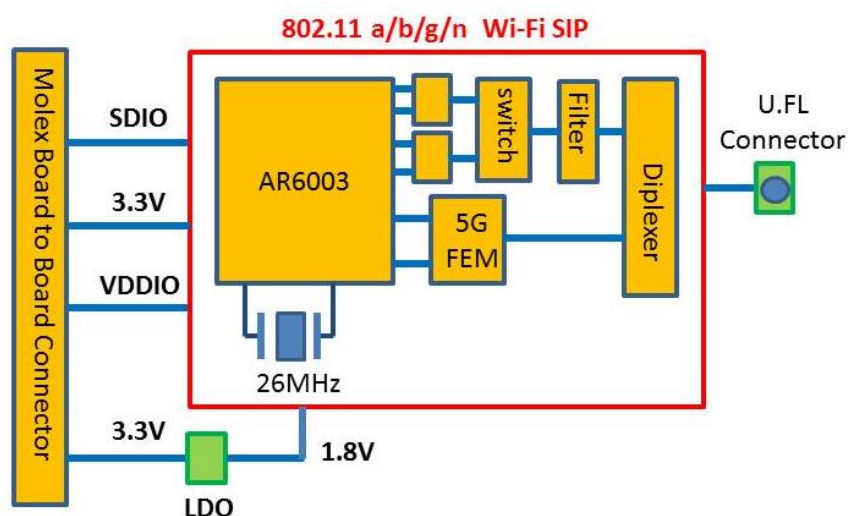


Figure 1: MSD45 Block Diagram

**Note:** Transmitter frequencies for Wi-Fi are 2412-2462 MHz and 5180-5805 MHz.

### 4 SPECIFICATIONS

Table 1: Specifications

| Feature                    | Description                                                                                |
|----------------------------|--------------------------------------------------------------------------------------------|
| Physical Interface         | Molex 54722-0607 60-pin connector (mates to Molex 55560-0607 60-pin connector)             |
| Wi-Fi Interface            | 1-bit or 4-bit Secure Digital I/O                                                          |
|                            | <b>Note:</b> Can support 1.8 V or 3.3 V depending on the supply voltage on VDDIO (pin-21). |
| Antenna Interface          | 1 Hirose U.FL connector                                                                    |
| Main Chip                  | Qualcomm Atheros AR6003 single-chip client                                                 |
| Input Voltage Requirements | 3.3 VDC $\pm$ 5% (core)                                                                    |
| I/O Signalling Voltage     | 3.3 VDC $\pm$ 5%<br>1.8 VDC $\pm$ 5%                                                       |

| Feature                                                                                                                                                           | Description                                                                                                                      |          |              |              |                   |                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------|--------------|--------------|-------------------|-------------------|
| <b>Average Current Consumption</b><br><b>(At maximum transmit power setting)</b><br><br>Note: <i>Standby</i> refers to the radio operating in PM1 powersave mode. |                                                                                                                                  | Mode     | 1.8 V        |              | 3.3 V             |                   |
|                                                                                                                                                                   |                                                                                                                                  |          | Avg. Current | Max. Current | Avg. Current (mA) | Max. Current (mA) |
|                                                                                                                                                                   | <b>802.11a</b>                                                                                                                   | Transmit | 0.11         | 0.11         | 496               | 500               |
|                                                                                                                                                                   |                                                                                                                                  | Receive  | 0.11         | -            | 0.2               | -                 |
|                                                                                                                                                                   |                                                                                                                                  | Standby  | TBD          | TBD          | TBD               | TBD               |
|                                                                                                                                                                   | <b>802.11b</b>                                                                                                                   | Transmit | 0.11         | 0.11         | 380               | 420               |
|                                                                                                                                                                   |                                                                                                                                  | Receive  | 0.11         | -            | 0.2               | -                 |
|                                                                                                                                                                   |                                                                                                                                  | Standby  | TBD          | TBD          | TBD               | TBD               |
|                                                                                                                                                                   | <b>802.11g</b>                                                                                                                   | Transmit | 0.11         | 0.11         | 355               | 410               |
|                                                                                                                                                                   |                                                                                                                                  | Receive  | 0.11         | -            | 0.2               | -                 |
|                                                                                                                                                                   |                                                                                                                                  | Standby  | TBD          | TBD          | TBD               | TBD               |
|                                                                                                                                                                   | <b>802.11n (2.4 GHz)</b>                                                                                                         | Transmit | 0.11         | 0.11         | 342               | 420               |
|                                                                                                                                                                   |                                                                                                                                  | Receive  | 0.11         | -            | 0.2               | -                 |
|                                                                                                                                                                   |                                                                                                                                  | Standby  | TBD          | TBD          | TBD               | TBD               |
|                                                                                                                                                                   | <b>802.11n (5 GHz)</b>                                                                                                           | Transmit | 0.11         | 0.11         | 422               | 500               |
|                                                                                                                                                                   |                                                                                                                                  | Receive  | 0.11         | -            | 0.2               | -                 |
|                                                                                                                                                                   |                                                                                                                                  | Standby  | TBD          | TBD          | TBD               | TBD               |
|                                                                                                                                                                   | <b>Sleep</b>                                                                                                                     | N/A      | TBD          | TBD          | TBD               | TBD               |
| <b>Operating Temperature</b>                                                                                                                                      | -20° to 70°C (-4° to 158°F)                                                                                                      |          |              |              |                   |                   |
| <b>Operating Humidity</b>                                                                                                                                         | 10 to 90% (non-condensing)                                                                                                       |          |              |              |                   |                   |
| <b>Storage Temperature</b>                                                                                                                                        | -40° to 85°C (-40° to 185°F)                                                                                                     |          |              |              |                   |                   |
| <b>Storage Humidity</b>                                                                                                                                           | 10 to 90% (non-condensing)                                                                                                       |          |              |              |                   |                   |
| <b>Maximum Electrostatic Discharge</b>                                                                                                                            | Maximum Contact Discharge (CD): 4 kV<br>Maximum Air Discharge (AD): 8 kV                                                         |          |              |              |                   |                   |
| <b>Length</b>                                                                                                                                                     | 32 mm (1.26 in.)                                                                                                                 |          |              |              |                   |                   |
| <b>Width</b>                                                                                                                                                      | 22 mm (0.87 in.)                                                                                                                 |          |              |              |                   |                   |
| <b>Thickness</b>                                                                                                                                                  | 3.38 mm (0.17 in.)                                                                                                               |          |              |              |                   |                   |
| <b>Weight</b>                                                                                                                                                     | 0.2 g (0.08 oz.)                                                                                                                 |          |              |              |                   |                   |
| <b>Mounting</b>                                                                                                                                                   | 60-pin connector, three grounded mounting holes (M2 screws)                                                                      |          |              |              |                   |                   |
| <b>Wi-Fi Media</b>                                                                                                                                                | Direct Sequence-Spread Spectrum (DSSS)<br>Complementary Code Keying (CCK)<br>Orthogonal Frequency Divisional Multiplexing (OFDM) |          |              |              |                   |                   |
| <b>Wi-Fi Media Access Protocol</b>                                                                                                                                | Carrier sense multiple access with collision avoidance (CSMA/CA)                                                                 |          |              |              |                   |                   |
| <b>Network Architecture Types</b>                                                                                                                                 | Infrastructure and ad hoc                                                                                                        |          |              |              |                   |                   |
| <b>Wi-Fi Standards</b>                                                                                                                                            | IEEE 802.11a, 802.11b, 802.11d, 802.11e, 802.11g, 802.11h, 802.11i, 802.11n                                                      |          |              |              |                   |                   |

| Feature                           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Wi-Fi Data Rates Supported</b> | 802.11a (OFDM): 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>802.11b (DSSS, CCK): 1, 2, 5.5, 11 Mbps<br>802.11g (OFDM): 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>802.11n (OFDM, HT20, MCS 0-7): 6.5, 13, 19.5, 26, 39, 52, 58.5, 72.2 Mbps<br>7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65 Mbps                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Wi-Fi Modulation</b>           | BPSK @ 1, 6, 6.5, 7.2 and 9 Mbps<br>QPSK @ 2, 5.5, 11, 12, 13, 14.4, 18, 19.5 and 21.7 Mbps<br>16-QAM @ 24, 26, 28.9, 36, 39 and 43.3 Mbps<br>64-QAM @ 48, 52, 54, 57.8, 58.5, 65, and 72.2 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>802.11n Spatial Streams</b>    | 1x1 SISO (Single Input, Single Output)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Regulatory Domain Support</b>  | FCC (Americas, Parts of Asia, and Middle East)<br>ETSI (Europe, Middle East, Africa, and Parts of Asia)<br>MIC (Japan) (formerly TELEC)<br>KC (Korea) (formerly KCC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>2.4 GHz Frequency Bands</b>    | ETSI: 2.4 GHz to 2.483 GHz<br>FCC: 2.4 GHz to 2.483 GHz<br>MIC (Japan): 2.4 GHz to 2.495 GHz<br>KC: 2.4 GHz to 2.483 GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>2.4 GHz Operating Channels</b> | ETSI: 13 (3 non-overlapping)      MIC (Japan): 14 (4 non-overlapping)<br>FCC: 11 (3 non-overlapping)      KCC: 13 (3 non-overlapping)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>5 GHz Frequency Bands</b>      | <b>ETSI</b><br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124/128/132/136/140)<br><b>FCC</b><br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124/128/ 132/136/140)<br>5.725 GHz to 5.85 GHz (Ch 149/153/157/161/165)<br><b>MIC (Japan)</b><br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124/128/ 132/136/140)<br><b>KC</b><br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124)<br>5.725 GHz to 5.825 GHz (Ch 149/153/157/161) |
| <b>5 GHz Operating Channels</b>   | ETSI: 19 non-overlapping      MIC: 19 non-overlapping<br>FCC: 24 non-overlapping      KC: 19 non-overlapping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

| Feature                                                                                                                                                                                                                                       | Description                                                                          |                 |                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------|---------------------|
| <b>Transmit Power</b><br><br>Note: Transmit power varies according to individual country regulations. All values nominal, +/-2 dBm.<br><br>Note: Laird 45 series radios support a single spatial stream and 20 MHz wide channels for N rates. | 802.11a:                                                                             | 6 Mbps          | 15 dBm (32 mW)      |
|                                                                                                                                                                                                                                               |                                                                                      | 54 Mbps         | 12 dBm (16 mW)      |
|                                                                                                                                                                                                                                               | 802.11b:                                                                             | 1 Mbps          | 16 dBm (40 mW)      |
|                                                                                                                                                                                                                                               |                                                                                      | 11 Mbps         | 16 dBm (40 mW)      |
|                                                                                                                                                                                                                                               | 802.11g:                                                                             | 6 Mbps          | 16 dBm (40 mW)      |
|                                                                                                                                                                                                                                               |                                                                                      | 54 Mbps         | 12 dBm (16 mW)      |
|                                                                                                                                                                                                                                               | 802.11n (2.4 GHz):                                                                   | 6.5 Mbps (MCS0) | 16 dBm (40 mW)      |
|                                                                                                                                                                                                                                               |                                                                                      | 65 Mbps (MCS7)  | 12 dBm (16 mW)      |
|                                                                                                                                                                                                                                               | 802.11n (5 GHz):                                                                     | 6.5 Mbps (MCS0) | 15 dBm (32 mW)      |
|                                                                                                                                                                                                                                               |                                                                                      | 65 Mbps (MCS7)  | 12 dBm (16 mW)      |
| <b>Typical Receiver Sensitivity</b><br><br>Note: All values nominal, +/-3 dBm.                                                                                                                                                                | 802.11a:                                                                             | 6 Mbps          | -90 dBm             |
|                                                                                                                                                                                                                                               |                                                                                      | 54 Mbps         | -73 dBm (PER <=10%) |
|                                                                                                                                                                                                                                               | 802.11b:                                                                             | 1 Mbps          | -89 dBm             |
|                                                                                                                                                                                                                                               |                                                                                      | 11 Mbps         | -82 dBm (PER <=10%) |
|                                                                                                                                                                                                                                               | 802.11g:                                                                             | 6 Mbps          | -85 dBm             |
|                                                                                                                                                                                                                                               |                                                                                      | 54 Mbps         | -68 dBm (PER <=10%) |
|                                                                                                                                                                                                                                               | 802.11n (2.4 GHz):                                                                   | MCS0 Mbps       | -86 dBm             |
|                                                                                                                                                                                                                                               |                                                                                      | MCS7 Mbps       | -65 dBm             |
|                                                                                                                                                                                                                                               | 802.11n (5 GHz):                                                                     | MCS0 Mbps       | -90 dBm             |
|                                                                                                                                                                                                                                               |                                                                                      | MCS7 Mbps       | -70 dBm             |
| <b>Operating Systems Supported</b>                                                                                                                                                                                                            | Android, Linux                                                                       |                 |                     |
| <b>Security</b>                                                                                                                                                                                                                               | <b>Standards</b>                                                                     |                 |                     |
|                                                                                                                                                                                                                                               | Wireless Equivalent Privacy (WEP)                                                    |                 |                     |
|                                                                                                                                                                                                                                               | Wi-Fi Protected Access (WPA)                                                         |                 |                     |
|                                                                                                                                                                                                                                               | IEEE 802.11i (WPA2)                                                                  |                 |                     |
|                                                                                                                                                                                                                                               | <b>Note:</b> Support for Federal Information Processing Standards (FIPS) is pending. |                 |                     |
|                                                                                                                                                                                                                                               | <b>Encryption</b>                                                                    |                 |                     |
|                                                                                                                                                                                                                                               | Wireless Equivalent Privacy (WEP, RC4 Algorithm)                                     |                 |                     |
|                                                                                                                                                                                                                                               | Temporal Key Integrity Protocol (TKIP, RC4 Algorithm)                                |                 |                     |
|                                                                                                                                                                                                                                               | Advanced Encryption Standard (AES, Rijndael Algorithm)                               |                 |                     |
|                                                                                                                                                                                                                                               | <b>Encryption Key Provisioning</b>                                                   |                 |                     |
|                                                                                                                                                                                                                                               | Static (40-bit and 128-bit lengths)                                                  |                 |                     |
|                                                                                                                                                                                                                                               | Pre-Shared (PSK)                                                                     |                 |                     |
|                                                                                                                                                                                                                                               | Dynamic                                                                              |                 |                     |
|                                                                                                                                                                                                                                               | <b>802.1X Extensible Authentication Protocol Types</b>                               |                 |                     |
|                                                                                                                                                                                                                                               | EAP-FAST                                                                             | PEAP-MSCHAPv2   |                     |
|                                                                                                                                                                                                                                               | EAP-TLS                                                                              | PEAP-TLS        |                     |
|                                                                                                                                                                                                                                               | EAP-TTLS                                                                             | LEAP            |                     |
|                                                                                                                                                                                                                                               | PEAP-GTC                                                                             |                 |                     |

| Feature                                                        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Compliance</b>                                              | <b>ETSI Regulatory Domain</b><br>EN 300 328<br>EN 301 489-1<br>EN 301 489-17<br>EN 301 893<br>EN 60950-1<br>EN 62311<br>2011/65/EU (RoHS)<br><b>FCC Regulatory Domain</b><br>FCC 15.247 DTS – 802.11b/g (Wi-Fi) – 2.4 GHz & 5.8 GHz<br>FCC 15.407 UNII – 802.11a (Wi-Fi) – 2.4 GHz & 5.4 GHz<br><b>Industry Canada</b><br>RSS-247 – 802.11a/b/g/n (Wi-Fi) – 2.4 GHz, 5.8 GHz, 5.2 GHz, and 5.4 GHz<br><b>NCC (Taiwan)</b><br><b>MIC (Japan)</b> |
| <b>Certifications</b><br><b>Note:</b> CCX is pending.          | Wi-Fi Alliance<br>802.11a, 802.11b, 802.11g , 802.11n<br>WPA Enterprise<br>WPA2 Enterprise<br>Cisco Compatible Extensions (Version 4)                                                                                                                                                                                                                                                                                                           |
| <b>Warranty</b>                                                | Limited Lifetime                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>All specifications are subject to change without notice</i> |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |



## 5 RECOMMENDED OPERATING CONDITIONS AND DC ELECTRICAL CHARACTERISTICS

**Table 2: Absolute Maximum Ratings**

| Symbol         | Parameter                                                          | Min. | Typ. | Max. | Unit |
|----------------|--------------------------------------------------------------------|------|------|------|------|
| VCC3_3         | Power supply voltage with respect to ground                        | -0.3 | -    | 4.0  | V    |
| VDD_IO         | Power supply voltage with respect to ground                        | -0.3 | -    | 4.0  | V    |
| Voltage Ripple | +/-2%, 10KHz~100KHz<br>Max. values not exceeding Operating voltage | -    | -    | 2    | %    |
| RFin           | Maximum RF input (reference to 50 ohm)                             | -    | -    | +10  | dBm  |

**Table 3: Recommended Operating Conditions**

| Symbol | Parameter                                   | Min. | Typ. | Max. | Unit |
|--------|---------------------------------------------|------|------|------|------|
| VCC3_3 | Power supply voltage with respect to ground | 3.14 | 3.3  | 3.46 | V    |
| VDD_IO | Power supply voltage with respect to ground | 1.71 | 1.8  | 1.89 | V    |
|        |                                             | 3.14 | 3.3  | 3.46 | V    |

**Note:** VDD\_IO is a voltage from the host platform to configure the I/O signal level. It can be set 1.8 or 3.3 V.

## 5.1 SDIO Timing Requirements

The following figure and table display SDIO default mode timing.

**Note:** The SDIO bus should not exceed a 25 MHz clock rate.

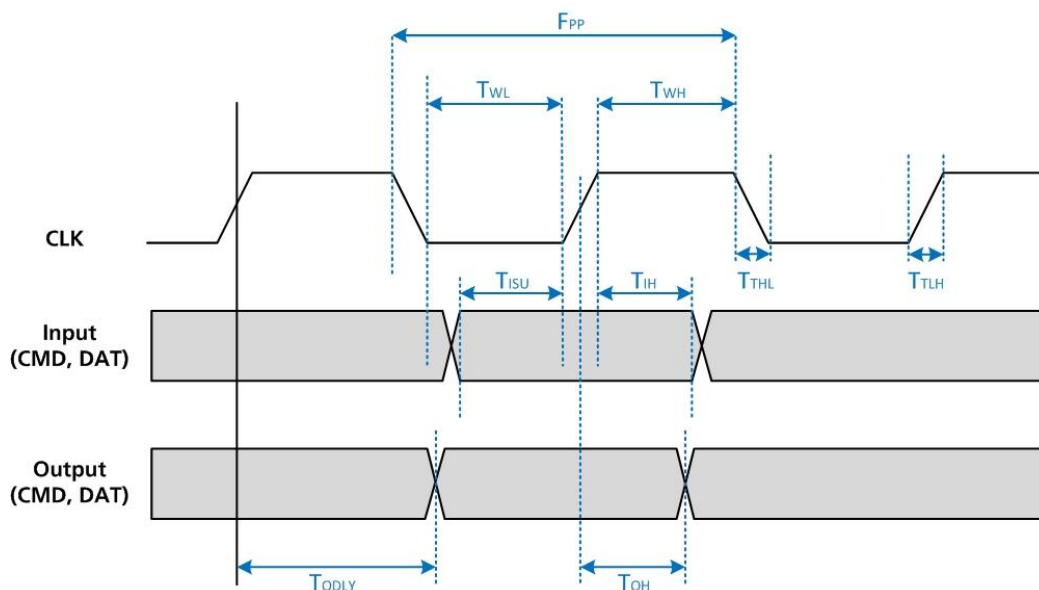


Figure 2: SDIO Default Mode Timing

**Note:** Timing is based on  $CL \leq 40$  pF load on CMD and Data.

Table 4: SDIO Timing Requirements

| Symbol                                       | Parameter                              | Min. | Typ. | Max. | Unit |
|----------------------------------------------|----------------------------------------|------|------|------|------|
| f <sub>PP</sub>                              | Frequency – Data Transfer mode         | 0    | -    | 50   | MHz  |
| t <sub>WL</sub>                              | Clock low time                         | 7    | -    | -    | ns   |
| t <sub>WH</sub>                              | Clock high time                        | 7    | -    | -    | ns   |
| t <sub>TLH</sub>                             | Clock rise time                        | -    | -    | 10   | ns   |
| t <sub>THL</sub>                             | Clock low time                         | -    | -    | 10   | ns   |
| <b>Inputs: CMD, DAT (referenced to CLK)</b>  |                                        |      |      |      |      |
| t <sub>ISU</sub>                             | Input setup time                       | 6    | -    | -    | ns   |
| t <sub>IH</sub>                              | Input hold time                        | 2    | -    | -    | ns   |
| <b>Outputs: CMD, DAT (referenced to CLK)</b> |                                        |      |      |      |      |
| t <sub>ODLY</sub>                            | Output delay time – Data Transfer mode | 0    | -    | 14   | ns   |

## 6 PIN DEFINITIONS

**Table 5: Pin Definitions**

| Pin # | Name        | I/O | Default State | Ref.   | Description                                                                                                           | If Unused                                         |
|-------|-------------|-----|---------------|--------|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| 1     | GND         | -   |               |        | Ground                                                                                                                | Must be connected to GND                          |
| 2     | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 3     | BT_PRIORITY | I   | Hi-Z          | VDD_IO | 3-Wire Wi-Fi/BT coexistence signal<br>BT_PRIORITY for Bluetooth coexistence                                           |                                                   |
| 4     | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 5     | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 6     | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 7     | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 8     | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 9     | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 10    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 11    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 12    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 13    | VCC3_3      | -   |               |        | 3.3 V Module Power                                                                                                    |                                                   |
| 14    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 15    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 16    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 17    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 18    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 19    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 20    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 21    | VDD_IO      | -   |               |        | I/O bus voltage configuration;<br>Either 3.3 V or 1.8 V                                                               |                                                   |
| 22    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 23    | No Connect  |     |               |        | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 24    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 25    | No Connect  |     |               |        | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 26    | No Connect  | -   |               | -      | No internal connection. Leave it open                                                                                 | Leave open                                        |
| 27    | SDIO_DATA_2 | I/O | Pull-H        | VDD_IO | SDIO Data2<br><b>Note:</b> See “ <a href="#">Integration Considerations</a> ” for additional integration information. |                                                   |
| 28    | WL_ACTIVE   | O   | Low           | VDD_IO | 3-Wire Wi-Fi/BT coexistence signal;<br>WLAN_ACTIVE for Bluetooth coexistence                                          | If not attached to a BT chip, is not pulled high. |

| Pin # | Name                | I/O | Default State | Ref.   | Description                                                                                                                                                                                                       | If Unused                |
|-------|---------------------|-----|---------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 29    | VCC3_3              | -   |               |        | 3.3 V Module Power                                                                                                                                                                                                |                          |
| 30    | GND                 | -   |               |        | Ground                                                                                                                                                                                                            | Must be connected to GND |
| 31    | GND                 | -   |               |        | Ground                                                                                                                                                                                                            | Must be connected to GND |
| 32    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 33    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 34    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 35    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 36    | BT_ACTIVE           | I   | Hi-Z          | VDD_IO | 3-Wire Wi-Fi/BT coexistence signal;<br>BT_ACTIVE for Bluetooth coexistence                                                                                                                                        |                          |
| 37    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 38    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 39    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 40    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 41    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 42    | WL_LED_ACT/<br>ANTE | O   | LOW           | VCC3_3 | Used for the following:<br>Antenna switch control signal when sharing antenna with BT signal. See "Sharing Antenna Implementation" for more information.<br>LED indicator for Wi-Fi is active (sending a signal). |                          |
| 43    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 44    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 45    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 46    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 47    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 48    | CHIP_PWD_L          | I   | Pull-H        | VDD_IO | Input signal to power down the module.<br>Active low<br>See <a href="#">Note 1</a> .<br>See <a href="#">Note</a> Regarding CHIP_PWD_L.                                                                            |                          |
| 49    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 50    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 51    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 52    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 53    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |
| 54    | No Connect          | -   |               | -      | No internal connection. Leave it open                                                                                                                                                                             | Leave open               |

| Pin # | Name        | I/O | Default State | Ref.   | Description             | If Unused                |
|-------|-------------|-----|---------------|--------|-------------------------|--------------------------|
| 55    | SDIO_CMD    | I/O | Pull-H        | VDD_IO | SDIO Command            |                          |
| 56    | SDIO_CLK    | I   | Hi-Z          | VDD_IO | SDIO Clock (25 MHz max) |                          |
| 57    | SDIO_DATA_0 | I/O | Pull-H        | VDD_IO | SDIO Data 0             |                          |
| 58    | SDIO_DATA_3 | I/O | Pull-H        | VDD_IO | SDIO Data 3             |                          |
| 59    | SDIO_DATA_1 | I/O | Pull-H        | VDD_IO | SDIO Data 1             |                          |
| 60    | GND         | -   |               |        | Ground                  | Must be connected to GND |

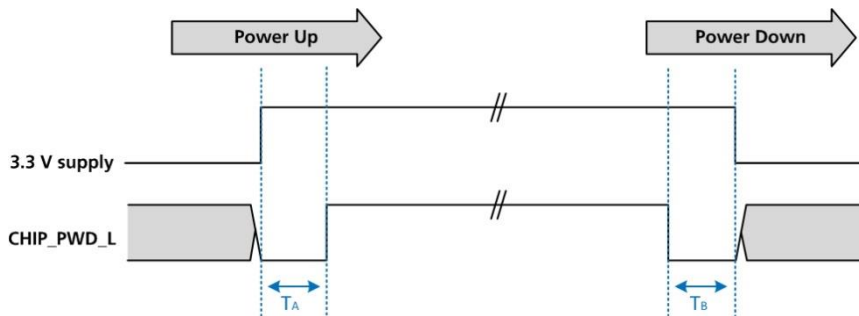
**Note 1:** If the following lines are available on the radio you are integrating into your system, you must connect and control them with the host device.

CHIP\_PWD\_L  
SYS\_RST\_L  
BT\_RST\_L  
VDDIO\_DR

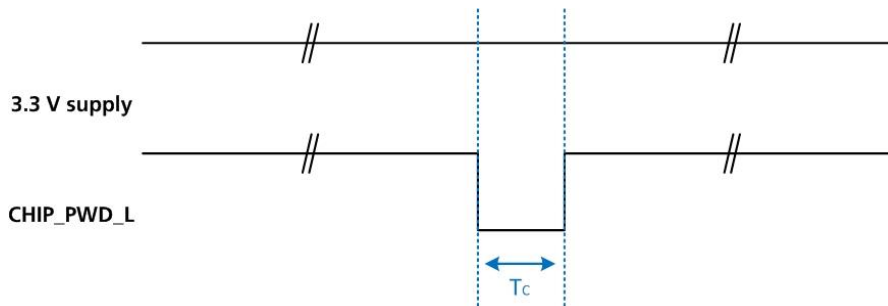
If the radio stays powered up and the host goes down or is reset, communications cannot be re-established with the radio. The host SDIO controller must re-establish communication with the radio by reloading the radio firmware after a power-on or a reset.

Note Regarding CHIP\_PWD\_L: During power on/down period, the CHIP\_PWD\_L must be held in low state longer than 5  $\mu$ sec ( $T_A$  and  $T_B$ ) after the VCC3\_3 reaches its high state. See [Figure 3](#).

To reset the MSD45N, set the CHIP\_PWD\_L in low state longer than 5  $\mu$ sec ( $T_C$ ). See [Figure 4](#).



**Figure 3: Power on/down timing**



**Figure 4: Reset timing**

## 7 MSD40NBT AND MSD45N PIN COMPARISON TABLE

| Pin # | Pin Name<br>MSD40NBT | Pin Name<br>MSD45N | Pin # | Pin Name<br>MSD40NBT | Pin Name<br>MSD45N |
|-------|----------------------|--------------------|-------|----------------------|--------------------|
| 1     | GND                  | GND                | 31    | GND                  | GND                |
| 2     | BT_UART_TXD          | No Connect         | 32    | BT_RST_L             | No Connect         |
| 3     | BT_PRIORITY          | BT_PRIORITY        | 33    | No Connect           | No Connect         |
| 4     | BT_GPIO_6            | No Connect         | 34    | No Connect           | No Connect         |
| 5     | BT_UART_RTS_N        | No Connect         | 35    | No Connect           | No Connect         |
| 6     | BT_UART_RXD          | No Connect         | 36    | RSVD                 | BT_ACTIVE          |
| 7     | BT_HOST_WAKE_B       | No Connect         | 37    | No Connect           | No Connect         |
| 8     | RSVD                 | No Connect         | 38    | No Connect           | No Connect         |
| 9     | RSVD                 | No Connect         | 39    | No Connect           | No Connect         |
| 10    | BT_PCM_OUT           | No Connect         | 40    | No Connect           | No Connect         |
| 11    | BT_UART_CTS_N        | No Connect         | 41    | No Connect           | No Connect         |
| 12    | BT_WAKE_B            | No Connect         | 42    | RSVD                 | WL_LED_ACT/ANTE    |
| 13    | VCC3_3               | VCC3_3             | 43    | No Connect           | No Connect         |
| 14    | No Connect           | No Connect         | 44    | No Connect           | No Connect         |
| 15    | No Connect           | No Connect         | 45    | No Connect           | No Connect         |
| 16    | No Connect           | No Connect         | 46    | No Connect           | No Connect         |
| 17    | No Connect           | No Connect         | 47    | No Connect           | No Connect         |
| 18    | No Connect           | No Connect         | 48    | CHIP_PWD_L           | CHIP_PWD_L         |
| 19    | No Connect           | No Connect         | 49    | No Connect           | No Connect         |
| 20    | BT_PCM_SYNC          | No Connect         | 50    | RSVD                 | No Connect         |
| 21    | No Connect           | VDD_IO             | 51    | No Connect           | No Connect         |
| 22    | BT_PCM_IN            | No Connect         | 52    | RSVD                 | No Connect         |
| 23    | No Connect           | No Connect         | 53    | RSVD                 | No Connect         |
| 24    | BT_PCM_CLK           | No Connect         | 54    | RSVD                 | No Connect         |
| 25    | No Connect           | No Connect         | 55    | SDIO_CMD             | SDIO_CMD           |
| 26    | SYS_RST_L            | No Connect         | 56    | SDIO_CLK             | SDIO_CLK           |
| 27    | SDIO_DATA_2          | SDIO_D2            | 57    | SDIO_DATA_0          | SDIO_D0            |
| 28    | RSVD                 | WL_ACTIVE          | 58    | SDIO_DATA_3          | SDIO_D3            |
| 29    | VCC3_3               | VCC3_3             | 59    | SDIO_DATA_1          | SDIO_D1            |
| 30    | GND                  | GND                | 60    | GND                  | GND                |

## 7.1 Integration Considerations

The following Wi-Fi information should be taken into consideration when integrating the MSD45N.

Series resistors are recommended in all six SDIO lines (27-56 ohms typically):

- |               |               |
|---------------|---------------|
| ▪ SDIO_CLK    | ▪ SDIO_DATA_1 |
| ▪ SDIO_CMD    | ▪ SDIO_DATA_2 |
| ▪ SDIO_DATA_0 | ▪ SDIO_DATA_3 |

---

**Note:** Although these values may vary with the properties of your host interface and the PCB, they are a reasonable starting point.

**Note:** The series resistors in the SDIO bus provide several design benefits:

If a host controller has too high of a drive strength, then bus ringing may result. Series resistors can reduce this ringing on the I/O lines.

Adding 27-56 ohms of series resistance on the SDIO bus will reduce sharp transitional edges, which may reduce EMI.

Having the series resistors in the PCB layout allows for design flexibility; if they are later found to be unnecessary, zero (0) ohm jumpers may be used in their place.

---

**Also note the following:**

- Route the SDIO bus as short and as similar in length as possible.
- Keep the clock trace separate from other signal traces.

---

**Notes:** No pull-up is required on the CLK line.

Make sure to apply the proper voltage on the VDD\_IO input to the SiP to match the signalling voltage of the SDIO host interface (1.8V or 3.3V typically, but it can be anything in between these values).

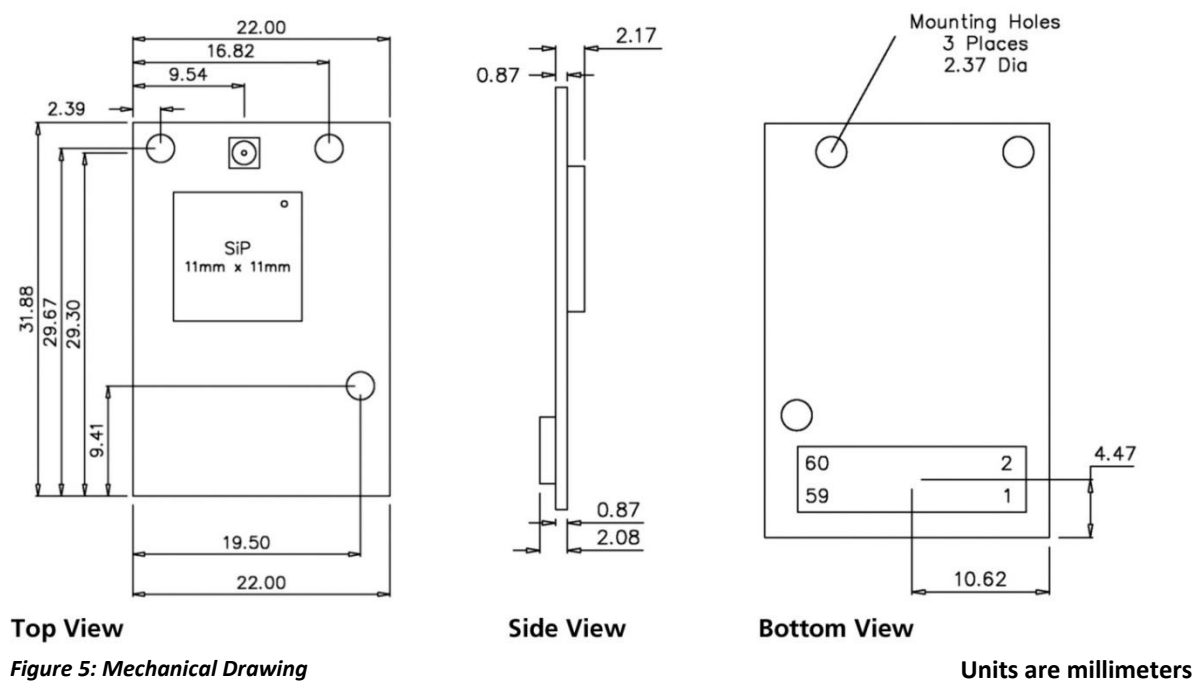
The SDIO host must wait a minimum of 5 µsec before initiating access to the MSD45N after VCC3\_3 ramps up and settles

## 8 MECHANICAL SPECIFICATIONS

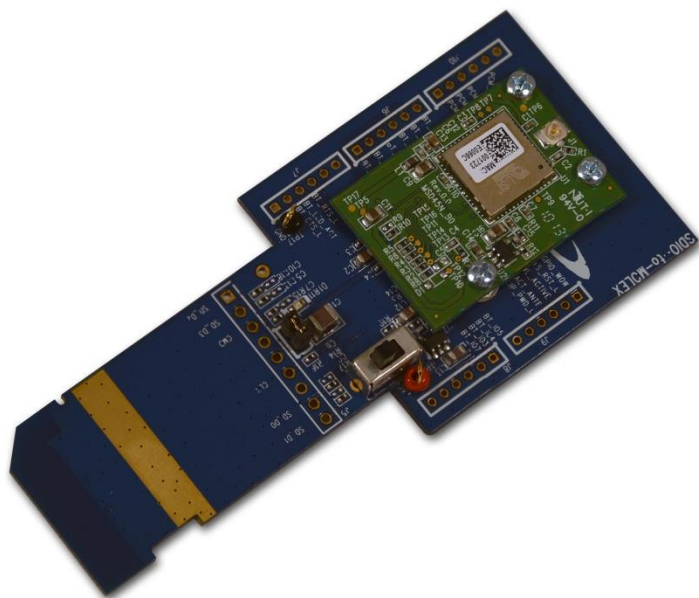
### 8.1 Connector Overview

**MSD45N connector:** Molex 54722-0607 60-pin connector

**Mating connector (on board):** Molex 55560-0607 60-pin connector



#### 8.1.1 MSD45N Attached to T-Board

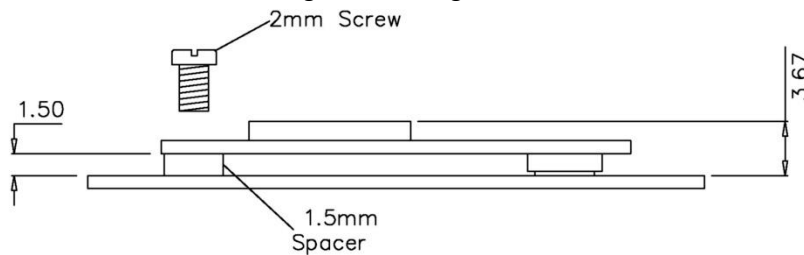


**Figure 6: MSD45N attached to T-board**

## 8.2 Mounting

The MSD45N connects to the host via a 60-pin connector. In addition, there are three mounting holes used to secure the device to the host using 2 mm mounting screws.

Laird recommends a 1.5 mm metal spacer (bushing) with a conductive mounting screw to connect the exposed ground pads of the radio circuit board to the host ground plane. A 1.5 mm conductive metal spacer with a maximum OD of 4 mm maximizes grounding of the radio and helps to reduce emissions from the radio circuit board. The spacer may also prevent the MSD board from slanting and breaking the connection to the host device when the board is attached to the host.



**Figure 7: Mounting Recommendations**

## 9 RF LAYOUT DESIGN GUIDELINES

The following is a list of RF layout design guidelines and recommendation when installing a Laird radio into your device.

- Do not run antenna cables directly above or directly below the radio.
- Do not place any parts or run any high speed digital lines below the radio.
- If there are other radios or transmitters located on the device (such as a Bluetooth radio), place the devices as far apart from each other as possible.
- Ensure that there is the maximum allowable spacing separating the antenna connectors on the Laird radio from the antenna. In addition, do not place antennas directly above or directly below the radio.
- Laird recommends the use of a double shielded cable for the connection between the radio and the antenna elements.
- Laird has provided three plated mounting holes that can be used for grounding. When additional ground plane is required, you may use some or all of these grounded mounting holes.
- Use proper electro-static-discharge (ESD) procedures when installing the Laird radio module.

## 10 REGULATORY

### 10.1 Certified Antennas

The MSD45N will be tested to the regulatory standards defined in the “Certifications” section of the Specifications table above. Laird Technologies plans to conduct these tests with the following antennas:

| Model                              | Type               | Connector           | Maximum Gain                                                                                 |
|------------------------------------|--------------------|---------------------|----------------------------------------------------------------------------------------------|
| MAG.LAYERS EDA-1513-25GR2-B2-CY    | Dipole             | SMA<br>Jack Reverse | 2 dBi                                                                                        |
| MAG.LAYERS PCA-4606-2G4C1-A13-CY   | PCB Dipole         | TNOV                | 2.2 dBi                                                                                      |
| Laird NanoBlade-IP04               | PCB Dipole         | IPEX MHF            | 2.4-2.5 GHz: 2 dBi<br>5.15-5.35 GHz: 3.9 dBi<br>5.6 GHz: 4 dBi                               |
| Laird MAF95310 Mini NanoBlade Flex | PCB Dipole         | IPEX MHF            | 2.4 GHz: 2.79 dBi<br>5 GHz: 3.38 dBi                                                         |
| Laird NanoBlue-IP04                | PCB Dipole         | IPEX MHF            | 2.5 GHz only: 2 dBi                                                                          |
| Ethertronics WLAN_1000146          | Magnetic<br>Dipole | IPEX MHF            | 2.4-2.5 GHz: 2 dBi<br>4.9-5.1 GHz: 3.5 dBi<br>5.15-5.35 GHz: 3.5 dBi<br>5.7-5.9 GHz: 3.5 dBi |

Antennas of differing types and higher gains may be integrated as well. If necessary, with the Laird Manufacturing Utility software utility, OEMs may reduce the transmit power of the MSD45N to account for higher antenna gain. In some cases, OEMs may be able to reduce certification efforts by using antennas that are of like type and equal or lesser gain to the above listed antennas.

### 10.2 FCC and Industry Canada

In order to maintain regulatory compliance, when integrating the Laird MSD45N into a host device and leveraging Laird’s grants and certifications, it is necessary to meet the documentation requirements set forth by the applicable regulatory agencies. The following sections (FCC, Industry Canada, and European Union) outline the information that may be included in the user’s guide and external labels for the host devices into which the MSD45N is integrated.

#### 10.2.1 FCC

**Note:** You must place “Contains FCC ID: SQG-MSD45N” on the host product in such a location that it can be seen by an operator at the time of purchase.

#### *User’s Guide Requirements*

When integrating the MSD45N into a host device, the integrator must include specific information in the user’s guide for the device into which the MSD45N is integrated. The integrator must not provide information to the end user regarding how to install or remove this RF module in the user’s manual of the device into which the MSD45N is integrated. The following FCC statements must be added in their entirety and without modification into a prominent place in the user’s guide for the device into which the MSD45N is integrated:

### Federal Communication Commission Interference Statement

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 in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

---

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

---

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.

This device is restricted to **indoor** use when operated in the 5.15 to 5.25 GHz frequency range.

FCC requires this product to be used indoors for the frequency range 5.15 to 5.25 GHz to reduce the potential for harmful interference to co-channel Mobile Satellite systems.

This device does not permit operations on channels 116-128 (5580 – 5640 MHz) for 11na and 120-128 (5600-5640 MHz) for 11a which overlap the 5600 -5650 MHz band.

---

### IMPORTANT NOTE: FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

---

### This device is intended only for OEM integrators under the following conditions:

- The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- The transmitter module may not be co-located with any other transmitter or antenna,
- For all products marketed in the United States, the OEM must limit the operation channels from CH1 to CH11 for 2.4 GHz band by the supplied firmware programming tool. The OEM shall not supply any tool or information to the end-user regarding Regulatory Domain change.

As long as the three conditions above are met, further transmitter testing is not required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

---

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>IMPORTANT NOTE:</b> | In the event that these conditions cannot be met (for example, certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator is responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization. |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

---

## End Product Labeling

This transmitter module is authorized only for use in device where the antenna is installed such that 20 cm is maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: SQG-MSD45N".

## Manual Information to the End User

The OEM integrator **may NOT** provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warnings as show in this Hardware Integration Guide.

## 10.2.2 Industry Canada

### Industry Canada Statement

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference
- (2) This device must accept any interference, including interference that may cause undesired operation of the device

Cet appareil contient des émetteurs / récepteurs exempts de licence qui sont conformes au (x) RSS (s) exemptés de licence d'Innovation, Sciences et Développement économique Canada. L'opération est soumise aux deux conditions suivantes:

- (1) Cet appareil ne doit pas causer d'interférences
- (2) Cet appareil doit accepter toute interférence, y compris les interférences pouvant provoquer un fonctionnement indésirable de l'appareil

This radio transmitter (IC: 3147A-MSD45N) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (IC: 3147A-MSD45N) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

| Antenna information                   | Type       | Connector        | Operating Frequencies (MHz)/Antenna Gain (dBi) |           |           |           |           |
|---------------------------------------|------------|------------------|------------------------------------------------|-----------|-----------|-----------|-----------|
|                                       |            |                  | 2400-2483.5                                    | 5150-5250 | 5250-5350 | 5470-5725 | 5725-5850 |
| MAG.LAYERS<br>EDA-1513-25GR2-B2-CY    | Dipole     | SMA Jack Reverse | 2                                              | 2         | 2         | 2         | 2         |
| MAG.LAYERS<br>PCA-4606-2G4C1-A13-CY   | PCB Dipole | UFL              | 2.21                                           | 2.21      | 2.21      | 2.21      | 2.21      |
| Laird NanoBlade-IP04                  | PCB Dipole | UFL              | 2                                              | 3.9       | 3.9       | 4         | 4         |
| Laird MAF95310 Mini<br>NanoBlade Flex | PCB Dipole | UFL              | 2.79                                           | 3.38      | 3.38      | 3.38      | 3.38      |
| Laird NanoBlue-IP04                   | PCB Dipole | UFL              | 2                                              | -         | -         | -         | -         |
| Ethertronics WLAN_1000146             | PIFA       | UFL              | 2.5                                            | 3.5       | 3.5       | 3.5       | 3.5       |
| SAA MG7018-41-000-R                   | Dipole     | UFL              | 1.87                                           | 0.85      | 0.6       | 0.94      | 0.92      |
| SAA MG7324-41-000-R                   | Dipole     | UFL              | 1.32                                           | 1.04      | 1.6       | 2.75      | 2.24      |
| Laird EMF2449A1-33UFL                 | PCB Dipole | UFL              | 0.8                                            | 3.3       | 3.3       | 3.3       | 3.3       |

### *Caution:*

- (i) the device for operation in the band 5150–5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;
  - (ii) for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit;
  - (iii) for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits specified for point-to-point and non-point-to-point operation as appropriate; and
- Operations in the 5.25-5.35GHz band are restricted to indoor usage only.

### *Avertissement:*

- (i) les dispositifs fonctionnant dans la bande de 5150 à 5250MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;
  - (ii) pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis pour les dispositifs utilisant les bandes de 5250 à 5350MHz et de 5470 à 5725 MHz doit être conforme à la limite de la p.i.r.e;
  - (iii) pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis (pour les dispositifs utilisant la bande de 5725 à 5850 MHz) doit être conforme à la limite de la p.i.r.e. spécifiée pour l'exploitation point à point et l'exploitation non point à point, selon le cas;
- Les opérations dans la bande de 5.25-5.35GHz sont limités à un usage intérieur seulement.

### *Radiation Exposure Statement*

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

### *Déclaration d'exposition aux radiations*

Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à distance minimum de 20cm entre le radiateur et votre corps.

This device is intended only for OEM integrators under the following conditions:

1. The transmitter module may not be co-located with any other transmitter or antenna.

As long as the condition above is met, further transmitter testing is not required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes:

1. Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 1 condition ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

### *IMPORTANT NOTE*

If these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

**NOTE IMPORTANTE**

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

**End Product Labeling**

The final end product must be labeled in a visible area with the following: "Contains IC: 3147A-MSD45N".

**Plaque signalétique du produit final**

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 3147A-MSD45N".

**Manual Information to the End User**

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

**Manuel d'information à l'utilisateur final**

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

**10.3 European Union****10.3.1 EU Declarations of Conformity**

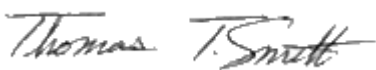
|                            |                                              |
|----------------------------|----------------------------------------------|
| <b>Manufacturer</b>        | Laird                                        |
| <b>Products</b>            | MSD45N                                       |
| <b>Product Description</b> | 802.11 a/b/g/n Enterprise Wi-Fi module       |
| <b>EU Directives</b>       | 2014/53/EU – Radio Equipment Directive (RED) |

**Reference standards used for presumption of conformity:**

| Article Number | Requirement                                                           | Reference standard(s)                                           |
|----------------|-----------------------------------------------------------------------|-----------------------------------------------------------------|
| 3.1a           | Low voltage equipment safety                                          | EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011                    |
|                | RF Exposure                                                           | EN 62311:2008<br>EN 50385:2002                                  |
| 3.1b           | Protection requirements with respect to electromagnetic compatibility | EN 301 489-1 v2.2.0 (2017-03)<br>EN 301 489-17 v3.2.0 (2017-03) |
| 3.2            | Protection requirements – Electromagnetic compatibility               | EN 300 328 v2.1.1 (2016-11)<br>EN 301 893 v2.1.1 (2017-05)      |

**Declaration:**

We, Laird, declare under our sole responsibility that the essential radio test suites have been carried out and that the above product to which this declaration relates is in conformity with all the applicable essential requirements of Article 3 of the EU Directive 2014/53/EU, when used for its intended purpose.

|                                        |                                                                                                       |
|----------------------------------------|-------------------------------------------------------------------------------------------------------|
| <b>Place of Issue:</b>                 | Laird<br>W66N220 Commerce Court, Cedarburg, WI 53012 USA<br>tel: +1-262-375-4400 fax: +1-262-364-2649 |
| <b>Date of Issue:</b>                  | June 2017                                                                                             |
| <b>Name of Authorized Person:</b>      | Thomas T Smith, Director of EMC Compliance                                                            |
| <b>Signature of Authorized Person:</b> |                      |

*User's Guide Requirements*

The integrator must include specific information in the user's guide for the device into which the MSD45N is integrated. In addition to the required FCC and IC statements outlined above, the following Radio Equipment Directive (RED) statements must be added in their entirety and without modification into a prominent place in the user's guide for the device into which the MSD45N is integrated:

This device complies with the essential requirements of the Radio Equipment Directive: 2014/53/EU. The following test methods have been applied in order to prove presumption of conformity with the essential requirements of this directive:

- **EN 60950-1:2006+A11+A1:2010+A12:2011**  
Safety of Information Technology Equipment
- **EN 300 328 v2.1.1**  
Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband Transmission systems; Data transmission equipment operating in the 2.4 GHz ISM band and using spread spectrum modulation 2014/53/EU.
- **EN 301 489-1 v2.2.0**  
Electromagnetic compatibility and Radio Spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
- **EN 301 489-17 3.2.0**  
Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for 2,4 GHz wideband transmission systems and 5 GHz high performance RLAN equipment
- **EN 301 893 v2.1.1**  
Electromagnetic compatibility and Radio spectrum Matters (ERM); Broadband Radio Access Networks (BRAN); Specific conditions for 5 GHz high performance RLAN equipment
- **EU 2011/65/EU (RoHS)**  
Declaration of Compliance – EU Directive 2011/65/EU; Reduction of Hazardous Substances (RoHS)

This device is a 2.4 GHz wideband transmission system (transceiver), intended for use in all EU member states and EFTA countries, except in France and Italy where restrictive use applies.

In Italy the end-user should apply for a license at the national spectrum authorities in order to obtain authorization to use the device for setting up outdoor radio links and/or for supplying public access to telecommunications and/or network services.

This device may not be used for setting up outdoor radio links in France and in some areas the RF output power may be limited to 10 mW EIRP in the frequency range of 2454 – 2483.5 MHz. For detailed information the end-user should contact the national spectrum authority in France.

## Maximum Output Power for Each Frequency

20.00 dBm, 2.4G: 2.412 GHz~2.472GHz

22.20 dBm, 5.15-5.25GHz

22.10 dBm, 5.47-5.725GHz

## Software Version for Testing

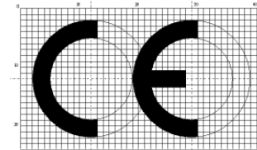
SW version: 23.3.3.5

The minimum distance between the user and/or any bystander and the radiating structure of the transmitter is 20 cm.

5150 ~ 5350 MHz is limited to indoor used in the following countries:



|    |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|----|
| BE | DK | IE | FR | CY | LU | NL | PT | SK | UK | NO |
| BG | DE | EL | HR | LV | HU | AT | RO | FI | LI | TR |
| CZ | EE | ES | IT | LT | MT | PL | SI | SE | IS | CH |



|                          |                                                                                                                                                                                                                         |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Český<br>[Czech]         | [Jméno výrobce] tímto prohlašuje, že tento [typ zařízení] je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice 2014/53/EU.                                                                   |
| Dansk<br>[Danish]        | Undertegnede [fabrikantens navn] erklærer herved, at følgende udstyr [udstyrets typebetegnelse] overholder de væsentlige krav og øvrige relevante krav i direktiv 2014/53/EU.                                           |
| Deutsch<br>[German]      | Hiermit erkläre [Name des Herstellers], dass sich das Gerät [Gerätetyp] in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 2014/53/EU befindet.           |
| Eesti<br>[Estonian]      | Käesolevaga kinnitab [tootja nimi = name of manufacturer] seadme [seadme tüüp = type of equipment] vastavust direktiivi 2014/53/EU põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele. |
| English                  | Hereby, [name of manufacturer], declares that this [type of equipment] is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.                                          |
| Español<br>[Spanish]     | Por medio de la presente [nombre del fabricante] declara que el [clase de equipo] cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 2014/53/EU.            |
| Ελληνική<br>[Greek]      | ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ [name of manufacturer] ΔΗΛΩΝΕΙ ΟΤΙ [type of equipment] ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 2014/53/EU.                                             |
| Français<br>[French]     | Par la présente [nom du fabricant] déclare que l'appareil [type d'appareil] est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 2014/53/EU.                                  |
| Italiano<br>[Italian]    | Con la presente [nome del costruttore] dichiara che questo [tipo di apparecchio] è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 2014/53/EU.                         |
| Latvīski<br>[Latvian]    | Ar šo [name of manufacturer / izgatavotājas nosaukums] deklarē, ka [type of equipment / iekārtas tips] atbilst Direktīvas 2014/53/EU būtiskajām prasībām un citiem tai saistītajiem noteikumiem.                        |
| Lietuvių<br>[Lithuanian] | Šiuo [manufacturer name] deklaruojama, kad šis [equipment type] atitinka esminius reikalavimus ir kitas 2014/53/EU Direktyvos nuostatas.                                                                                |
| Nederlands<br>[Dutch]    | Hierbij verklaart [naam van de fabrikant] dat het toestel [type van toestel] in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 2014/53/EU.                                  |
| Malti<br>[Maltese]       | Hawn hekk, [isem tal-manifattur], jiddikjara li dan [il-mudell tal-prodott] jikkonforma mal-ħtiġijiet essenzjali u ma provvedimenti oħrajn relevanti li hemm fid-Dirrettiva 2014/53/EU.                                 |
| Magyar<br>[Hungarian]    | Alulírott, [gyártó neve] nyilatkozom, hogy a [... típus] megfelel a vonatkozó alapvető követelményeknek és az 2014/53/EU irányelv egyéb előírásainak.                                                                   |

|                                |                                                                                                                                                                                                                                       |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [pl] Polski<br>[Polish]        | Niniejszym <i>[nazwa producenta]</i> oświadcza, że <i>[nazwa wyrobu]</i> jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 2014/53/EU.                                                        |
| [pt] Português<br>[Portuguese] | <i>[Nome do fabricante]</i> declara que este <i>[tipo de equipamento]</i> está conforme com os requisitos essenciais e outras disposições da Directiva 2014/53/EU.                                                                    |
| [sl] Slovensko<br>[Slovenian]  | <i>[Ime proizvajalca]</i> izjavlja, da je ta <i>[tip opreme]</i> v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 2014/53/EU.                                                                              |
| Slovensky<br>[Slovak]          | <i>[Menovýrobcu]</i> týmtovyhlasuje, že <i>[typzariadenia]</i> spĺňa základné požiadavky a všetky príslušné ustanovenia Smernice 2014/53/EU.                                                                                          |
| [fi] Suomi<br>[Finnish]        | <i>[Valmistaja = manufacturer]</i> vakuuttaa täten että <i>[type of equipment = laitteen tyyppimerkintä]</i> tyyppinen laite on direktiivin 2014/53/EU oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen. |
| [sv] Svenska<br>[Swedish]      | Härmed intygar <i>[företag]</i> att denna <i>[utrustningstyp]</i> står i överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 2014/53/EU.                                       |

## 10.4 NCC – Taiwan

第十二條→經型式認證合格之低功率射頻電機，非經許可，公司，商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條→低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

**Note:** You must place “本產品內含射頻模組：☼ CCAF16LP1970T0” on the host product in such a location that it can be seen by an operator at the time of purchase.

## 10.5 MIC – Japan

The MSD45N is approved for use in the Japanese market.

| Model  | Certificate Number |
|--------|--------------------|
| MSD45N | 201-180907         |

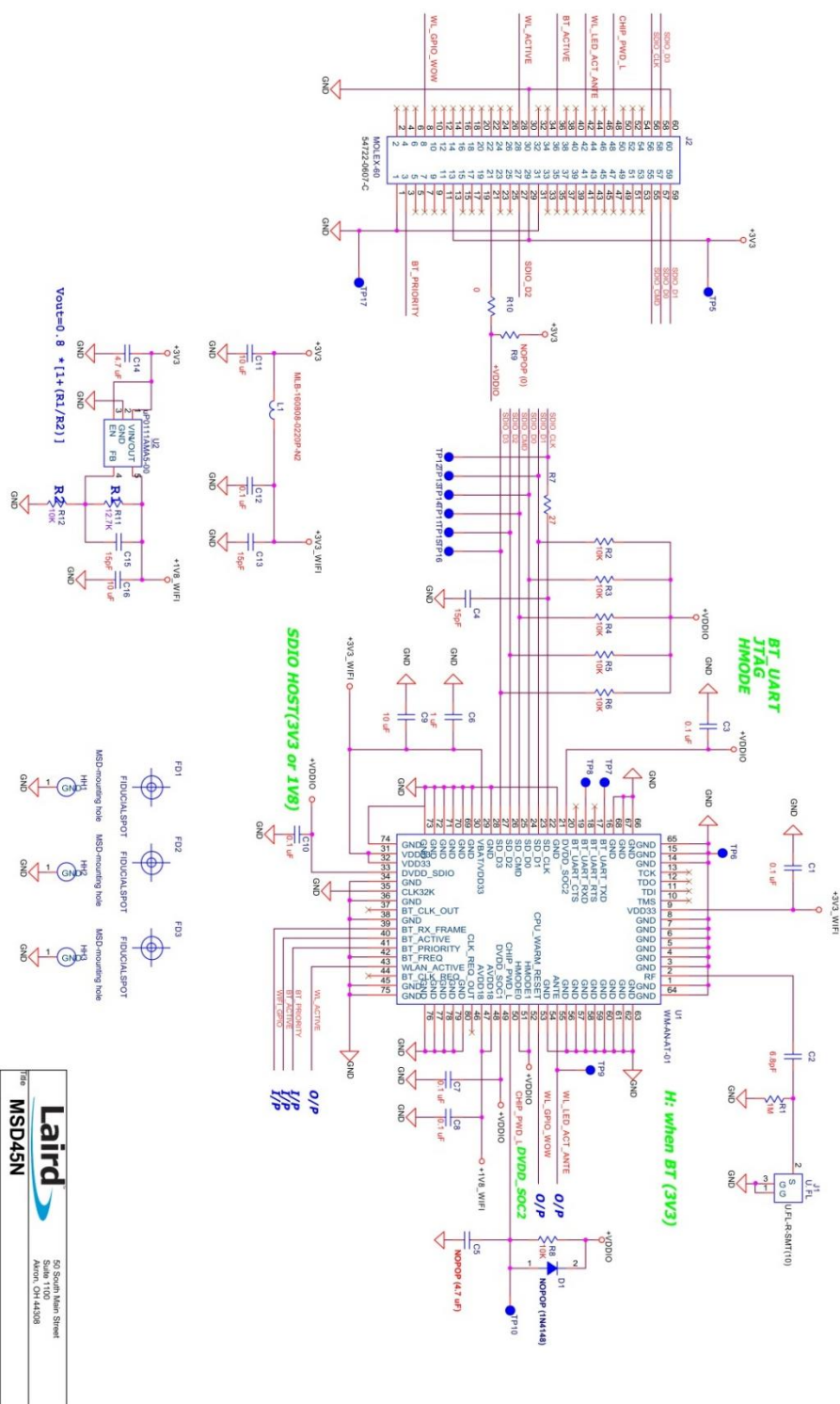
It is recommended that the host device bears a label showing the Japanese “GITEKI” mark and the certification number accompanied by the following statement:

当該機器には電波法に基づく、技術基準適合証明等を受けた特定無線設備を装着している

Translation: “This equipment contains specified radio equipment that has been certified to the Technical Regulation Conformity Certification under the Radio Law.”



The following MSD45N schematic may be used as a reference.



**Figure 8: Laird MSD45N Schematic**

## 12 ADDITIONAL ASSISTANCE

Please contact your local sales representative or our support team for further assistance:

Email: [wireless.support@lairdtech.com](mailto:wireless.support@lairdtech.com)

Phone: Americas: +1-800-492-2320

Europe: +44-1628-858-940

Hong Kong: +852 2923 0610

Web: <https://connectivity.lairdtech.com/>

© Copyright 2019 Laird. All Rights Reserved. Any information furnished by Laird and its agents is believed to be accurate and reliable. All specifications are subject to change without notice. Responsibility for the use and application of Laird materials or products rests with the end user since Laird and its agents cannot be aware of all potential uses. Laird makes no warranties as to non-infringement nor as to the fitness, merchantability, or sustainability of any Laird materials or products for any specific or general uses. Laird, Laird Technologies, Inc., or any of its affiliates or agents shall not be liable for incidental or consequential damages of any kind. All Laird products are sold pursuant to the Laird Terms and Conditions of Sale in effect from time to time, a copy of which will be furnished upon request. When used as a tradename herein, *Laird* means Laird PLC or one or more subsidiaries of Laird PLC. Laird<sup>™</sup>, Laird Technologies<sup>™</sup>, corresponding logos, and other marks are trademarks or registered trademarks of Laird. Other marks may be the property of third parties. Nothing herein provides a license under any Laird or any third party intellectual property right.