

## Integrated 802.11 b/g/n WLAN Module

### FEATURES

- IEEE 802.11 b/g/n (single stream n)
- Typical WLAN Transmit Power:
  - +19.0 dBm, 1 Mbps, CCK (b)
  - +15.8 dBm, 54 Mbps, OFDM (g)
  - +15.0 dBm, HT20 MCS7 (n)
- Typical WLAN Sensitivity:
  - -90 dBm, 8% PER, 11 Mbps (b)
  - -73 dBm, 10% PER, 54 Mbps (g)
  - -71 dBm, 10% PER, MCS7 (n)
- Miniature footprint: 10.5 mm x 10.5 mm
- Low height profile: 1.4 mm
- Operating voltage: 3.13V to 3.46V
- Operating temperature: -40 to +85° C
- Compact design based on Broadcom BCM4390 SoC
- Integrated ARM Cortex-M3 apps processor
- Wireless Security WEP, WPA Personal, WPA2 Personal
- Transmit and receive antenna diversity
- UART serial host interface
- Simple integration with microcontrollers and microprocessors
- Worldwide acceptance: FCC (USA), IC (Canada), and CE (Europe)
- Modular certification allows reuse of LSR FCC ID and ETSI certification without repeating the expensive testing on your end product
- RoHS compliant
- Streamlined development with LSR Design Services

### APPLICATIONS

- Thermostats, appliances, HVAC controller, and remote displays, Smart Energy
- Home entertainment control
- Sensor Networks
- Medical
- Home Monitoring
- Toys

### DESCRIPTION

The TiWi-C-W is a high performance 2.4 GHz WLAN module that contains an IP networking stack in a pre-certified footprint that simplifies the process of implementing internet connectivity.



The module includes the necessary PHY, MAC, and network layers to support WLAN applications on the integrated applications processor, or through a simple host interface.

Need to get to market quickly? Not an expert in 802.11. Need a custom antenna? Would you like to own the design? Would you like a custom design? Not quite sure what you need? Do you need help with your host board? LSR Design Services will be happy to develop custom hardware or software, or assist with integrating the design. Contact us at sales@lsr.com or call us at 262-375-4400.





- Home automation
- Home Network aggregators
- Remote appliance diagnostics/support
- Home security
- Remote storage devices
- Home network appliance
- Cameras and video surveillance
- Fitness
- Cable replacement for medical and personal healthcare

**ORDERING INFORMATION**

| Order Number | Description                                    |
|--------------|--|
| 450-0118C    | TiWi-C-W Module (Cut Tape)                     |
| 450-0118R    | TiWi-C-W Module (Tape and Reel, SPQ = 2000)    |
| 450-0137     | TiWi-C-W Evaluation Platform                   |
| 450-0143     | TiWi-C-W Development Kit featuring TiWiConnect |
| 450-0164     | TiWi-C-W Serial-to-WiFi Development Kit        |

**Table 1 Orderable TiWi-C-W Part Numbers**

**MODULE ACCESSORIES**

|   | Order Number    | Description  |
|---|-----------------|--|
|    | <b>001-0001</b> | 2.4 GHz Dipole Antenna with Reverse Polarity SMA Connector |
|   | <b>080-0001</b> | U.FL to Reverse Polarity SMA Bulkhead Cable 105mm          |
|  | <b>001-0014</b> | 2.4 GHz FlexPIFA Antenna                                   |
|  | <b>001-0030</b> | 2.4 GHz Metal FlexPIFA Antenna w/U.FL Cable, 100 mm        |

**Table 2 Module Accessories**

**APPLICABLE DOCUMENTS**

- TiWi-C-W Module Application Guide (330-0158)
- TiWi-C-W Evaluation Platform User Guide (330-0159)

The information in this document is subject to change without notice.

---

**TABLE OF CONTENTS**

---

|  |           |
|--|-----------|
| <b>FEATURES .....</b>  | <b>1</b>  |
| <b>APPLICATIONS .....</b>                                    | <b>1</b>  |
| <b>DESCRIPTION .....</b>                                     | <b>1</b>  |
| <b>ORDERING INFORMATION .....</b>                            | <b>2</b>  |
| <b>MODULE ACCESSORIES.....</b>                               | <b>2</b>  |
| <b>APPLICABLE DOCUMENTS .....</b>                            | <b>2</b>  |
| <b>BLOCK DIAGRAM .....</b>                                   | <b>5</b>  |
| <b>FUNCTIONAL BLOCK FEATURES .....</b>                       | <b>5</b>  |
| <b>WLAN Features .....</b>                                   | <b>5</b>  |
| <b>Network Stack Supported Protocols .....</b>               | <b>6</b>  |
| <b>Wireless Security System Features .....</b>               | <b>6</b>  |
| <b>TIWI-C-W MODULE FOOTPRINT AND PIN DEFINITIONS.....</b>    | <b>7</b>  |
| <b>PIN DESCRIPTIONS .....</b>                                | <b>8</b>  |
| <b>ELECTRICAL SPECIFICATIONS .....</b>                       | <b>10</b> |
| <b>Absolute Maximum Ratings .....</b>                        | <b>10</b> |
| <b>Recommended Operating Conditions .....</b>                | <b>10</b> |
| <b>General Characteristics .....</b>                         | <b>11</b> |
| <b>Power Consumption .....</b>                               | <b>12</b> |
| <b>Power Supply Requirements.....</b>                        | <b>13</b> |
| <b>RF Characteristics .....</b>                              | <b>14</b> |
| <b>UART HOST INTERFACE .....</b>                             | <b>20</b> |
| <b>Overview .....</b>  | <b>20</b> |
| <b>UART Interface .....</b>                                  | <b>20</b> |
| <b>UART Signal Description .....</b>                         | <b>20</b> |
| <b>Recommended Reflow Profile for Lead Free Solder .....</b> | <b>21</b> |
| <b>CLEANING .....</b>  | <b>22</b> |
| <b>OPTICAL INSPECTION .....</b>                              | <b>22</b> |

---

The information in this document is subject to change without notice.

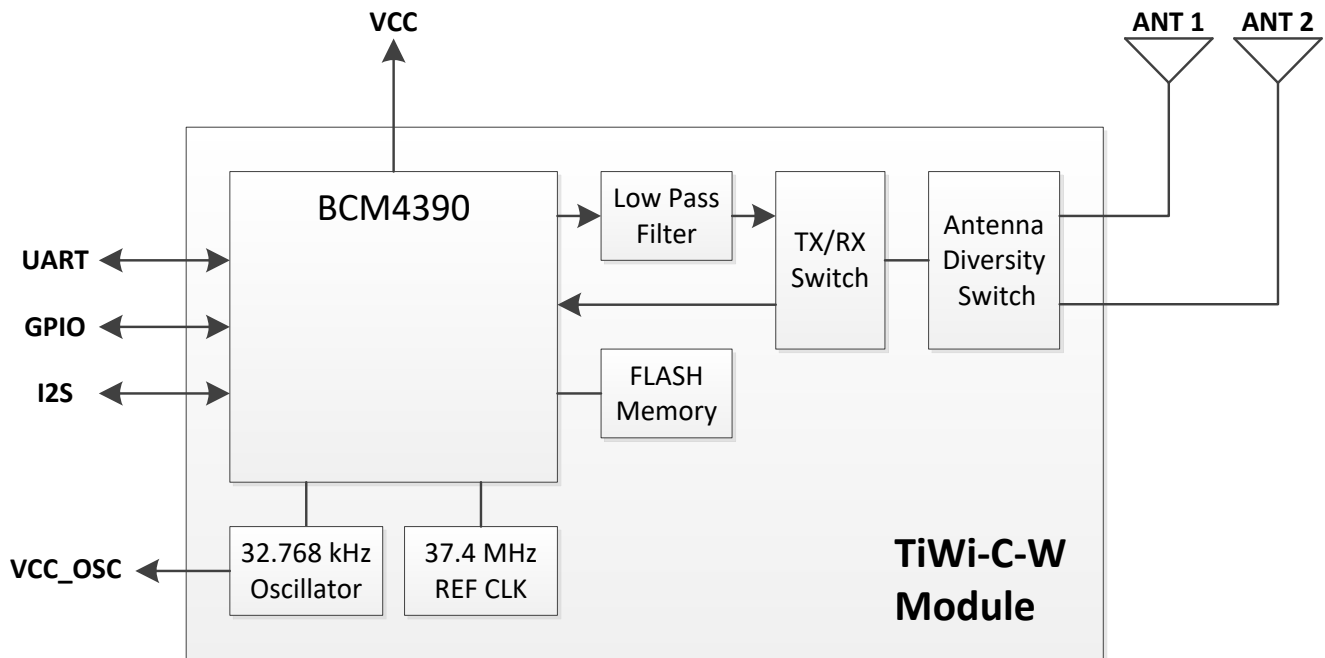
---

|   |           |
|---|-----------|
| <b>REWORK .....</b>   | <b>22</b> |
| <b>SHIPPING, HANDLING, AND STORAGE .....</b>  | <b>22</b> |
| Shipping.....   | 22        |
| Handling .....  | 22        |
| Moisture Sensitivity Level (MSL).....   | 22        |
| Storage .....   | 22        |
| Repeating Reflow Soldering.....   | 23        |
| <b>AGENCY CERTIFICATIONS .....</b>  | <b>24</b> |
| <b>AGENCY STATEMENTS.....</b>   | <b>24</b> |
| Federal Communication Commission Interference Statement .....                       | 24        |
| Industry Canada Statements.....   | 25        |
| <b>OEM RESPONSIBILITIES TO COMPLY WITH FCC AND INDUSTRY CANADA REGULATIONS.....</b> | <b>26</b> |
| <b>OEM LABELING REQUIREMENTS FOR END-PRODUCT .....</b>                              | <b>27</b> |
| <b>OEM END PRODUCT USER MANUAL STATEMENTS.....</b>                                  | <b>28</b> |
| <b>EUROPE .....</b>   | <b>29</b> |
| CE Notice .....   | 29        |
| Declaration of Conformity (DOC) .....   | 29        |
| <b>MECHANICAL DATA.....</b>   | <b>30</b> |
| <b>PCB FOOTPRINT .....</b>  | <b>31</b> |
| <b>RECOMMENDED SOLDER STENCIL .....</b>   | <b>32</b> |
| <b>TAPE AND REEL PACKAGING.....</b>   | <b>33</b> |
| <b>DEVICE MARKINGS.....</b>   | <b>34</b> |
| Rev 1 Devices.....  | 34        |
| Rev 3 Devices.....  | 34        |
| <b>CONTACTING LSR .....</b>   | <b>35</b> |

---

The information in this document is subject to change without notice.

**BLOCK DIAGRAM**



**Figure 1 TiWi-C-W Module Block Diagram – Top Level**

**FUNCTIONAL BLOCK FEATURES**

**WLAN Features**

- IEEE802.11b/g/n 1x1 2.4 GHz Radio
- Single Transmit and Single or Dual Receive Antenna Support
- **Media Access Controller (MAC)**
- Baseband Processor
- **Standards**
  - IEEE 802.11b, 802.11g, 802.11n
  - IEEE 802.11 d/i (regulatory domains and WPA2)
  - IEEE 802.11r (fast roaming between Aps)
  - IEEE 802.11w (secure management frames)

### Network Stack Supported Protocols

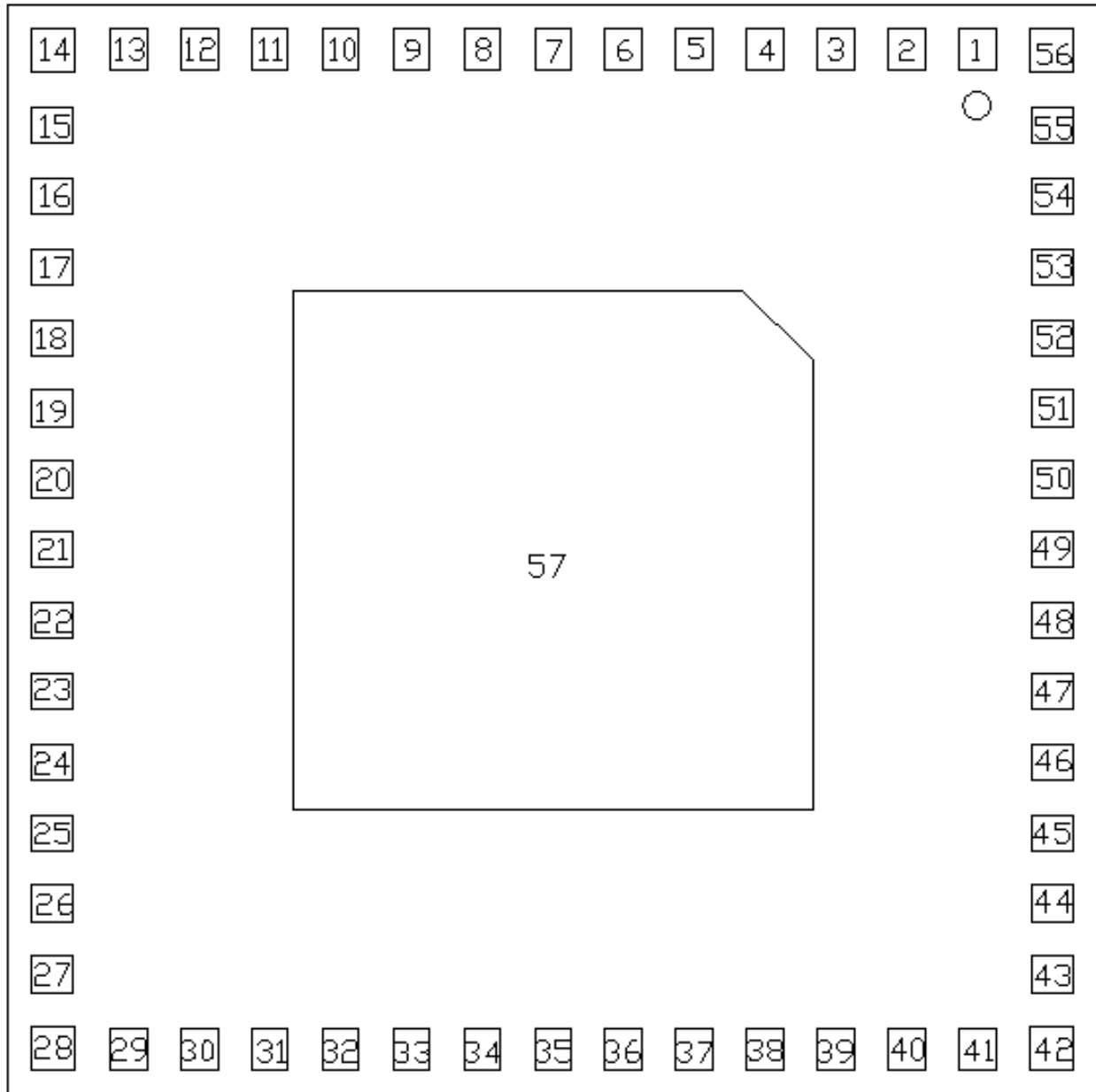
- **Transport layer:**
  - TCP
  - UDP
- **Network layer:**
  - IPv4, IPv6
  - Ping
  - DHCP
  - HTTP
  - NTP
  - DNS Client
- **Link layer:**
  - ARP

### Wireless Security System Features

- **Supported modes:**
  - Open (no security)
  - WEP
  - WPA Personal
  - WPA2 Personal
- **Supported encryption types:**
  - Open
  - WEP
  - AES (hardware accelerator)
  - TKIP (hardware accelerator)

**TIWI-C-W MODULE FOOTPRINT AND PIN DEFINITIONS**

To apply the TiWi-C-W module, it is important to use the module pins in your application as they are designated below, and in the corresponding pin definition table found on pages 8 and 9. Not all the pins on the TiWi-C-W module may be used, as some are reserved.



**Figure 2 TiWi-C-W Pinout (Top View)**

## PIN DESCRIPTIONS

| Module Pin | Name                | I/O Type | Description   |
|------------|---------------------|----------|---|
| 1          | GND                 | GND      | GROUND  |
| 2          | VCC                 | PI       | POWER TO MODULE (3.13-3.46 VDC)   |
| 3          | GND                 | GND      | GROUND  |
| 4          | RESET_N             | DI       | ACTIVE LOW RESET INPUT. MUST BE PULLED UP TO VCC WITH A 10k OHM RESISTOR.   |
| 5          | GPIO_A11            | DIO      | GPIO A11  |
| 6          | FLASH_OVERRIDE      | DIO      | INTERNAL FLASH PROGRAMMING OVERRIDE. CAN BE USED TO ASSIST IN A FORCED FLASH ERASE. SHOULD BE BROUGHT TO AND EXTERNAL PAD OR PIN. |
| 7          | OSC_32K_OUT         | DO       | 32.768 kHz OSCILLATOR OUTPUT  |
| 8          | VCC_OSC             | PI       | POWER TO 32.768 kHz OSCILLATOR (3.13-3.46 VDC)  |
| 9          | GND                 | GND      | GROUND  |
| 10         | ANTENNA 1           | RF       | ANTENNA 1, 50 OHMS, SECONDARY RX ANTENNA  |
| 11         | GND                 | GND      | GROUND  |
| 12         | GPIO_A10            | DIO      | GPIO A10  |
| 13         | GND                 | GND      | GROUND  |
| 14         | ANTENNA 0           | RF       | ANTENNA 0, 50 OHMS, TX AND PRIMARY RX ANTENNA   |
| 15         | GND                 | GND      | GROUND  |
| 16         | I2S_WS_UART2_TXD_A7 | DIO      | UART2 TRANSMIT DATA OUTPUT / GPIO A7  |
| 17         | I2S_WS_UART2_RXD_A9 | DIO      | UART 2 RECEIVE DATA INPUT / GPIO A9   |
| 18         | GPIO_A8             | DIO      | GPIO A8   |
| 19         | GPIO_A6             | DIO      | GPIO A6   |
| 20         | GND                 | GND      | GROUND  |
| 21         | UART1_CTS_N_A1      | DIO      | UART 1 ACTIVE LOW CLEAR-TO-SEND / GPIO A1   |
| 22         | UART1_RXD           | DI       | UART 1 RECEIVE DATA INPUT   |
| 23         | UART1_RTS_N_A0      | DIO      | UART 1 ACTIVE LOW REQUEST-TO-SEND / GPIO A0   |
| 24         | UART1_TXD           | DO       | UART 1 TRANSMIT DATA OUTPUT   |
| 25         | GND                 | GND      | GROUND  |
| 26         | VCC                 | PI       | POWER TO MODULE (3.13-3.46 VDC)   |
| 27         | GND                 | GND      | GROUND  |
| 28         | JTAG_TCK_A3         | DIO      | APPS JTAG TCK / GPIO A3   |

The information in this document is subject to change without notice.



| Module Pin | Name         | I/O Type | Description  |
|------------|--------------|----------|--|
| 29         | JTAG_TDO_A5  | DIO      | APPS JTAG TDO / GPIO A5                                  |
| 30         | JTAG_TMS_A2  | DIO      | APPS JTAG TMS / GPIO A2                                  |
| 31         | JTAG_TDI_A4  | DIO      | APPS JTAG TDI / GPIO A4                                  |
| 32         | WRF_GPIO_OUT | DIO      |  |
| 33         | UART4_TXD    | DO       | UART 4 TRANSMIT DATA OUTPUT                              |
| 34         | UART4_RXD    | DI       | UART 4 RECEIVE DATA INPUT                                |
| 35         | NC           | -        | NO CONNECT (DO NOT CONNECT)                              |
| 36         | NC           | -        | NO CONNECT (DO NOT CONNECT)                              |
| 37         | CLK_IN       | -        | UNUSED CLOCK IN. CONNECT TO GND THROUGH 1k OHM RESISTOR. |
| 38         | NC           | -        | NO CONNECT (DO NOT CONNECT)                              |
| 39         | NC           | -        | NO CONNECT (DO NOT CONNECT)                              |
| 40         | NC           | -        | NO CONNECT (DO NOT CONNECT)                              |
| 41         | GPIO_B2      | DIO      | GPIO B2  |
| 42         | GPIO_B3      | DIO      | GPIO B3  |
| 43         | GPIO_B5      | DIO      | GPIO B5  |
| 44         | GPIO_B6      | DIO      | GPIO B6  |
| 45         | GPIO_B4      | DIO      | GPIO B4  |
| 46         | GND          | GND      | GROUND   |
| 47         | VCC          | PI       | POWER TO MODULE (3.13-3.46 VDC)                          |
| 48         | GND          | GND      | GROUND   |
| 49         | GPIO_B0      | DIO      | GPIO B0  |
| 50         | GPIO_B1      | DIO      | GPIO B1  |
| 51         | GPIO_B9      | DIO      | GPIO B9  |
| 52         | GPIO_B10     | DIO      | GPIO B10   |
| 53         | GPIO_B11     | DIO      | GPIO B11   |
| 54         | GPIO_B8      | DIO      | GPIO B8  |
| 55         | GPIO_B7      | DIO      | GPIO B7  |
| 56         | GND          | GND      | GROUND   |
| 57         | GND          | GND      | GROUND   |

PI = Power Input DI = Digital Input DO = Digital Output DIO = Bi-directional Digital Port RF = Bi-directional RF Port GND=Ground

**Table 3 TiWi-C-W Module Pin Descriptions**

The information in this document is subject to change without notice.

**ELECTRICAL SPECIFICATIONS**

**Absolute Maximum Ratings**

| Parameter                                 | Min  | Max       | Unit |
|---|------|-----------|------|
| Power supply voltage (VCC)                | 0    | 3.46      | V    |
| Oscillator power supply voltage (VCC_OSC) | 0    | 3.46      | V    |
| Power supply voltage ripple               | -2   | +2        | %    |
| Voltage on digital pins                   | -0.5 | VCC + 0.5 | V    |
| RF input power, antenna port              |      | +10       | dBm  |
| Operating temperature                     | -40  | +85       | °C   |
| Storage temperature                       | -40  | +85       | °C   |

**Table 4 Absolute Maximum Ratings**

**Recommended Operating Conditions**

| Parameter                 | Min  | Typical | Max  | Unit |
|---------------------------|------|---------|------|------|
| VCC                       | 3.13 | 3.30    | 3.46 | V    |
| VCC_OSC                   | 3.13 | 3.30    | 3.46 | V    |
| Voltage on digital pins   | 0    | 3.3     | VCC  | V    |
| Ambient temperature range | -40  | 25      | 85   | °C   |

**Table 5 Recommended Operating Conditions**

**General Characteristics**

**DC Characteristics – General Purpose I/O**

| Parameter                   | Test Conditions | Min | Typical | Max | Unit |
|-----------------------------|-----------------|-----|---------|-----|------|
| Logic input low, $V_{IL}$   |                 | 0   | -       | 0.8 | V    |
| Logic input high, $V_{IH}$  |                 | 2.0 | -       | VCC | V    |
| Logic output low, $V_{OL}$  | 12mA            | 0   | -       | 0.8 | V    |
| Logic output high, $V_{OH}$ | 12mA            | 2.3 | -       | VCC | V    |

**Table 6 DC Characteristics General Purpose I/O**

**RF Characteristics**

| Parameter          | Min  | Typical                      | Max  | Unit |
|--------------------|------|------------------------------|------|------|
| RF frequency range | 2412 |                              | 2472 | MHz  |
| RF data rate       | 1    | 802.11 b/g/n rates supported | 54   | Mbps |

**Table 7 RF Characteristics**

**Power Consumption**

| Parameter       | Test Conditions                         | Min | Typical | Max | Unit |
|-----------------|---|-----|---------|-----|------|
| 11b TX Current  | 11 Mbps, T <sub>amb</sub> = +25°C, 3.3V | -   | 310     | 360 | mA   |
| 11g TX Current  | 6 Mbps, T <sub>amb</sub> = +25°C, 3.3V  | -   | 280     | 320 | mA   |
| 11g TX Current  | 54 Mbps, T <sub>amb</sub> = +25°C, 3.3V | -   | 230     | 280 | mA   |
| 11n TX Current  | MCS0, T <sub>amb</sub> = +25°C, 3.3V    | -   | 260     | 310 | mA   |
| 11n TX Current  | MCS7, T <sub>amb</sub> = +25°C, 3.3V    | -   | 220     | 270 | mA   |
| 11b RX Current  | 11 Mbps, T <sub>amb</sub> = +25°C, 3.3V | -   | 65      | -   | mA   |
| 11g RX Current  | 54 Mbps, T <sub>amb</sub> = +25°C, 3.3V | -   | 65      | -   | mA   |
| 11n RX Current  | MCS7, T <sub>amb</sub> = +25°C, 3.3V    |     | 65      |     | mA   |
| Power Down Mode |   | -   |         | -   | uA   |

**Table 8 WLAN Power Consumption**

**Power Supply Requirements**

| Parameter      | Min  | Typical | Max  | Unit |
|----------------|------|---------|------|------|
| VCC            | 3.13 | 3.30    | 3.46 | V    |
| Supply Current | -    | 800     | -    | mA   |

**Table 9 Power Supply Requirements**

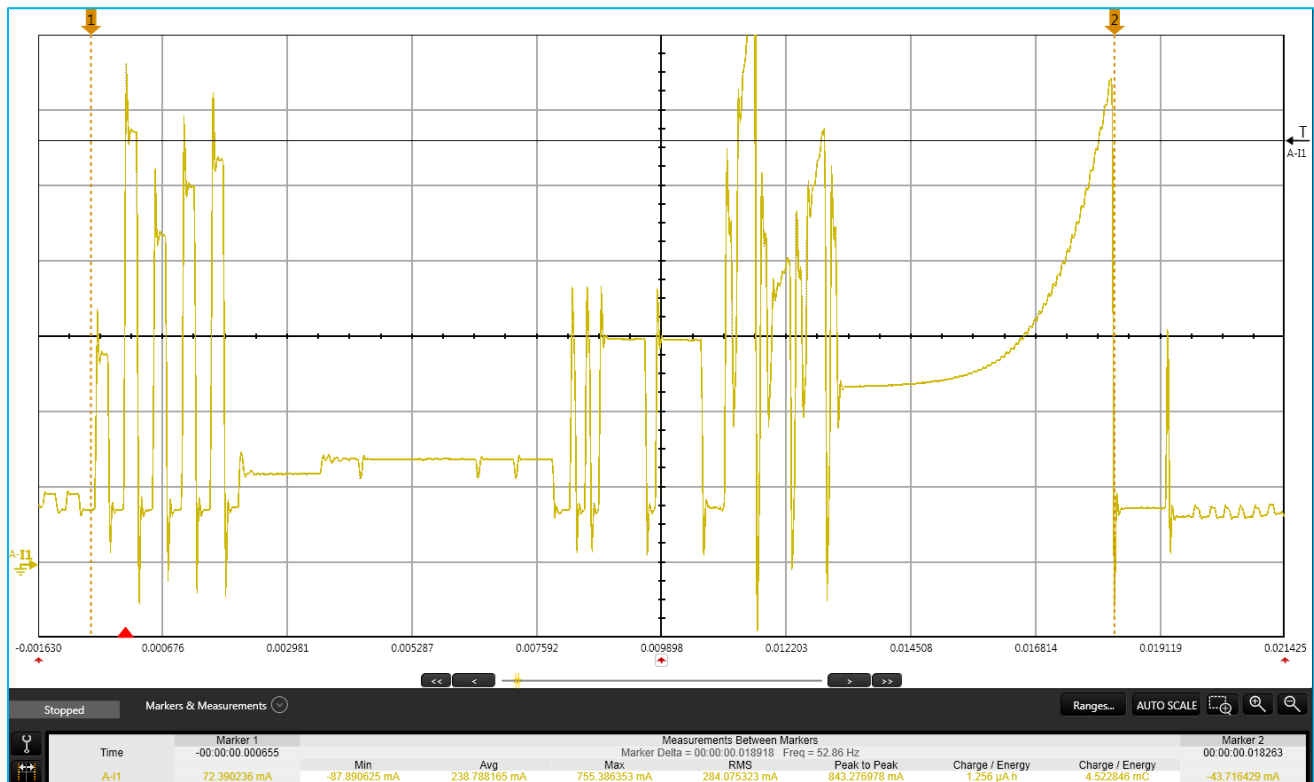
Although the Max continuous supply current to the module is >360 mA, when providing power to the module, a power source capable of supplying 800 mA peak current for a duration of ~30 mSec is required by the module transmitter during calibration.

Module calibration occurs:

- (1) When the Module is initially powered up.
- (2) The module is reset.
- (3) When the radio is initialized.
- (4) Every 2 minutes after the radio is initialized.

Note: Radio calibration will not occur while the module is in modes Doze, Deep Sleep, Power Down or if the radio is not initialized.

**Figure 3** shows the current profile of the TiWi-C-W module during calibration. If current is limited to <800mA during this process, the module will fail to calibrate.



**Figure 3 Module RF Calibration Current Profile**

The information in this document is subject to change without notice.

**RF Characteristics**
**WLAN Transmitter Characteristics  
(TA = +25°C, VCC = 3.3 V)**

| Parameter                         | Test Conditions   | Min | Typ  | Max | Unit |
|-----------------------------------|---|-----|------|-----|------|
| 1 Mbps DSSS (b) TX Output Power   | 1 Mbps BPSK 802.11(b) Mask Compliance<br>35% EVM RMS power over TX packet         | -   | 19.0 | -   | dBm  |
| 2 Mbps DSSS (b) TX Output Power   | 2 Mbps QPSK 802.11(b) Mask Compliance<br>35% EVM RMS power over TX packet         | -   | 19.0 | -   | dBm  |
| 5.5 Mbps DSSS (b) TX Output Power | 5.5 Mbps QPSK 802.11(b) Mask Compliance<br>35% EVM RMS power over TX packet       | -   | 19.0 | -   | dBm  |
| 11 Mbps DSSS (b) TX Output Power  | 11 Mbps CCK 802.11(b) Mask Compliance<br>35% EVM RMS power over TX packet         | -   | 19.0 | -   | dBm  |
| 6 Mbps OFDM (g) TX Output Power   | 6 Mbps BPSK 802.11(g) Mask Compliance<br>-5 dB EVM RMS power over TX packet       | -   | 17.5 | -   | dBm  |
| 9 Mbps OFDM (g) TX Output Power   | 9 Mbps BPSK 802.11(g) Mask Compliance<br>-8 dB EVM RMS power over TX packet       | -   | 17.5 | -   | dBm  |
| 12 Mbps OFDM (g) TX Output Power  | 12 Mbps QPSK 802.11(g) Mask Compliance<br>-10 dB EVM RMS power over TX packet     | -   | 17.5 | -   | dBm  |
| 18 Mbps OFDM (g) TX Output Power  | 18 Mbps QPSK 802.11(g) Mask Compliance<br>-13 dB EVM RMS power over TX packet     | -   | 17.5 | -   | dBm  |
| 24 Mbps OFDM (g) TX Output Power  | 24 Mbps 16-QAM 802.11(g) Mask Compliance<br>-16 dB EVM RMS power over TX packet   | -   | 15.8 | -   | dBm  |
| 36 Mbps OFDM (g) TX Output Power  | 36 Mbps 16-QAM 802.11(g) Mask Compliance<br>-19 dB EVM RMS power over TX packet   | -   | 15.8 | -   | dBm  |
| 48 Mbps OFDM (g) TX Output Power  | 48 Mbps 64-QAM 802.11(g) Mask Compliance<br>-22 dB EVM RMS power over TX packet   | -   | 15.8 | -   | dBm  |
| 54 Mbps OFDM (g) TX Output Power  | 54 Mbps 64-QAM 802.11(g) Mask Compliance<br>-25 dB EVM RMS power over TX packet   | -   | 15.8 | -   | dBm  |
| MCS0 OFDM (n) TX Output Power     | 6.5 Mbps BPSK 802.11(n) Mask Compliance<br>-5 dB EVM RMS power over TX packet     | -   | 15.5 | -   | dBm  |
| MCS1 OFDM (n) TX Output Power     | 13 Mbps QPSK 802.11(n) Mask Compliance<br>-10 dB EVM RMS power over TX packet     | -   | 15.5 | -   | dBm  |
| MCS2 OFDM (n) TX Output Power     | 19.5 Mbps QPSK 802.11(n) Mask Compliance<br>-13 dB EVM RMS power over TX packet   | -   | 15.5 | -   | dBm  |
| MCS3 OFDM (n) TX Output Power     | 26 Mbps 16-QAM 802.11(n) Mask Compliance<br>-16 dB EVM RMS power over TX packet   | -   | 15.0 | -   | dBm  |
| MCS4 OFDM (n) TX Output Power     | 39 Mbps 16-QAM 802.11(n) Mask Compliance<br>-19 dB EVM RMS power over TX packet   | -   | 15.0 | -   | dBm  |
| MCS5 OFDM (n) TX Output Power     | 52 Mbps 64-QAM 802.11(n) Mask Compliance<br>-22 dB EVM RMS power over TX packet   | -   | 15.0 | -   | dBm  |
| MCS6 OFDM (n) TX Output Power     | 58.5 Mbps 64-QAM 802.11(n) Mask Compliance<br>-25 dB EVM RMS power over TX packet | -   | 15.0 | -   | dBm  |
| MCS7 OFDM (n) TX Output Power     | 65 Mbps 64-QAM 802.11(n) Mask Compliance<br>-27 dB EVM RMS power over TX packet   | -   | 15.0 | -   | dBm  |

**Table 10 WLAN Transmitter RF Characteristics**

The information in this document is subject to change without notice.

**WLAN Transmitter Characteristics  
(TA = +85°C, VCC = 3.3 V)**

| Parameter                         | Test Conditions   | Min | Typ  | Max | Unit |
|-----------------------------------|---|-----|------|-----|------|
| 1 Mbps DSSS (b) TX Output Power   | 1 Mbps BPSK 802.11(b) Mask Compliance<br>35% EVM RMS power over TX packet         | -   | 19.0 | -   | dBm  |
| 2 Mbps DSSS (b) TX Output Power   | 2 Mbps QPSK 802.11(b) Mask Compliance<br>35% EVM RMS power over TX packet         | -   | 19.0 | -   | dBm  |
| 5.5 Mbps DSSS (b) TX Output Power | 5.5 Mbps QPSK 802.11(b) Mask Compliance<br>35% EVM RMS power over TX packet       | -   | 19.0 | -   | dBm  |
| 11 Mbps DSSS (b) TX Output Power  | 11 Mbps CCK 802.11(b) Mask Compliance<br>35% EVM RMS power over TX packet         | -   | 19.0 | -   | dBm  |
| 6 Mbps OFDM (g) TX Output Power   | 6 Mbps BPSK 802.11(g) Mask Compliance<br>-5 dB EVM RMS power over TX packet       | -   | 17.6 | -   | dBm  |
| 9 Mbps OFDM (g) TX Output Power   | 9 Mbps BPSK 802.11(g) Mask Compliance<br>-8 dB EVM RMS power over TX packet       | -   | 17.6 | -   | dBm  |
| 12 Mbps OFDM (g) TX Output Power  | 12 Mbps QPSK 802.11(g) Mask Compliance<br>-10 dB EVM RMS power over TX packet     | -   | 17.6 | -   | dBm  |
| 18 Mbps OFDM (g) TX Output Power  | 18 Mbps QPSK 802.11(g) Mask Compliance<br>-13 dB EVM RMS power over TX packet     | -   | 17.6 | -   | dBm  |
| 24 Mbps OFDM (g) TX Output Power  | 24 Mbps 16-QAM 802.11(g) Mask Compliance<br>-16 dB EVM RMS power over TX packet   | -   | 15.8 | -   | dBm  |
| 36 Mbps OFDM (g) TX Output Power  | 36 Mbps 16-QAM 802.11(g) Mask Compliance<br>-19 dB EVM RMS power over TX packet   | -   | 15.8 | -   | dBm  |
| 48 Mbps OFDM (g) TX Output Power  | 48 Mbps 64-QAM 802.11(g) Mask Compliance<br>-22 dB EVM RMS power over TX packet   | -   | 15.8 | -   | dBm  |
| 54 Mbps OFDM (g) TX Output Power  | 54 Mbps 64-QAM 802.11(g) Mask Compliance<br>-25 dB EVM RMS power over TX packet   | -   | 15.8 | -   | dBm  |
| MCS0 OFDM (n) TX Output Power     | 6.5 Mbps BPSK 802.11(n) Mask Compliance<br>-5 dB EVM RMS power over TX packet     | -   | 15.5 | -   | dBm  |
| MCS1 OFDM (n) TX Output Power     | 13 Mbps QPSK 802.11(n) Mask Compliance<br>-10 dB EVM RMS power over TX packet     | -   | 15.5 | -   | dBm  |
| MCS2 OFDM (n) TX Output Power     | 19.5 Mbps QPSK 802.11(n) Mask Compliance<br>-13 dB EVM RMS power over TX packet   | -   | 15.5 | -   | dBm  |
| MCS3 OFDM (n) TX Output Power     | 26 Mbps 16-QAM 802.11(n) Mask Compliance<br>-16 dB EVM RMS power over TX packet   | -   | 15.0 | -   | dBm  |
| MCS4 OFDM (n) TX Output Power     | 39 Mbps 16-QAM 802.11(n) Mask Compliance<br>-19 dB EVM RMS power over TX packet   | -   | 15.0 | -   | dBm  |
| MCS5 OFDM (n) TX Output Power     | 52 Mbps 64-QAM 802.11(n) Mask Compliance<br>-22 dB EVM RMS power over TX packet   | -   | 15.0 | -   | dBm  |
| MCS6 OFDM (n) TX Output Power     | 58.5 Mbps 64-QAM 802.11(n) Mask Compliance<br>-25 dB EVM RMS power over TX packet | -   | 15.0 | -   | dBm  |
| MCS7 OFDM (n) TX Output Power     | 65 Mbps 64-QAM 802.11(n) Mask Compliance<br>-27 dB EVM RMS power over TX packet   | -   | 15.0 | -   | dBm  |

**Table 11 WLAN Transmitter RF Characteristics**

The information in this document is subject to change without notice.

**WLAN Transmitter Characteristics  
(TA = -40°C, VCC = 3.3 V)**

| Parameter                         | Test Conditions   | Min | Typ  | Max | Unit |
|-----------------------------------|---|-----|------|-----|------|
| 1 Mbps DSSS (b) TX Output Power   | 1 Mbps BPSK 802.11(b) Mask Compliance<br>35% EVM RMS power over TX packet         | -   | 18.6 | -   | dBm  |
| 2 Mbps DSSS (b) TX Output Power   | 2 Mbps QPSK 802.11(b) Mask Compliance<br>35% EVM RMS power over TX packet         | -   | 18.6 | -   | dBm  |
| 5.5 Mbps DSSS (b) TX Output Power | 5.5 Mbps QPSK 802.11(b) Mask Compliance<br>35% EVM RMS power over TX packet       | -   | 18.6 | -   | dBm  |
| 11 Mbps DSSS (b) TX Output Power  | 11 Mbps CCK 802.11(b) Mask Compliance<br>35% EVM RMS power over TX packet         | -   | 18.6 | -   | dBm  |
| 6 Mbps OFDM (g) TX Output Power   | 6 Mbps BPSK 802.11(g) Mask Compliance<br>-5 dB EVM RMS power over TX packet       | -   | 17.0 | -   | dBm  |
| 9 Mbps OFDM (g) TX Output Power   | 9 Mbps BPSK 802.11(g) Mask Compliance<br>-8 dB EVM RMS power over TX packet       | -   | 17.0 | -   | dBm  |
| 12 Mbps OFDM (g) TX Output Power  | 12 Mbps QPSK 802.11(g) Mask Compliance<br>-10 dB EVM RMS power over TX packet     | -   | 17.0 | -   | dBm  |
| 18 Mbps OFDM (g) TX Output Power  | 18 Mbps QPSK 802.11(g) Mask Compliance<br>-13 dB EVM RMS power over TX packet     | -   | 17.0 | -   | dBm  |
| 24 Mbps OFDM (g) TX Output Power  | 24 Mbps 16-QAM 802.11(g) Mask Compliance<br>-16 dB EVM RMS power over TX packet   | -   | 15.5 | -   | dBm  |
| 36 Mbps OFDM (g) TX Output Power  | 36 Mbps 16-QAM 802.11(g) Mask Compliance<br>-19 dB EVM RMS power over TX packet   | -   | 15.5 | -   | dBm  |
| 48 Mbps OFDM (g) TX Output Power  | 48 Mbps 64-QAM 802.11(g) Mask Compliance<br>-22 dB EVM RMS power over TX packet   | -   | 15.5 | -   | dBm  |
| 54 Mbps OFDM (g) TX Output Power  | 54 Mbps 64-QAM 802.11(g) Mask Compliance<br>-25 dB EVM RMS power over TX packet   | -   | 15.5 | -   | dBm  |
| MCS0 OFDM (n) TX Output Power     | 6.5 Mbps BPSK 802.11(n) Mask Compliance<br>-5 dB EVM RMS power over TX packet     | -   | 15.0 | -   | dBm  |
| MCS1 OFDM (n) TX Output Power     | 13 Mbps QPSK 802.11(n) Mask Compliance<br>-10 dB EVM RMS power over TX packet     | -   | 15.0 | -   | dBm  |
| MCS2 OFDM (n) TX Output Power     | 19.5 Mbps QPSK 802.11(n) Mask Compliance<br>-13 dB EVM RMS power over TX packet   | -   | 15.0 | -   | dBm  |
| MCS3 OFDM (n) TX Output Power     | 26 Mbps 16-QAM 802.11(n) Mask Compliance<br>-16 dB EVM RMS power over TX packet   | -   | 14.7 | -   | dBm  |
| MCS4 OFDM (n) TX Output Power     | 39 Mbps 16-QAM 802.11(n) Mask Compliance<br>-19 dB EVM RMS power over TX packet   | -   | 14.7 | -   | dBm  |
| MCS5 OFDM (n) TX Output Power     | 52 Mbps 64-QAM 802.11(n) Mask Compliance<br>-22 dB EVM RMS power over TX packet   | -   | 14.7 | -   | dBm  |
| MCS6 OFDM (n) TX Output Power     | 58.5 Mbps 64-QAM 802.11(n) Mask Compliance<br>-25 dB EVM RMS power over TX packet | -   | 14.7 | -   | dBm  |
| MCS7 OFDM (n) TX Output Power     | 65 Mbps 64-QAM 802.11(n) Mask Compliance<br>-27 dB EVM RMS power over TX packet   | -   | 14.7 | -   | dBm  |

**Table 12 WLAN Transmitter RF Characteristics**

The information in this document is subject to change without notice.



**WLAN Receiver Characteristics  
(TA = +25°C, VCC = 3.10V, 3.30V, & 3.46V)**

| Parameter                                | Test Conditions  | Min | Typ   | Max | Unit |
|--|------------------|-----|-------|-----|------|
| 1 Mbps DSSS (b) RX Sensitivity           | 8% PER           | -   | -90   | -   | dBm  |
| 2 Mbps DSSS (b) RX Sensitivity           | 8% PER           | -   | -90   | -   | dBm  |
| 5.5 Mbps DSSS (b) RX Sensitivity         | 8% PER           | -   | -89   | -   | dBm  |
| 11 Mbps DSSS (b) RX Sensitivity          | 8% PER           | -   | -87   | -   | dBm  |
|  |                  |     |       |     |      |
| 6 Mbps OFDM (g) RX Sensitivity           | 10% PER          | -   | -90   | -   | dBm  |
| 9 Mbps OFDM (g) RX Sensitivity           | 10% PER          | -   | -89   | -   | dBm  |
| 12 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -85   | -   | dBm  |
| 18 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -84.5 | -   | dBm  |
| 24 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -82   | -   | dBm  |
| 36 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -79   | -   | dBm  |
| 48 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -75   | -   | dBm  |
| 54 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -73   | -   | dBm  |
|  |                  |     |       |     |      |
| MCS0 (6.5 Mbps) OFDM (n) RX Sensitivity  | 10% PER          | -   | -90   | -   | dBm  |
| MCS1 (13 Mbps) OFDM (n) RX Sensitivity   | 10% PER          | -   | -87   | -   | dBm  |
| MCS2 (19.5 Mbps) OFDM (n) RX Sensitivity | 10% PER          | -   | -85   | -   | dBm  |
| MCS3 26 Mbps OFDM (n) RX Sensitivity     | 10% PER          | -   | -82   | -   | dBm  |
| MCS4 39 Mbps OFDM (n) RX Sensitivity     | 10% PER          | -   | -79   | -   | dBm  |
| MCS5 52 Mbps OFDM (n) RX Sensitivity     | 10% PER          | -   | -74   | -   | dBm  |
| MCS6 58.5 Mbps OFDM (n) RX Sensitivity   | 10% PER          | -   | -73   | -   | dBm  |
| MCS7 65 Mbps OFDM (n) RX Sensitivity     | 10% PER          | -   | -71   | -   | dBm  |
|  |                  |     |       |     |      |
| 11b RX Overload Level                    | 8% PER, 11 Mbps  | -10 | -     | -   | dBm  |
| 11g RX Overload Level                    | 10% PER, 54 Mbps | -20 | -     | -   | dBm  |
| 11n RX Overload Level                    | 10% PER, MCS7    | -20 | -     | -   | dBm  |

**Table 13 WLAN Receiver RF Characteristics**

The information in this document is subject to change without notice.

**WLAN Receiver Characteristics**  
(TA = +85°C, VCC = 3.10V, 3.30V, & 3.46V)

| Parameter                                | Test Conditions  | Min | Typ   | Max | Unit |
|--|------------------|-----|-------|-----|------|
| 1 Mbps DSSS (b) RX Sensitivity           | 8% PER           | -   | -89   | -   | dBm  |
| 2 Mbps DSSS (b) RX Sensitivity           | 8% PER           | -   | -89   | -   | dBm  |
| 5.5 Mbps DSSS (b) RX Sensitivity         | 8% PER           | -   | -88   | -   | dBm  |
| 11 Mbps DSSS (b) RX Sensitivity          | 8% PER           | -   | -86   | -   | dBm  |
|  |                  |     |       |     |      |
| 6 Mbps OFDM (g) RX Sensitivity           | 10% PER          | -   | -89   | -   | dBm  |
| 9 Mbps OFDM (g) RX Sensitivity           | 10% PER          | -   | -88   | -   | dBm  |
| 12 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -84   | -   | dBm  |
| 18 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -83.5 | -   | dBm  |
| 24 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -82   | -   | dBm  |
| 36 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -78   | -   | dBm  |
| 48 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -74   | -   | dBm  |
| 54 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -72   | -   | dBm  |
|  |                  |     |       |     |      |
| MCS0 (6.5 Mbps) OFDM (n) RX Sensitivity  | 10% PER          | -   | -89   | -   | dBm  |
| MCS1 (13 Mbps) OFDM (n) RX Sensitivity   | 10% PER          | -   | -86   | -   | dBm  |
| MCS2 (19.5 Mbps) OFDM (n) RX Sensitivity | 10% PER          | -   | -84   | -   | dBm  |
| MCS3 26 Mbps OFDM (n) RX Sensitivity     | 10% PER          | -   | -81   | -   | dBm  |
| MCS4 39 Mbps OFDM (n) RX Sensitivity     | 10% PER          | -   | -78   | -   | dBm  |
| MCS5 52 Mbps OFDM (n) RX Sensitivity     | 10% PER          | -   | -73   | -   | dBm  |
| MCS6 58.5 Mbps OFDM (n) RX Sensitivity   | 10% PER          | -   | -72   | -   | dBm  |
| MCS7 65 Mbps OFDM (n) RX Sensitivity     | 10% PER          | -   | -70   | -   | dBm  |
|  |                  |     |       |     |      |
| 11b RX Overload Level                    | 8% PER, 11 Mbps  | -10 | -     | -   | dBm  |
| 11g RX Overload Level                    | 10% PER, 54 Mbps | -20 | -     | -   | dBm  |
| 11n RX Overload Level                    | 10% PER, MCS7    | -20 | -     | -   | dBm  |

**Table 14 WLAN Receiver RF Characteristics**

The information in this document is subject to change without notice.

**WLAN Receiver Characteristics  
(TA = -40°C, VCC = 3.10V, 3.30V, & 3.46V)**

| Parameter                                | Test Conditions  | Min | Typ   | Max | Unit |
|--|------------------|-----|-------|-----|------|
| 1 Mbps DSSS (b) RX Sensitivity           | 8% PER           | -   | -91   | -   | dBm  |
| 2 Mbps DSSS (b) RX Sensitivity           | 8% PER           | -   | -91   | -   | dBm  |
| 5.5 Mbps DSSS (b) RX Sensitivity         | 8% PER           | -   | -90   | -   | dBm  |
| 11 Mbps DSSS (b) RX Sensitivity          | 8% PER           | -   | -88   | -   | dBm  |
|  |                  |     |       |     |      |
| 6 Mbps OFDM (g) RX Sensitivity           | 10% PER          | -   | -91   | -   | dBm  |
| 9 Mbps OFDM (g) RX Sensitivity           | 10% PER          | -   | -90   | -   | dBm  |
| 12 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -86   | -   | dBm  |
| 18 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -85.5 | -   | dBm  |
| 24 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -83   | -   | dBm  |
| 36 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -80   | -   | dBm  |
| 48 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -76   | -   | dBm  |
| 54 Mbps OFDM (g) RX Sensitivity          | 10% PER          | -   | -74   | -   | dBm  |
|  |                  |     |       |     |      |
| MCS0 (6.5 Mbps) OFDM (n) RX Sensitivity  | 10% PER          | -   | -91   | -   | dBm  |
| MCS1 (13 Mbps) OFDM (n) RX Sensitivity   | 10% PER          | -   | -88   | -   | dBm  |
| MCS2 (19.5 Mbps) OFDM (n) RX Sensitivity | 10% PER          | -   | -86   | -   | dBm  |
| MCS3 26 Mbps OFDM (n) RX Sensitivity     | 10% PER          | -   | -83   | -   | dBm  |
| MCS4 39 Mbps OFDM (n) RX Sensitivity     | 10% PER          | -   | -80   | -   | dBm  |
| MCS5 52 Mbps OFDM (n) RX Sensitivity     | 10% PER          | -   | -75   | -   | dBm  |
| MCS6 58.5 Mbps OFDM (n) RX Sensitivity   | 10% PER          | -   | -74   | -   | dBm  |
| MCS7 65 Mbps OFDM (n) RX Sensitivity     | 10% PER          | -   | -72   | -   | dBm  |
|  |                  |     |       |     |      |
| 11b RX Overload Level                    | 8% PER, 11 Mbps  | -10 | -     | -   | dBm  |
| 11g RX Overload Level                    | 10% PER, 54 Mbps | -20 | -     | -   | dBm  |
| 11n RX Overload Level                    | 10% PER, MCS7    | -20 | -     | -   | dBm  |

**Table 15 WLAN Receiver RF Characteristics**

The information in this document is subject to change without notice.

## UART HOST INTERFACE

The main interface to the TiWi-C-W Module is a Universal Asynchronous Receiver Transmitter (UART). This section describes the UART host interface.

### Overview

The UART is a standard TTL level 4-wire interface (RX, TX, RTS, and CTS) with support for baud rates from 9600 bps to 4.0 Mbps. Default parameters are 115200 baud, 8 data bits, no parity bits, 1 stop bit, hardware flow control disabled.

### UART Interface

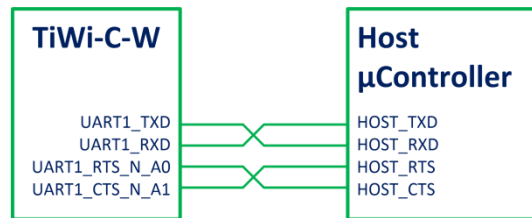


Figure 4 UART Connection from TiWi-C-W to Host

### UART Signal Description

| Port Name      | Input/Output | Description                       |
|----------------|--------------|-----------------------------------|
| UART1_TXD      | DO           | UART 1 TRANSMIT DATA OUTPUT       |
| UART1_RXD      | DI           | UART 1 RECEIVE DATA INPUT         |
| UART1_RTS_N_A0 | DO           | UART 1 ACTIVE LOW REQUEST-TO-SEND |
| UART1_CTS_N_A1 | DI           | UART 1 ACTIVE LOW CLEAR-TO-SEND   |

Table 16 UART Interface Signal Description

### UART TIMING

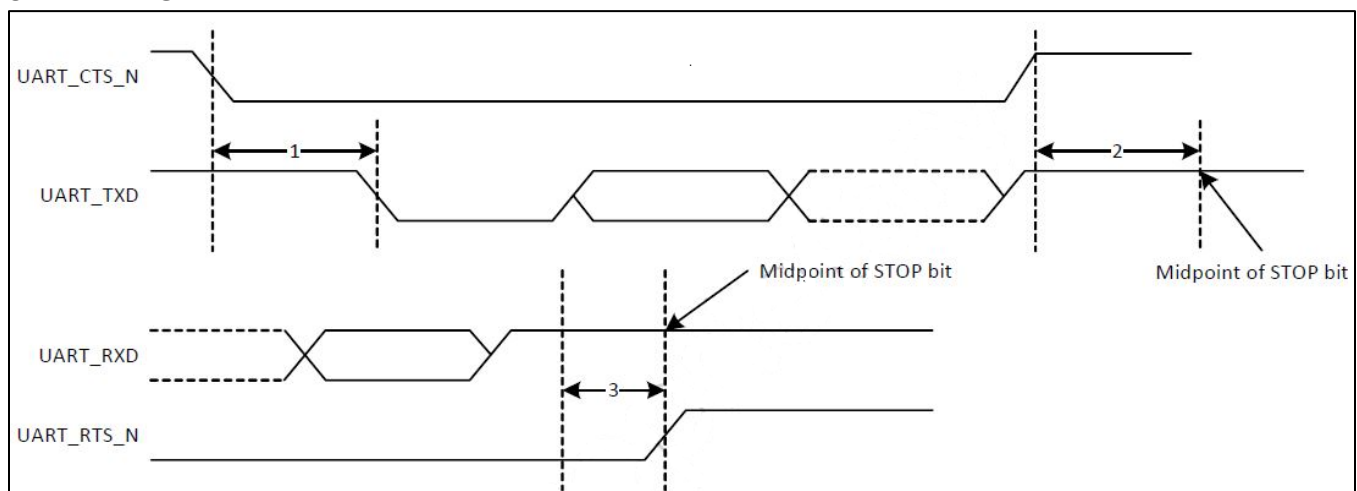


Figure 5 UART Timing

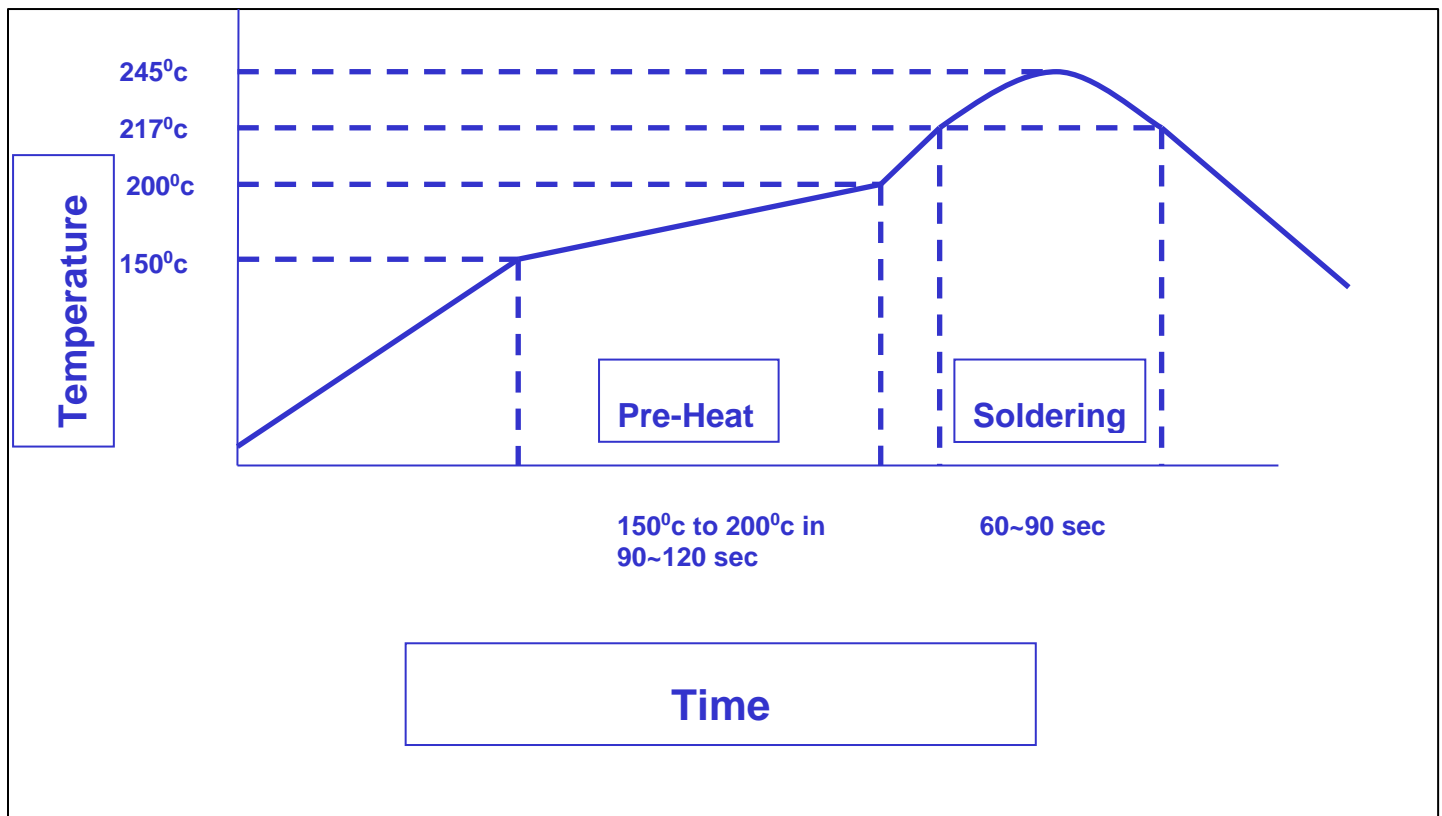
The information in this document is subject to change without notice.

**Soldering Recommendations**

**Reflow for Lead Free Solder Paste**

- Optimal solder reflow profile depends on solder paste properties and should be optimized as part of an overall process development.
- It is important to provide a solder reflow profile that matches the solder paste supplier's recommendations.
- Temperature ranges beyond that of the solder paste supplier's recommendation could result in poor solderability.
- All solder paste suppliers recommend an ideal reflow profile to give the best solderability.

**Recommended Reflow Profile for Lead Free Solder**



**Figure 6 Recommended Soldering Profile**

**Note: The quality of solder joints on the surface mount pads where they contact the host board should meet the appropriate IPC Specification. See IPC-A-610-D Acceptability of Electronic Assemblies, section 8.2.1 "Bottom Only Terminations."**

## CLEANING

In general, cleaning the populated modules is strongly discouraged. Residuals under the module cannot be easily removed with any cleaning process.

- Cleaning with water can lead to capillary effects where water is absorbed into the gap between the host board and the module. The combination of soldering flux residuals and encapsulated water could lead to short circuits between neighboring pads. Water could also damage any stickers or labels.
- Cleaning with alcohol or a similar organic solvent will likely flood soldering flux residuals into the RF shield, which is not accessible for post-washing inspection. The solvent could also damage any stickers or labels.
- Ultrasonic cleaning could damage the module permanently.

## OPTICAL INSPECTION

After soldering the Module to the host board, consider optical inspection to check the following:

- Proper alignment and centering of the module over the pads.
- Proper solder joints on all pads.
- Excessive solder or contacts to neighboring pads, or vias.

## REWORK

The TiWi-C-W module can be unsoldered from the host board if the Moisture Sensitivity Level (MSL) requirements are met as described in this datasheet.

**Never attempt a rework on the module itself, e.g. replacing individual components. Such actions will terminate warranty coverage.**

## SHIPPING, HANDLING, AND STORAGE

### Shipping

Bulk orders of the TiWi-C-W modules are delivered in reels of 2000.

### Handling

The TiWi-C-W modules contain a highly sensitive electronic circuitry. Handling without proper ESD protection may damage the module permanently.

### Moisture Sensitivity Level (MSL)

Per J-STD-020, devices rated as MSL 3 and not stored in a sealed bag with desiccant pack should be baked prior to use.

Devices are packaged in a Moisture Barrier Bag with a desiccant pack and Humidity Indicator Card (HIC). Devices that will be subjected to reflow should reference the HIC and J-STD-033 to determine if baking is required.

If baking is required, refer to J-STD-033 for bake procedure.

### Storage

Per J-STD-033, the shelf life of devices in a Moisture Barrier Bag is 12 months at <40°C and <90% room humidity (RH).

Do not store in salty air or in an environment with a high concentration of corrosive gas, such as Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, or NO<sub>x</sub>.

Do not store in direct sunlight.

The product should not be subject to excessive mechanical shock.

## Repeating Reflow Soldering

Only a single reflow soldering process is encouraged for host boards.

---

## AGENCY CERTIFICATIONS

FCC ID: TFB-1001, 15.247

IC ID: 5969A-1001, RSS 210

CE: Compliant to standards EN 60950-1, EN 300 328, and EN 301 489

## AGENCY STATEMENTS

### 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:

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

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.

**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.



## Industry Canada Statements

This Device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This device has been designed to operate with the antenna(s) listed below and having a maximum gain of 2.0 dBi (LSR Dipole), 2.0 dBi (LSR FlexPIFA), 2.0 dBi (LSR mFlexPIFA), and 0.5dBi (Johanson Chip). Antennas not included in this list or having a gain greater than 2.0 dBi, 2.0 dBi, 2.0 dBi, and 0.5dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

List of all Antennas Acceptable for use with the Transmitter

- 1) LSR 001-0001 2.4 GHz center-fed dipole antenna and LSR 080-0001 U.FL to Reverse Polarity SMA connector cable.
- 2) LSR 001-0014 2.4 GHz FlexPIFA antenna.
- 3) LSR 001-0030 2.4 GHz Metal FlexPIFA (mFlexPIFA) antenna.
- 4) Johanson 2450AT18A100 chip antenna.

Cet appareil est conforme avec Industrie Canada , exempts de licence standard RSS (s). L'opération est soumise aux deux conditions suivantes: (1) cet appareil ne peut pas provoquer d'interférences et (2) cet appareil doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

Pour réduire le risque d'interférence aux autres utilisateurs, le type d'antenne et son gain doivent être choisis de manière que la puissance isotrope rayonnée équivalente (PIRE) ne dépasse pas celle permise pour une communication réussie.

Cet appareil a été conçu pour fonctionner avec l'antenne (s) ci-dessous, et ayant un gain maximum de 2,0 dBi (LSR Dipole), 2.0 dBi (LSR FlexPIFA), 2.0 dBi (LSR mFlexPIFA), et 0.5dBi (Johanson Chip). Antennes pas inclus dans cette liste ou présentant un gain supérieure à 2,0 dBi, 2.0 dBi, 2.0 dBi, et 0.5dBi sont strictement interdits pour une utilisation avec cet appareil. L'impédance d'antenne requise est de 50 ohms.

Liste de toutes les antennes acceptables pour une utilisation avec l'émetteur

- 1) Antenne LSR 001-0001 2.4 GHz de centre-dipôle alimenté et LSR 080-0001 U.FL inverser câble connecteur SMA à polarité.
- 2) LSR 001-0014 antenne FlexPIFA 2,4 GHz.
- 3) LSR 001-0030 antenne Métal FlexPIFA (mFlexPIFA) 2,4 GHz.
- 4) Antenne de puce Johanson 2450AT18A100.

## OEM RESPONSIBILITIES TO COMPLY WITH FCC AND INDUSTRY CANADA REGULATIONS

The TiWi-C-W Module has been certified for integration into products only by OEM integrators under the following conditions:

This device is granted for use in Mobile only configurations in which the antennas used for this transmitter must be installed to provide a separation distance of at least 20cm from all person and not be co-located with any other transmitters except in accordance with FCC and Industry Canada multi-transmitter product procedures.

As long as the two conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

**IMPORTANT NOTE: In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC and Industry Canada authorizations are no longer considered valid and the FCC ID and IC Certification Number 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 FCC and Industry Canada authorization.**

Le module de TiWi-C-W a été certifié pour l'intégration dans des produits uniquement par des intégrateurs OEM dans les conditions suivantes:

Ce dispositif est accordé pour une utilisation dans des configurations mobiles seul dans lequel les antennes utilisées pour cet émetteur doit être installé pour fournir une distance de séparation d'au moins 20cm de toute personne et ne pas être colocalisés avec les autres émetteurs, sauf en conformité avec la FCC et de l'Industrie Canada, multi-émetteur procédures produit.

Tant que les deux conditions précitées sont réunies, les tests de transmetteurs supplémentaires ne seront pas tenus. Toutefois, l'intégrateur OEM est toujours responsable de tester leur produit final pour toutes les exigences de conformité supplémentaires requis avec ce module installé (par exemple, les émissions appareil numérique, les exigences de périphériques PC, etc.)

**NOTE IMPORTANTE: Dans le cas où ces conditions ne peuvent être satisfaites (pour certaines configurations ou de co-implantation avec un autre émetteur), puis la FCC et Industrie autorisations Canada ne sont plus considérés comme valides et l'ID de la FCC et IC numéro de certification ne peut pas être utilisé sur la produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'un distincte de la FCC et Industrie Canada l'autorisation.**

---

## OEM LABELING REQUIREMENTS FOR END-PRODUCT

The TiWi-C-W module is labeled with its own FCC ID and IC Certification Number. The FCC ID and IC certification numbers are not visible when the module is installed inside another device, as such the end device into which the module is installed must display a label referring to the enclosed module. The final end product must be labeled in a visible area with the following:

**“Contains Transmitter Module FCC ID: TFB-1001”**

**“Contains Transmitter Module IC: 5969A-1001”**

or

**“Contains FCC ID: TFB-1001”**

**“Contains IC: 5969A-1001”**

The OEM of the TiWi-C-W Module must only use the approved antenna(s) listed above, which have been certified with this module.

Le module de TiWi-C-W est étiqueté avec son propre ID de la FCC et IC numéro de certification. L'ID de la FCC et IC numéros de certification ne sont pas visibles lorsque le module est installé à l'intérieur d'un autre appareil, comme par exemple le terminal dans lequel le module est installé doit afficher une étiquette faisant référence au module ci-joint. Le produit final doit être étiqueté dans un endroit visible par le suivant:

**“Contient Module émetteur FCC ID: TFB-1001”**

**“Contient Module émetteur IC: 5969A-1001”**

ou

**“Contient FCC ID: TFB-1001”**

**“Contient IC: 5969A-1001”**

Les OEM du module TiWi-C-W ne doit utiliser l'antenne approuvée (s) ci-dessus, qui ont été certifiés avec ce module.

## OEM END PRODUCT USER MANUAL STATEMENTS

The OEM integrator should not provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.

**The user manual for the end product must include the following information in a prominent location:**

This device is granted for use in Mobile only configurations in which the antennas used for this transmitter must be installed to provide a separation distance of at least 20cm from all person and not be co-located with any other transmitters except in accordance with FCC and Industry Canada multi-transmitter product procedures.

Other user manual statements may apply.

L'intégrateur OEM ne devraient pas fournir des informations à l'utilisateur final sur la façon d'installer ou de supprimer ce module RF ou modifier les paramètres liés RF dans le manuel utilisateur du produit final.

**Le manuel d'utilisation pour le produit final doit comporter les informations suivantes dans un endroit bien en vue:**

Ce dispositif est accordé pour une utilisation dans des configurations mobiles seule dans laquelle les antennes utilisées pour cet émetteur doit être installé pour fournir une distance de séparation d'au moins 20cm de toute personne et ne pas être co-localisés avec les autres émetteurs, sauf en conformité avec FCC et Industrie Canada, multi-émetteur procédures produit.

Autres déclarations manuel de l'utilisateur peuvent s'appliquer.

## EUROPE

### CE Notice

This device has been tested and certified for use in the European Union. See the Declaration of Conformity (DOC) for specifics.

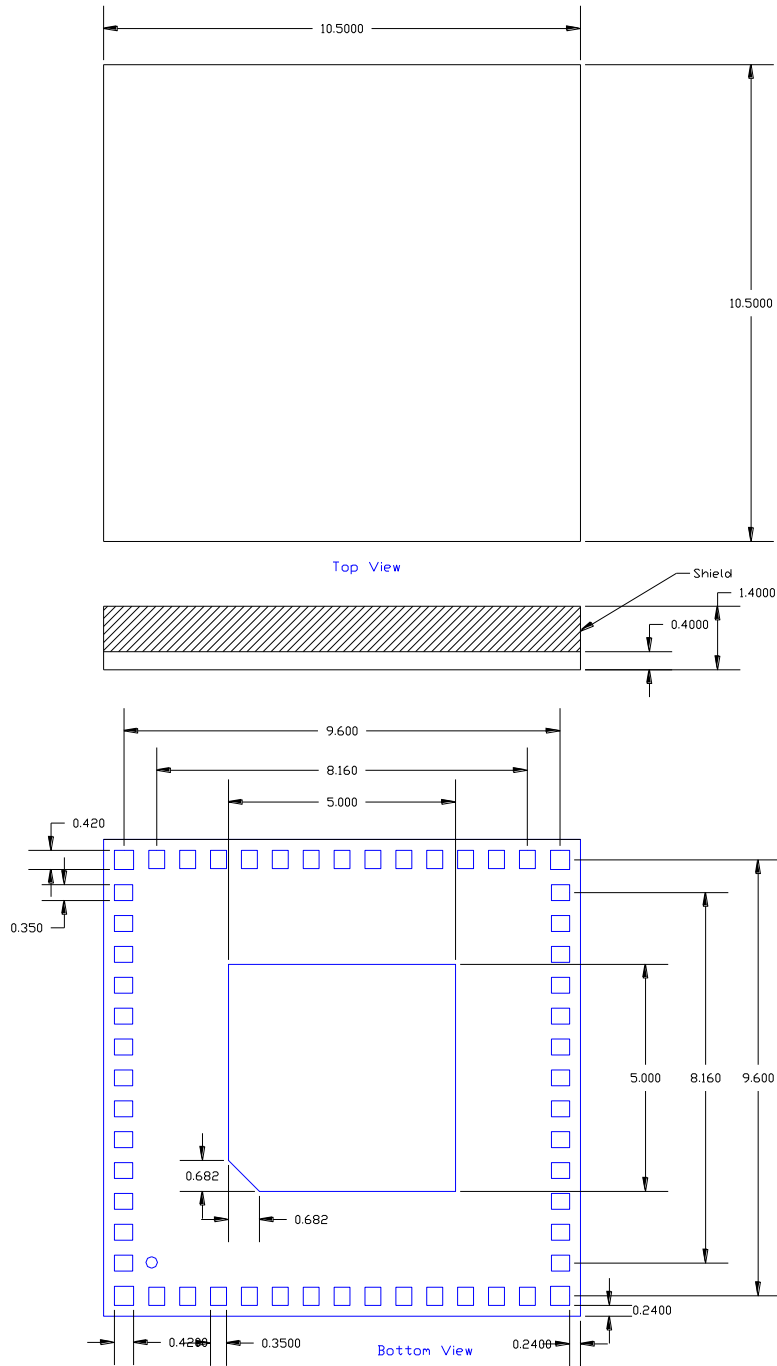
If this device is used in a product, the OEM has responsibility to verify compliance of the final product to the EU standards. A Declaration of Conformity must be issued and kept on file as described in the Radio and Telecommunications Terminal Equipment (R&TTE) Directive.

The 'CE' mark must be placed on the OEM product per the labeling requirements of the Directive.

### Declaration of Conformity (DOC)

This DOC can be downloaded from the LSR Wiki.

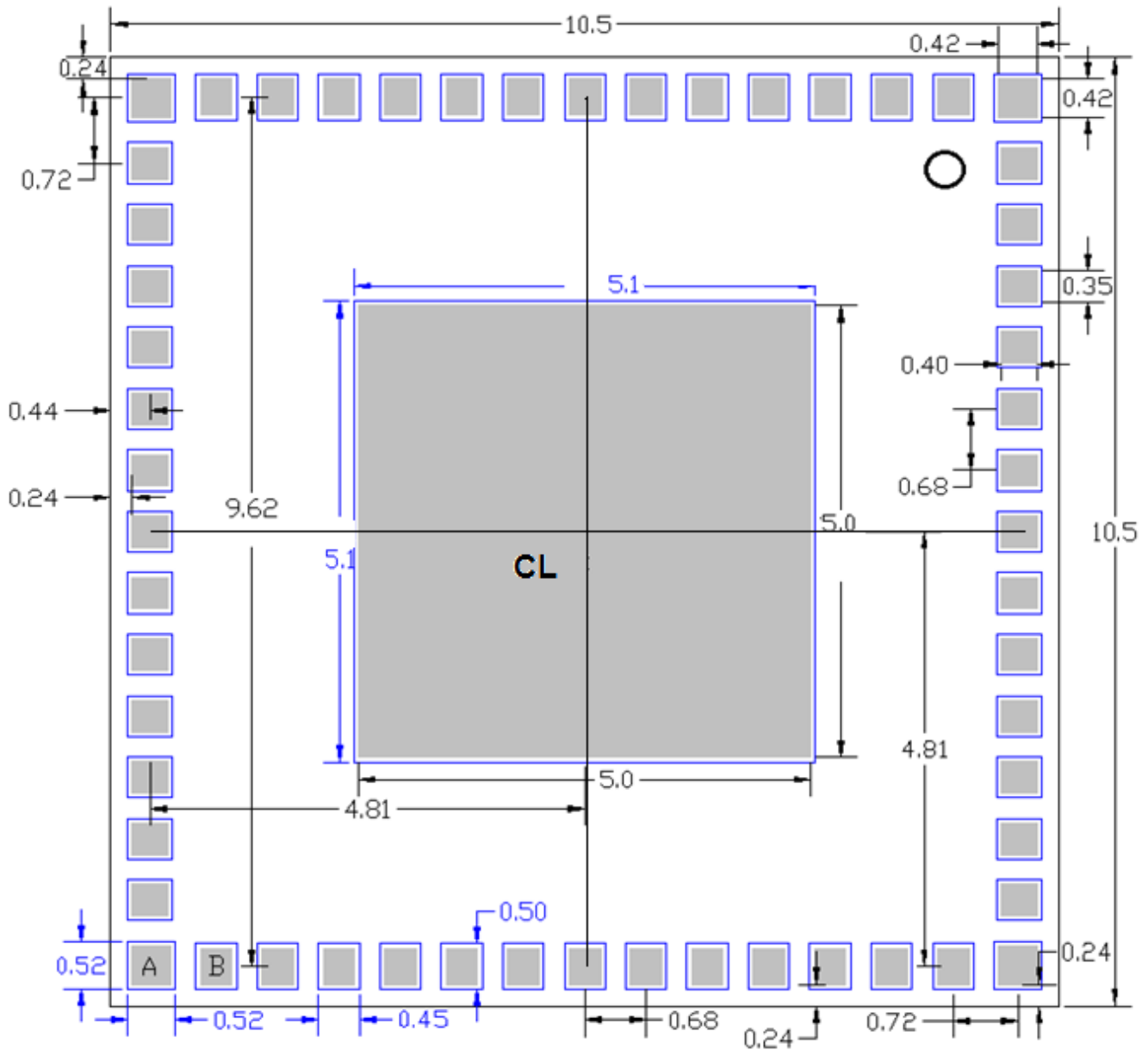
**MECHANICAL DATA**



**Figure 7 Module Mechanical Dimensions (Maximum Module Height = 1.40mm)**

The information in this document is subject to change without notice.

**PCB FOOTPRINT**



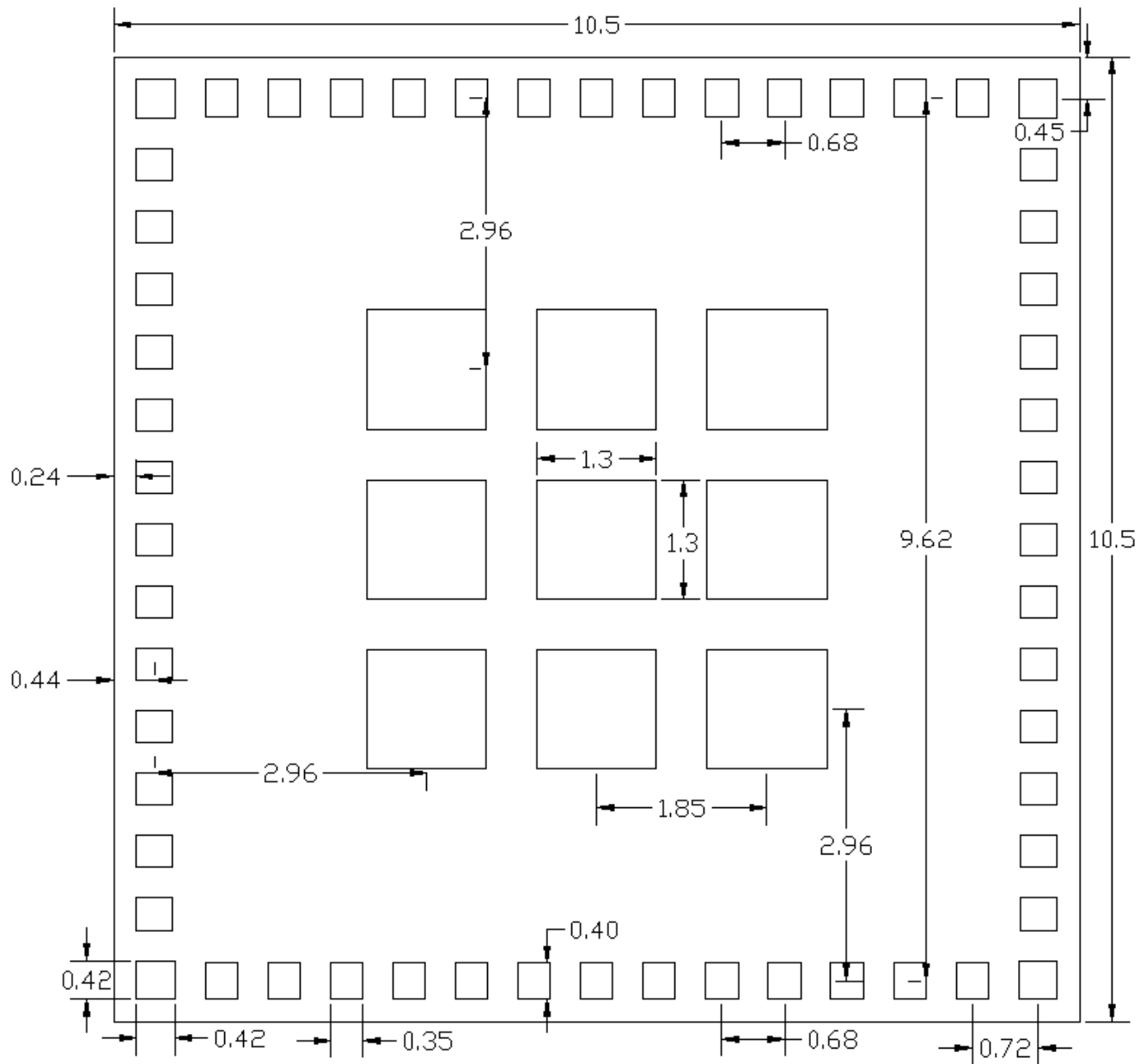
**Figure 8 TiWi-C-W Footprint (Top View)**

Note:

| Three Pad Sizes         | Solder Mask                                 |
|-------------------------|---|
| Type A - 0.42 x 0.42 mm | 0.52 x 0.52 mm                              |
| Type B - 0.35 x 0.40 mm | 0.45 x 0.50mm (Not Centered on Type A pads) |
| Type C - 5.0 x 5.0 mm   | 5.1 x 5.1 mm                                |

The information in this document is subject to change without notice.

**RECOMMENDED SOLDER STENCIL**

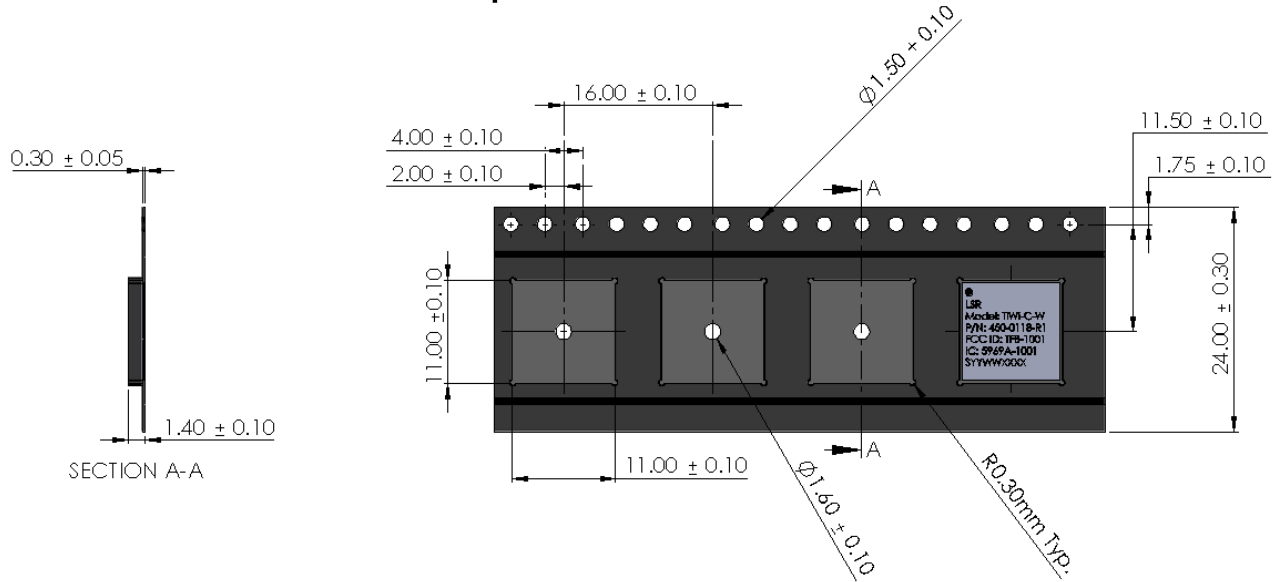


**Figure 9 - Recommended Solder Stencil (Top View)**



**TAPE AND REEL PACKAGING**

**Tape Dimensions**



**NOTES:**

1. DIM in mm.
2. 10 Sprocket Hole Pitch Cumulative Tolerance  $\pm 0.20$ mm.
3. Camber not to Exceed 1.0mm in 250mm.
4. Pocket Position Relative to Sprocket Hole Measured as True Position of Pocket, not Pocket Hole
5. A Full Reel contains 2000 Modules

**(MODULE MUST BE IN THIS ORIENTATION WHEN FEEDING)**

**Figure 10 Tape and Reel Specification**

---

## DEVICE MARKINGS

### Rev 1 Devices

|   |
|---|
| LSR<br>Model: TiWi-C-W<br>P/N: 450-0118-R1<br>FCC ID: TFB-1001<br>IC: 5969A-1001<br>50C0D0001 |
|---|

Where R1 = Revision 1  
Manufacturer Code: 50C0D0001

### Rev 3 Devices

|   |
|---|
| LSR<br>Model: TiWi-C-W<br>P/N: 450-0118-R3<br>FCC ID: TFB-1001<br>IC: 5969A-1001<br>50C0D0001 |
|---|

Where R3 = Revision 3  
Manufacturer Code: 50C0D0001

\*Skipped Rev 2 to align Internal MRP System\*

---

**CONTACTING LSR**

|                          |  |
|--------------------------|--|
| <b>Headquarters</b>      | LS Research, LLC<br>W66 N220 Commerce Court<br>Cedarburg, WI 53012-2636<br>USA<br>Tel: (262) 375-4400<br>Fax: (262) 375-4248 |
| <b>Website</b>           | <a href="http://www.lsr.com">www.lsr.com</a>   |
| <b>Technical Support</b> | <a href="http://forum.lsr.com">forum.lsr.com</a>   |
| <b>Sales Contact</b>     | <a href="mailto:sales@lsr.com">sales@lsr.com</a>   |

© Copyright 2018 Laird. All Rights Reserved. Patent pending. 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 Limited due to the acquisition by Advent or one or more subsidiaries of Laird Limited. Laird™, Laird Technologies™, 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.

---

The information in this document is subject to change without notice.

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



Тел: +7 (812) 336 43 04 (многоканальный)

Email: [org@lifeelectronics.ru](mailto:org@lifeelectronics.ru)