

# Datasheet

## BTM510/511 Multimedia Module

*Version 7.1 – Specific to FW v22.2.5.0*

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**Note:** For additional information on features and functionality of the BTM510/511, refer to the user guide and other documents found on the Laird Connectivity Embedded Wireless Support site's product page for this module.

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## REVISION HISTORY

| Version | Date         | Notes   | Approver      |
|---------|--------------|---|---------------|
| 1.0     | 3/01/2012    | Initial Release   | Jonathan Kaye |
| 2.0     | 3/30/2012    | Updates and correct to firmware   | Jonathan Kaye |
| 3.0     | 4/13/2012    | v18.1.3.0   | Jonathan Kaye |
| 4.0     | 10/16/2012   | General reformatting edits  | Jonathan Kaye |
| 5.0     | 1/10/2013    | Fixed Search bug.   | Jonathan Kaye |
| 6.0     | 3/22/2013    | Fixed general formatting and hyperlink issues                               | Jonathan Kaye |
| 6.1     | 13 Jan 2014  | Update FCC and IC statements  | Sue White     |
| 6.2     | 06 Feb 2014  | Updated mechanical drawings   | Jonathan Kaye |
| 6.3     | 20 Feb 2014  | Updated document for new firmware: v18.1.4.0/BTM51x - 08                    | Jonathan Kaye |
| 6.4     | 15 Dec 2014  | Separated document into two docs: Hardware Integration Guide and User Guide | Jonathan Kaye |
| 6.5     | 22 Jan 2015  | Updated Bluetooth SIG Qualification section                                 | Jonathan Kaye |
| 6.6     | 08 Jun 2015  | Removed USB D+ and USB D- references  | Jonathan Kaye |
| 6.7     | 15 Nov 2015  | Changed USB references to UART  | Andrew Chen   |
| 6.8     | 08 Feb 2017  | Fixed module height   | Andrew Chen   |
| 6.9     | 07 June 2017 | Updated EU DoC for new RED standards  | Tom Smith     |
| 7.0     | 17 Dec 2020  | Updated all regulatory information  | Jonathan Kaye |
| 7.1     | 16 Feb 2021  | Moved detailed regulatory information to a separate document                | Jonathan Kaye |

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# 1 OVERVIEW

The BTM510 and BTM511 are low-power Bluetooth® modules designed for adding robust audio and voice capabilities. Based on the market-leading Cambridge Silicon Radio BC05 chipset, these modules provide exceptionally low power consumption with outstanding range. Supporting Bluetooth v3.0 specification, these modules provide the important advantage of secure simple pairing that improves security and enhances easy use.

At only 14 mm x 20 mm, the compact size of the BTM510 is ideal for battery-powered or headset form factor audio and voice devices. With a 16-bit stereo codec and microphone inputs to support both stereo and mono applications, these modules also contain a full, integrated Bluetooth-qualified stack along with SPP, HFP 1.6, HSP, AVRCP v1.5, and A2DP profiles.

The BTM510/511 modules include an embedded 32-bit, 64-MIPS DSP core within the BC05. This is integrated with the Bluetooth functionality which allows designers to add significant product enhancements including features such as echo cancellation, noise reduction, and audio enhancement using additional soft codecs. The availability of the 16MB of flash memory in the module allows complex functionality to be included. DSP routines can be licensed through a number of specialist partners. Typical applications for these modules include Bluetooth stereo headsets, VoIP phones, and wireless audio links.

To speed product development and integration, Laird Connectivity has developed a comprehensive AT command interface that simplifies application development, including support for audio and headset functionality. Access to GPIO pins allows mapping for direct connection to actuator buttons on headsets. Combined with a low-cost development kit, Laird Connectivity Bluetooth® modules provide faster time to market.

## Features

- Fully featured Bluetooth® multimedia module
- Bluetooth® v3.0 (FW v22.2.5.0 onwards)
- Supports mono and stereo headset applications
- Adaptive Frequency Hopping to cope with interference from other wireless devices
- 32-bit Kalimba DSP for enhanced audio applications
- Support for Secure Simple Pairing
- External or internal antenna options
- HSP, HFP, A2DP, and AVRCP audio profiles
- 16-bit stereo codec and microphone input
- Integrated audio amplifiers for driving stereo speaker
- Comprehensive AT interface for simple programming
- Bluetooth END product qualified
- Compact size
- Class 2 output – 4 dBm
- Low power operation
- Wi-Fi co-existence hardware support

## Application Areas

- High-quality stereo headsets
- Mono voice headsets
- Hands-free devices
- Wireless audio cable replacement
- MP3 and music players
- Phone accessories
- VoIP products
- Cordless headsets
- Automotive

# 2 SPECIFICATIONS

## 2.1 Detailed Specifications

**Table 1: Detailed specifications**

| Categories             | Feature             | Implementation   |
|------------------------|---------------------|--|
| Wireless Specification | Standards Supported | Bluetooth® v3.0  |
|                        | Transmit Class      | Class 2  |
|                        | Frequency           | 2.402 – 2.480 GHz  |
|                        | Channels            | 79 channels Frequency Hopping Adaptive Frequency Hopping |

| Categories                       | Feature                    | Implementation   |
|----------------------------------|----------------------------|--|
|                                  | Maximum Transmit Power     | +4 dBm @ antenna pad – BTM510<br>+4 dBm from integrated antenna – BTM511   |
|                                  | Minimum Transmit Power     | -27 dBm @ antenna pad – BTM510<br>-27 dBm from integrated antenna – BTM511   |
|                                  | Receive Sensitivity        | Better than -86 dBm  |
|                                  | Data Transfer Rate         | Up to 300 kbps   |
|                                  | Range                      | Up to 30 meters  |
|                                  | <b>Antenna Modes</b>       | External Antenna   |
|                                  | Integrated Antenna         | +0 dB multilayer ceramic – BTM511  |
| <b>UART Interface</b>            | Serial Interface           | RS-232 bi-directional for commands and data  |
|                                  | Baud Rate                  | 16550 compatible   |
|                                  | Bits                       | Configurable from 1,200 to 921,600 bps   |
|                                  | Parity                     | Non-standard baud rates supported  |
|                                  | Stop bits                  | 8  |
|                                  | Default Serial parameters  | Odd, even, none  |
|                                  | Levels                     | 1 or 2   |
|                                  | Modem Control              | 9600,n,8,1   |
| <b>General Purpose Interface</b> | I/O                        | 4 general purpose I/O pins   |
|                                  | I2S                        | Stereo Audio Digital Interface Bus   |
|                                  | LED                        | 2  |
| <b>Audio</b>                     | Codec                      | Integrated stereo codec with -95 dB SNR for DAC  |
|                                  | Amplifiers                 | Direct drive for 16 Ω Speakers   |
|                                  | Microphone                 | Input for low noise microphone   |
|                                  | Sample Rates (DAC and ADC) | 8, 11.025, 16, 22.05, 32 & 44.1kHz   |
| <b>Protocols and Firmware</b>    | Bluetooth® Stack           | V3.0 compliant. Fully integrated.  |
|                                  | Profiles                   | GAP Generic Access Profile<br>SDP Service Discovery Profile<br>SPP Serial Port Profile<br>HSP – Audio Gateway and Headset unit<br>HFP v1.6 – Audio Gateway and Handsfree<br>A2DP – Source and Sink<br>AVRCP v1.5 – Target and Controller |
|                                  | Protocols                  | RFCOMM<br>AVCTP<br>AVDTP   |
| <b>Command Interface</b>         | AT Instruction set         | Comprehensive control of connection and module operation, including extensions for Audio control.<br>Direct mapping of GPIO to audio functions, e.g. Play, Volume, etc.<br>S Registers for non-volatile storage of parameters            |
| <b>DSP</b>                       | Kalimba DSP                | Integrated in BC05 32bit, 64MIPS, 16 Mbps Flash Memory (shared)  |
|                                  | Applications               | Available from partners  |

| Categories                         | Feature                   | Implementation  |
|------------------------------------|---------------------------|---|
| <b>Current Consumption</b>         | Data Transfer             | Typically < 35 mA   |
|                                    | Stereo Music              | Typically < 70 mA (including speaker drive)   |
|                                    | Low Power Sniff Mode      | Less than 1.5 mA  |
| <b>Supply Voltage</b>              | Supply                    | 3.0 V – 3.6 V DC  |
|                                    | I/O                       | 1.7 V – 3.6 V DC  |
|                                    | UART                      | 1.7 V – 3.6 V DC  |
| <b>Coexistence / Compatibility</b> | WLAN (802.11)             | 2-wire and 3-wire hardware coexistence schemes supported                            |
| <b>Connections</b>                 | External Antenna (option) | Pad for 50 Ohm antenna – BTM510   |
|                                    | Interface                 | Surface Mount Pads  |
| <b>Physical</b>                    | Dimensions                | 14.0 mm x 20.0 mm x 2.9 mm - BTM510<br>14.0 mm x 25.0 mm x 2.9 mm - BTM511          |
|                                    | Weight                    | 3 grams   |
| <b>Environmental</b>               | Operating Temperature     | -40° C to +85° C  |
|                                    | Storage Temperature       | -40° C to +85° C  |
| <b>Approvals</b>                   | Bluetooth®                | Qualified as an END product   |
|                                    | FCC                       | Limited Modular Approval – BTM510<br>Modular Approval (Integrated Antenna – BTM511) |
|                                    | MIC                       | (Japan)   |
|                                    | EU                        | Meets CE and R&TTE requirements   |
| <b>Miscellaneous</b>               | Lead free                 | Lead-free within EU requirements and RoHS compliant                                 |
|                                    | Warranty                  | 1-Year <a href="#">Warranty</a>   |
| <b>Development Tools</b>           | Development Kit           | Development board and software tools  |

## 2.2 Pin Definitions

Table 2: Pin definitions

| Pin | Signal                          | Description               | Voltage Specification      |
|-----|---------------------------------|---------------------------|----------------------------|
| 1   | GPIO_8 / DTR                    | Host I/O                  | VIO                        |
| 2   | GPIO_5 / BT_STATE / BT_PRIORITY | Host I/O, BT Co-existence | VIO                        |
| 3   | PCM_IN                          | PCM Data I/P              | VIO                        |
| 4   | PCM_OUT                         | PCM Data O/P              | VIO                        |
| 5   | PCM_SYNC                        | PCM Sync I/P              | VIO                        |
| 6   | PCM_CLK                         | PCM CLK I/P               | VIO                        |
| 7   | LED_EXT1                        | Host I/O                  | See <a href="#">Note 2</a> |
| 8   | LED_EXT0                        | Host I/O                  | See <a href="#">Note 2</a> |
| 9   | GND                             |                           |                            |
| 10  | VDD_UART                        | UART supply voltage       |                            |
| 11  | VDD_IO                          | I/O supply voltage        |                            |
| 12  | VDD_IN                          | Main supply voltage       |                            |
| 13  | GND                             |                           |                            |

| Pin | Signal               | Description  | Voltage Specification                         |
|-----|----------------------|--|---|
| 14  | SPI_CS               | SPI bus chip select I/P                              | VIO   |
| 15  | SPI_MISO             | SPI bus serial O/P                                   | VIO   |
| 16  | SPI_CLK              | SPI bus clock I/P                                    | VIO   |
| 17  | SPI_MOSI             | SPI bus serial I/P                                   | VIO   |
| 18  | GPIO_3 / DSR         | Host I/O   | VIO   |
| 19  | GPIO_4 / RI          | Host I/O   | VIO   |
| 20  | GPIO_2 / DCD         | Host I/O   | VIO   |
| 21  | GPIO_1 / BT_ACTIVE   | Host I/O, BT Co-existence                            | VIO   |
| 22  | GND                  |  |   |
| 23  | AUDIO_GND            | Audio ground   |   |
| 24  | SPKR_A_N             | Speaker, channel A- (left)                           | See <a href="#">Audio Design Requirements</a> |
| 25  | SPKR_A_P             | Speaker, channel A+ (left)                           | See <a href="#">Audio Design Requirements</a> |
| 26  | SPKR_B_N             | Speaker, channel B- (right)                          | See <a href="#">Audio Design Requirements</a> |
| 27  | SPKR_B_P             | Speaker, channel B+ (right)                          | See <a href="#">Audio Design Requirements</a> |
| 28  | MIC_BIAS             | Microphone bias                                      | See <a href="#">Audio Design Requirements</a> |
| 29  | MIC_BP_C             | Microphone, channel B+ (right)                       | See <a href="#">Audio Design Requirements</a> |
| 30  | MIC_BN_C             | Microphone, channel B- (right)                       | See <a href="#">Audio Design Requirements</a> |
| 31  | MIC_AP_C             | Microphone, channel A+ (left)                        | See <a href="#">Audio Design Requirements</a> |
| 32  | MIC_AN_C             | Microphone, channel A- (left)                        | See <a href="#">Audio Design Requirements</a> |
| 33  | Unused               |  |   |
| 34  | ANT                  | Antenna connection – BTM510 only<br>(50 ohm matched) |   |
| 35  | Unused               |  |   |
| 36  | Unused               |  |   |
| 37  | Unused               |  |   |
| 38  | Unused               |  |   |
| 39  | Unused               |  |   |
| 40  | Unused               |  |   |
| 41  | Unused               |  |   |
| 42  | Unused               |  |   |
| 43  | Unused               |  |   |
| 44  | Unused               |  |   |
| 45  | Unused               |  |   |
| 46  | Unused               |  |   |
| 47  | GND                  |  |   |
| 48  | UART_RTS             | Request to Send O/P                                  | VUSB  |
| 49  | UART_CTS             | Clear to Send I/P                                    | VUSB  |
| 50  | UART_TX              | Transmit data O/P                                    | VUSB  |
| 51  | UART_RX              | Receive data I/P                                     | VUSB  |
| 52  | GPIO_7 / RF_Active   | Host I/O, BT Co-existence                            | VIO   |
| 53  | GPIO_6 / WLAN_ACTIVE | Host I/O, BT Co-existence                            | VIO   |

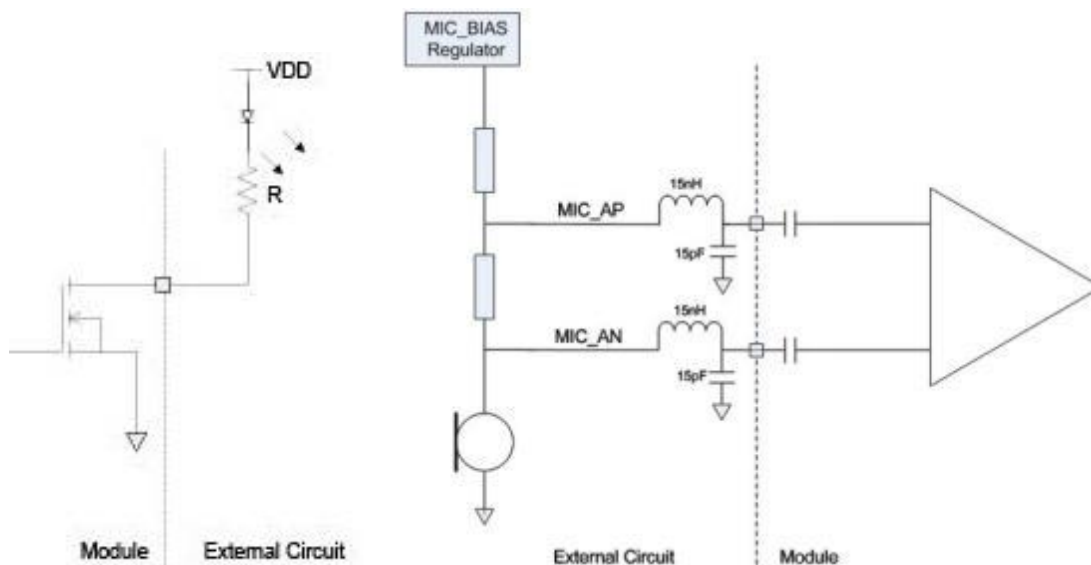
| Pin | Signal | Description      | Voltage Specification |
|-----|--------|------------------|-----------------------|
| 54  | Reset  | Module reset I/P | See Note 1            |

**Note:**

1. Reset input is active low. Input is pulled up to VDD\_IN via 22 k. Minimum reset pulse width is 5 ms.
2. LED drive pins are open drain outputs, so the external circuit to the right should be used. The voltage on the module pad should be maintained below 0.5 V in which case the RON of the FET is around 20 Ω. If this condition is met, the current flowing through the diode is as follows:

$$I_{led} = \frac{VDD - V_f}{R + 20}$$

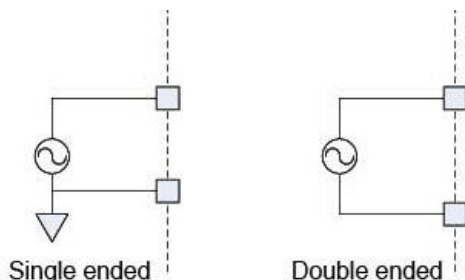
Where VF is the forward bias voltage of the LED.



**Figure 1: Microphone mode**

The input impedance on the microphone inputs (in microphone mode) is typically 6kΩ. The audio input is designed for use with inputs of between 1 μA and 10 μA at 94 dB SPL. If the biasing resistors are set to 1 kΩ, this implies a microphone with sensitivity in the range -40 dBV to -60 dBV.

The low pass filter elements formed by the inductor and capacitor are necessary to eliminate RF pick up on the microphone inputs and should be placed as close to the module as possible. When operating in line input mode, the input can be connected directly to the module input pins in either single or double ended configuration as follows:



**Figure 2: Line input mode**



## 2.3 Operating Parameters

**Table 3: Operating parameters**

| Recommended Operating Conditions |     |     |
|----------------------------------|-----|-----|
| Operating Condition              | Min | Max |
| VDD_UART                         | 1.7 | 3.6 |
| VDD_IO                           | 1.7 | 3.3 |
| VDD_IN                           | 3.0 | 3.6 |

## 2.4 Voltage Specifications

**Table 4: Voltage specifications (VUART)**

| Logic Levels (VUART)                      |                |         |      |
|---|----------------|---------|------|
| Input Voltage Levels                      | Min            | Typical | Max  |
| V <sub>ih</sub>                           | 0.7VDD_UART    |         |      |
| V <sub>il</sub>                           | -0.4           |         | +0.8 |
| OUTPUT VOLTAGE LEVELS                     |                |         |      |
| V <sub>oh</sub> (I <sub>out</sub> = -4mA) | VDD_UART – 0.4 |         |      |
| V <sub>ol</sub> (I <sub>out</sub> = 4mA)  | 0              |         | 0.4  |

**Table 5: Voltage specifications (VIO)**

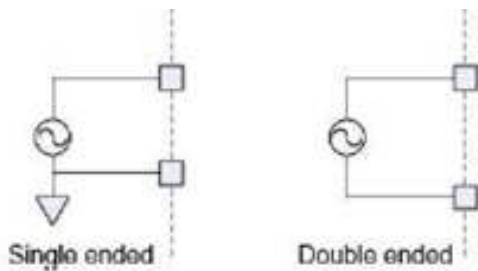
| Logic Levels (VIO)                        |                |         |            |
|---|----------------|---------|------------|
| INPUT VOLTAGE LEVELS                      | MIN            | TYPICAL | MAX        |
| V <sub>ih</sub>                           | 0.625 VDD_UART |         | VDD_IO+0.3 |
| V <sub>il</sub>                           | -0.3           |         | 0.25VDD_IO |
| Output Voltage Levels                     |                |         |            |
| V <sub>oh</sub> (I <sub>out</sub> = -4mA) | 0.75VDD_IO     |         | VDD_IO     |
| V <sub>ol</sub> (I <sub>out</sub> = 4mA)  | 0              |         | 0.125      |

**Notes for PCB layout:**

1. The RF output pin must match to a 50 Ω strip-line or coplanar waveguide on the BTM510 (no antenna).
3. Ensure there are no exposed conductors under the module to avoid shorts to the module test points.
4. The PCB footprint is provided for guidance only. Users may wish to modify the PCB land dimensions to suit their specific manufacturing or process.

## 2.5 Audio Design Requirements

The audio inputs of the BTM510/511 can operate in either line input mode or microphone mode. The input circuit has a two stage amplifier – the first stage provides a fixed 24 dB gain and the second a variable gain of between -3 dB and 18 dB. If an input gain of less than 24 dB is selected, then the first stage is switched out and the module is operating in line input mode. The BTM511 can support both Single-Ended and Fully Differential Stereo Line Input (Figure 3).



**Figure 3: Single and Double Ended Line Inputs**

A 15nH / 15pF low pass filter must be added to each input line and placed as close to the BTM511 input pins as possible. Otherwise the BT envelope may be demodulated, causing audio artifacts in the 800 – 1600kHz range that cannot be removed.

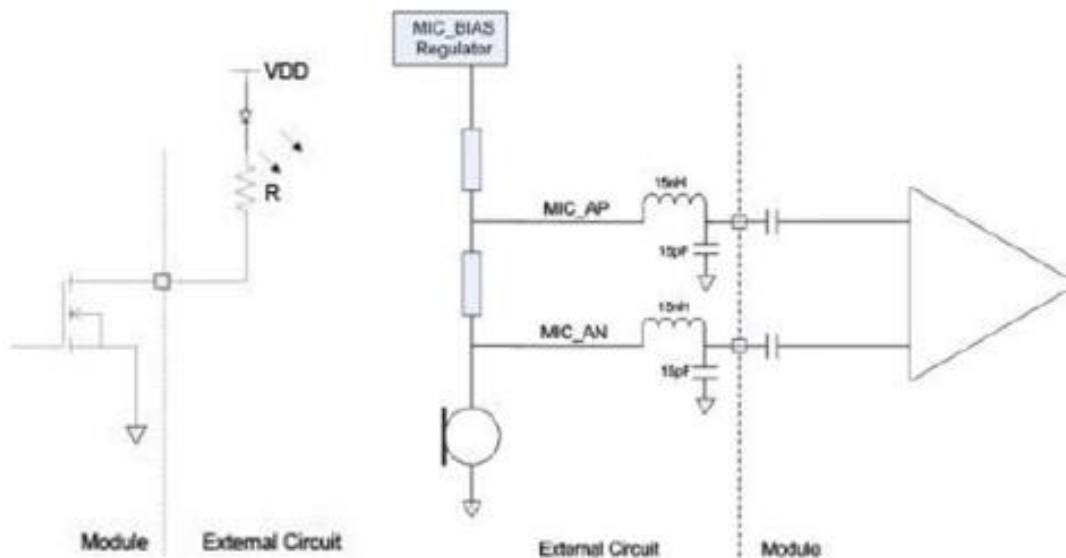
If using single-ended line input, it is only necessary to fit one low pass filter per channel. For both Stereo Line In and Microphone modes, you may connect the input signal to either the positive or negative side of the input. The unused input should be connected to either MIC\_BIAS or AGND (Note: The ADK-BTM511-v04 design fits one low pass filter on each of the 4 channel inputs).

The Left channel (MIC\_AP\_C / MIC\_AN\_C) should be used as the standard mono channel, the Right channel inputs (MIC\_BP\_C / MIC\_BN\_C) can be used as an auxiliary mono channel or connected to AGND if unused (Remember to fit the low pass filter on one or both of the unused Right channel inputs).

A typical line input signal has a voltage of 1.75Vrms or 5Vpk-pk. However, the BTM511 can only tolerate 0.4Vrms on the audio inputs. A resistive network can be used to divide the input signal down to 0.4Vrms if necessary.

The audio inputs can operate in either line input mode or microphone mode. The input circuit has a two stage amplifier – the first stage provides a fixed 24 dB gain and the second a variable gain of between -3 dB and 18 dB. If an input gain of less than 24 dB is selected, then the first stage is switched out and the module is operating in line input mode.

When operating in microphone mode the microphone should be biased as shown in Figure 4.



**Figure 4: Microphone biasing for microphone mode**

The input impedance on the microphone inputs (in microphone mode) is typically 6kΩ. The audio input is designed for use with inputs of between 1 μA and 10 μA at 94 dB SPL. If the biasing resistors are set to 1 kΩ, this implies a microphone with sensitivity in the range -40 dBV to -60 dBV.

### 2.5.1 Speaker Output

The speaker output is capable of driving loads with a minimum impedance of 16Ω directly.

### 3 REGULATORY

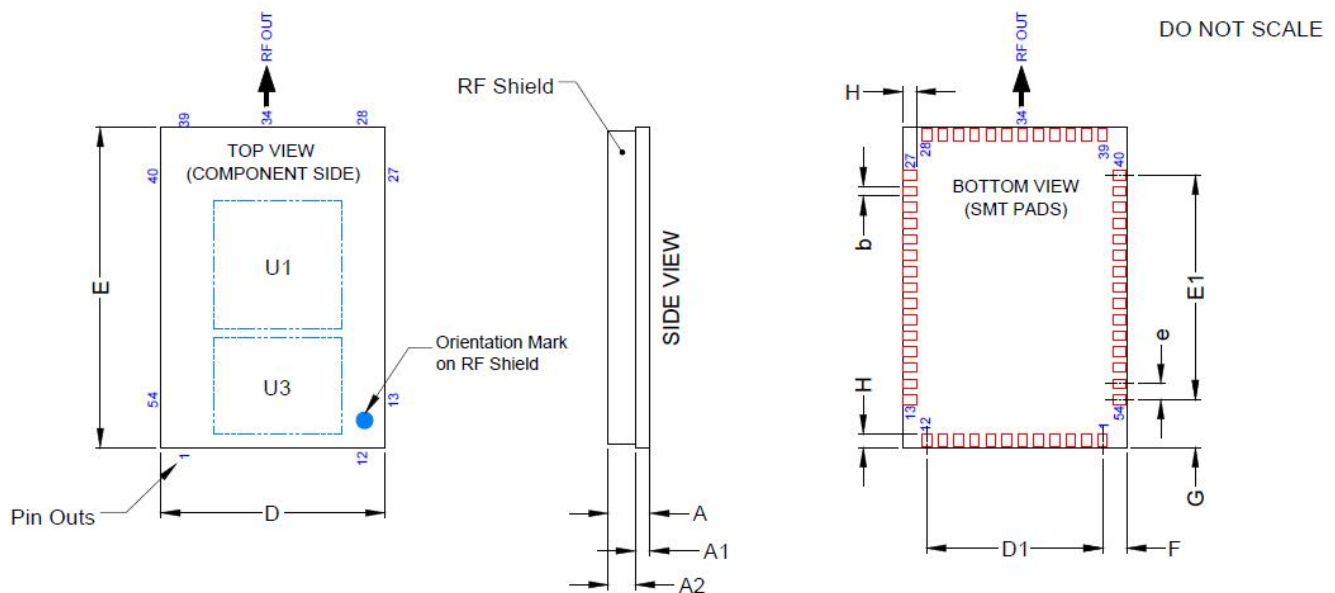
**Note:** For complete regulatory information, refer to the [BTM51x Regulatory Information](#) document which is also available from the [BTM51x product page](#).

The BTM51x holds current certifications in the following countries:

| Country/Region | Regulatory ID                                |
|----------------|--|
| USA (FCC)      | PI4511B                                      |
| EU             | N/A  |
| Canada (ISED)  | BTM510: 1931B-BTM510<br>BTM511: 1931B-BTM511 |

### 4 MECHANICAL DRAWINGS

#### 4.1 BTM510 Mechanical Drawings



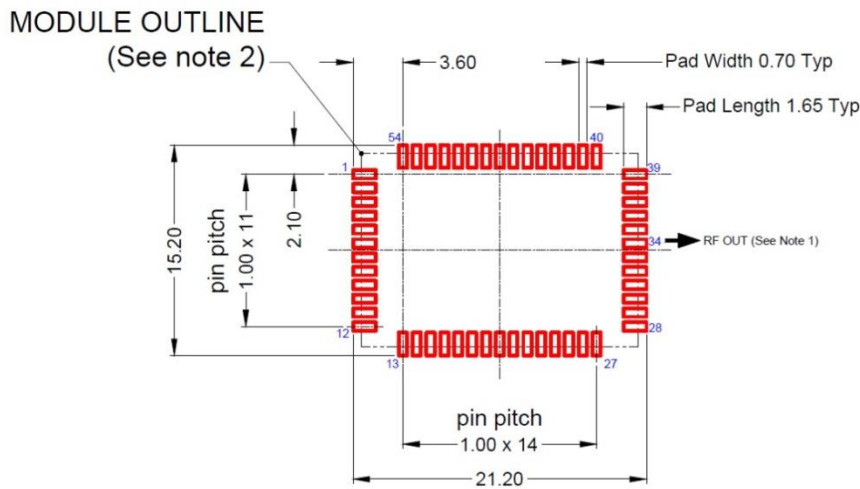
|             |  |         |         |
|-------------|--|---------|---------|
| Description | BTM510   |         |         |
| Size        | 20.0 x 14.0 x 2.95mm   |         |         |
| Pitch       | 1.0mm  |         |         |
| Dimension   | Minimum  | Typical | Maximum |
| A           | 2.80   | 2.95    | 3.10    |
| A1          | 0.81   | 0.91    | 1.01    |
| A2          | 1.99   | 2.04    | 2.09    |
| b           | 0.55   | 0.60    | 0.65    |
| D           | 13.87  | 14.0    | 14.13   |
| E           | 19.87  | 20.0    | 20.13   |
| e           |  | 1.0     |         |
| D1          |  | 11.0    |         |
| E1          |  | 14.0    |         |
| F           |  | 1.50    |         |
| G           |  | 3.00    |         |
| H           |  | 0.85    |         |
| Notes       | PCB Thickness<br>RF Shield Height<br>Global pad width<br>Global pitch<br>Pad Centre to Board edge<br>Pad Centre to Board edge<br>Global length of pad to edge of board |         |         |
| Units       | mm   |         |         |

| Laird TECHNOLOGIES             |            |                        |                                     |
|--------------------------------|------------|------------------------|-------------------------------------|
| Module Package Dimensions      |            |                        |                                     |
| TOLERANCE UNLESS STATED        |            | MATERIAL               | DRAWN M.Welch                       |
| x +0.3                         | x.xx +0.03 | FINISH                 | CHECKED N.Hunn                      |
| x.xx+0.1                       |            | COLOUR                 | APPROVED N.Hunn                     |
| DIMENSIONS IN MM UNLESS STATED | SCALE      | THIRD ANGLE PROJECTION | DWG No: BTV-R-003-POL-03 Page 1of 3 |
| PROJECT BTM510                 |            |                        |                                     |

**Notes:** An area of 1.5 mm around the module should be reserved as a keep-out area.  
The Development Kit Schematics for this product can be accessed from the following link: [Development Kit Schematics – BTM510](#)

## 4.2 BTM510 Mechanical Diagrams

### PCB LAND PATTERN/DECAL DIMENSIONS

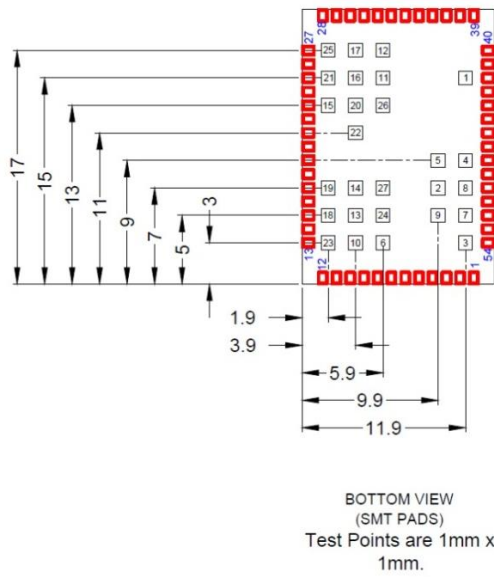


#### Notes

- 1 Connect External Antenna to RF I/O pin 34 with 50ohm microstrip or coplaner waveguide.
- 2: Ensure no exposed copper under module to avoid shorting to test points on underside of module.
- 3: The user may modify the PCB land pattern dimensions based on their experience and/or process capability.

**Note:** An area of 1.5 mm around the module should be reserved as a keep-out area.  
The Development Kit Schematics for this product can be accessed on the software downloads tab of the [BTM51x product page](#).

### 4.3 BTM510 Mechanical Diagrams

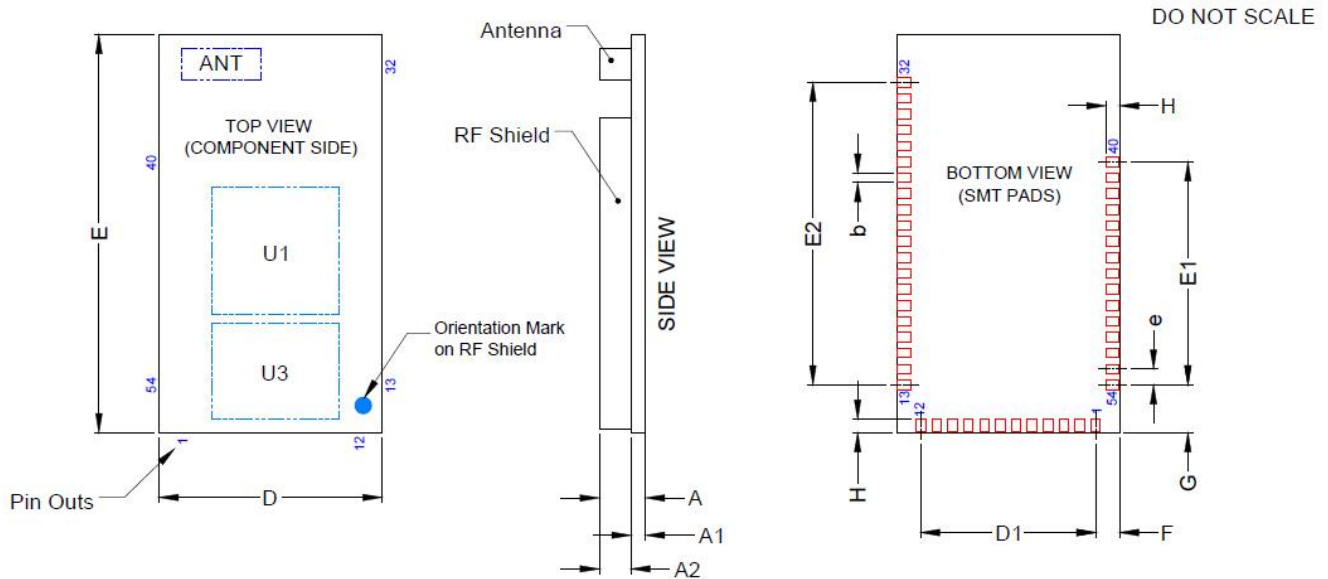



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**WARNING:** Test point dimensions are for reference only. *DO NOT* make electrical connections to these test points. This voids the warranty. Laird does not recommend routing on the top layer underneath the module.

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### 4.4 BTM511 Mechanical Diagrams

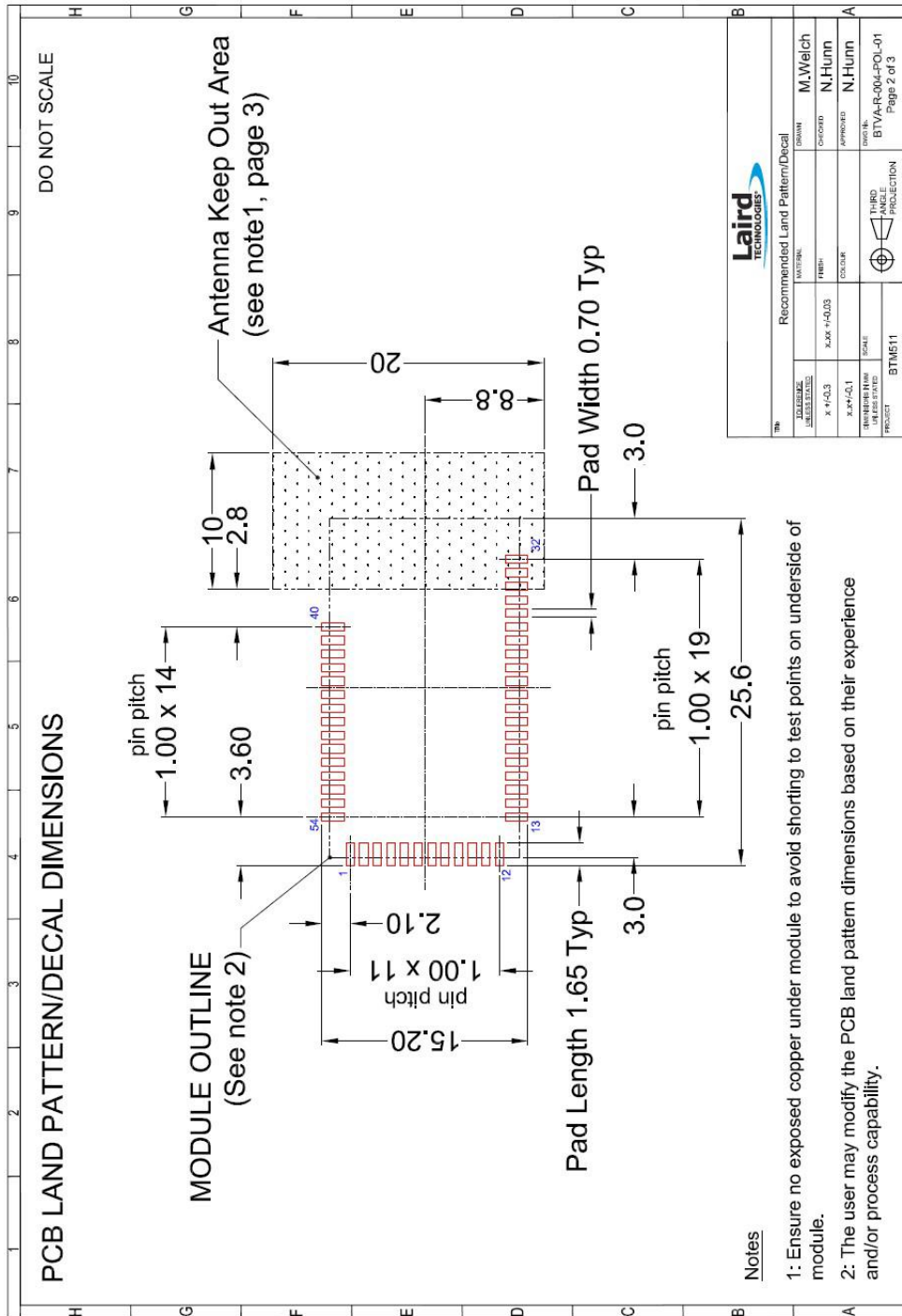


| Description | BTM511               |         |         |                                       |
|-------------|----------------------|---------|---------|---------------------------------------|
| Size        | 25.0 x 14.0 x 2.95mm |         |         |                                       |
| Pitch       | 1.0mm                |         |         |                                       |
| Dimension   | Minimum              | Typical | Maximum | Notes                                 |
| A           | 2.80                 | 2.95    | 3.10    |                                       |
| A1          | 0.81                 | 0.91    | 1.01    | PCB Thickness                         |
| A2          | 1.99                 | 2.04    | 2.09    | RF Shield Height                      |
| b           | 0.55                 | 0.60    | 0.65    | Global pad width                      |
| D           | 13.87                | 14.0    | 14.13   |                                       |
| E           | 24.87                | 25.0    | 25.63   |                                       |
| e           |                      | 1.0     |         | Global pitch                          |
| D1          |                      | 11.0    |         |                                       |
| E1          |                      | 14.0    |         |                                       |
| E2          |                      | 19.0    |         |                                       |
| F           |                      | 1.50    |         | Pad Centre to Board edge              |
| G           |                      | 3.00    |         | Pad Centre to Board edge              |
| H           |                      | 0.85    |         | Global length of pad to edge of board |
| Units       | mm                   |         |         |                                       |

| Laird TECHNOLOGIES               |              |                        |                           |
|----------------------------------|--------------|------------------------|---------------------------|
| Title: Module Package Dimensions |              |                        |                           |
| TOLERANCE UNLESS STATED:         |              | MATERIAL:              | DRAWN: M.Welch            |
| x +/-0.3                         | x.xx +/-0.03 | FINISH:                | CHECKED: N.Hunn           |
| x.x +/-0.1                       |              | COLOR:                 | APPROVED: N.Hunn          |
| DIMENSIONS IN MM UNLESS STATED   | SCALE:       | THIRD ANGLE PROJECTION | DWG No: BTVA-R-001-POL-01 |
| PROJECT: BTM511                  |              |                        | Page 1 of 3               |

**Note:** An area of 1.5 mm around the module should be reserved as a keep-out area. The Development Kit Schematics for this product can be accessed on the software downloads tab of the [BTM51x product page](#).

## 4.5 BTM511 Mechanical Diagrams




**Note:** An area of 1.5 mm around the module should be reserved as a keep-out area. The Development Kit Schematics for this product can be accessed on the software downloads tab of the [BTM51x product page](#).



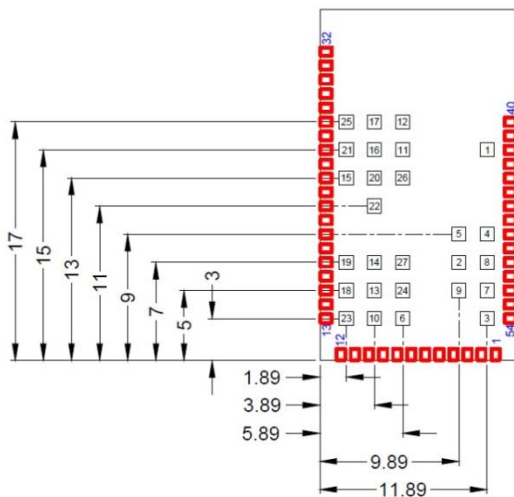
## 4.6 BTM511 Mechanical Diagrams

### APPLICATION NOTES

- 1.) Ensure there is no copper in the antenna keep out area on any layers of the host p.c. board. Also keep all mounting hardware or any metal clear of this area to prevent affecting proper antenna radiation.
- 2.) For best antenna performance the module should be placed on the edge of the host p.c. board and preferably in the corner with the antenna facing the corner.
- 3.) Antenna keep out area definition comes from the module's Developer Kit board which was used for module development and antenna performance evaluation.
- 4.) Ensure no exposed copper under module on host p.c. board to avoid shorting to test points on underside of module.
- 5.) The user may modify the PCB land pattern dimensions based on their experience and/or process capability.


| Title                          |               | Application Notes   |                           |
|--------------------------------|---------------|---|---------------------------|
| REV. ENGINEERING               |               | MATERIAL  | DRAWN M. Welch            |
| REV. PRODUCTION                |               | FINISH  | CHECKED N. Hunn           |
| x +/-0.3                       | x.xxx +/-0.03 | COLOR   | APPROVED N. Hunn          |
| x.xx +/-0.1                    |               |   |                           |
| DIMENSIONS IN MM UNLESS STATED | SCALE         |  THIRD ANGLE PROJECTION | DWG NO. BTVA-R-001-POL-01 |
| PROJECT BTM511                 |               |   | Page 3 of 4               |

## 4.7 BTM511 Mechanical Diagrams



BOTTOM VIEW  
(SMT PADS)

Test Points are 1mm x 1mm.

| Title                          |               | Module Test Point Locations  |                           |
|--------------------------------|---------------|--|---------------------------|
| REV. ENGINEERING               |               | MATERIAL   | DRAWN D Chapman           |
| REV. PRODUCTION                |               | FINISH   | CHECKED                   |
| x +/-0.3                       | x.xxx +/-0.03 | COLOR  | APPROVED                  |
| x.xx +/-0.1                    |               |  |                           |
| DIMENSIONS IN MM UNLESS STATED | SCALE         |  THIRD ANGLE PROJECTION | DWG NO. BTVA-R-001-POL-01 |
| PROJECT BTM511                 |               |  | Page 4 of 4               |

**WARNING:** Test point dimensions are for reference only. *DO NOT* make electrical connections to these test points. This voids the warranty. Laird Connectivity does not recommend routing on the top layer underneath the module.



## 5 ORDERING INFORMATION

| Part Number  | Description  |
|--------------|--|
| BTM510       | Bluetooth® Multimedia Module (external antenna)      |
| BTM511       | Bluetooth® Multimedia Module with integrated antenna |
| DVK – BTM510 | Development Board with BTM510 soldered in place      |
| DVK – BTM511 | Development Board with BTM511 soldered in place      |

### 5.1 General Comments

Refer to the schematic BTV-R-003.pdf for the Development Kit on the following two pages for examples of typical pin connections. A PDF of the schematic can be downloaded from the product web page.

## 6 APPLICATION NOTE

### 6.1 Introduction

Laird Connectivity surface mount modules are designed to conform to all major manufacturing guidelines. This application note provides additional guidance beyond the information that is presented in the user's manual. This application note is a living document and is updated as new information is presented.

The modules are designed to meet the needs of many commercial and industrial applications. The modules are designed to be easily manufactured and conform to current automated manufacturing processes.

### 6.2 Shipping

Modules are shipped in ESD (Electrostatic Discharge) safe trays that can be loaded into most manufacturers pick and place machines. Layouts of the trays are provided in [Figure 5](#).

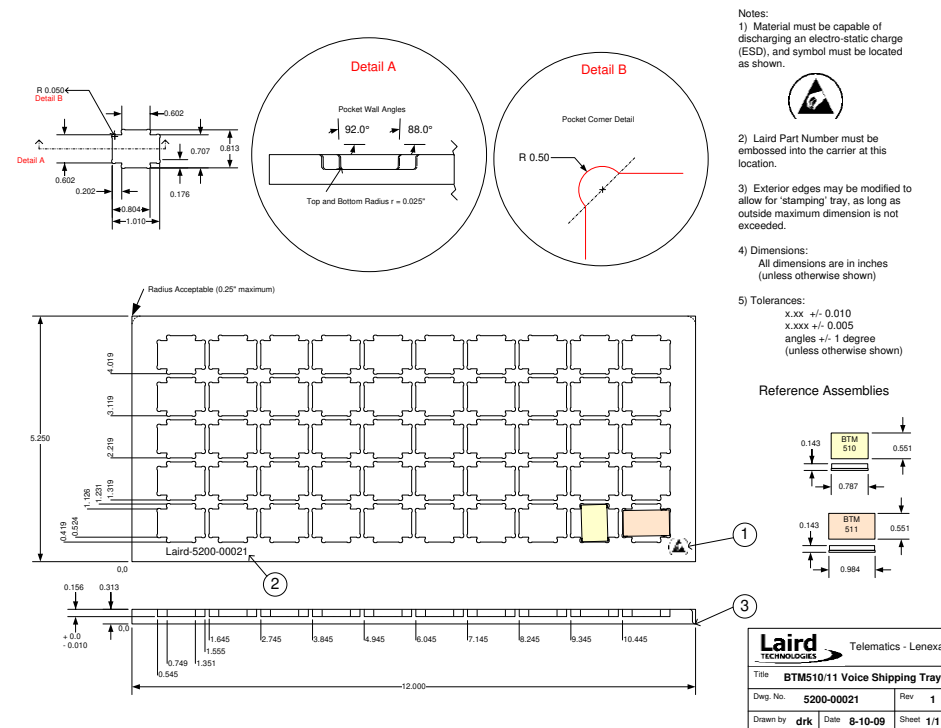
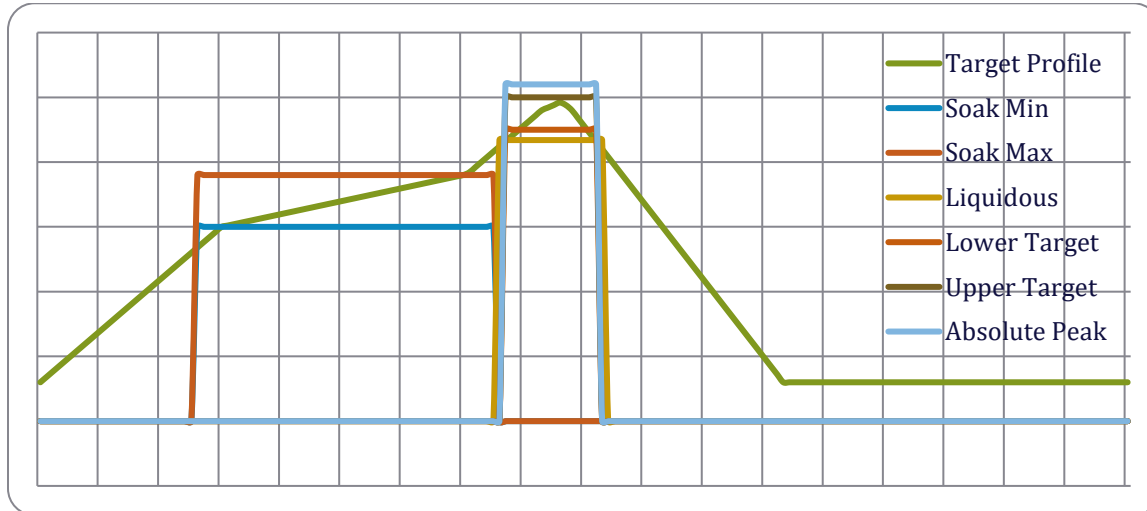


Figure 5: BTM510 and BTM511 shipping tray detail

### 6.3 Reflow Parameters

Laird Connectivity surface mount modules are designed to be easily manufactured including reflow soldering to a PCB. It is the responsibility of the customer to choose the appropriate solder paste and to ensure oven temperatures during reflow meet the requirements of the solder paste. Laird Connectivity’s surface mount modules conform to J-STD-020D1 standards for reflow temperatures.

**Important:** During reflow, modules should not be above 260° and not for more than 30 seconds.



**Figure 6: Recommended reflow temperature**

Temperatures should not exceed the minimums or maximums presented in [Table 6-1: Recommended maximum and minimum temperatures](#).

**Table 6-1: Recommended maximum and minimum temperatures**

| Specification                      | Value  | Unit     |
|------------------------------------|--------|----------|
| Temperature Inc./Dec. Rate (max)   | 3      | °C / Sec |
| Temperature Decrease rate (goal)   | 2-3    | °C / Sec |
| Soak Temp Increase rate (goal)     | .5 - 1 | °C / Sec |
| Flux Soak Period (min)             | 60     | Sec      |
| Flux Soak Period (max)             | 90     | Sec      |
| Flux Soak Temp (min)               | 150    | °C       |
| Flux Soak Temp (max)               | 190    | °C       |
| Time Above Liquidous (max)         | 60     | Sec      |
| Time Above Liquidous (min)         | 20     | Sec      |
| Time In Target Reflow Range (goal) | 30     | Sec      |
| Time At Absolute Peak (max)        | 30     | Sec      |
| Liquidous Temperature (SAC305)     | 217    | °C       |
| Lower Target Reflow Temperature    | 225    | °C       |
| Upper Target Reflow Temperature    | 250    | °C       |
| Absolute Peak Temperature          | 260    | °C       |

## 7 BLUETOOTH SIG QUALIFICATION

The BTM510 and BTM511 modules are listed on the Bluetooth SIG website as qualified End Products.

| Design Name       | Owner                 | Declaration ID | Link to listing on the SIG website  |
|-------------------|-----------------------|----------------|---|
| BTM510,<br>BTM511 | Laird<br>Connectivity | D023160        | <a href="https://www.bluetooth.org/tpg/QLI_viewQDL.cfm?qid=23160">https://www.bluetooth.org/tpg/QLI_viewQDL.cfm?qid=23160</a> |

It is a mandatory requirement of the Bluetooth Special Interest Group (SIG) that every product implementing Bluetooth technology has a Declaration ID. Every Bluetooth design is required to go through the qualification process, even when referencing a Bluetooth Design that already has its own Declaration ID. The Qualification Process requires each company to be registered as a member of the Bluetooth SIG – [www.bluetooth.org](http://www.bluetooth.org)

The following link provides a link to the Bluetooth Registration page:  
<https://www.bluetooth.org/login/register/>

For each Bluetooth Design it is necessary to purchase a Declaration ID. This can be done before starting the new qualification, either through invoicing or credit card payment. The fees for the Declaration ID will depend on your membership status, please refer to the following webpage:  
<https://www.bluetooth.org/en-us/test-qualification/qualification-overview/fees>

For a detailed procedure of how to obtain a new Declaration ID for your design, please refer to the following SIG document:  
[https://www.bluetooth.org/DocMan/handlers/DownloadDoc.ashx?doc\\_id=283698&vId=317486](https://www.bluetooth.org/DocMan/handlers/DownloadDoc.ashx?doc_id=283698&vId=317486)

To start the listing, go to: [https://www.bluetooth.org/tpg/QLI\\_SDoc.cfm](https://www.bluetooth.org/tpg/QLI_SDoc.cfm).

In step 1, select the option, **Reference a Qualified Design** and enter 16227 in the End Product table entry. You can then select your pre-paid Declaration ID from the drop down menu or go to the Purchase Declaration ID page, (please note that unless the Declaration ID is pre-paid or purchased with a credit card, it will not be possible to proceed until the SIG invoice is paid.

Once all the relevant sections of step 1 are finished, complete steps 2, 3, and 4 as described in the help document. Your new Design will be listed on the SIG website and you can print your Certificate and DoC.

For further information please refer to the following training material:

<https://www.bluetooth.org/en-us/test-qualification/qualification-overview/listing-process-updates>

## 8 ADDITIONAL ASSISTANCE

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

Laird Technologies Connectivity Products Business Unit

Support Centre: [support@lairdconnect.com](mailto:support@lairdconnect.com)

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

Europe: +44-1628-858-940

Hong Kong: +852 2923 0610

Web: [www.lairdconnect.com](http://www.lairdconnect.com)

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**Note:** Information contained in this document is subject to change.

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