# Datasheet

## Vela IF820

*Version 0.1*

## REVISION HISTORY

| Version | Date | Notes | Contributors | Approver |
|---|---|---|---|---|
| 0.1 | July 2023 | Preliminary version | Louis Chang | |
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# 1 SCOPE

This document describes key hardware aspects of the Laird Connectivity Vela IF820 series wireless modules providing high-speed 4-wire UART interface for Bluetooth® connection. This document is intended to assist device manufacturers and related parties with the integration of this radio into their host devices. Data in this document is drawn from several sources and includes information found in the Infineon CYW20820 data sheet issued on September 26, 2022 along with other documents provided by Infineon.

**Note:** **The information in this document is subject to change.** Please contact Laird Connectivity to obtain the most recent version of this document.

# 2 GENERAL DESCRIPTION

The Vela IF820 is a high-performance Bluetooth 5.2 dual mode module based on latest-generation silicon (Infineon's AIROC™ CYW20820). With an industrial temperature rating, broad country certifications, the Vela IF820 provides two different variants to meet various end user application needs.
The integrated chip antenna package style for Vela IF820 eliminates complexity for design integration, user can assemble this package type to the product for acquiring BT/BLE function directly.
The MHF4 type variant, which provides more flexibility for user to choose their own external antenna considering the performance or appearance of product.
In addition, packaged USB Adapter to add Classic Bluetooth and Bluetooth LE connectivity to a variety of additional products in the Bluetooth portfolio
The latest Linux and Android drivers are supported directly by Laird Connectivity and Infineon. Please contact Laird Connectivity Sales/FAE for further information. Ordering information is listed in Table 1.

***Table 1: Product ordering information***

| Part | Description |
|---|---|
| 453-00171R | Vela IF820 - Dual Mode Bluetooth Module, Integrated Antenna (Infineon CYW20820) - Tape / Reel |
| 453-00171C | Vela IF820 - Dual Mode Bluetooth Module, Integrated Antenna (Infineon CYW20820) – Cut / Tape |
| 453-00172R | Vela IF820 - Dual Mode Bluetooth Module, MHF4 Connector (Infineon CYW20820) - Tape / Reel |
| 453-00172C | Vela IF820 - Dual Mode Bluetooth Module, MHF4 Connector (Infineon CYW20820) – Cut / Tape |
| 453-00171-K1 | Vela IF820 - Development Kit with integrated chip antenna |
| 453-00172-K1 | Vela IF820 - Development Kit with MHF4 Connector |
| 450-00185 | Vela IF820 - Dual Mode Bluetooth USB Adapter with integrated antenna (Infineon CYW20820) |



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# 3 FEATURES SUMMARY

The Laird Connectivity Vela IF820 series device features are described in Table 2.

***Table 2: Vela IF820 series wireless module features***

| Feature | Description |
|---|---|
| **Variants** | • Integrated antenna variant<br>• MHF4 connector variant |
| **Bluetooth subsystem** | • Complies with Bluetooth® core specification version 5.2<br>• Includes support for basic data rate (BR), EDR 2 Mbps and 3 Mbps, extended synchronous connection-oriented<br>• (eSCO), Bluetooth® LE, and LE 2 Mbps.<br>• Up to 10dBm EIRP output power<br>• Excellent receiver sensitivity (-94dBm for Bluetooth® LE 1 Mbps) |
| **Microcontroller** | • Powerful Arm® Cortex®-M4 core with a maximum speed of 96 MHz<br>• Bluetooth® stack in ROM allowing standalone operation without any external MCU<br>• 256-KB on-chip flash<br>• 176-KB on-chip RAM<br>Bluetooth® stack, peripheral drivers, security functions built into ROM (1 MB) allowing application to efficiently use on-chip flash<br>• AES-128 and true random number generator (TRNG)<br>• Security functions in ROM including elliptic curve digital signature algorithm (ECDSA) signature verification<br>• Over-the-air (OTA) firmware updates |
| **Peripherals** | • Up to 22 GPIOs<br>• I2C, I2S, UART, and PCM interfaces<br>• Two Quad-SPI interfaces<br>• Auxiliary ADC with up to 28 analog channels<br>• Programmable key scan 20 ´ 8 matrix<br>• Three-axis quadrature signal decoder<br>• General-purpose timers and pulse width modulation (PWM)<br>• Real-time clock (RTC) and watchdog timer (WDT) |
| **Power management** | • On-chip power-on reset (POR)<br>• Integrated buck (DC-DC) and low drop out (LDO) regulators<br>• On-chip software controlled power management unit<br>• On-chip 32 kHz low power oscillator (LPO) with optional external 32 kHz crystal oscillator support |



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# 4 SPECIFICATIONS

***Table 3: Vela IF820 Specifications***

| Feature | Description |
|---|---|
| **Physical Interface** | 54-pin LGA package for integrated antenna variant<br>44-pin LGA package for MHF4 connector variant |
| **Bluetooth/BLE Interface** | Host Controller Interface (HCI) using high speed UART |
| **Main Chip** | Infineon CYW20820 |
| **Input Voltage Requirements** | 3V Typ, 2.6V Min, 3.3V Max |
| **I/O Signalling Voltage** | Set to 3V or 1.8V, by the power domains connected to VDDIO |
| **Operating Temperature** | -40° to +85°C (-40° to +185°F) |
| **Operating Humidity** | Less than 85% RH (non-condensing) |
| **Storage Temperature** | -40° to +85°C (-40° to +185°F) |
| **Storage Humidity** | Less than 60% RH (non-condensing) |
| **MSL (Moisture Sensitivity Level)** | 4 |
| **Maximum Electrostatic Discharge** | 4kV Indirect application<br>(follow EN 301489) |
| Size – mm | Integrated Antenna variant : 9.3 x 12.5 x 2.15 mm<br>MHF4 Connector variant: 7.5 x 7.5 x 2.15 mm<br>USB Adapter: 18.39 x 50.74 x 11mm |
| **Weight – g (oz.)** | ~0.x (~0.0x) |
| **Bluetooth Media** | Frequency Hopping Spread Spectrum (FHSS) |
| **Bluetooth Standards** | Bluetooth 5.2 Core Spec |
| **Bluetooth Data Rates Supported** | 1, 2, 3 Mbps |
| **Bluetooth Modulation** | GFSK@ 1 Mbps<br>Pi/4-DQPSK@ 2 Mbps (EDR)<br>8-DPSK@ 3 Mbps (EDR)<br>BLE 1 Mbps, 2Mbps |
| **Regulatory Certifications** | TBD |
| **Operating Systems Supported** | Linux<br>Android |



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| Compliance | TBD |
|---|---|
| **Certifications (Pending)** | ***Bluetooth*® SIG Qualification**  |
| **Warranty** | One Year Warranty |
| ***All specifications are subject to change without notice*** | |



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# 5 BLOCK DIAGRAM

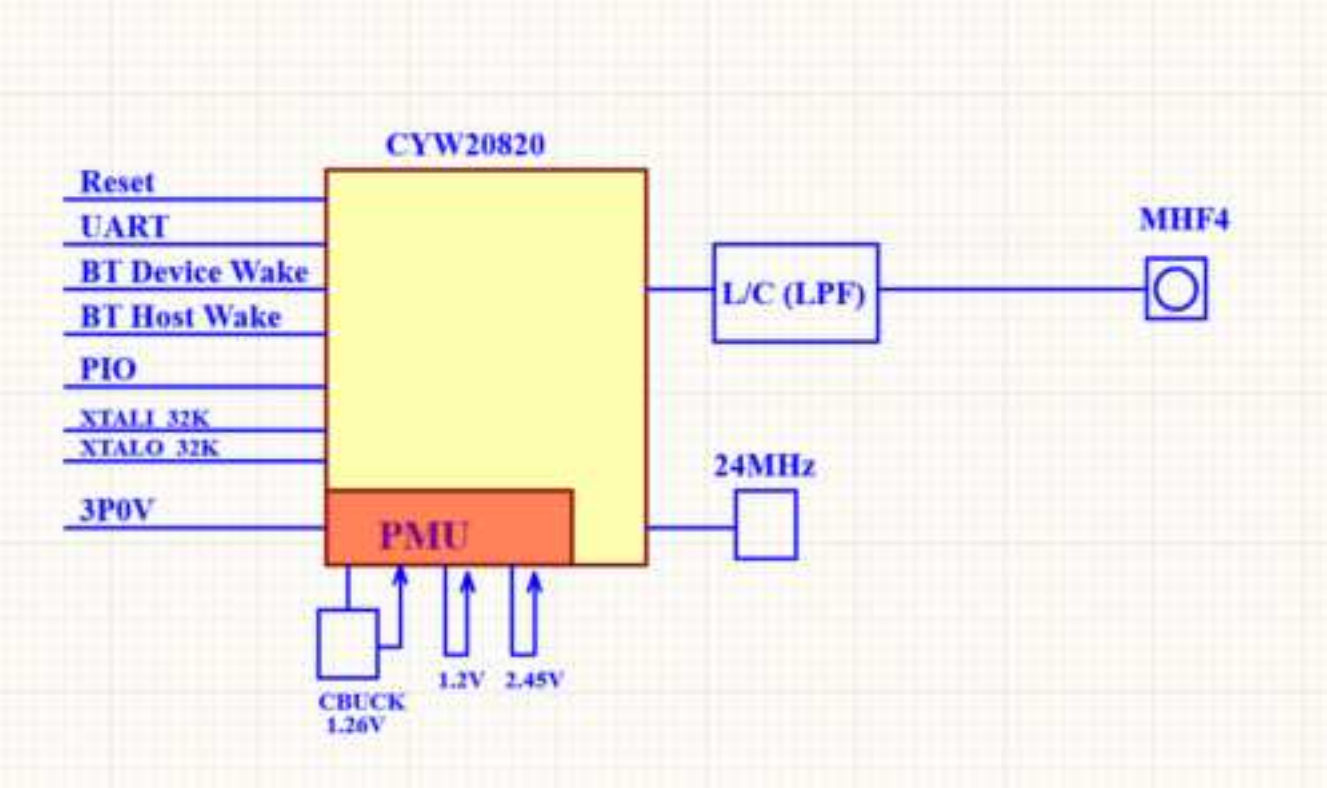


***Figure 1: MHF4 connector variant diagram***



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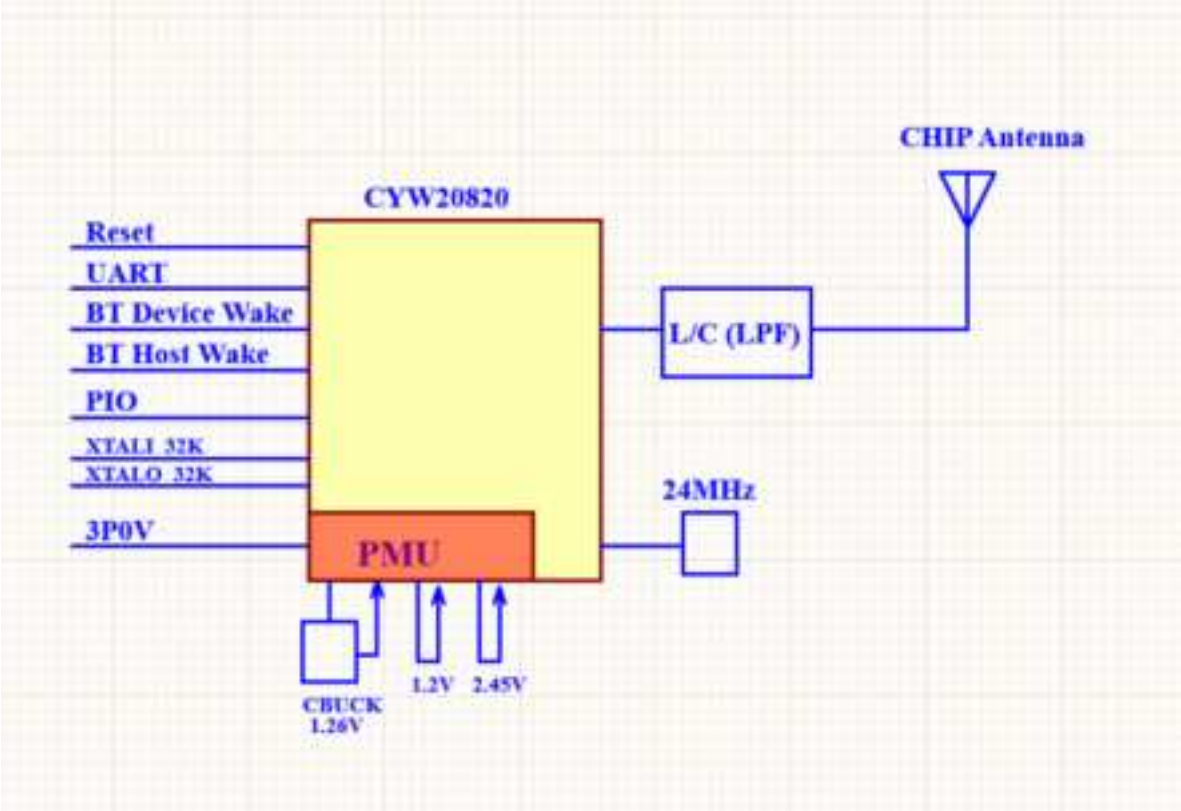


***Figure 2: Integrated antenna variant diagram***



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# 6 ELECTRICAL CHARACTERISTICS

## 6.1 Absolute Maximum Ratings

Table summarizes the absolute maximum ratings and Table lists the recommended operating conditions for the Vela IF820 series wireless module. Absolute maximum ratings are those values beyond which damage to the device can occur. Functional operation under these conditions, or at any other condition beyond those indicated in the operational sections of this document, is not recommended.

**Note:** Maximum rating for signals follows the supply domain of the signals.

***Table 4: Absolute maximum ratings***

| Symbol | Parameter | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| 3P0V | Power supply for Internal Regulators | -0.5 | | 3.45 | V |
| VDDIO | DC supply voltage for digital I/O | -0.5 | | 3.45 | V |

## 6.2 Recommended Operating Conditions

***Table 5: Recommended operating conditions***

| Symbol (Domain) | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| 3P0V | Power supply for Internal Regulators | 2.6 | 3.0 | 3.3 | V |
| VDDIO | DC supply voltage for digital I/O | 1.71 | 1.8/3.0 | 3.3 | V |
| T-ambient | Ambient temperature | -40 | 25 | 85 | °C |

## 6.3 General DC Electrical Characteristics

Table list the general DC electrical characteristics over recommended operating conditions (unless otherwise specified).

***Table 6: General DC electrical characteristics (For 1.8V or 3V operation VIO)***

| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $V_{IL}$ | Input low voltage (VDDIO = 3V) | — | — | 0.8 | V |
| $V_{IH}$ | Input high voltage (VDDIO = 3V) | 2.4 | — | — | |
| $V_{IL}$ | Input low voltage (VDDIO = 1.8V) | — | — | 0.4 | |
| $V_{IH}$ | Input high voltage (VDDIO = 1.8V) | 1.4 | — | — | |
| $V_{OL}$ | output low voltage | — | — | 0.4 | |
| $V_{OH}$ | output high voltage | VDDIO-0.4V | — | — | |
| $I_{IL}$ | input low current | — | — | 1 | uA |



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| | | | | | |
|---|---|---|---|---|---|
| $I_{IH}$ | input high current | — | — | 1 | |
| $I_{OL}$ | output low current (VDDIO = 3V, VOL = 0.4V) | — | — | 4 | mA |
| $I_{OL}$ | output low current (VDDIO = 3V, VOL = 1.8V) | — | — | 2 | |
| $I_{OH}$ | output high current (VDDIO = 3V, VOH = 2.6V) | — | — | 8 | |
| $I_{OH}$ | output high current (VDDIO = 1.8V, VOH = 1.4V) | — | — | 4 | |
| $C_{IN}$ | Input capacitance | — | — | 0.4 | pF |



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# 7 RF CHARACTERISTICS

## 7.1 Bluetooth Radio Characteristics

Table 4 through Table describe the basic rate transmitter performance, basic rate receiver performance, enhanced rate receiver performance, and current consumption conditions at 25°C.

***Table 4: Basic rate transmitter performance temperature at 25°C (3V)***

| Test Parameter | | Min | Typ | Max | BT Spec. | Unit |
|---|---|---|---|---|---|---|
| RF Output Power[4] (test at UHF4 connector) | BR | — | 6.5 | 7.5 | 0 ~ +20 | dBm |
| | EDR 2M | — | 2 | 2.5 | | |
| | EDR 3M | — | 0.5 | 1 | | |
| Max EIRP (Integrated antenna variant) | | | | 10 | | dBm |
| Frequency Range | | 2.4 | — | 2.480 | 2.4 ≤ f ≤ 2.480 | GHz |

***Table 8: Basic rate receiver performance at (3V)***

| Test Parameter | | Min | Typ | Max | Bluetooth Spec. | Unit |
|---|---|---|---|---|---|---|
| Sensitivity (1DH5) | BER ≤ 0.1% | — | -90 | -87 | ≤ -70 | dBm |
| Maximum Input | BER ≤ 0.1% | — | — | -20 | ≥ -20 | dBm |

***Table 9: Enhanced data rate receiver performance (3V)***

| Test Parameter | | Min | Typ | Max | Bluetooth Spec. | Unit |
|---|---|---|---|---|---|---|
| Sensitivity (BER ≤ 0.01%) | π/4-DQPSK | — | -92.5 | -89.5 | ≤ -70 | dBm |
| | 8-DPSK | — | -86 | -83 | ≤ -70 | dBm |

***Table 10: BLE RF Specifications (3V)***

| Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Frequency range | — | 2402 | — | 2480 | MHz |
| Rx sensitivity[3] | GFSK, 30.8% PER, 1Mbps | — | -94 | -91 | dBm |
| Rx sensitivity[3] | GFSK, 30.8% PER, 2Mbps | — | -90 | -87 | dBm |
| RF Output Power[4] (test at UHF4 connector) | — | — | — | 7.5 | dBm |
| Max EIRP (Integrated antenna variant | | | | 10 | dBm |

**Note[3]:** Dirty Tx is Off.

**Note[4]:** The Bluetooth LE TX power cannot exceed 10 dBm EIRP specification limit. The front-end losses and antenna gain/loss must be factored in so as not to exceed the limit.



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***Table 11: Bluetooth current consumption, VBAT=3V VDDIO=3V, MHF4 connector variant***

| operating mode | data rate | module 3V | Unit |
|---|---|---|---|
| TX | DH1 | 13.5 | mA |
| | DH3 | 13.5 | |
| | DH5 | 13.5 | |
| | 2DH1 | 20.2 | |
| | 2DH3 | 20 | |
| | 2DH5 | 20.1 | |
| | 3DH1 | 19.8 | |
| | 3DH3 | 20 | |
| | 3DH5 | 20.1 | |
| | LE1M | 13.3 | |
| | LE2M | 13.3 | |
| RX | DH5 | 6.2 | mA |
| | LE1M | 6.4 | |
| | LE2M | 7.4 | |

***Table 12: Bluetooth current consumption, VBAT=3V VDDIO=3V, Integrated antenna variant***

| operating mode | data rate | module 3V | Unit |
|---|---|---|---|
| TX | DH1 | 14.4 | mA |
| | DH3 | 14.5 | |
| | DH5 | 14.5 | |
| | 2DH1 | 19.9 | |
| | 2DH3 | 20.4 | |
| | 2DH5 | 20.4 | |
| | 3DH1 | 20.2 | |
| | 3DH3 | 20.1 | |
| | 3DH5 | 20.1 | |
| | LE1M | 16.4 | |
| | LE2M | 16.3 | |
| RX | DH5 | 6.2 | mA |
| | LE1M | 6.4 | |
| | LE2M | 7.4 | |

**Note : current consumption is measured at average of the TX-on time**



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# 8 HOST INTERFACE SPECIFICATIONS

## 8.1 High-Speed UART Specifications

***Table 13: UART timing specifications***

| Reference | Characterstics | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| 1 | Delay time, UART_CTS_N LOW to UART_TXD valid. | — | — | 1.5 | Bit periods |
| 2 | Setup time, UART_CTS_N HIGH before midpoint of stop bit. | | — | 0.67 | |
| 3 | Delay time, midpoint of stop bit to UART_RTS_N HIGH. | — | — | 1.33 | |

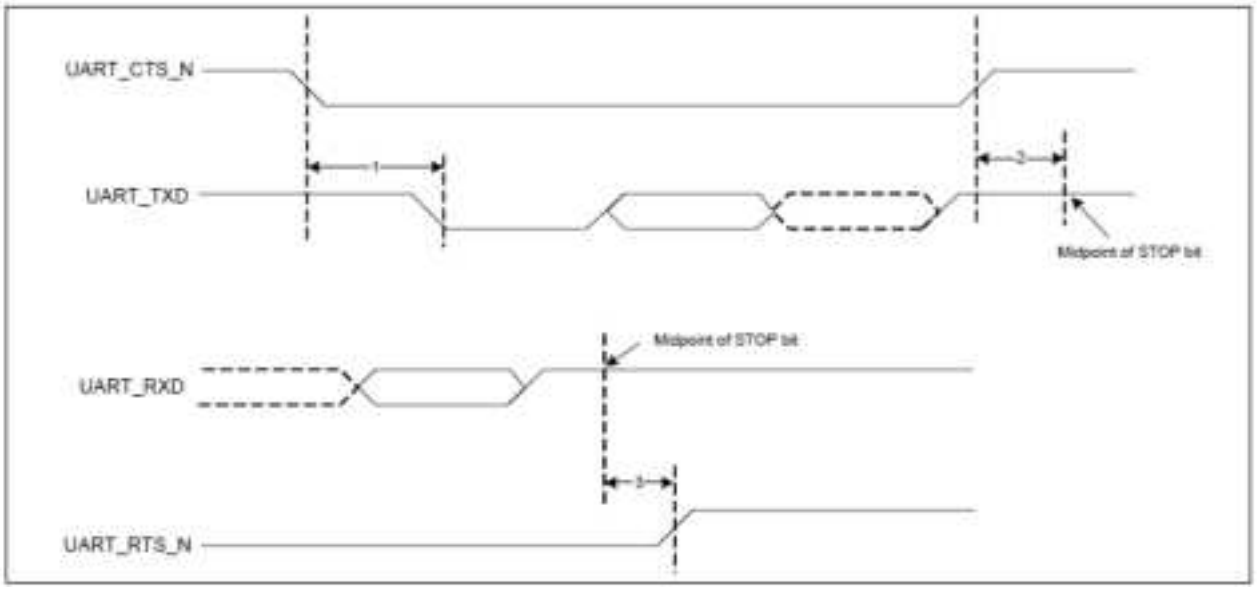


***Figure 3: UART timing diagram***

## 8.2 SPI timing

***Table 14: SPI mode 0 and 2***

| Reference | Characterstics | Min | Max | Units |
|---|---|---|---|---|
| 1 | Time from master assert SPI_CSN to first clock edge | 45 | — | ns |
| 2 | Setup time for MOSI data lines | 6 | 1/2 SCK | |
| 3 | Idle time between subsequent SPI transactions | 1 SCK | — | |



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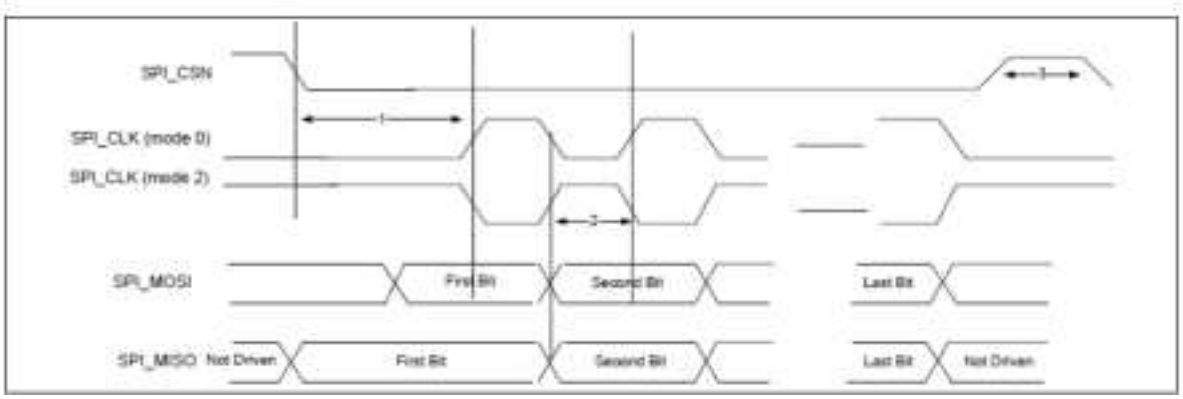


***Figure 4: SPI timing, mode 0 and 2***

***Table 15: SPI mode 1 and 3***

| Reference | Characterstics | Min | Max | Units |
|---|---|---|---|---|
| 1 | Time from master assert SPI_CSN to first clock edge | 45 | — | ns |
| 2 | Setup time for MOSI data lines | 6 | 1/2 SCK | |
| 3 | Idle time between subsequent SPI transactions | 1 SCK | — | |

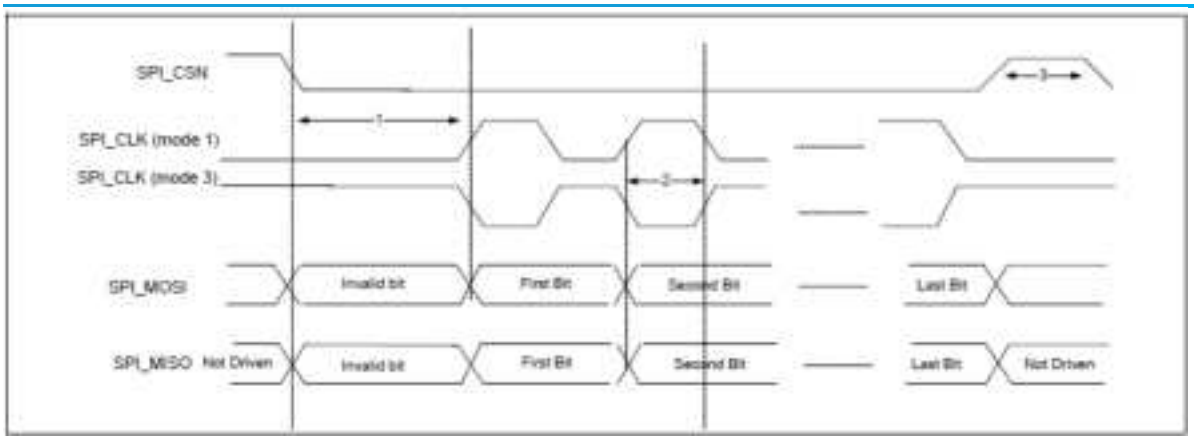


***Figure 5: SPI timing, mode 1 and 3***

## 8.3 I²C timing

***Table 16: I²C interface timing specifications (up to 1 MHz)***

| Reference | Characterstics | Min | Max | Units |
|---|---|---|---|---|
| 1 | Clock frequency | — | 100<br>400<br>800<br>1000 | KHz |



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| | | | | |
|---|---|---|---|---|
| 2 | START condition setup time | 650 | — | |
| 3 | START condition hold time | 280 | — | |
| 4 | Clock low time | 650 | — | |
| 5 | Clock high time | 280 | | |
| 6 | Data input hold time[1] | 0 | — | us |
| 7 | Data input setup time | 100 | — | |
| 8 | STOP condition setup time | 280 | | |
| 9 | Output valid from clock | — | 400 | |
| 10 | Bus free time[2] | 650 | — | |

**Notes**

1.As a transmitter, 125 ns of delay is provided to bridge the undefined region of the falling edge of SCL to avoid unintended generation of START or STOP conditions.

2.Time that the CBUS must be free before a new transaction can start.

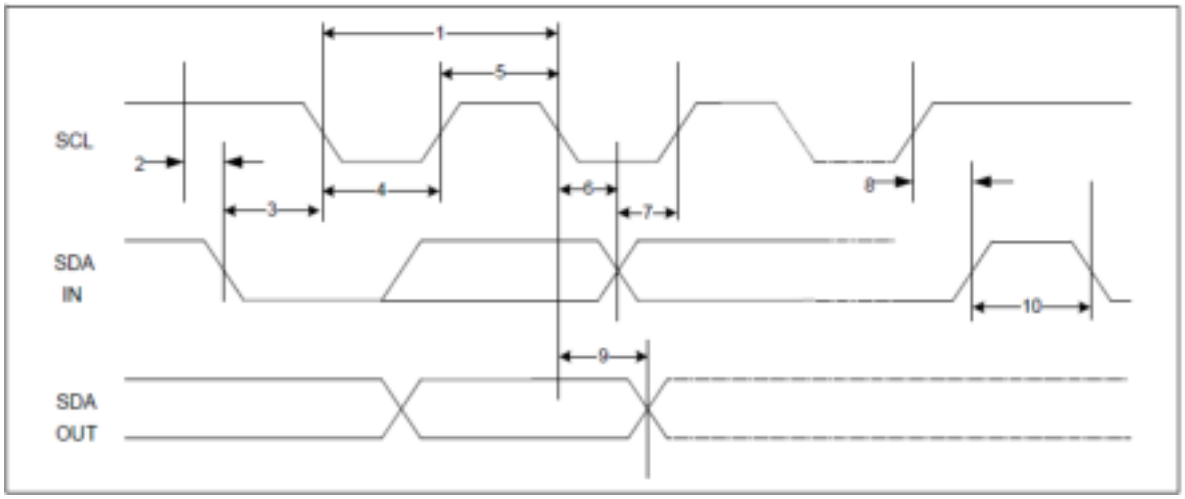


***Figure 2: I²C interface timing diagram***



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## 8.4 I²S timing

***Table 17: Timing for I²S transmitters and receivers***

| | Transmitter | | | | Receiver | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | Lower limit | | Upper limit | | Lower limit | | Upper limit | | |
| | Min | Max | Min | Max | Min | Max | Min | Max | |
| Clock Period T | $T_{tr}$ | - | - | - | $T_r$ | - | - | - | [3] |
| **Master mode: Clock generated by transmitter or receiver** | | | | | | | | | |
| HIGH $t_{HC}$ | 0.35 x $T_{tr}$ | - | - | - | 0.35 x $T_{tr}$ | - | - | - | [4] |
| LOW $t_{LC}$ | 0.35 x $T_{tr}$ | - | - | - | 0.35 x $T_{tr}$ | - | - | - | [4] |
| **Slave mode: Clock accepted by transmitter or receiver** | | | | | | | | | |
| HIGH $t_{HC}$ | - | 0.35 x $T_{tr}$ | - | - | - | 0.35 x $T_{tr}$ | - | - | [3] |
| LOW $t_{LC}$ | - | 0.35 x $T_{tr}$ | - | - | - | 0.35 x $T_{tr}$ | - | - | [3] |
| Rise time $t_{RC}$ | - | - | 0.15 x $T_{tr}$ | - | - | - | - | - | [4] |
| **Transmitter** | | | | | | | | | |
| Delay $t_{dtr}$ | - | - | - | 0.8 x T | - | - | - | - | [5] |
| Hold time $t_{htr}$ | 0 | - | - | - | - | - | - | - | [4] |
| **Receiver** | | | | | | | | | |
| Setup time $t_{sr}$ | - | - | - | - | 0.2 x $T_{tr}$ | - | - | - | [6] |
| Hold time $t_{hr}$ | - | - | - | - | 0.2 x $T_{tr}$ | - | - | - | [6] |

**Notes**

3.The system clock period T must be greater than $T_{tr}$ and $T_r$ because both the transmitter and receiver have to be able to handle the data transfer rate.

4.At all data rates in master mode, the transmitter or receiver generates a clock signal with a fixed mark/space ratio. For this reason, $t_{HC}$ and $t_{LC}$ are specified with respect to T.

5.In slave mode, the transmitter and receiver need a clock signal with minimum HIGH and LOW periods so that they can detect the signal. So long as the minimum periods are greater than 0.35$T_r$, any clock that meets the requirements can be used.

6.Because the delay ($t_{dtr}$) and the maximum transmitter speed (defined by $T_{tr}$) are related, a fast transmitter driven by a slow clock edge can result in $t_{dtr}$ not exceeding $t_{RC}$ which means $t_{htr}$ becomes zero or negative. Therefore, the transmitter has to guarantee that $t_{htr}$ is greater than or equal to zero, so long as the clock rise-time $t_{RC}$ is not more than $t_{RCmax}$, where $t_{RCmax}$ is not less than 0.15$T_{tr}$.

7.To allow data to be clocked out on a falling edge, the delay is specified with respect to the rising edge of the clock signal and T, always giving the receiver sufficient setup time.

8.The data setup and hold time must not be less than the specified receiver setup and hold time.



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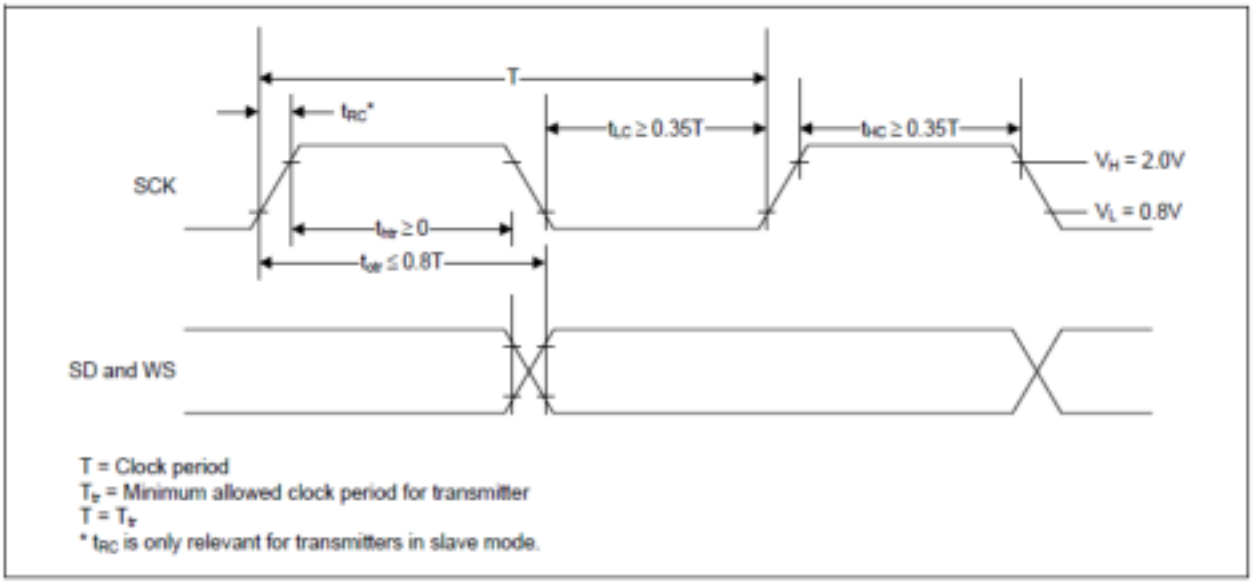


***Figure 3: I²S transmitter timing***

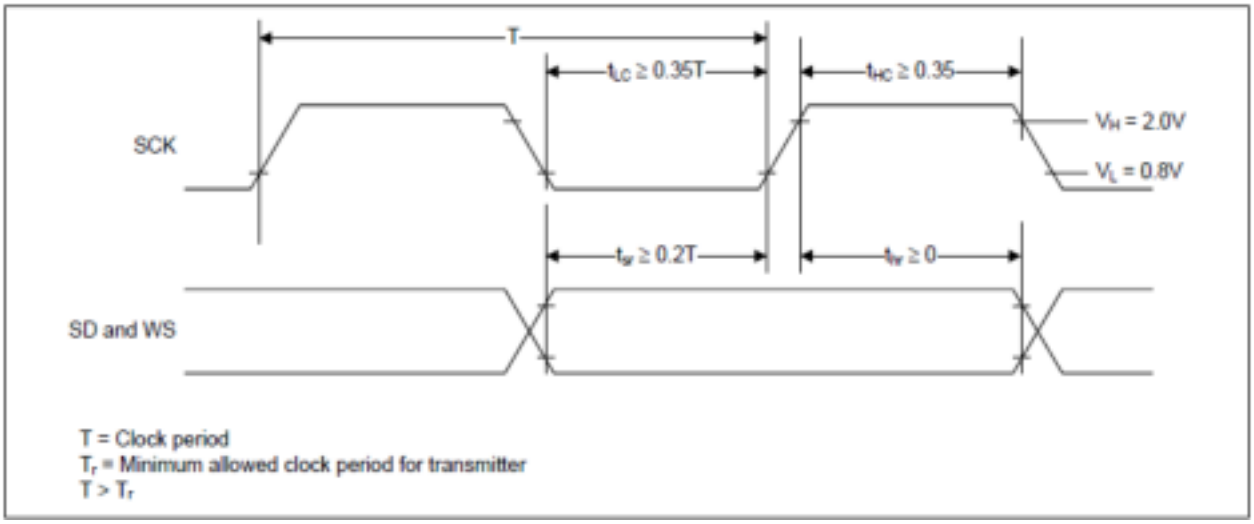


***Figure 8: I²S receiver timing***



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# 9 MHF4 CONNECTOR VARIANT MODULE FOOTPRINT AND PIN DEFINITIONS

**Note**: The following footprint and pin definitions apply to the Vela IF820. There are two module footprints, depending on which variant of the module is used. *It is important to ensure you are using the correct version on your design*.

**Note on regulatory testing:**
TBD

## 9.1 MHF4 connector variant Mechanical Definition

Module dimensions of MHF4 connector variant module is 7.5 x 7.5 x 2.15 mm. Detail drawings are shown in Figure 9.

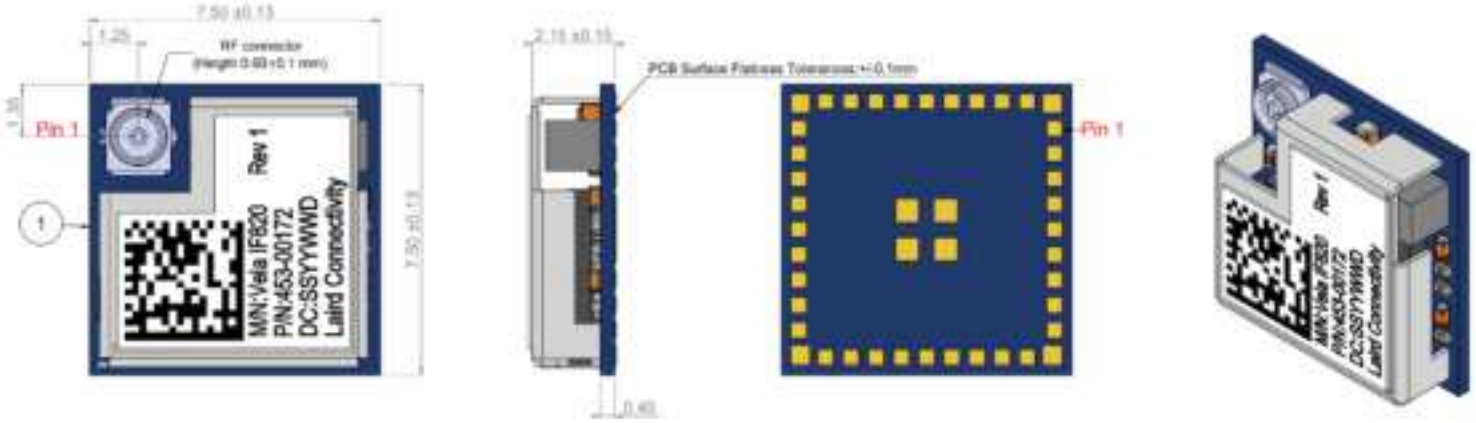


***Figure 9: Mechanical Details – MHF4 Variant (453-00172)***



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## 9.2 MHF4 connector variant Module Footprint

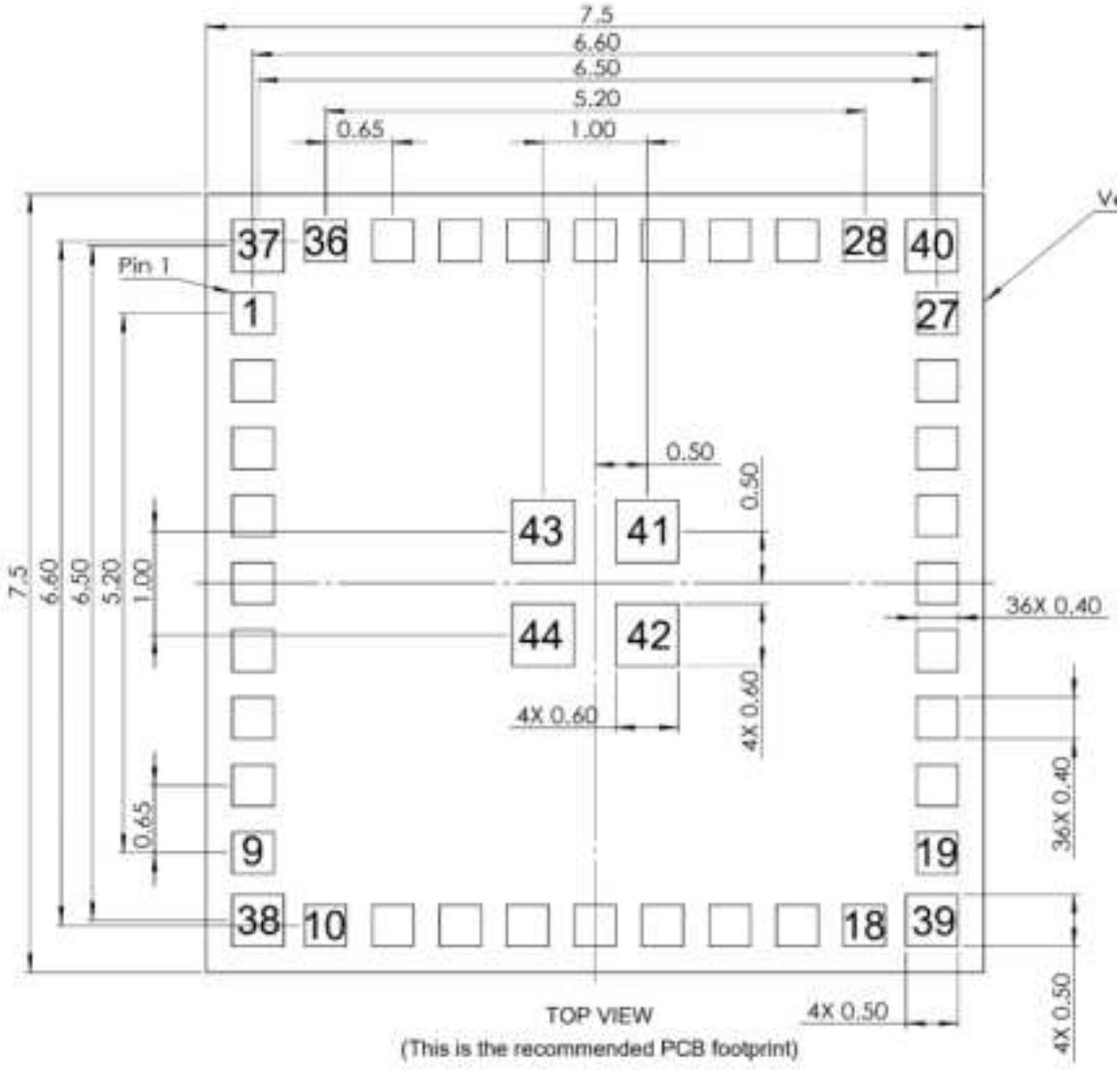


***Figure 10: MHF4 connector variant module pinout (top view)***



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## 9.3 MHF4 connector variant Module Pin Definition

***Table 18: Pin definitions of MHF4 connector variant module***

| Pin # | Name | I/O | Voltage Ref. | Description |
|---|---|---|---|---|
| 1 | BT_DEV_WAKE | I | VDDIO | A signal from the CYW20820 device to the host indicating that the Bluetooth® device requires attention. |
| 2 | BT_HOST_WAKE | O | VDDIO | A signal from the host to the CYW20820 indicating that the host requires attention. |
| 3 | GND | - | - | NA |
| 4 | P28 | I/O | VDDIO | Recommended functions for P28<br>• PWM2<br>• SCL3 (master and slave)<br>• Optical control output: QOC2<br>• A/D converter input 11<br>• Current: 16 mA sink<br>P28 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 5 | P4 | I/O | VDDIO | Recommended functions for P4<br>• Keyboard scan input (row): KSI4<br>• Quadrature: QDY0<br>• SPI_1: MOSI (master only)<br>P4 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 6 | P2 | I/O | VDDIO | Recommended functions for P2<br>• Keyboard scan input (row): KSI2<br>• Quadrature: QDX0<br>• SPI_1: MOSI (master only)<br>• UART1_RTS_N<br>P2 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |



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| | | | | |
|---|---|---|---|---|
| 7 | P15 | I/O | VDDIO | Recommended functions for P15<br>• Keyboard scan output (column): KSO7<br>• A/D converter input 20<br>P15 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 8 | P5 | I/O | VDDIO | Recommended functions for P5<br>• Keyboard scan input (row): KSI5<br>• Quadrature: QDY1<br>• Peripheral UART: puart_tx<br>• SPI_1: MISO (slave only)<br>• I2C: SDA<br>P5 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 9 | P8 | I/O | VDDIO | Recommended functions for P8<br>• Keyboard scan output (column): KSO0<br>• A/D converter input 27<br>• External T/R switch control: ~tx_pd<br>P8 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 10 | VDDIO | I | VDDIO | 1.71V to 3.3V is recommended to supply for digital I/O |
| 11 | GND | - | - | NA |
| 12 | XTALI_32K | I | VDDIO | Low-power oscillator input |
| 13 | XTALO_32K | O | VDDIO | Low-power oscillator output |
| 14 | P3 | I/O | VDDIO | Recommended functions for P3<br>• Keyboard scan input (row): KSI3<br>• Quadrature: QDX1<br>• UART1_CTS_N<br>• SPI_1: SPI_CLK (master only)<br>P3 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |



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| | | | | |
|---|---|---|---|---|
| 15 | P6 | I/O | VDDIO | Recommended functions for P6<br>• Keyboard scan input (row): KSI6<br>• Quadrature: QDZ0<br>• Peripheral UART: puart_rts<br>• PWM2<br>P6 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 16 | P17 | I/O | VDDIO | Recommended functions for P17<br>• Keyboard scan output (column): KSO9<br>• A/D converter input 18<br>P17 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 17 | P9 | I/O | VDDIO | Recommended functions for P9<br>• Keyboard scan output (column): KSO1<br>• A/D converter input 26<br>• External T/R switc0h control: tx_pd<br>P9 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 18 | P12 | I/O | VDDIO | Recommended functions for P12<br>• Keyboard scan output (column): KSO4<br>• A/D converter input 23<br>P12 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 19 | P13 | I/O | VDDIO | Recommended functions for P13<br>• Keyboard scan output (column): KSO5<br>• A/D converter input 22<br>• PWM3<br>P13 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |



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| | | | | |
|---|---|---|---|---|
| 20 | P1 | I/O | VDDIO | Recommended functions for P1<br>• Keyboard scan input (row): KSI1<br>• A/D converter input 28<br>• Peripheral UART: puart_rts<br>• SPI_1: MISO (slave only)<br>• UART1_RXD<br>• Can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 21 | P11 | I/O | VDDIO | Recommended functions for P11<br>• Keyboard scan output (column): KSO3<br>• A/D converter input 24<br>P11 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 22 | P10 | I/O | VDDIO | Recommended functions for P10<br>• Keyboard scan output (column): KSO2<br>• A/D converter input 25<br>• External PA ramp control: PA_Ramp<br>P10 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 23 | P27 | I/O | VDDIO | Recommended functions for P27<br>• Keyboard scan output (column): KSO19<br>• PWM1<br>• SPI_1: MOSI (master only)<br>• Optical control output: QOC1<br>• Current: 16 mA sink<br>P27 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 24 | RST | I | VDDIO | Active-low system reset with internal pull-up resistor. |
| 25 | P0 | I/O | VDDIO | Recommended functions for P0<br>• Keyboard scan input (row): KSI0<br>• A/D converter input 29<br>• Peripheral UART: puart_tx<br>• SPI_1: MOSI (master only)<br>• UART1_TXD<br>P0 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |



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| | | | | |
|---|---|---|---|---|
| 26 | P37 | I/O | VDDIO | Recommended functions for P37<br>• A/D converter input 2<br>• Quadrature: QDZ1<br>• SPI_1: MISO (slave only)<br>• Auxiliary clock output: ACLK1<br>• I2C: SCL<br>P37 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 27 | P32 | I/O | VDDIO | Recommended functions P32<br>• A/D converter input 7<br>• Quadrature: QDX0<br>• Auxiliary clock output: ACLK0<br>• Peripheral UART: puart_tx<br>P32 Can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 28 | P14 | I/O | VDDIO | Recommended functions for P14<br>• Keyboard scan output (column): KSO6<br>• A/D converter input 21<br>• PWM2<br>P14 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 29 | P29 | I/O | VDDIO | Recommended functions for P29<br>• PWM3<br>• SDA3 (master and slave)<br>• Optical control output: QOC3<br>• A/D converter input 10<br>• Current: 16 mA sink<br>P29 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 30 | P26 | I/O | VDDIO | Recommended functions for P26<br>• Keyboard scan output (column): KSO18<br>• PWM0<br>• SPI_1: SPI_CS (slave only)<br>• Optical control output: QOC0<br>• Current: 16 mA sink<br>P26 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |



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| | | | | |
|---|---|---|---|---|
| 31 | 3P0V | I | 3V | Power supply input |
| 32 | GND | - | - | Ground |
| 33 | BT_UART_RTS | O, PU | VDDIO | Request to send (RTS) for HCI UART interface.<br>Leave unconnected if not used. |
| 34 | BT_UART_TXD | O, PU | VDDIO | UART serial output. Serial data output for the HCI UART interface. |
| 35 | BT_UART_RXD | I | VDDIO | UART serial input. Serial data input for the HCI UART interface. |
| 36 | BT_UART_CTS | I, PU | VDDIO | Clear to send (CTS) for HCI UART interface.<br>Leave unconnected if not used. |
| 37 | GND | - | - | Ground |
| 38 | GND | - | - | Ground |
| 39 | GND | - | - | Ground |
| 40 | GND | - | - | Ground |
| 41 | GND | - | - | Ground |
| 42 | GND | - | - | Ground |
| 43 | GND | - | - | Ground |
| 44 | GND | - | - | Ground |



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## 9.4 Reference schematic design

Suggest to put bypass capacitor 100nF in the 3P0V (pin31) and VDDIO (pin10).

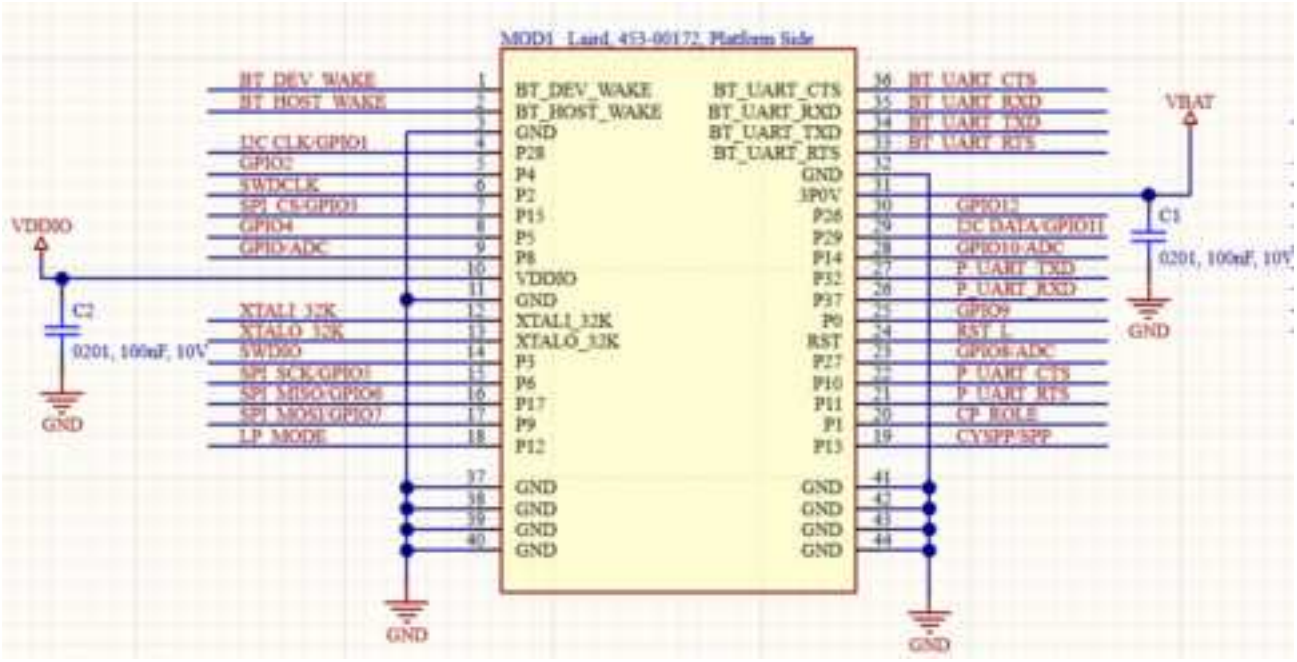


***Figure 4: MHF4 connector variant schematic***



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# 10 INTEGRATED ANTENNA VARIANT MODULE FOOTPRINT AND PIN DEFINITIONS

## 10.1 Integrated Antenna variant Mechanical Definition

Module dimensions of integrated antenna variant module is 12.5 x 9.3 x 2.15 mm. Detail drawings are shown in Figure 12.

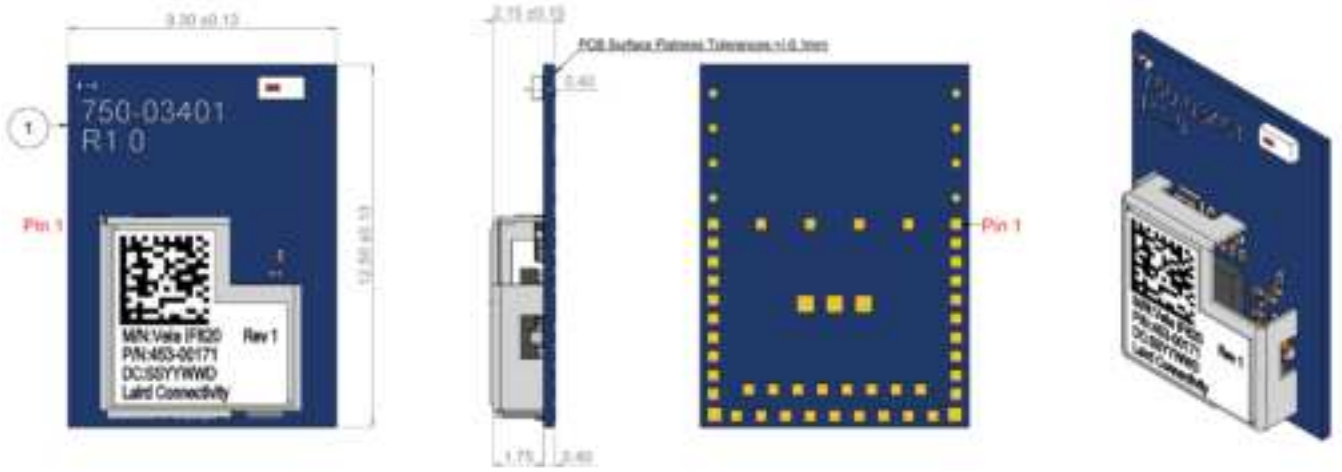


***Figure 5: Mechanical Details – Integrated Antenna Variant (453-00171)***

**Note on regulatory testing:**
**none**



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## 10.2 Integrated Antenna variant Module Footprint

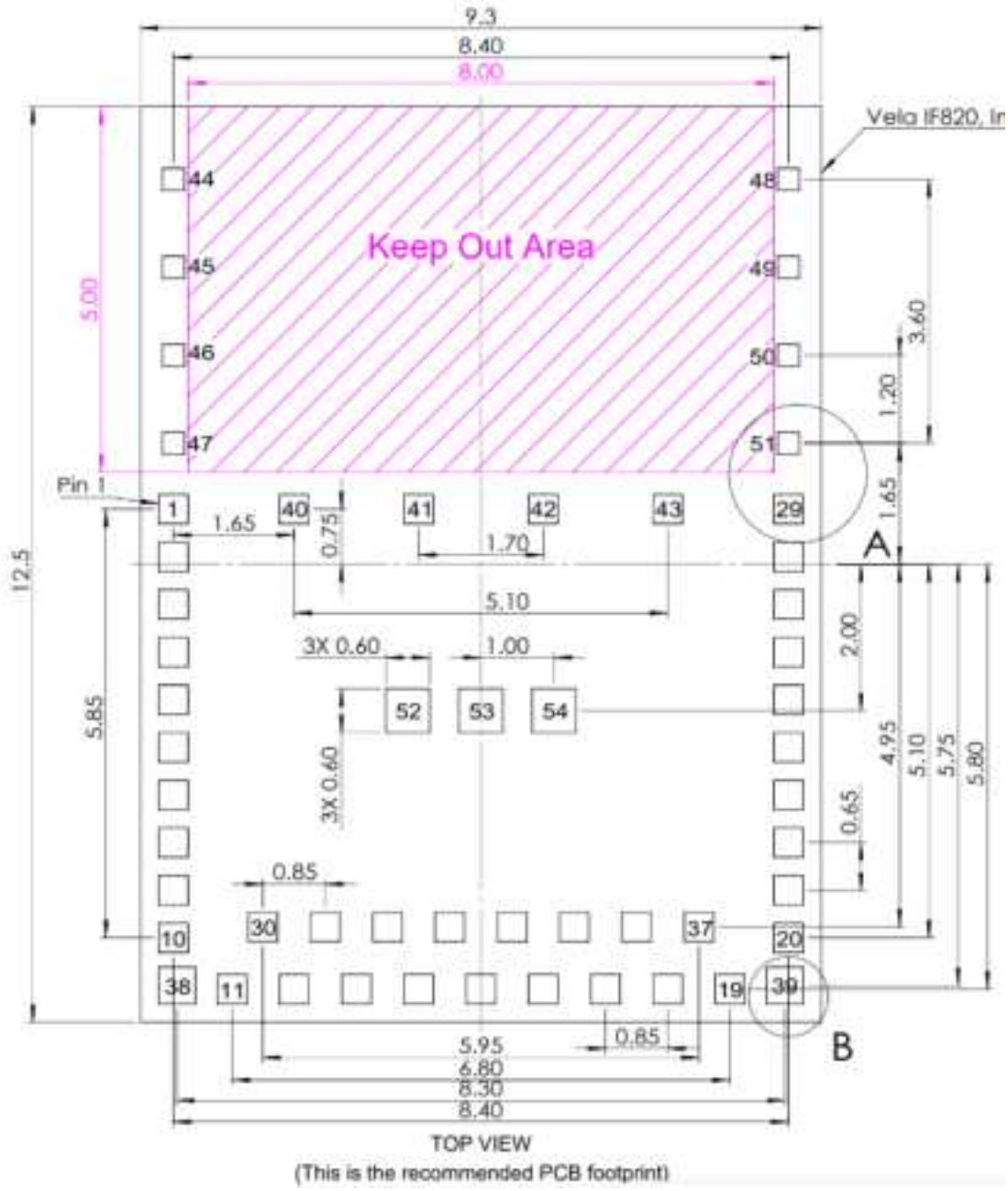


***Figure 13: Integrated antenna variant module pinout (top view)***



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## 10.3 Integrated Antenna variant Module Pin Definition

***Table 19: Pin definitions of Vela IF820 chip Antenna module***

| Pin # | Name | I/O | Voltage Ref. | Description |
|---|---|---|---|---|
| 1 | GND | - | - | Ground |
| 2 | VDDIO | I | VDDIO | 1.71V to 3.3V is recommended to supply for digital I/O |
| 3 | GND | - | - | Ground |
| 4 | XTALI_32K | I | VDDIO | Low-power oscillator input |
| 5 | XTALO_32K | O | VDDIO | Low-power oscillator output |
| 6 | P15 | I/O | VDDIO | Recommended functions for P15<br>• Keyboard scan output (column): KSO7<br>• A/D converter input 20<br>P15 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 7 | P8 | I/O | VDDIO | Recommended functions for P8<br>• Keyboard scan output (column): KSO0<br>• A/D converter input 27<br>• External T/R switch control: ~tx_pd<br>P8 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 8 | P2 | I/O | VDDIO | Recommended functions for P2<br>• Keyboard scan input (row): KSI2<br>• Quadrature: QDX0<br>• SPI_1: MOSI (master only)<br>• UART1_RTS_N<br>P2 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 9 | P3 | I/O | VDDIO | Recommended functions for P3<br>• Keyboard scan input (row): KSI3<br>• Quadrature: QDX1<br>• UART1_CTS_N<br>• SPI_1: SPI_CLK (master only)<br>P3 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |



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| | | | | |
|---|---|---|---|---|
| 10 | P6 | I/O | VDDIO | Recommended functions for P6<br>• Keyboard scan input (row): KSI6<br>• Quadrature: QDZ0<br>• Peripheral UART: puart_rts<br>• PWM2<br>P6 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 11 | P17 | I/O | VDDIO | Recommended functions for P17<br>• Keyboard scan output (column): KSO9<br>• A/D converter input 18<br>P17 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 12 | P13 | I/O | VDDIO | Recommended functions for P13<br>• Keyboard scan output (column): KSO5<br>• A/D converter input 22<br>• PWM3<br>P13 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 13 | P9 | I/O | VDDIO | Recommended functions for P9<br>• Keyboard scan output (column): KSO1<br>• A/D converter input 26<br>• External T/R switc0h control: tx_pd<br>P9 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 14 | P10 | I/O | VDDIO | Recommended functions for P10<br>• Keyboard scan output (column): KSO2<br>• A/D converter input 25<br>• External PA ramp control: PA_Ramp<br>P10 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |



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| | | | | |
|---|---|---|---|---|
| 15 | P37 | I/O | VDDIO | Recommended functions for P37<br>• A/D converter input 2<br>• Quadrature: QDZ1<br>• SPI_1: MISO (slave only)<br>• Auxiliary clock output: ACLK1<br>• I2C: SCL<br>P37 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 16 | P11 | I/O | VDDIO | Recommended functions for P11<br>• Keyboard scan output (column): KSO3<br>• A/D converter input 24<br>P11 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 17 | P32 | I/O | VDDIO | Recommended functions P32<br>• A/D converter input 7<br>• Quadrature: QDX0<br>• Auxiliary clock output: ACLK0<br>• Peripheral UART: puart_tx<br>P32 Can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 18 | P14 | I/O | VDDIO | Recommended functions for P14<br>• Keyboard scan output (column): KSO6<br>• A/D converter input 21<br>• PWM2<br>P14 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 19 | P5 | I/O | VDDIO | Recommended functions for P5<br>• Keyboard scan input (row): KSI5<br>• Quadrature: QDY1<br>• Peripheral UART: puart_tx<br>• SPI_1: MISO (slave only)<br>• I2C: SDA<br>P5 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |



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| | | | | |
|---|---|---|---|---|
| 20 | P28 | I/O | VDDIO | Recommended functions for P28<br>• PWM2<br>• SCL3 (master and slave)<br>• Optical control output: QOC2<br>• A/D converter input 11<br>• Current: 16 mA sink<br>P28 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 21 | GND | - | - | Ground |
| 22 | 3P0V | I | 3V | Power supply input |
| 23 | GND | - | - | Ground |
| 24 | BT_UART_RTS | O, PU | VDDIO | Request to send (RTS) for HCI UART interface.<br>Leave unconnected if not used. |
| 25 | BT_UART_TXD | O, PU | VDDIO | UART serial output. Serial data output for the HCI UART interface. |
| 26 | BT_UART_RXD | I | VDDIO | UART serial input. Serial data input for the HCI UART interface. |
| 27 | BT_UART_CTS | I, PU | VDDIO | Clear to send (CTS) for HCI UART interface.<br>Leave unconnected if not used. |
| 28 | BT_DEV_WAKE | I | VDDIO | A signal from the CYW20820 device to the host indicating that the Bluetooth® device requires attention. |
| 29 | BT_HOST_WAKE | O | VDDIO | A signal from the host to the CYW20820 indicating that the host requires attention. |
| 30 | P12 | I/O | VDDIO | Recommended functions for P12<br>• Keyboard scan output (column): KSO4<br>• A/D converter input 23<br>P12 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 31 | P1 | I/O | VDDIO | Recommended functions for P1<br>• Keyboard scan input (row): KSI1<br>• A/D converter input 28<br>• Peripheral UART: puart_rts<br>• SPI_1: MISO (slave only)<br>• UART1_RXD<br>• Can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |



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| | | | | |
|---|---|---|---|---|
| 32 | P0 | I/O | VDDIO | Recommended functions for P0<br>• Keyboard scan input (row): KSI0<br>• A/D converter input 29<br>• Peripheral UART: puart_tx<br>• SPI_1: MOSI (master only)<br>• UART1_TXD<br>P0 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 33 | P27 | I/O | VDDIO | Recommended functions for P27<br>• Keyboard scan output (column): KSO19<br>• PWM1<br>• SPI_1: MOSI (master only)<br>• Optical control output: QOC1<br>• Current: 16 mA sink<br>P27 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 34 | RST | I | VDDIO | Active-low system reset with internal pull-up resistor. |
| 35 | P29 | I/O | VDDIO | Recommended functions for P29<br>• PWM3<br>• SDA3 (master and slave)<br>• Optical control output: QOC3<br>• A/D converter input 10<br>• Current: 16 mA sink<br>P29 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 36 | P26 | I/O | VDDIO | Recommended functions for P26<br>• Keyboard scan output (column): KSO18<br>• PWM0<br>• SPI_1: SPI_CS (slave only)<br>• Optical control output: QOC0<br>• Current: 16 mA sink<br>P26 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |



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| | | | | |
|---|---|---|---|---|
| 37 | P4 | I/O | VDDIO | Recommended functions for P4<br>• Keyboard scan input (row): KSI4<br>• Quadrature: QDY0<br>• SPI_1: MOSI (master only)<br>P4 can also be remapped using Supermux I/O functions as defined in Table 6 and Table 7. |
| 38 | GND | - | - | Ground |
| 39 | GND | - | - | Ground |
| 40 | GND | - | - | Ground |
| 41 | GND | - | - | Ground |
| 42 | GND | - | - | Ground |
| 43 | GND | - | - | Ground |
| 44 | GND | - | - | Ground |
| 45 | GND | - | - | Ground |
| 46 | GND | - | - | Ground |
| 47 | GND | - | - | Ground |
| 48 | GND | - | - | Ground |
| 49 | GND | - | - | Ground |
| 50 | GND | - | - | Ground |
| 51 | GND | - | - | Ground |
| 52 | GND | - | - | Ground |
| 53 | GND | - | - | Ground |
| 54 | GND | - | - | Ground |



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## 10.4 Reference schematic design

Same as MHF4 connector variant, suggest to put bypass capacitors 100nF in the 3P0V (pin22) and VDDIO (pin2).

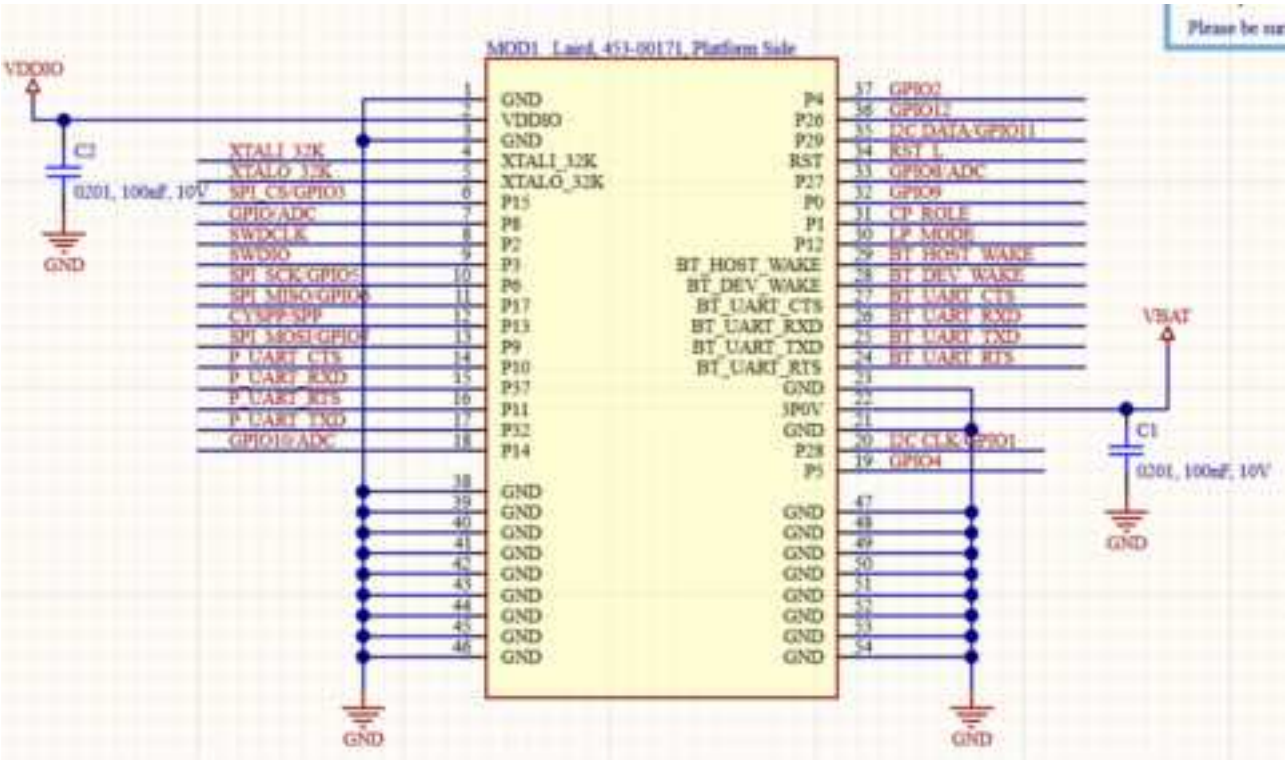


***Figure 6: Integrated antenna variant schematic***



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# 11 RF LAYOUT DESIGN GUIDELINES

## 11.1 General consideration

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

- Do not run antenna cables directly above or directly below the radio.
- Do not place any parts or run any high-speed digital lines below the radio.
- If there are other radios or transmitters located on the device (such as a Bluetooth radio), place the devices as far apart from each other as possible. Also, make sure there is at least 25 dB isolation between these two antennas.
- Ensure that there is the maximum allowable spacing separating the antenna connectors on the Laird Connectivity radio from the antenna. In addition, do not place antennas directly above or directly below the radio.
- Laird Connectivity recommends the use of a double-shielded cable for the connection between the radio and the antenna elements.
- Be sure to put a 100nF capacitor on EACH power pin. Also, place that capacitor to the pin as close as possible to make sure the internal PMU working correctly.

Use proper electro-static-discharge (ESD) procedures when installing the Laird Connectivity radio module. To avoid negatively impacting Tx power and receiver sensitivity, do not cover the antennas with metallic objects or components.



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## 11.2 Layout recommendations for integrated antenna variant

1. Align module edge with PCB edge
2. In order to perform antenna radiation efficiency, keep at least 15mm width of the GND plane to the sides the module.

Please see the figure below for a layout example

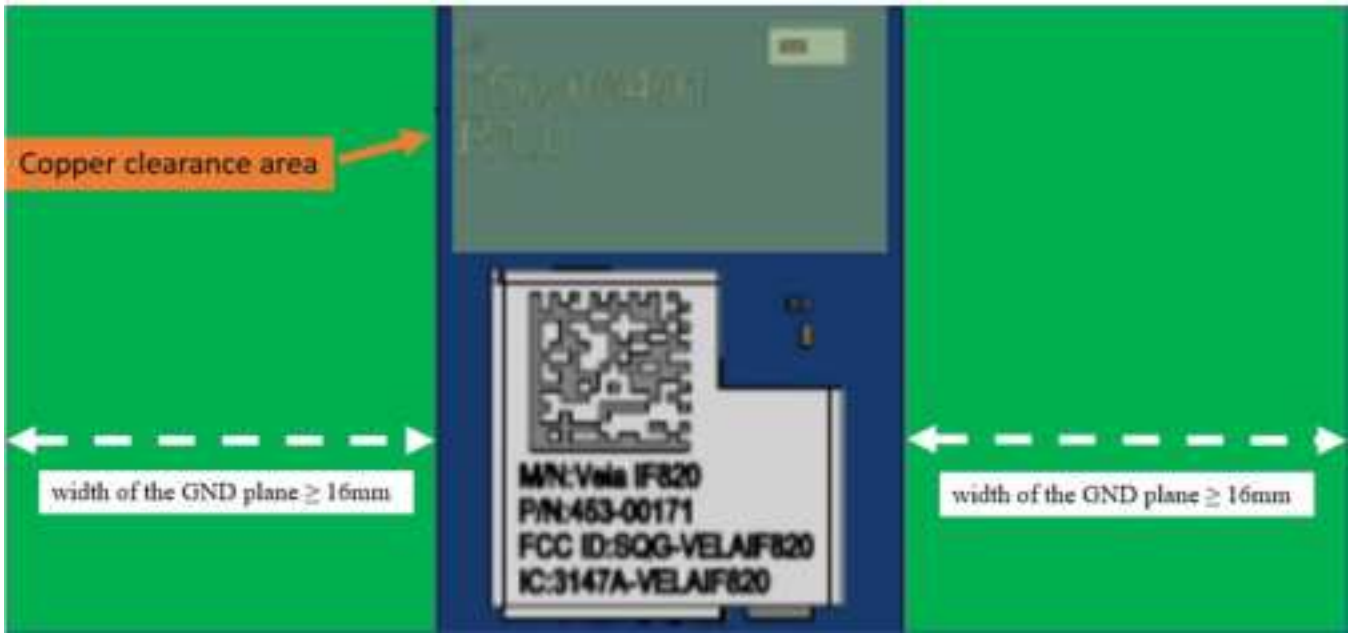


***Figure 15: Integrated antenna variant layout suggestion example***



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# 12 Application Note for Surface Mount Modules

## 12.1 Introduction

Laird Connectivity's surface mount modules are designed to conform to all major manufacturing guidelines. This application note is intended to provide additional guidance beyond the information that is presented in the user manual. This application note is considered a living document and will be updated as new information is presented.
The modules are designed to meet the needs of several commercial and industrial applications. They are easy to manufacture and conform to current automated manufacturing processes.

## 12.2 Base SiP Shipping

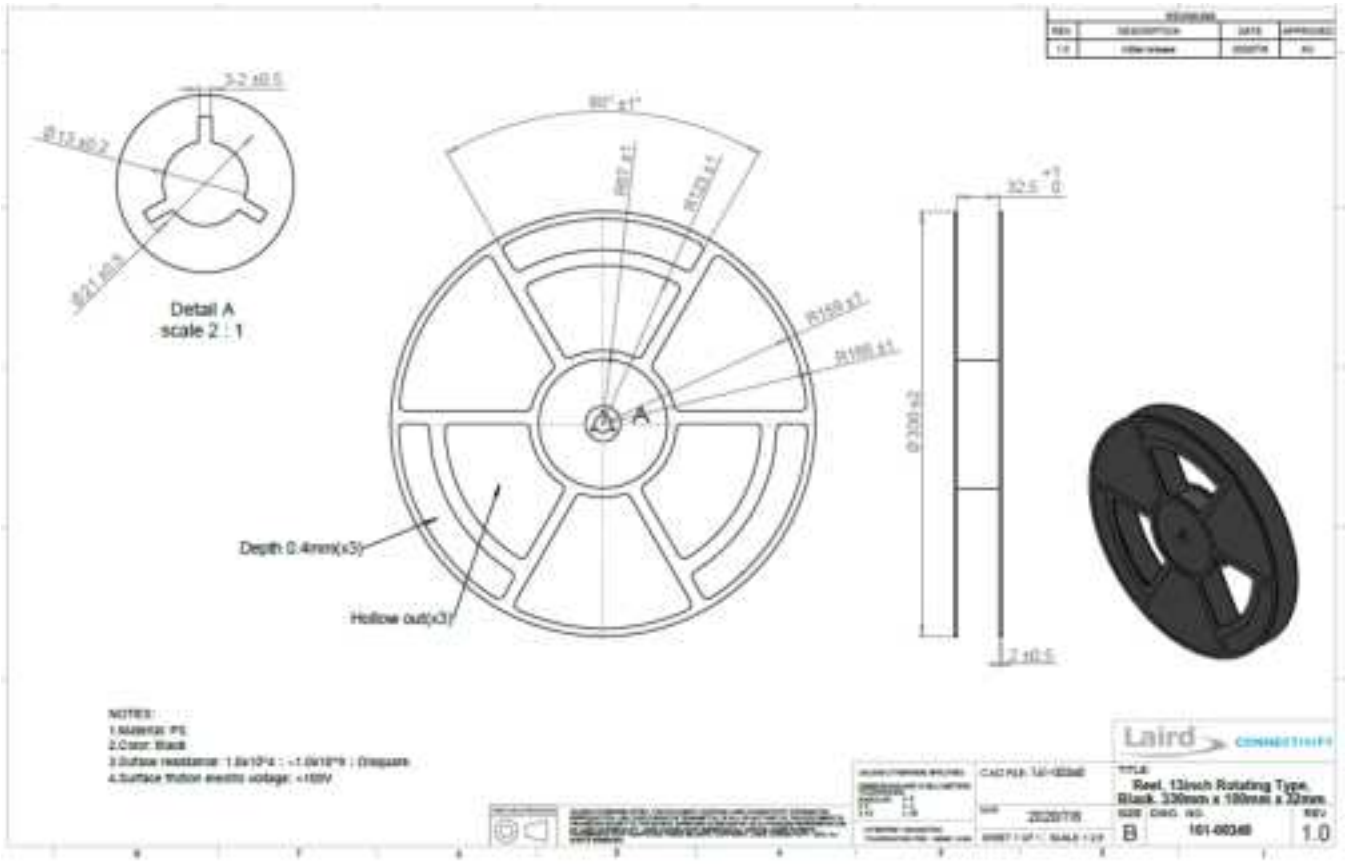


***Figure 16: Reel specifications***



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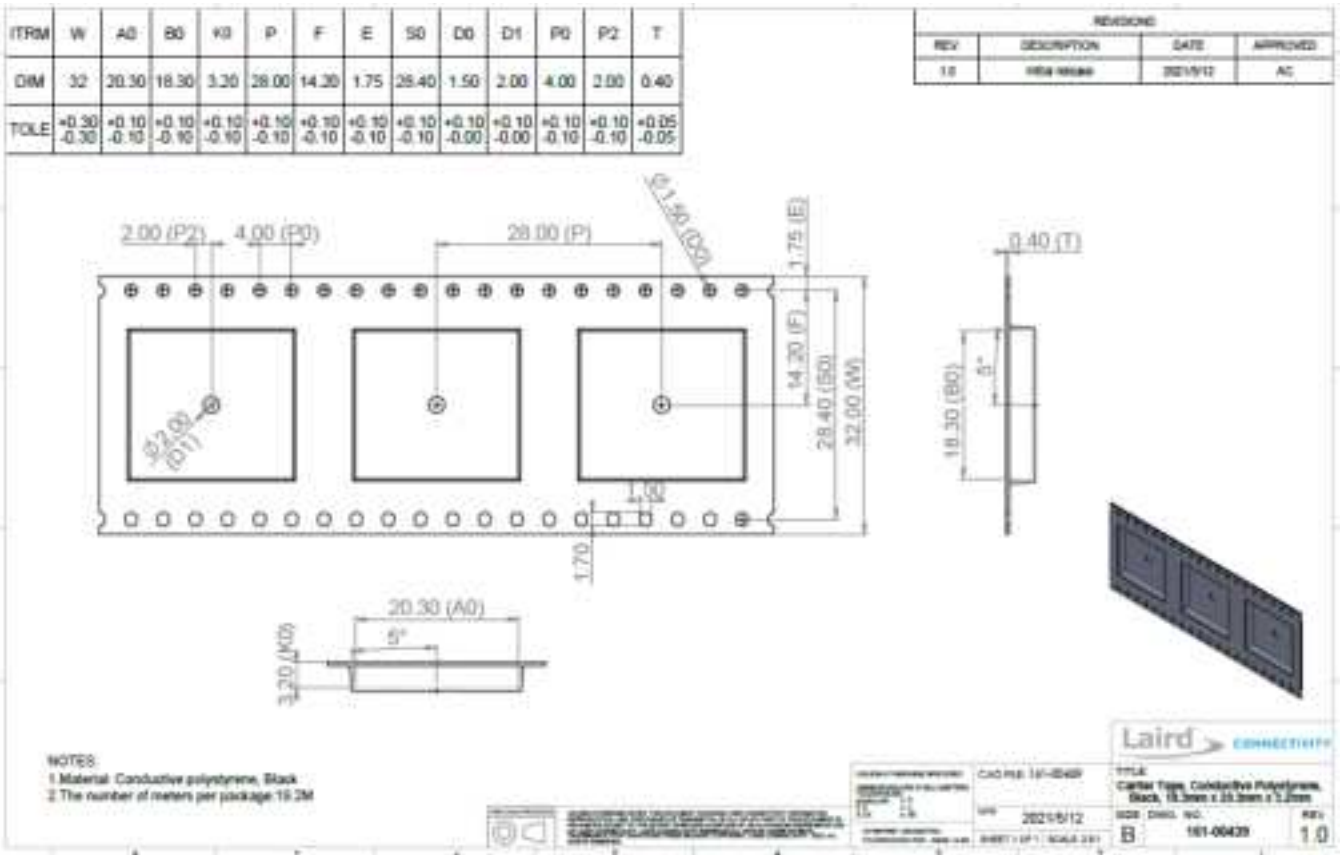


***Figure 17: Tape specifications, 161-00439***




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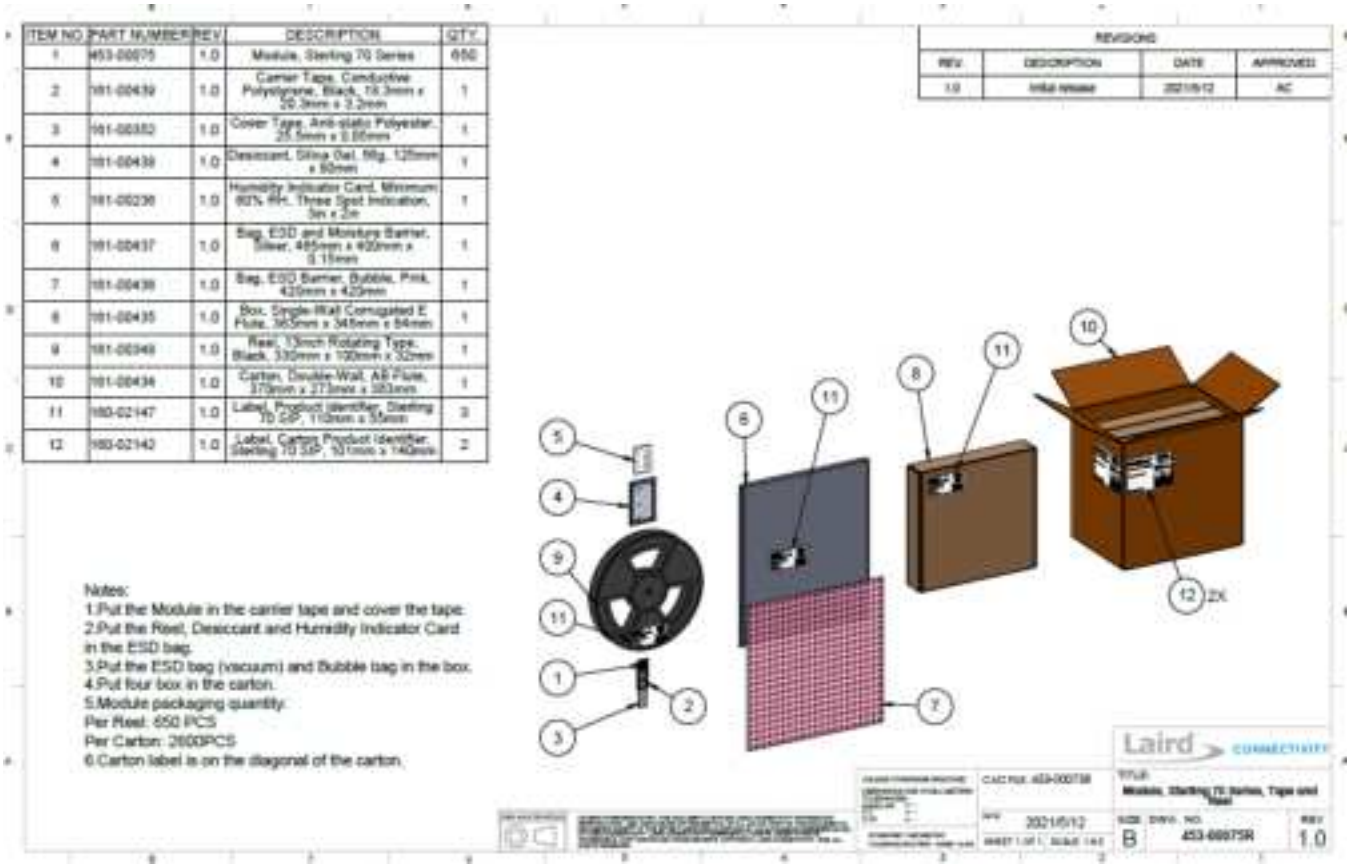


***Figure 18: Vela IF820 packaging process***

## 12.3 M.2 Module Shipping

All modems are shipped in trays and sealed in ESD Bags.



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## 12.4 Labelling

The following labels are located on the antistatic bag.

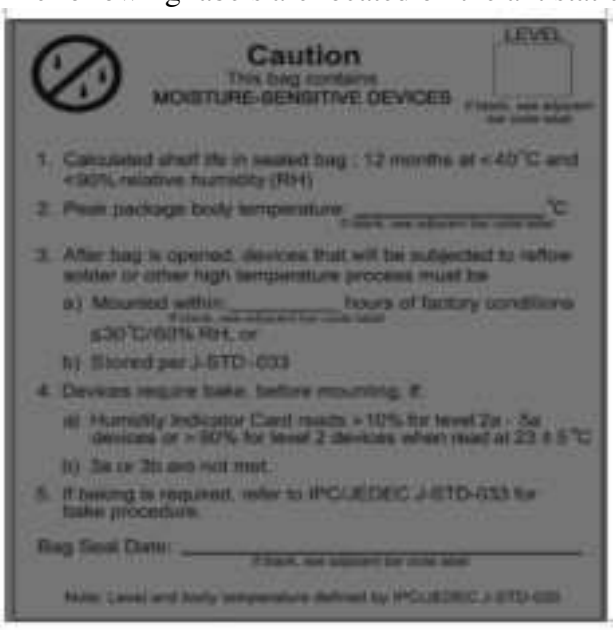


***Figure 19: Anti-static bag label – 1***

TBD

***Figure 20: Anti-static bag label – 2***

The following label is located on the pizza box.
TBD

***Figure 21: Box label***

The following package label is located on adjacent sides of the master carton.
TBD

***Figure 21: Master carton package label***

## 12.5 Required Storage Conditions

### 12.5.1 Prior to Opening the Dry Packing

The following are required storage conditions ***prior* to opening the dry packing**:

- Normal temperature: 5~40˚C
- Normal humidity: 80% (Relative humidity) or less
- Storage period: One year or less

---

**Note:** Humidity means relative humidity.

---



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### 12.5.2 After Opening the Dry Packing

The following are required storage conditions ***after*** **opening the dry packing** (to prevent moisture absorption):

- Storage conditions for one-time soldering:
  - Temperature: 5-25°C
  - Humidity: 60% or less
  - Period: 72 hours or less after opening
- Storage conditions for two-time soldering
  - Storage conditions following opening and prior to performing the 1st reflow:
    - Temperature: 5-25°C
    - Humidity: 60% or less
    - Period: A hours or less after opening
  - Storage conditions following completion of the 1st reflow and prior to performing the 2nd reflow
    - Temperature: 5-25°C
    - Humidity: 60% or less
    - Period: B hours or less after completion of the 1st reflow

**Note:** Should keep A+B within 72 hours.

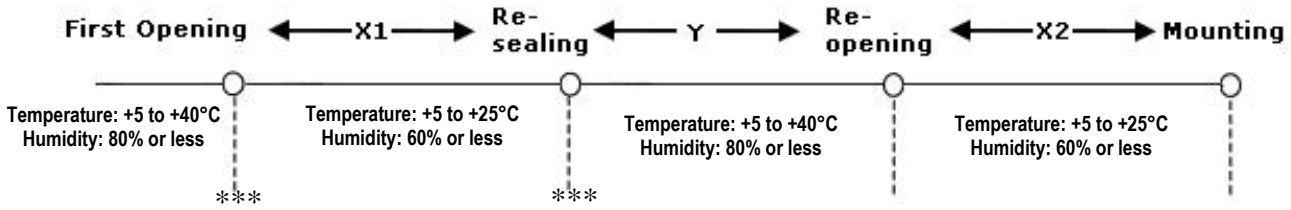
### 12.5.3 Temporary Storage Requirements after Opening

The following are temporary storage requirements after opening:

- Only re-store the devices *once* prior to soldering.
- Use a dry box or place desiccant (with a blue humidity indicator) with the devices and perform dry packing again using vacuumed heat-sealing.

The following indicate the required storage period, temperature, and humidity for this temporary storage:

- Storage temperature and humidity:




*** - External atmosphere temperature and humidity of the dry packing

- Storage period:
  - X1+X2 – Refer to After Opening the Dry Packing storage requirements. Keep is X1+X2 within 72 hours.
  - Y – Keep within two weeks or less.

## 12.6 Baking Conditions

Baking conditions and processes for the module follow the J-STD-033 standard which includes the following:

- The calculated shelf life in a sealed bag is 12 months at <40°C and <80% relative humidity.
- Once the packaging is opened, the SiP must be mounted (per MSL4/Moisture Sensitivity Level 4) within 72 hours at <30˚C and <60% relative humidity.
- If the SiP is not mounted within 72 hours or if, when the dry pack is opened, the humidity indicator card displays >10% humidity, then the product must be baked for 48 hours at 125 ˚C (±5 ˚C).



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## 12.7 Surface Mount Conditions

The following soldering conditions are recommended to ensure device quality.

### 12.7.1 Soldering

**Note:** When soldering, the stencil thickness should be ≥ 0.1 mm.

Convection reflow or IR/Convection reflow (one-time soldering or two-time soldering in air or nitrogen environment)

- Measuring point – IC package surface
- Temperature profile:

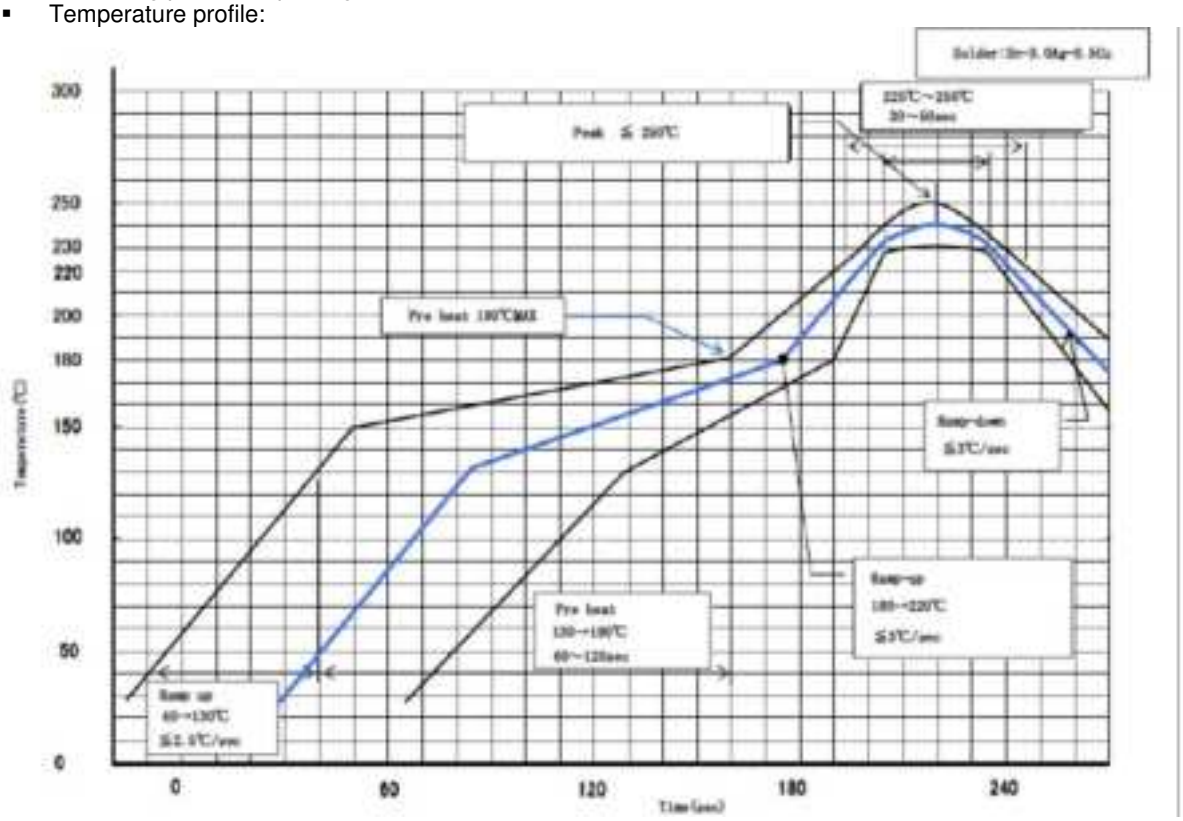


***Figure 22: Temperature profile***

- Ramp-up: 40-130˚C. Less than 2.5˚C/sec
- Pre heat: 130-180˚C 60-120 sec, 180˚C MAX
- Ramp-up: 180-220˚C. Less than 3˚C/sec
- Peak Temperature: MAX 250˚C
    - 225˚C ~ 250˚C, 30 ~ 50 sec
- Ramp-down: Less than 3˚C/sec



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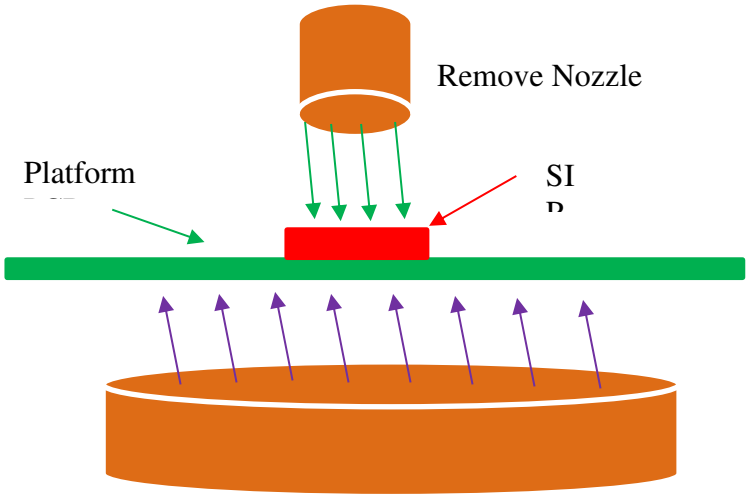
### 12.7.2 Cautions When Removing the SIP from the Platform for RMA

- Bake the platform before removing the SIP from the platform. Reference baking conditions.
- Remove the SIP by using a hot air gun. This process should be carried out by a skilled technician.

Suggestion conditions:

- One-side component platform:
  - Set the hot plate at 280°C.
  - Put the platform on the hot plate for 8~10 seconds.
  - Remove the SIP from platform.

- Two-side components platform:
  - Use two hot air guns
  - On the bottom side, use a pre-heated nozzle (temperature setting of 200~250°C) at a suitable distance from the platform PCB.
  - On the top side, apply a remove nozzle (temperature setting of 330°C). Heat the SIP until it can be removed from platform PCB.




- Remove the residue solder under the bottom side of SIP. (Note: Alternate module pictured as an example)

(Not accepted for RMA)

***Example SIP with residue solder on the bottom***

(Accepted for RMA analysis)

***Example Module, no residue solder***

- Remove and clean the residue flux as needed.

### 12.7.3 Precautions for Use

- Opening/handing/removing must be done on an anti-ESD treated workbench. All workers must also have undergone anti-ESD treatment.
- The devices should be mounted within one year of the date of delivery.
- The Vela IF820 modules are MSL level 4.



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# 13 RELIABILITY TEST

## 13.1 Climatic And Dynamic

***Table 5: Climatic and Dynamic Reliability Test Results for Lyra 24P USB Adapter***

| Test Item | Specification | Standard | Test Result |
|---|---|---|---|
| Thermal Shock | 1. Temperature: -40 ~ 85℃<br>2. Ramp time: Less than 10 seconds.<br>3. Dwell Time: 10 minutes<br>4. Number of Cycles: 500 times | *JESD22-A106<br>*IEC 60068-2-14 for dwell time and number of cycles | Pass |
| Vibration<br>Non-operating<br>Unpackaged device | 1. Vibration Wave Form: Sine Waveform<br>2. Vibration frequency / Displacement: 20-80 Hz/1.5mm<br>3. Vibration frequency / Acceleration: 80-2000 Hz/20g<br>4. Cycle Time: 4 min/cycle<br>5. Number of Cycles: 4 cycle/axis<br>6. Vibration Axes：X, Y and Z (Rotate each axis on vertical vibration table) | JEDEC 22-B103B (2016) | Pass |
| Mechanical Shock<br>Non-operating<br>Unpackaged device | 1. Pulse shape: Half-sine waveform<br>2. Impact acceleration: 1500 g<br>3. Pulse duration: 0.5 ms<br>4. Number of shocks: 30 shocks (5 shocks for each face)<br>5. Orientation: Bottom, top, left, right, front and rear faces | JEDEC 22-B110B.01 (2019) | Pass |



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## 13.3 Reliability MTBF Prediction

***Table 6: MTBF Prediction for Lyra 24P Modules***

| Laird Part Number | Environment | Test Result 40 °C (Hours) |
|---|---|---|
| 453-00171R<br>453-00171C | Ground, Fixed, Uncontrolled | TBD |
| 453-00172R<br>453-00172C | Ground, Fixed, Uncontrolled | TBD |
| 453-00171R<br>453-00171C | Mobile, Fixed, Uncontrolled | TBD |
| 453-00172R<br>453-00172C | Mobile, Fixed, Uncontrolled | TBD |
| **Laird Part Number** | **Environment** | **Test Result 85 °C (Hours)** |
| 453-00171R<br>453-00171C | Ground, Fixed, Uncontrolled | TBD |
| 453-00172R<br>453-00172C | Ground, Fixed, Uncontrolled | TBD |
| 453-00171R<br>453-00171C | Mobile, Fixed, Uncontrolled | TBD |
| 453-00172R<br>453-00172C | Mobile, Fixed, Uncontrolled | TBD |

# 14 REGULATORY

**Note:** For complete regulatory information, refer to the Vela IF820 document which is also available from the Vela IF820 product page.

The Vela IF820 holds current certifications in the following countries:

***Table 20: Vela IF820 Regions of Certifications***

| Country/Region | Regulatory ID |
|---|---|
| USA (FCC) | SQG-VELAIF820 |
| EU | N/A |
| UKCA | N/A |
| Canada (ISED) | 3147A-VELAIF820 |
| Japan (MIC) | 201-230307 |
| Australia (RCM) | N/A |
| New Zealand (RCM) | N/A |
| Korea | R-C-L8C-VELAIF820 |



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***Table 21: Vela IF820 Approved Antenna***

| Laird Model | Laird Part Number | Type | Gain 2.4GHz |
|---|---|---|---|
| NanoBlue | EBL2400A1-10MH4L | PCB Dipole | 2dBi |
| FlexPIFA | 001-0022 | PCB Dipole | 2dBi |
| EDA-8709-2G4C1-B27-CY | 0600-00057 | IPEX MHF4 | 2.3dBi |
| mFlexPIFA | EFA2400A3S-10MH4L | IPEX MHF4 | 2dBi |



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# 15 ORDERING INFORMATION

***Table 22: Orderable Vela IF820 part numbers***

| Part | Description |
|---|---|
| 453-00171R | Vela IF820 - Dual Mode Bluetooth Module, Integrated Antenna (Infineon CYW20820) - Tape / Reel |
| 453-00171C | Vela IF820 - Dual Mode Bluetooth Module, Integrated Antenna (Infineon CYW20820) – Cut / Tape |
| 453-00172R | Vela IF820 - Dual Mode Bluetooth Module, MHF4 Connector (Infineon CYW20820) - Tape / Reel |
| 453-00172C | Vela IF820 - Dual Mode Bluetooth Module, MHF4 Connector (Infineon CYW20820) – Cut / Tape |
| 453-00171-K1 | Vela IF820 - Development Kit with integrated chip antenna |
| 453-00172-K1 | Vela IF820 - Development Kit with MHF4 Connector |
| 450-00185 | Vela IF820 - Dual Mode Bluetooth USB Adapter with integrated antenna (Infineon CYW20820) |

## 15.1 General Comments

This is a preliminary datasheet. Please check with Laird Connectivity for the latest information before commencing a design. If in doubt, ask. For additional information visit Vela IF820 product page



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# 16 BLUETOOTH SIG QUALIFICATION

## 16.1 Overview

The Vela IF820 module is listed on the Bluetooth SIG website as a qualified Controller Subsystem.

***Table 22: Vela IF820 Listing and QDID***

| Design Name | Owner | Declaration ID | Link to listing on the SIG website |
|---|---|---|---|
| Vela IF820 | Laird Connectivity | | |

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 register as a member of the Bluetooth SIG – www.bluetooth.org
The following is 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, (login is required to views this document):
https://www.bluetooth.org/DocMan/handlers/TBD

## 16.2 Qualification Steps When Referencing a Laird Connectivity Controller Subsystem Design

To qualify your product when referencing a Laird Connectivity Controller Subsystem design, follow these steps:

1. To start a listing, go to: https://www.bluetooth.org/tpg/QLI_SDoc.cfm

   **Note:** A username and password are required to access this site.

2. In step 1, select the option, New Listing and Reference a Qualified Design.
3. Enter D056403 in the Controller Subsystem table entry.
4. Enter your complimentary Host Subsystem and optional Profile Subsystem QDID in the table entry.
5. Select your pre-paid Declaration ID from the drop-down menu or go to the Purchase Declaration ID page.

   **Note:** Unless the Declaration ID is pre-paid or purchased with a credit card, you cannot proceed until the SIG invoice is paid.

6. Once all the relevant sections of step 1 are finished, complete steps 2, 3, and 4 as described in the help document accessible from the site.

   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



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If you require assistance with the qualification process please contact our recommended Bluetooth Qualification Expert (BQE), Steve Flooks, steve.flooks@eurexuk.com.



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# 17 CHIP ANTENNA PERFORMANCE

## 17.1 Summary of Antenna Performance

| Unit in dBi | XY-plane | | XZ-plane | | YZ-plane | | Efficiency |
|---|---|---|---|---|---|---|---|
| | Peak | Avg. | Peak | Avg. | Peak | Avg. | |
| @2400MHz | -1.4 | -2.6 | -2.1 | -5 | 0.1 | -2.8 | 45% |
| @2440MHz | -1.5 | -2.3 | -1.2 | -4.3 | 0.6 | -2.3 | 51% |
| @2480MHz | -2.1 | -2.7 | -1.8 | -4.4 | 0.2 | -2.7 | 48% |

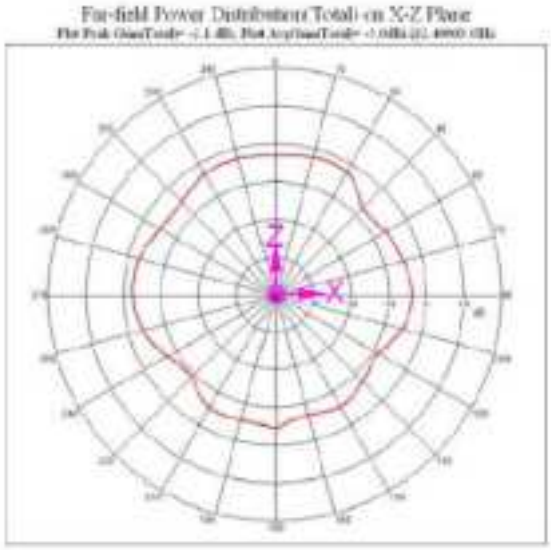
Note : The result is measured with Laird DVK part # 453-00171-K1

## 17.2 2.4GHz Radiated Performance

2400MHz radiation pattern

◆XY-plane

◆XZ-plane





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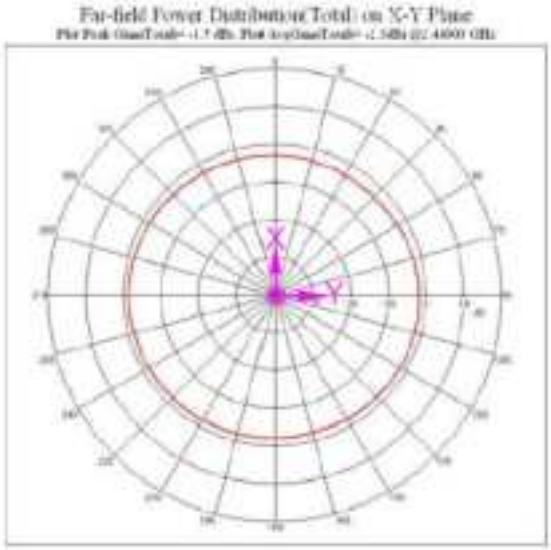
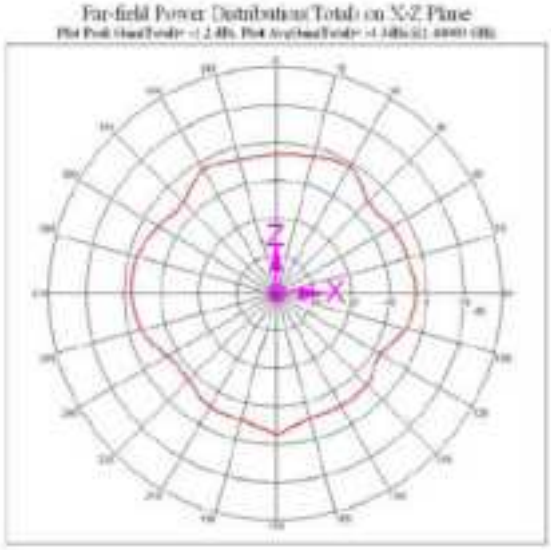
## ◆YZ-plane


2440MHz radiation pattern

## ◆XY-plane




## ◆XZ-plane



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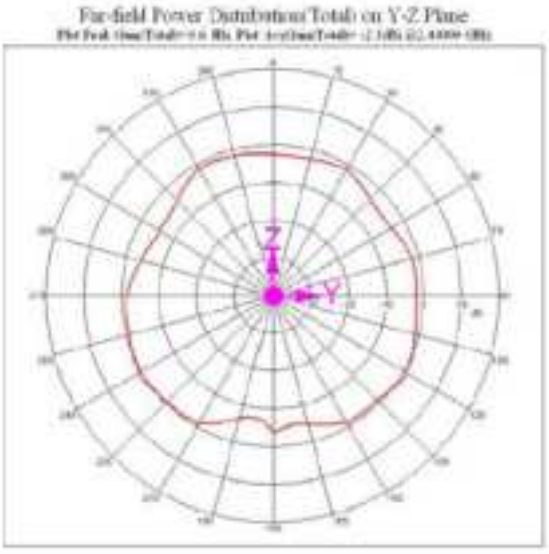
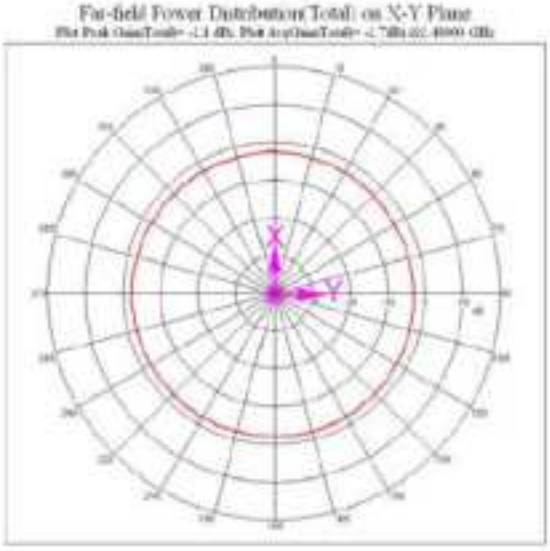
## ◆YZ-plane

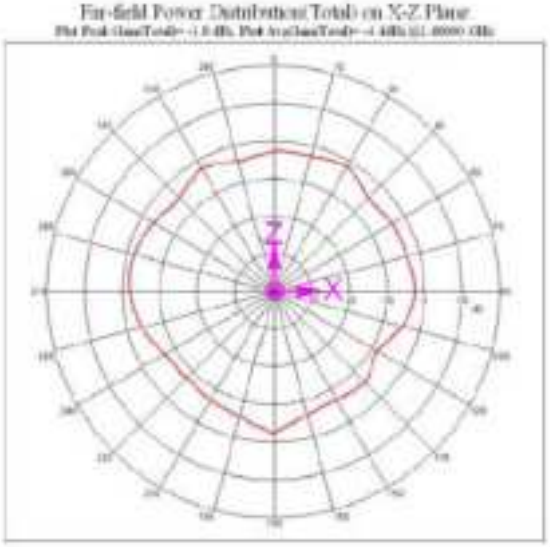



2480MHz radiation pattern

## ◆XY-plane




## ◆XZ-plane



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## ◆YZ-plane




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## 18 ADDITIONAL ASSISTANCE

Please contact your local sales representative or our support team for further assistance:
Laird Connectivity
Support Centre: https://www.lairdconnect.com/resources/support
Email: wireless.support@lairdconnectivity.com
Phone: Americas: +1-800-492-2320
Europe: +44-1628-858-940
Hong Kong: +852 2923 0610
Web: https://www.lairdconnect.com/products

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



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



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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.

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

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

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

Country Code selection feature to be disabled for products marketed to the US/CANADA



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## Integration instructions for host product manufacturers

**Applicable FCC rules to module**

FCC Part 15.247

**Summarize the specific operational use conditions**

The module is must be installed in mobile device.

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

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna

As long as 2 conditions above are met, further transmitter test 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.

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not 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 authorization. The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

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

**Limited module procedures**

Not applicable

**Trace antenna designs**

Not applicable

**RF exposure considerations**

Co-located issue shall be met as mentioned in "Summarize the specific operational use conditions".

Product manufacturer shall provide below text in end-product manual

"Radiation Exposure Statement:

The product comply with the US portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.."

**Antennas**

| Ant. No. | Manufacturer | Model | Laird Part Number | Type | Connector | Gain |
|---|---|---|---|---|---|---|
| 1 | Laird | NanoBlue | EBL2400A1-10MH4L | PCB Dipole | IPEX MHF4 | 2dBi |
| 2 | Laird | FlexPIFA | 001-0022 | PCB Dipole | IPEX MHF4 | 2dBi |
| 3 | Mag.Layers | EDA-8709-2G4C1-B27-CY | 0600-00057 | Dipole | IPEX MHF4 | 2.32dBi |
| 4 | Laird | mFlexPIFA | EFA2400A3S-10MH4L | PIFA | IPEX MHF4 | 2dBi |
| 5 | ACX | AD1608 | AD1608-A2455AAT/LF | Chip Antenna | N/A | 1dBi |



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**Label and Compliance Information**
Product manufacturers need to provide a physical or e-label stating
"Contains FCC ID: SQG-VELAIF820" with finished product
**Information on Test Modes and Additional Testing Requirements**
Test tool: cybluetool
**Additional Testing, Part 15 Subpart B Disclaimer**
The module is only FCC authorized for the specific rule parts listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed

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

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

*L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :*
*(1) L'appareil ne doit pas produire de brouillage;*
*(2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

This radio transmitter [IC: 3147A-VELAIF820] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.



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Le présent émetteur radio [IC: 3147A-VELAIF820] a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

| Ant. No. | Manufacturer | Model | Laird Part Number | Type | Connector | Gain |
|---|---|---|---|---|---|---|
| 1 | Laird | NanoBlue | EBL2400A1-10MH4L | PCB Dipole | IPEX MHF4 | 2dBi |
| 2 | Laird | FlexPIFA | 001-0022 | PCB Dipole | IPEX MHF4 | 2dBi |
| 3 | Mag.Layers | EDA-8709-2G4C1-B27-CY | 0600-00057 | Dipole | IPEX MHF4 | 2.32dBi |
| 4 | Laird | mFlexPIFA | EFA2400A3S-10MH4L | PIFA | IPEX MHF4 | 2dBi |
| 5 | ACX | AD1608 | AD1608-A2455AAT/LF | Chip Antenna | N/A | 1dBi |



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

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

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

As long as 1 condition above are met, further transmitter test 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.

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

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

**IMPORTANT NOTE:**

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

**NOTE IMPORTANTE:**

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

**End Product Labeling**



**Americas**: +1-800-492-2320
**Europe**: +44-1628-858-940
**Hong Kong**: +852 2762 4823

The final end product must be labeled in a visible area with the following: “Contains IC: 3147A-VELAIF820”.

**Plaque signalétique du produit final**

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 3147A-VELAIF820".

**Manual Information To the End User**

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module.
The end user manual shall include all required regulatory information/warning as show in this manual.

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

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.
Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.



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