

# Datasheet

## Sona MT320

*Version 0.1*

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## REVISION HISTORY

| Version | Date          | Notes                     | Contributors | Approver  |
|---------|---------------|---------------------------|--------------|-----------|
| 0.1     | 22 Sept. 2023 | Initial version           | Various      | Andy Ross |
| 0.2     | 5. Feb. 2024  | Update BT standard to 5.4 | Andrew Chen  | Andy Ross |
|         |               |                           |              |           |
|         |               |                           |              |           |

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# 1 SCOPE

This document describes key hardware aspects of the Laird Connectivity Sona™ MT320 series wireless modules providing SDIO 3.0 interface for WLAN connection and 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 Mediatek MT7921LSN data sheet issued on September 07, 2021, along with other documents provided by Mediatek.

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

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# 2 INTRODUCTION

## 2.1 General Description

The Sona MT320 series wireless module is an integrated, small form factor 802.11 a/b/g/n/ac/ax dual-band Wi-Fi and a Bluetooth v5.3 system in SDIO 3.0 interface. Sona MT320 integrates MediaTek MT7921LSN SoC with a 32-bit RISC MCU that handles Wi-fi and Bluetooth protocols that provide easy to use for platform integration.

There are two physical sizes for Laird Sona MT320 M.2 module. One (M.2 2230) is following the standard M.2 2230, the other one (M.2 1420) is footprint compatible to the standard M.2 1216 but **with module PCB size extended to 14X20mm.**

This device is pre-calibrated and integrates the complete transmit/receive RF paths including bandpass filter, diplexer, switches, reference crystal oscillator, and power management units (PMU). Both variants support two RF output ports, one (ANT0) for WLAN only and the other (ANT1) is shared between WLAN and Bluetooth.

The M.2 1420 solder down module also supports an RF trace pin option for use with external antenna solutions. For a list of certified antennas see [Certified Antennas](#) in the datasheet.

The Sona MT320 series device supports IEEE 802.11ax 2x2 MIMO with data rates up to MCS11. The device's low power consumption, radio architecture and power management unit (PMU) proprietary power save technologies allow for extended battery life.

The Sona MT320 series wireless modules include three product SKUs which have different RF paths. Please contact Laird Connectivity Sales/FAE for further information. Ordering information is listed in [Table 1](#).

**Table 1: Product ordering information**

| Part Number | Product Description                       |
|-------------|---|
| 453-00176R  | Module, Sona MT320, M.2 1420, MHF4        |
| 453-00177R  | Module, Sona MT320, M.2 1420, Trace Pin   |
| 453-00178   | Module, Sona MT320, M.2 2230, Key E, SDIO |

## 2.2 Sona MT320 Series Features Summary

The Laird Connectivity Sona MT320 series device features are described in [Table 2](#).

**Table 2: Sona MT320 series wireless module features**

| Feature  | Description  |
|--|--|
| <b>Radio Front End</b>   | <ul style="list-style-type: none"> <li>Integrates the complete transmit/receive RF paths including bandpass filter, diplexer, switches, reference crystal oscillator, and power manage unit (PMU)</li> <li>Supports dual band (2.4/5 GHz)</li> <li>Supports 20/40/80 MHz channel bandwidth.</li> <li>Supports 2x2 MIMO, one antenna dedicates for WLAN, the other is shared with BT.</li> </ul>  |
| <p>The <i>Bluetooth</i>® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. Any use of such marks by Laird Connectivity is under license. Other trademarks and trade names are those of their respective owners.</p> |  |
| <b>Power Management</b>  | Two buck regulator, multiple LDO regulators, and a power management unit (PMU) are integrated into the MT7921LSN. All regulators are programmable via the PMU. These blocks simplify power supply design for Bluetooth and WLAN functions in embedded designs.   |
| <b>Pre-Calibration</b>   | RF system tested and calibrated in production  |
| <b>Host Interface</b>  | SDIO 3.0 for WLAN and BT.  |
| <b>Advanced WLAN</b>   | <ul style="list-style-type: none"> <li>IEEE 802.11a/b/g/n/ac/ax compliant, dual-band capable (2.4/5 GHz)</li> <li>2x2 MIMO, supports 20, 40, and 80 MHz channels with optional SGI (1024-QAM modulation)</li> <li>DFS radar detection.</li> <li>On-chip power amplifiers and low-noise amplifiers for both bands.</li> <li>Security support for WFA WPA/WPA2/WPA3 personal, WPS2.0, WAPI</li> </ul>  |
| <b>Advanced Bluetooth</b>  | <ul style="list-style-type: none"> <li>Bluetooth 5.3 (BDR + EDR + Bluetooth LE)</li> <li>Bluetooth Class 1 or Class 2 transmitter operation</li> <li>Support data rate: 1 Mbps (GFSK), 2 Mbps (<math>\pi/4</math>-DQPSK), 3 Mbps (8-DPSK), LE-1 Mbps, LE-2 Mbps</li> <li>Fully functional Bluetooth baseband: AFH, forward error correction, header error control, access code correlation, CRC, whitening.</li> <li>Single-ended, RF port with integrated Balun and T/R switch, Integrated high efficiency PA and TSSI</li> </ul> |

## 2.3 SPECIFICATIONS

Table 3: Specifications

| Feature                          | Description   |          |           |                 |                 |                |                |                      |                     |
|----------------------------------|---|----------|-----------|-----------------|-----------------|----------------|----------------|----------------------|---------------------|
| Physical Interface               | M.2 2230 E-Key standard form factor<br>M.2 1420 108-pin LGA package (including 8 thermal ground pads under the package)   |          |           |                 |                 |                |                |                      |                     |
| Wi-Fi/BT Interface               | Secure Digital I/O 2.0/3.0  |          |           |                 |                 |                |                |                      |                     |
| Main Chipset                     | Mediatek MT7921LSN  |          |           |                 |                 |                |                |                      |                     |
| Input Voltage Requirements       | Typical DC 3.3 V, operating range from DC 3.13V to 3.6V   |          |           |                 |                 |                |                |                      |                     |
| I/O Signalling Voltage           | Compliant with M.2 standard<br>Typical DC 1.8 V ± 10%   |          |           |                 |                 |                |                |                      |                     |
| Operating Temperature            | -40° to +85°C (-40° to +185°F)<br>Note:   |          |           |                 |                 |                |                |                      |                     |
| Operating Humidity               | 10 to 90% (non-condensing)  |          |           |                 |                 |                |                |                      |                     |
| Storage Temperature              | -40° to +85°C (-40° to +185°F)  |          |           |                 |                 |                |                |                      |                     |
| Storage Humidity                 | 10 to 90% (non-condensing)  |          |           |                 |                 |                |                |                      |                     |
| MSL (Moisture Sensitivity Level) | 4   |          |           |                 |                 |                |                |                      |                     |
| Maximum Electrostatic Discharge  | Conductive 4KV; Air coupled 8KV (follows EN61000-4-2)   |          |           |                 |                 |                |                |                      |                     |
| Size                             | <table border="0"> <tr> <td>M.2 1420</td> <td>M.2 E-Key</td> </tr> <tr> <td>▪ Length: 20 mm</td> <td>▪ Length: 30 mm</td> </tr> <tr> <td>▪ Width: 14 mm</td> <td>▪ Width: 22 mm</td> </tr> <tr> <td>▪ Thickness: 2.42 mm</td> <td>▪ Thickness: 2.3 mm</td> </tr> </table> | M.2 1420 | M.2 E-Key | ▪ Length: 20 mm | ▪ Length: 30 mm | ▪ Width: 14 mm | ▪ Width: 22 mm | ▪ Thickness: 2.42 mm | ▪ Thickness: 2.3 mm |
| M.2 1420                         | M.2 E-Key   |          |           |                 |                 |                |                |                      |                     |
| ▪ Length: 20 mm                  | ▪ Length: 30 mm   |          |           |                 |                 |                |                |                      |                     |
| ▪ Width: 14 mm                   | ▪ Width: 22 mm  |          |           |                 |                 |                |                |                      |                     |
| ▪ Thickness: 2.42 mm             | ▪ Thickness: 2.3 mm   |          |           |                 |                 |                |                |                      |                     |
| Weight – g (oz.)                 | <table border="0"> <tr> <td>M.2 1420</td> <td>M.2 E-Key</td> </tr> <tr> <td>▪ ~1.0</td> <td>▪ 2.5</td> </tr> </table>   | M.2 1420 | M.2 E-Key | ▪ ~1.0          | ▪ 2.5           |                |                |                      |                     |
| M.2 1420                         | M.2 E-Key   |          |           |                 |                 |                |                |                      |                     |
| ▪ ~1.0                           | ▪ 2.5   |          |           |                 |                 |                |                |                      |                     |
| Wi-Fi Media                      | Direct Sequence-Spread Spectrum (DSSS)<br>Complementary Code Keying (CCK)<br>Orthogonal Frequency Division Multiplexing (OFDM)<br>Orthogonal Frequency Division Multiple Access (OFDMA)   |          |           |                 |                 |                |                |                      |                     |
| Bluetooth Media                  | Frequency Hopping Spread Spectrum (FHSS)  |          |           |                 |                 |                |                |                      |                     |
| Wi-Fi Multimedia                 | WMM<br>Wi-Fi Multimedia - PowerSave (WMM-PS)  |          |           |                 |                 |                |                |                      |                     |
| Network Architecture Types       | Infrastructure (client operation)   |          |           |                 |                 |                |                |                      |                     |
| Wi-Fi Standards                  | IEEE 802.11ax, 11ac, 11a/b/g/n, 11d/h, 11i, 11r, 11w, 11e, 11k,11j, 11v   |          |           |                 |                 |                |                |                      |                     |
| Bluetooth Standards              | Bluetooth 2.1 + EDR, 3.0, 4.2, 5.0, 5.1, 5.2, 5.3   |          |           |                 |                 |                |                |                      |                     |
| Wi-Fi Data Rates Supported       | Support 802.11 ax/ac/a/b/g/n 2x2 MU-MIMO.<br>802.11b (DSSS, CCK) 1, 2, 5.5, 11 Mbps<br>802.11a/g (OFDM) 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>802.11n (OFDM, HT20/HT40, MCS0-15)   |          |           |                 |                 |                |                |                      |                     |

| Feature | Description   |
|---------|---|
|         | 802.11ac (OFDM, VHT20, MCS0-8; OFDM, VHT40/HT80, MCS0-9)  |
|         | 802.11ax (2.4 GHz / OFDM / HE20 / MCS0-11; 2.4 GHz / OFDMA / HE20 / MCS0-11)                        |
|         | 802.11ax (5 GHz / OFDM / HE20, HE40, HE80 / MCS0-11;<br>5 GHz / OFDMA / HE20, HE40, HE80 / MCS0-11) |

**Modulation Table** BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM

| Modulation Type |     |                |            |          |       |          | OFDM (IEEE 802.11n/ac) |          |          |          |          |          | OFDM (IEEE 802.11ax) |          |          |          |          |          |          |          |
|-----------------|-----|----------------|------------|----------|-------|----------|------------------------|----------|----------|----------|----------|----------|----------------------|----------|----------|----------|----------|----------|----------|----------|
| MCS Index       |     | Spatial Stream | Modulation | Coding   | 20MHz |          | 40MHz                  |          | 80MHz    |          | 20MHz    |          | 40MHz                |          | 80MHz    |          |          |          |          |          |
| HT              | VHT |                |            |          | HE    | 0.8us GI | 0.4us GI               | 0.8us GI | 0.4us GI | 0.8us GI | 0.4us GI | 0.8us GI | 1.6us GI             | 3.2us GI | 0.8us GI | 1.6us GI | 3.2us GI | 0.8us GI | 1.6us GI | 3.2us GI |
| 0               | 0   | 0              | 1          | BPSK     | 1/2   | 6.5      | 7.2                    | 13.5     | 15       | 29.3     | 32.5     | 8.6      | 8.1                  | 7.3      | 17.2     | 16.3     | 14.6     | 36       | 34       | 30.6     |
| 1               | 1   | 1              | 1          | QPSK     | 1/2   | 13       | 14.4                   | 27       | 30       | 58.5     | 65       | 17.2     | 16.3                 | 14.6     | 34.4     | 32.5     | 29.3     | 72.1     | 68.1     | 61.3     |
| 2               | 2   | 2              | 1          | QPSK     | 3/4   | 19.5     | 21.7                   | 40.5     | 45       | 87.8     | 97.5     | 25.8     | 24.4                 | 21.9     | 51.6     | 48.8     | 43.9     | 108.1    | 102.1    | 91.9     |
| 3               | 3   | 3              | 1          | 16-QAM   | 1/2   | 26       | 28.9                   | 54       | 60       | 117      | 130      | 34.4     | 32.5                 | 29.3     | 68.8     | 65       | 58.5     | 144.1    | 136.1    | 122.5    |
| 4               | 4   | 4              | 1          | 16-QAM   | 3/4   | 39       | 43.3                   | 81       | 90       | 175.5    | 195      | 51.6     | 48.8                 | 43.9     | 103.2    | 97.5     | 87.8     | 216.2    | 204.2    | 183.8    |
| 5               | 5   | 5              | 1          | 64-QAM   | 2/3   | 52       | 57.8                   | 108      | 120      | 234      | 260      | 68.8     | 65                   | 58.5     | 137.6    | 130      | 117      | 288.2    | 272.2    | 245      |
| 6               | 6   | 6              | 1          | 64-QAM   | 3/4   | 58.5     | 65                     | 121.5    | 135      | 263.3    | 292.5    | 77.4     | 73.1                 | 65.8     | 154.9    | 146.3    | 131.6    | 324.3    | 306.3    | 275.6    |
| 7               | 7   | 7              | 1          | 64-QAM   | 5/6   | 65       | 72.2                   | 135      | 150      | 292.5    | 325      | 86       | 81.3                 | 73.1     | 172.1    | 162.5    | 146.3    | 360.3    | 340.3    | 306.3    |
| 8               | 8   | 8              | 1          | 256-QAM  | 3/4   | 78       | 86.7                   | 162      | 180      | 351      | 390      | 103.2    | 97.5                 | 87.8     | 206.5    | 195      | 175.5    | 432.4    | 408.3    | 367.5    |
| 9               | 9   | 9              | 1          | 256-QAM  | 5/6   | N/A      | N/A                    | 180      | 200      | 390      | 433.3    | 114.7    | 108.3                | 97.5     | 229.4    | 216.7    | 196      | 480.4    | 453.7    | 408.3    |
| 10              | 10  | 10             | 1          | 1024-QAM | 3/4   | N/A      | N/A                    | 200      | 220      | 400      | 433.3    | 129      | 121.9                | 109.7    | 258.1    | 243.8    | 219.4    | 540.4    | 510.4    | 459.4    |
| 11              | 11  | 11             | 1          | 1024-QAM | 5/6   | N/A      | N/A                    | 220      | 240      | 440      | 433.3    | 143.4    | 135.4                | 121.9    | 286.8    | 270.8    | 243.8    | 600.5    | 567.1    | 510.4    |
| 8               | 0   | 0              | 2          | BPSK     | 1/2   | 13       | 14.4                   | 27       | 30       | 58.5     | 65       | 17.2     | 16.3                 | 14.6     | 34.4     | 32.5     | 29.3     | 72.1     | 68.1     | 61.3     |
| 9               | 1   | 1              | 2          | QPSK     | 1/2   | 26       | 28.9                   | 54       | 60       | 117      | 130      | 34.4     | 32.5                 | 29.3     | 68.8     | 65       | 58.5     | 144.1    | 136.1    | 122.5    |
| 10              | 2   | 2              | 2          | QPSK     | 3/4   | 39       | 43.3                   | 81       | 90       | 175.5    | 195      | 51.6     | 48.8                 | 43.9     | 103.2    | 97.5     | 87.8     | 216.2    | 204.2    | 183.8    |
| 11              | 3   | 3              | 2          | 16-QAM   | 1/2   | 52       | 57.8                   | 108      | 120      | 234      | 260      | 68.8     | 65                   | 58.5     | 137.6    | 130      | 117      | 288.2    | 272.2    | 245      |
| 12              | 4   | 4              | 2          | 16-QAM   | 3/4   | 78       | 86.7                   | 162      | 180      | 351      | 390      | 103.2    | 97.5                 | 87.8     | 206.5    | 195      | 175.5    | 432.4    | 408.3    | 367.5    |
| 13              | 5   | 5              | 2          | 64-QAM   | 2/3   | 104      | 115.6                  | 216      | 240      | 468      | 520      | 137.6    | 130                  | 117      | 275.3    | 260      | 234      | 576.5    | 544.4    | 490      |
| 14              | 6   | 6              | 2          | 64-QAM   | 3/4   | 117      | 130                    | 243      | 270      | 526.5    | 585      | 154.9    | 146.3                | 131.6    | 309.7    | 292.5    | 263.3    | 648.5    | 612.5    | 551.3    |
| 15              | 7   | 7              | 2          | 64-QAM   | 5/6   | 130      | 144.4                  | 270      | 300      | 585      | 650      | 172.1    | 162.5                | 146.3    | 344.1    | 325      | 292.5    | 720.6    | 680.6    | 612.5    |
| 8               | 8   | 8              | 2          | 256-QAM  | 3/4   | 156      | 173.3                  | 324      | 360      | 702      | 780      | 206.5    | 195                  | 175.5    | 412.9    | 390      | 351      | 864.7    | 816.7    | 735      |
| 9               | 9   | 9              | 2          | 256-QAM  | 5/6   | N/A      | N/A                    | 360      | 400      | 780      | 866.7    | 229.4    | 216.7                | 195      | 458.8    | 433.3    | 390      | 960.8    | 907.4    | 816.7    |
| 10              | 10  | 10             | 2          | 1024-QAM | 3/4   | N/A      | N/A                    | 400      | 440      | 880      | 966.7    | 258.1    | 243.8                | 219.4    | 516.2    | 487.5    | 438.8    | 1080.9   | 1020.8   | 918.8    |
| 11              | 11  | 11             | 2          | 1024-QAM | 5/6   | N/A      | N/A                    | 440      | 480      | 960      | 1020.8   | 286.8    | 270.8                | 243.8    | 573.5    | 541.7    | 487.5    | 1201     | 1134.3   | 1020.8   |

| OFDMA (IEEE 802.11ax) |                |            |        |            |          |            |          |             |          |             |          |             |          |             |          |
|-----------------------|----------------|------------|--------|------------|----------|------------|----------|-------------|----------|-------------|----------|-------------|----------|-------------|----------|
| MCS Index             | Spatial Stream | Modulation | Coding | 25-tone RU |          | 52-tone RU |          | 106-tone RU |          | 242-tone RU |          | 484-tone RU |          | 996-tone RU |          |
| HE                    |                |            |        | 0.8us GI   | 1.6us GI | 0.8us GI   | 1.6us GI | 0.8us GI    | 1.6us GI | 0.8us GI    | 1.6us GI | 0.8us GI    | 1.6us GI | 0.8us GI    | 1.6us GI |
| 0                     | 1              | BPSK       | 1/2    | 0.9        | 0.8      | 0.8        | 1.8      | 1.7         | 1.5      | 3.8         | 3.5      | 3.2         | 8.6      | 8.1         | 7.3      |
| 1                     | 1              | QPSK       | 1/2    | 1.8        | 1.7      | 1.5        | 3.5      | 3.3         | 3        | 7.5         | 7.1      | 6.4         | 17.2     | 16.3        | 14.6     |
| 2                     | 1              | QPSK       | 3/4    | 2.6        | 2.5      | 2.3        | 5.3      | 5           | 4.5      | 11.3        | 10.6     | 9.6         | 25.8     | 24.4        | 21.9     |
| 3                     | 1              | 16-QAM     | 1/2    | 3.5        | 3.3      | 3          | 7.1      | 6.7         | 6        | 15          | 14.2     | 12.8        | 34.4     | 32.5        | 29.3     |
| 4                     | 1              | 16-QAM     | 3/4    | 5.3        | 5        | 4.5        | 10.6     | 10          | 9        | 22.5        | 21.3     | 19.1        | 51.6     | 48.8        | 43.9     |
| 5                     | 1              | 64-QAM     | 2/3    | 7.1        | 6.7      | 6          | 14.1     | 13.3        | 12       | 30          | 28.3     | 25.5        | 68.8     | 65          | 58.5     |
| 6                     | 1              | 64-QAM     | 3/4    | 7.9        | 7.5      | 6.8        | 15.9     | 15          | 13.5     | 33.8        | 31.9     | 28.7        | 77.4     | 73.1        | 65.8     |
| 7                     | 1              | 64-QAM     | 5/6    | 8.6        | 8.3      | 7.5        | 17.6     | 16.7        | 15       | 37.5        | 35.4     | 31.9        | 89       | 81.3        | 73.1     |
| 8                     | 1              | 256-QAM    | 3/4    | 10.6       | 10       | 9          | 21.2     | 20          | 18       | 45          | 42.5     | 38.3        | 103.2    | 97.5        | 87.8     |
| 9                     | 1              | 256-QAM    | 5/6    | 11.8       | 11.1     | 10         | 23.5     | 22.2        | 20       | 50          | 47.2     | 42.5        | 114.7    | 108.3       | 97.5     |
| 10                    | 1              | 1024-QAM   | 3/4    | 13.2       | 12.5     | 11.3       | 26.5     | 25          | 22.5     | 56.3        | 53.1     | 47.8        | 129      | 121.9       | 109.7    |
| 11                    | 1              | 1024-QAM   | 5/6    | 14.7       | 13.9     | 12.5       | 29.4     | 27.8        | 25       | 62.5        | 59       | 53.1        | 143.4    | 135.4       | 121.9    |
| 0                     | 2              | BPSK       | 1/2    | 1.8        | 1.7      | 1.5        | 3.5      | 3.3         | 3        | 7.5         | 7.1      | 6.4         | 17.2     | 16.3        | 14.6     |
| 1                     | 2              | QPSK       | 1/2    | 3.5        | 3.3      | 3          | 7.1      | 6.7         | 6        | 15          | 14.2     | 12.8        | 34.4     | 32.5        | 29.3     |
| 2                     | 2              | QPSK       | 3/4    | 5.3        | 5        | 4.5        | 10.6     | 10          | 9        | 22.5        | 21.3     | 19.1        | 51.6     | 48.8        | 43.9     |
| 3                     | 2              | 16-QAM     | 1/2    | 7.1        | 6.7      | 6          | 14.1     | 13.3        | 12       | 30          | 28.3     | 25.5        | 68.8     | 65          | 58.5     |
| 4                     | 2              | 16-QAM     | 3/4    | 10.6       | 10       | 9          | 21.2     | 20          | 18       | 45          | 42.5     | 38.3        | 103.2    | 97.5        | 87.8     |
| 5                     | 2              | 64-QAM     | 2/3    | 14.1       | 13.3     | 12         | 28.2     | 26.7        | 24       | 60          | 56.7     | 51          | 137.6    | 130         | 117      |
| 6                     | 2              | 64-QAM     | 3/4    | 15.9       | 15       | 13.5       | 31.9     | 30          | 27       | 67.5        | 63.8     | 57.4        | 154.9    | 146.3       | 131.6    |
| 7                     | 2              | 64-QAM     | 5/6    | 17.6       | 16.7     | 15         | 35.3     | 33.3        | 30       | 75          | 70.8     | 63.8        | 172.1    | 162.5       | 146.3    |
| 8                     | 2              | 256-QAM    | 3/4    | 21.2       | 20       | 18         | 42.4     | 40          | 36       | 90          | 85       | 75.5        | 206.5    | 195         | 175.5    |
| 9                     | 2              | 256-QAM    | 5/6    | 23.5       | 22.2     | 20         | 47.1     | 44.4        | 40       | 100         | 94.4     | 85          | 229.4    | 216.7       | 195      |
| 10                    | 2              | 1024-QAM   | 3/4    | 26.5       | 25       | 22.5       | 52.9     | 50          | 45       | 112.5       | 105.3    | 95.6        | 258.1    | 243.8       | 219.4    |
| 11                    | 2              | 1024-QAM   | 5/6    | 29.4       | 27.8     | 25         | 58.8     | 55.6        | 50       | 125         | 118.1    | 106.3       | 286.8    | 270.8       | 243.8    |

**802.11ax/ac/n Spatial Streams** 2 (2x2 MU-MIMO)

**Bluetooth Data Rates Supported** 1, 2, 3 Mbps

**Bluetooth Modulation** GFSK @ 1 Mbps  
Pi/4-DQPSK @ 2 Mbps  
8-DPSK @ 3 Mbps

**Bluetooth LE Data Rates Supported** 1, 2 Mbps, 500 Kbps (S=2), 125 Kbps (S=8)

**Bluetooth LE Modulation** GFSK @ 1, 2 Mbps  
GFSK @ 125, 500 Kbps


**Regulatory Certifications** United States (FCC)  
EU - Member countries of European Union (ETSI)  
Great Britain (UKCA)  
Canada (ISED)  
Australia (RCM): **To be added in the feature.**  
Japan (MIC): **To be added in the feature.**



| Feature  | Description  |
|--|--|
| <b>2.4 GHz Frequency Bands</b>   | <b>EU:</b> 2.4 GHz to 2.483 GHz<br><b>FCC/ISED:</b> 2.4 GHz to 2.473 GHz<br><b>UKCA:</b> 2.4 GHz to 2.483 GHz<br><b>MIC:</b> 2.4 GHz to 2.483 GHz<br><b>RCM:</b> 2.4 GHz to 2.483 GHz  |
| <b>2.4 GHz Operating Channels (Wi-Fi)</b>  | <b>EU:</b> 13 (3 non-overlapping)<br><b>FCC/ISED:</b> 11 (3 non-overlapping)<br><b>UKCA:</b> 13 (3 non-overlapping)<br><b>MIC:</b> 13 (4 non-overlapping)<br><b>RCM:</b> 13 (3 non-overlapping)  |
| <b>5 GHz Frequency Bands</b>   | <b>EU</b><br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124/128/132/136/140)<br>5.725 GHz to 5.85 GHz (Ch 149/153/157/161/165)<br><b>FCC</b><br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124/128/132/136/140/144)<br>5.725 GHz to 5.85 GHz (Ch 149/153/157/161/165)<br><b>ISED</b><br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/132/136/140/144)<br>5.725 GHz to 5.85 GHz (Ch 149/153/157/161/165)<br><b>UKCA</b><br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.730 GHz (Ch 100/104/108/112/116/120/124/128/132/136/140/144)<br>5.725 GHz to 5.850 GHz (Ch 149/153/157/161/165)<br><b>MIC</b><br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124/128/132/136/140)<br><b>RCM</b><br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/132/136/140)<br>5.725 GHz to 5.85 GHz (Ch 149/153/157/161/165) |
| <b>5 GHz Operating Channels (Wi-Fi)</b>  | <b>EU:</b> 24 non-overlapping; <b>FCC:</b> 25 non-overlapping<br><b>ISED:</b> 22 non-overlapping; <b>MIC:</b> 19 non-overlapping<br><b>RCM:</b> 21 non-overlapping; <b>UKCA:</b> 25 non-overlapping  |
| <b>Transmit Power</b>  | <b>802.11a</b><br>6 Mbps <b>16.5 dBm (44.66mW)</b><br>54 Mbps <b>16 dBm (39.81mW)</b><br><b>802.11b</b><br>1 Mbps <b>17 dBm (50.11 mW)</b><br>11 Mbps <b>17 dBm (50.11mW)</b><br><b>802.11g</b><br>6 Mbps <b>16.5 dBm (44.66 mW)</b><br>54 Mbps <b>16 dBm (39.81 mW)</b><br><b>802.11n (2.4 GHz)</b><br>HT20; MCS0-4, MCS8-12 <b>16 dBm (39.81 mW)</b><br>HT20; MCS5-7, MCS13-15 <b>15 dBm (31.62 mW)</b>  |
| <p><b>Note:</b> Transmit power on each channel varies per individual country regulations. All values are nominal with +/- 2 dBm tolerance at room temperature. Tolerance could be up to +/- 2.5 dBm across operating temperature.</p> <p><b>Note:</b> HT20/VHT20/HE20 – 20 MHz-wide channels</p> |  |

| Feature   | Description               |                       |
|---|---------------------------|-----------------------|
| <i>HT40/VHT40/HE40 –<br/>40 MHz-wide channels</i> | <b>802.11ax (2.4 GHz)</b> |                       |
|   | HE20; MCS0-4              | 16 dBm (39.81 mW)     |
|   | HE20; MCS5-7              | 15 dBm (31.62 mW)     |
|   | HE20; MCS8-9              | 14 dBm (25.12 mW)     |
| <i>HT80/VHT80/HE80 –<br/>80 MHz-wide channels</i> | HE20; MCS10-11            | 14 dBm (25.12 mW)     |
|   | <b>802.11n (5 GHz)</b>    |                       |
|   | HT20; MCS0-4, MCS8-12     | 16.5 dBm (44.66 mW)   |
|   | HT20; MCS5-7, MCS13-15    | 16 dBm (39.81 mW)     |
|   | HT40; MCS0-4, MCS8-12     | 16 dBm (39.81 mW)     |
|   | HT40; MCS5-7, MCS13-15    | 16 dBm (39.81 mW)     |
|   | <b>802.11ac (5 GHz)</b>   |                       |
|   | VHT20; MCS0-4             | 16.5 dBm (44.66 mW)   |
|   | VHT20; MCS5-7             | 16 dBm (39.81 mW)     |
|   | VHT20; MCS8               | 14 dBm (25.12 mW)     |
|   | VHT40; MCS0-4             | 16 dBm (39.81 mW)     |
|   | VHT40; MCS5-7             | 15 dBm (31.62 mW)     |
|   | VHT40; MCS8-9             | 14 dBm (25.12 mW)     |
|   | VHT80; MCS0-4             | 16 dBm (39.81 mW)     |
|   | VHT80; MCS5-7             | 15 dBm (31.62 mW)     |
|   | VHT80; MCS8-9             | 14 dBm (25.12 mW)     |
|   | <b>802.11ax (5 GHz)</b>   |                       |
|   | HE20; MCS0-4              | 16.5 dBm (44.66 mW)   |
|   | HE20; MCS5-7              | 16 dBm (39.81 mW)     |
|   | HE20; MCS8-9              | 14 dBm (25.12 mW)     |
|   | HE20; MCS10-11            | 13 dBm (19.95 mW)     |
|   | HE40; MCS0-4              | 16 dBm (39.81 mW)     |
|   | HE40; MCS5-7              | 15 dBm (31.62 mW)     |
|   | HE40; MCS8-9              | 14 dBm (25.12 mW)     |
|   | HE40; MCS10-11            | 12 dBm (15.85 mW)     |
|   | HE80; MCS0-4              | 16 dBm (39.81 mW)     |
|   | HE80; MCS5-7              | 15 dBm (31.62 mW)     |
|   | HE80; MCS8-9              | 14 dBm (15.85 mW)     |
|   | HE80; MCS10-11            | 12 dBm (12.59 mW)     |
|   | <b>Bluetooth</b>          |                       |
|   | 1 Mbps (1DH1, 3, 5)       | 7 dBm (5 mW), Maximum |
|   | 2 Mbps (2DH1, 3, 5)       | 7 dBm (5 mW), Maximum |
|   | 3 Mbps (3DH1, 3, 5)       | 7 dBm (5 mW), Maximum |
|   | LE (1 Mbps, 2 Mbps)       | 7 dBm (5 mW), Maximum |
|   | LE-LR (S=2, S=8)          | 7 dBm (5 mW), Maximum |

| Feature  | Description   |       |
|--|---|-------|
| <b>Typical Receiver Sensitivity</b><br>(PER <= 10%)<br><i>Note: All values nominal, +/- 3 dBm.</i> | <b>802.11a:</b><br>6 Mbps -92 dBm<br>54 Mbps -75 dBm  |       |
|  | <b>802.11b:</b><br>1 Mbps -96 dBm (PER < 8%)<br>11 Mbps -89 dBm (PER < 8%)  |       |
|  | <b>802.11g:</b><br>6 Mbps -93 dBm<br>54 Mbps -76 dBm  |       |
|  | <b>802.11n (2.4 GHz)</b><br>6.5 Mbps (MCS0; HT20) -93 dBm<br>65 Mbps (MCS7; HT20) -74.5 dBm   |       |
|  | <b>802.11ax (2.4 GHz)</b><br>7.3 Mbps (MCS0; HE20) -93 dBm<br>121.9 Mbps (MCS11; HE20) -63 dBm<br>7.3 Mbps (MCS0; HE20/RU242) -93 dBm   |       |
|  | <b>802.11n (5 GHz)</b><br>6.5 Mbps (MCS0; HT20) -92 dBm<br>65 Mbps (MCS7; HT20) -73 dBm<br>13.5Mbps (MCS0; HT40) -89 dBm<br>135Mbps (MCS7; HT40) -70 dBm  |       |
|  | <b>802.11ac (5 GHz)</b><br>6.5 Mbps (MCS0; VHT20) -92 dBm<br>78 Mbps (MCS8; VHT20) -69 dBm<br>13.5 Mbps (MCS0; VHT40) -89 dBm<br>180 Mbps (MCS9; VHT40) -64 dBm<br>29.3 Mbps (MCS0; VHT80) -86 dBm<br>390 Mbps (MCS9; VHT80) -61 dBm  |       |
|  | <b>802.11ax (5 GHz)</b><br>7.3 Mbps (MCS0; HE20) -91 dBm<br>121.9 Mbps (MCS11; HE20) -62 dBm<br>7.3 Mbps (MCS0; HE20/RU242) -92 dBm<br>14.6 Mbps (MCS0; HE40) -89 dBm<br>243.8 Mbps (MCS11; HE40) -59 dBm<br>14.6 Mbps (MCS0; HE40/RU484) -89 dBm<br>30.6 Mbps (MCS0; HE80) -86 dBm<br>510.4 Mbps (MCS11; HE80) -55 dBm<br>30.6 Mbps (MCS0; HE80/RU996) -86 dBm |       |
|  | <b>Bluetooth:</b><br>1 Mbps (1DH5) -94 dBm<br>2Mbps (2DH5) -93 dBm<br>3 Mbps (3DH5) -88 dBm<br>LE-1 Mbps -96 dBm<br>LE-2 Mbps -93 dBm<br>LE-LR (S=2) -101 dBm<br>LE-LR (S=8) -104 dBm   |       |
|  | <b>Operating Systems Supported</b>  | Linux |

| Feature  | Description  |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
|--|--|------------|-----------------|--------------|------------|---------------|------------|------------|-------------------|------------------------|---------|------------------------|---------|------------------------|--|------------------|--|--|--|--|-----------------------------------|--|----------------------|
| <b>Security</b>  | <ul style="list-style-type: none"> <li>WPA, WPA2 (Enterprise) and WPA3 (Enterprise) support for powerful encryption and authentication</li> <li>AES and TKIP in hardware for faster data encryption and IEEE 802.11i compatibility</li> <li>Reference WLAN subsystem provides Wi-Fi Protected Setup (WPS)</li> </ul>   |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
| <b>Compliance</b>  | <p><b>EU</b></p> <table border="1"> <tr> <td>EN 300 328</td> <td>EN 62368-1:2014</td> </tr> <tr> <td>EN 301 489-1</td> <td>EN 300 440</td> </tr> <tr> <td>EN 301 489-17</td> <td>EN 303 687</td> </tr> <tr> <td>EN 301 893</td> <td>2011/65/EU (RoHS)</td> </tr> </table> <p><b>FCC</b></p> <table border="1"> <tr> <td>47 CFR FCC Part 15.247</td> <td>RSS-247</td> </tr> <tr> <td>47 CFR FCC Part 15.407</td> <td>RSS-248</td> </tr> <tr> <td>47 CFR FCC Part 2.1091</td> <td></td> </tr> </table> <p><b>AS/NZS</b></p> <table border="1"> <tr> <td>AS/NZS 4268:2017</td> <td></td> </tr> </table> <p><b>ISED Canada</b></p> <table border="1"> <tr> <td></td> <td></td> </tr> </table> <p><b>MIC</b></p> <table border="1"> <tr> <td></td> <td>ARIB STD-T66/RCR STD-33 (2.4 GHz)</td> </tr> <tr> <td></td> <td>ARIB STD-T71 (5 GHz)</td> </tr> </table> | EN 300 328 | EN 62368-1:2014 | EN 301 489-1 | EN 300 440 | EN 301 489-17 | EN 303 687 | EN 301 893 | 2011/65/EU (RoHS) | 47 CFR FCC Part 15.247 | RSS-247 | 47 CFR FCC Part 15.407 | RSS-248 | 47 CFR FCC Part 2.1091 |  | AS/NZS 4268:2017 |  |  |  |  | ARIB STD-T66/RCR STD-33 (2.4 GHz) |  | ARIB STD-T71 (5 GHz) |
| EN 300 328   | EN 62368-1:2014  |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
| EN 301 489-1   | EN 300 440   |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
| EN 301 489-17  | EN 303 687   |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
| EN 301 893   | 2011/65/EU (RoHS)  |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
| 47 CFR FCC Part 15.247   | RSS-247  |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
| 47 CFR FCC Part 15.407   | RSS-248  |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
| 47 CFR FCC Part 2.1091   |  |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
| AS/NZS 4268:2017   |  |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
|  |  |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
|  | ARIB STD-T66/RCR STD-33 (2.4 GHz)  |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
|  | ARIB STD-T71 (5 GHz)   |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
| <b>Certifications</b>  | <p><b>Bluetooth® SIG Qualification</b></p> <p><b>TBD</b></p>    |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
| <b>Warranty</b>  | One Year Warranty  |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |
| <b>All specifications are subject to change without notice</b> |  |            |                 |              |            |               |            |            |                   |                        |         |                        |         |                        |  |                  |  |  |  |  |                                   |  |                      |

### 3 WLAN FUNCTIONAL DESCRIPTION

#### 3.1 Overview

The Sona MT320 series wireless module is designed based on the MediaTek MT7921LSN SoC chipset (2x2 MIMO). It is optimized for high speed, reliability, and low-power embedded applications. It is integrated with dual-band WLAN (2.4/5 GHz) and Bluetooth 5.3. Its functionality is listed in [Table 4](#).

**Table 4: WLAN functions**

| Feature              | Description  |
|----------------------|--|
| <b>WLAN MAC</b>      | <ul style="list-style-type: none"> <li>▪ Support all data rates of 802.11a/g including 6, 9, 12, 18, 24, 36, 48, and 54 Mbps.</li> <li>▪ Support short GI and all data rates of 802.11n including MCS0 to MCS7</li> <li>▪ Support 802.11ac MCS0 to MCS9</li> <li>▪ Support 802.11ax MCS0 to MCS11</li> <li>▪ AMPDU/AMSDU RX (de-aggregation) and TX (aggregation) support</li> <li>▪ TX rate adaptation</li> <li>▪ TX power control</li> <li>▪ Security               <ul style="list-style-type: none"> <li>○ 64-bit WEP (WEP-40) and 128-bit WEP (WEP-104) encryption with hardware TKIP and CKIP processing</li> <li>○ AES-CCMP hardware processing</li> <li>○ GCMP hardware processing</li> <li>○ SMS4-WPI (WAPI) hardware processing</li> </ul> </li> <li>▪ Low power beacon filtering</li> <li>▪ Management/control frame filtering</li> </ul> |
| <b>WLAN Security</b> | <ul style="list-style-type: none"> <li>▪ WLAN Encryption features supported include:               <ul style="list-style-type: none"> <li>– Temporal Key Integrity Protocol (TKIP)/Wired Equivalent Privacy (WEP)</li> <li>– Advanced Encryption Standard (AES)/Wi-Fi Multi-Media (WMM)</li> <li>– WLAN Authentication and Private Infrastructure (WPAI)</li> </ul> </li> </ul>  |

| Feature      | Description                  |         |                 |         |                 |         |                 |  |
|--------------|------------------------------|---------|-----------------|---------|-----------------|---------|-----------------|--|
| WLAN Channel | Channel frequency supported. |         |                 |         |                 |         |                 |  |
|              | 2.4 GHz / 20 MHz             |         | 5 GHz / 20 MHz  |         | 5 GHz / 40 MHz  |         | 5 GHz / 80 MHz  |  |
| Channel      | Frequency (MHz)              | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |  |
| 1            | 2412                         | 36      | 5180            | 38      | 5190            | 42      | 5210            |  |
| 2            | 2417                         | 40      | 5200            | 46      | 5230            | 58      | 5290            |  |
| 3            | 2422                         | 44      | 5220            | 54      | 5270            | 106     | 5530            |  |
| 4            | 2427                         | 48      | 5240            | 62      | 5310            | 122     | 5610            |  |
| 5            | 2432                         | 52      | 5260            | 102     | 5510            | 138     | 5690            |  |
| 6            | 2437                         | 56      | 5280            | 110     | 5550            | 155     | 5775            |  |
| 7            | 2442                         | 60      | 5300            | 118     | 5590            |         |                 |  |
| 8            | 2447                         | 64      | 5320            | 126     | 5630            |         |                 |  |
| 9            | 2452                         | 100     | 5500            | 134     | 5670            |         |                 |  |
| 10           | 2457                         | 104     | 5520            | 142     | 5710            |         |                 |  |
| 11           | 2462                         | 108     | 5540            | 151     | 5755            |         |                 |  |
| 12           | 2467                         | 112     | 5560            | 159     | 5795            |         |                 |  |
| 13           | 2472                         | 116     | 5580            |         |                 |         |                 |  |
|              |                              | 120     | 5600            |         |                 |         |                 |  |
|              |                              | 124     | 5620            |         |                 |         |                 |  |
|              |                              | 128     | 5640            |         |                 |         |                 |  |
|              |                              | 132     | 5660            |         |                 |         |                 |  |
|              |                              | 136     | 5680            |         |                 |         |                 |  |
|              |                              | 140     | 5700            |         |                 |         |                 |  |
|              |                              | 144     | 5720            |         |                 |         |                 |  |
|              |                              | 149     | 5745            |         |                 |         |                 |  |
|              |                              | 153     | 5765            |         |                 |         |                 |  |
|              |                              | 157     | 5785            |         |                 |         |                 |  |
|              |                              | 161     | 5805            |         |                 |         |                 |  |
|              |                              | 165     | 5825            |         |                 |         |                 |  |

## 4 BLUETOOTH FUNCTIONAL DESCRIPTION

The Sona MT320 series wireless module includes a fully integrated Bluetooth baseband/radio. Several features and functions are listed in [Table 5](#).

**Table 5: Bluetooth functions**

| Feature                    | Description  |
|----------------------------|--|
| <b>Bluetooth Interface</b> | <ul style="list-style-type: none"> <li>▪ Voice interface: PCM/I2S</li> <li>▪ SDIO interface</li> </ul>   |
| <b>Bluetooth Features</b>  | <ul style="list-style-type: none"> <li>▪ Bluetooth 5.4                             <ul style="list-style-type: none"> <li>○ LE 2M PHY and LE Coded PHY</li> <li>○ LE Extended Advertising and Periodic Advertising</li> <li>○ LE high duty cycle non-connectable ADV</li> <li>○ Channel Selection Algorithm #2</li> <li>○ Angle of Arrival (AoA) and Angle of Departure (AoD)</li> <li>○ Connected Isochronous Stream master and slave.</li> <li>○ Isochronous Broadcaster and Synchronized Receiver</li> </ul> </li> <li>▪ Compatible Bluetooth 4.2                             <ul style="list-style-type: none"> <li>○ LE privacy 1.2</li> <li>○ LE Data Packet Length Extension</li> <li>○ LE security connection</li> </ul> </li> <li>▪ Single-ended, RF port with integrated Balun and T/R switch</li> <li>▪ Integrated high efficiency PA and TSSI</li> <li>▪ Baseband and radio BDR and EDR packet types: 1Mbps (GFSK), 2Mbps (<math>\pi/4</math>-DQPSK), and 3Mbps (8PSK).</li> <li>▪ Fully functional Bluetooth baseband: AFH, forward error correction, header error control, access code correlation, CRC, whitening.</li> <li>▪ Standard pairing, authentication, link key, and encryption operation.</li> <li>▪ Standard power saving mechanisms: sniff mode and sniff-subrating.</li> <li>▪ Interlaced scan for faster connection setup</li> <li>▪ Up to 7 simultaneous active ACL connections with background inquiry and page scan</li> <li>▪ Up to 16 BLE links</li> <li>▪ Scatternet support</li> <li>▪ Channel quality driven data rate control</li> <li>▪ WB RSSI support. Monitor environment air condition to select good channel for AFH</li> <li>▪</li> </ul> |

## 5 BLOCK DIAGRAMS

### 5.1 M.2 1420

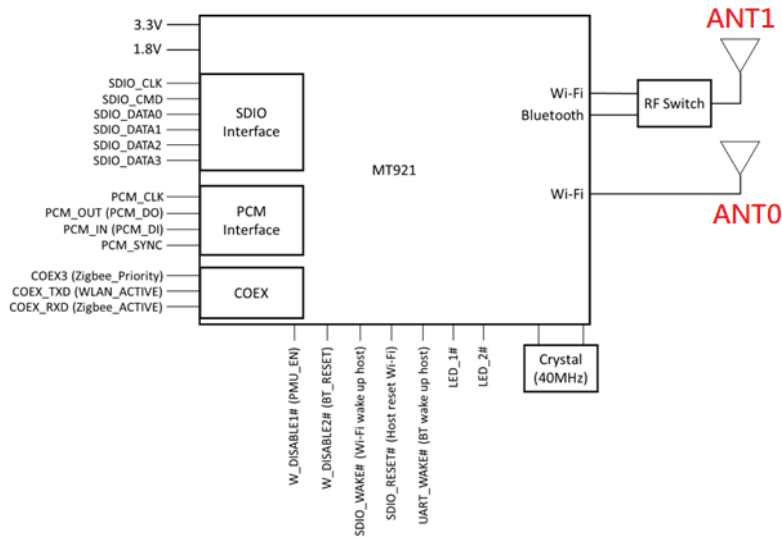


Figure 1: Block Diagram for M.2 1420 module.

### 5.2 M.2 2230 E-Key

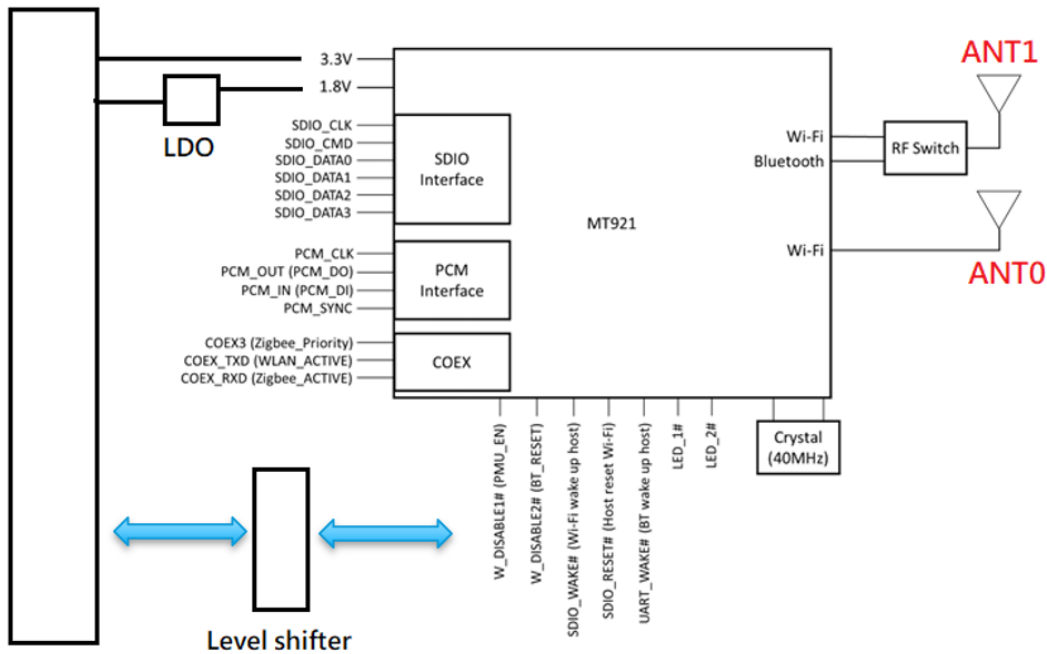


Figure 2: M.2 2230 E-Key



## 6 ELECTRICAL CHARACTERISTICS

### 6.1 Absolute Maximum Ratings

Table 6 summarizes the absolute maximum ratings and Table 7 lists the recommended operating conditions for the Sona MT320 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 6: Absolute maximum ratings**

| Symbol (Domain) | Description                                  | Max Rating   | Unit |
|-----------------|--|--------------|------|
| 3V3             | External 3.3V power supply (M.2 2230 E-Key)  | -0.3 to 3.63 | V    |
| VIO_1.8V        | DC supply voltage for digital I/O (M.2 1318) | -0.3 to 1.98 | V    |
| Storage         | Storage temperature                          | -40 to +125  | °C   |
| Antenna         | Maximum RF input (reference to 50-Ω input)   | +10          | dBm  |
| ESD             | Electrostatic discharge tolerance            | 2000         | V    |

### 6.2 Recommended Operating Conditions

**Table 7: Recommended operating conditions**

| Symbol (Domain) | Parameter                         | Min  | Typ  | Max  | Unit |
|-----------------|-----------------------------------|------|------|------|------|
| 3.3V            | External DC power supply          | 3.13 | 3.30 | 3.6  | V    |
| VIO_1.8V        | DC supply voltage for digital I/O | 1.71 | 1.8  | 1.89 | V    |
| T-ambient       | Ambient temperature               | -40  | 25   | +85  | °C   |

### 6.3 DC Electrical Characteristics

Table 8 lists the general DC electrical characteristics over recommended operating conditions (unless otherwise specified).

**Table 8: General DC electrical characteristics (For VIO\_1.8V=1.8V operation)**

| Symbol | Parameter                | Conditions | Min  | Typ | Max          | Unit |
|--------|--------------------------|------------|------|-----|--------------|------|
| VIH    | High Level Input Voltage | —          | 1.27 | —   | VIO_1.8V+0.3 | V    |
| VIL    | Low Level Input Voltage  | —          | -0.3 | —   | 0.58         | V    |
| VOH    | Output high Voltage      | —          | 1.4  | —   | VIO_1.8V+0.3 | V    |
| VOL    | Output low Voltage       | —          | -0.3 | —   | 0.45         | V    |

## 6.4 WLAN Radio Receiver Characteristics

Table 9, Table 10, and Table 11 summarize the Sona MT320 series wireless module receiver characteristics.

**Table 9: WLAN receiver characteristics for 2.4 GHz operation**

| Item  | Parameter                     | Conditions            | Min   | Typ | Max   | Unit |
|---|-------------------------------|-----------------------|-------|-----|-------|------|
| Frequency Range                               | Receive input frequency range | —                     | 2.412 | —   | 2.484 | GHz  |
| Modulation Type                               | Sensitivity                   |                       |       |     |       |      |
|   | CCK, 1 Mbps                   | See Note <sup>1</sup> | —     | -96 | —     | dBm  |
|   | CCK, 11 Mbps                  |                       | —     | -89 | —     |      |
|   | OFDM, 6 Mbps                  |                       | —     | -93 | —     |      |
|   | OFDM, 54 Mbps                 |                       | —     | -76 | —     |      |
|   | HT20, MCS0                    |                       | —     | -93 | —     |      |
|   | HT20, MCS7                    |                       | —     | -74 | —     |      |
|   | HE20, MCS0                    |                       | —     | -93 | —     |      |
| HE20, MCS11                                   |                               | —                     | -63   | —   |       |      |
| Receive Adjacent channel rejection.           | OFDM, 6 Mbps                  | See Note <sup>1</sup> | —     | 41  | —     | dB   |
|   | OFDM, 54 Mbps                 |                       | —     | 25  | —     |      |
| Receive Adjacent channel rejection.<br>(HT20) | HT20, MCS0                    |                       | —     | 36  | —     |      |
|   | HT20, MCS7                    |                       | —     | 13  | —     |      |
| Receive Adjacent channel rejection.<br>(HT40) | HE20, MCS0                    |                       | —     | 27  | —     |      |
|   | HE20, MCS7                    |                       | —     | 7   | —     |      |

**Table 10: WLAN receiver characteristics for 5 GHz operation**

| Item            | Parameter                     | Conditions            | Min  | Typ | Max   | Unit |
|-----------------|-------------------------------|-----------------------|------|-----|-------|------|
| Frequency Range | Receive input frequency range | —                     | 5.15 | —   | 5.825 | GHz  |
| Modulation Type | Sensitivity                   |                       |      |     |       |      |
|                 | OFDM, 6 Mbps                  | See Note <sup>1</sup> | —    | -92 | —     | dBm  |
|                 | OFDM, 54 Mbps                 |                       | —    | -75 | —     |      |
|                 | HT20, MCS0                    |                       | —    | -92 | —     |      |
|                 | HT20, MCS7                    |                       | —    | -73 | —     |      |
|                 | HT40, MCS0                    |                       | —    | -89 | —     |      |
|                 | HT40, MCS7                    |                       | —    | -70 | —     |      |
|                 | VHT20, MCS0                   |                       | —    | -92 | —     |      |
|                 | VHT20, MCS8                   |                       | —    | -69 | —     |      |
|                 | VHT40, MCS0                   |                       | —    | -89 | —     |      |
|                 | VHT40, MCS9                   |                       | —    | -64 | —     |      |
|                 | VHT80, MCS0                   |                       | —    | -86 | —     |      |
|                 | VHT80, MCS9                   |                       | —    | -61 | —     |      |
|                 | HE20, MCS0                    |                       | —    | -91 | —     |      |
|                 | HE20, MCS11                   |                       | —    | -62 | —     |      |
|                 | HE40, MCS0                    |                       | —    | -89 | —     |      |
|                 | HE40, MCS11                   |                       | —    | -59 | —     |      |
|                 | HE80, MCS0                    |                       | —    | -86 | —     |      |
|                 | HE80, MCS11                   |                       | —    | -55 | —     |      |

| Item                               | Parameter | Conditions            | Min | Typ | Max | Unit |
|------------------------------------|-----------|-----------------------|-----|-----|-----|------|
| Adjacent channel rejection (VHT20) | MCS0      | See Note <sup>1</sup> | —   | 27  | —   | dB   |
|                                    | MCS8      |                       | —   | 0   | —   |      |
| Adjacent channel rejection (VHT40) | MCS0      | See Note <sup>1</sup> | —   | 27  | —   | dB   |
|                                    | MCS9      |                       | —   | 0   | —   |      |
| Adjacent channel rejection (VHT80) | MCS0      | See Note <sup>1</sup> | —   | 31  | —   | dB   |
|                                    | MCS9      |                       | —   | 12  | —   |      |

Note 1: Receiver sensitivity is measured at antenna port with 3.3V voltage within +/-5% of the typical values.

## 6.5 WLAN Transmitter Characteristics

Table 12 through Table 21 summarize the Sona MT320 series wireless module transmitter characteristics.

**Table 11: WLAN transmitter characteristics for 2.4 GHz operation (3.3V, VIO\_1.8V = 1.8V)**

| Symbol                  | Parameter                        | Conditions            | Min   | Typ  | Max   | Unit |
|-------------------------|----------------------------------|-----------------------|-------|------|-------|------|
| Ftx                     | Transmit output frequency range  | —                     | 2.402 | —    | 2.484 | GHz  |
| Pout                    | Output power                     | See Note <sup>2</sup> | —     | —    | —     | —    |
|                         | 11b mask compliant               | 1-11Mbps              | —     | 17   | —     | dBm  |
|                         | 11g mask compliant               | 6-24Mbps              | —     | 16.5 | —     |      |
|                         | 11g mask compliant               | 36-48Mbps             | —     | 16.5 | —     |      |
|                         | 11g EVM compliant                | 54Mbps                | —     | 16   | —     |      |
|                         | 11n HT20 mask compliant          | MCS0-4                | —     | 16   | —     |      |
|                         | 11n HT20 mask compliant          | MCS5-6                | —     | 15   | —     |      |
|                         | 11n HT20 EVM compliant           | MCS7                  | —     | 15   | —     |      |
|                         | 11ax HE20 mask compliant         | MCS0-4                | —     | 16   | —     |      |
|                         | 11ax HE20 mask compliant         | MCS5-6                | —     | 15   | —     |      |
|                         | 11ax HE20 EVM compliant          | MCS7                  | —     | 15   | —     |      |
|                         | 11ax HE20 EVM compliant          | MCS8                  | —     | 14   | —     |      |
|                         | 11ax HE20 EVM compliant          | MCS9                  | —     | 14   | —     |      |
| 11ax HE20 EVM compliant | MCS10-11                         | —                     | 14    | —    |       |      |
| ATx                     | Transmit power accuracy at 25 °C | —                     | -2.0  | —    | +2.0  | dB   |

**Table 12: WLAN current consumption on 2.4 GHz (3.3V, VIO\_1.8V = 1.8V)**

| Modulation | Data Rate  | Spatial Stream | Output Power (dBm) | 3.3V Current Consumption (mA) | VIO_1.8V Current Consumption (mA) |
|------------|------------|----------------|--------------------|-------------------------------|-----------------------------------|
| CCK        | 1 Mbps     | 2              | 19.64              | 426                           | <1                                |
| BPSK       | 6 Mbps     | 2              | 19.75              | 430                           | <1                                |
| 64-QAM     | HT20 MCS7  | 2              | 19.53              | 346                           | <1                                |
| 64-QAM     | HT20 MCS15 | 2              | 19.51              | 282                           | <1                                |
| 256-QAM    | HE20 MCS9  | 2              | 19.75              | 356                           | <1                                |
| 1024-QAM   | HE20 MCS11 | 2              | 18.99              | 234                           | <1                                |

**Table 13: WLAN transmitter characteristics for 5 GHz operation (3.3V, VIO\_1.8V = 1.8V)**

| Symbol                   | Parameter                        | Conditions            | Min  | Typ  | Max   | Unit |
|--------------------------|----------------------------------|-----------------------|------|------|-------|------|
| Ftx                      | Transmit output frequency range  | —                     | 5.15 | —    | 5.925 | GHz  |
| Pout                     | Output power                     | See Note <sup>2</sup> | —    | —    | —     | —    |
|                          | 11a mask compliant               | 6-48Mbps              | —    | 16.5 | —     | dBm  |
|                          | 11a EVM compliant                | 54Mbps                | —    | 16   | —     |      |
|                          | 11n HT20 mask compliant          | MCS0-5                | —    | 16.5 | —     |      |
|                          | 11n HT20 EVM compliant           | MCS6-7                | —    | 16   | —     |      |
|                          | 11n HT40 mask compliant          | MCS0-5                | —    | 16   | —     |      |
|                          | 11n HT40 EVM compliant           | MCS6-7                | —    | 16   | —     |      |
|                          | 11ac VHT20 mask compliant        | MCS0-5                | —    | 16.5 | —     |      |
|                          | 11ac VHT20 EVM compliant         | MCS6-7                | —    | 16   | —     |      |
|                          | 11ac VHT20 EVM compliant         | MCS8                  | —    | 14   | —     |      |
|                          | 11ac VHT40 mask compliant        | MCS0-5                | —    | 16   | —     |      |
|                          | 11ac VHT40 EVM compliant         | MCS6-7                | —    | 15   | —     |      |
|                          | 11ac VHT40 EVM compliant         | MCS8-9                | —    | 14   | —     |      |
|                          | 11ac VHT80 mask compliant        | MCS0-5                | —    | 16   | —     |      |
|                          | 11ac VHT80 EVM compliant         | MCS6-7                | —    | 15   | —     |      |
|                          | 11ac VHT80 EVM compliant         | MCS8-9                | —    | 14   | —     |      |
|                          | 11ax HE20 mask compliant         | MCS0-5                | —    | 16.5 | —     |      |
|                          | 11ax HE20 EVM compliant          | MCS6-7                | —    | 16   | —     |      |
|                          | 11ax HE20 EVM compliant          | MCS8-9                | —    | 14   | —     |      |
|                          | 11ax HE20 EVM compliant          | MCS10-11              | —    | 13   | —     |      |
| 11ax HE40 mask compliant | MCS0-5                           | —                     | 16   | —    |       |      |
| 11ax HE40 EVM compliant  | MCS6-7                           | —                     | 15   | —    |       |      |
| 11ax HE40 EVM compliant  | MCS8-9                           | —                     | 14   | —    |       |      |
| 11ax HE40 EVM compliant  | MCS10-11                         | —                     | 12   | —    |       |      |
| 11ax HE80 mask compliant | MCS0-5                           | —                     | 16   | —    |       |      |
| 11ax HE80 EVM compliant  | MCS6-7                           | —                     | 15   | —    |       |      |
| 11ax HE80 EVM compliant  | MCS8-9                           | —                     | 14   | —    |       |      |
| 11ax HE80 EVM compliant  | MCS10-11                         | —                     | 12   | —    |       |      |
| ATx                      | Transmit power accuracy at 25 °C | —                     | -2.0 | —    | +2.0  | dB   |

**Table 14: WLAN current consumption on 5 GHz (3.3V, VIO\_1.8V = 1.8V)**

| Modulation | Bandwidth (MHz) | Data Rate   | Spatial Stream | Output Power (dBm) | 3.3V Current Consumption (mA) | VIO_1.8V Current Consumption (mA) |
|------------|-----------------|-------------|----------------|--------------------|-------------------------------|-----------------------------------|
| BPSK       | 20              | 6 Mbps      | 2              | 21.66              | 682                           | <1                                |
| 64-QAM     | 20              | 54 Mbps     | 2              | 21.39              | 604                           | <1                                |
| BPSK       | 20              | HE20 MCS0   | 2              | 20.27              | 642                           | <1                                |
| 64-QAM     | 20              | HE20 MCS7   | 2              | 21.08              | 608                           | <1                                |
| 256-QAM    | 20              | HE20 MCS9   | 2              | 20.09              | 632                           | <1                                |
| 1024-QAM   | 20              | HE20 MCS11  | 2              | 17.7               | 522                           | <1                                |
| BPSK       | 40              | HE40 MCS0   | 2              | 21.01              | 790                           | <1                                |
| 64-QAM     | 40              | HE40 MCS7   | 2              | 21.72              | 450                           | <1                                |
| 256-QAM    | 40              | HE40 MCS9   | 2              | 20.48              | 390                           | <1                                |
| 1024-QAM   | 40              | HE40 MCS11  | 2              | 17.96              | 350                           | <1                                |
| BPSK       | 80              | HE 80 MCS0  | 2              | 18.87              | 622                           | <1                                |
| 64-QAM     | 80              | HE 80 MCS7  | 2              | 20.02              | 330                           | <1                                |
| 256-QAM    | 80              | HE 80 MCS9  | 2              | 20.01              | 330                           | <1                                |
| 1024-QAM   | 80              | HE 80 MCS11 | 2              | 17.18              | 244                           | <1                                |

Note 2: TX power is measured at 3.3V within 5% at antenna port. Temperature us at 25 degree C.

## 7 BLUETOOTH RADIO CHARACTERISTICS

Table 16 through Table 17 describe the performance of the Bluetooth transmitter and receiver and the current consumption at 25°C.

Table 15: BR / EDR transmitter performance (3.3V, VIO\_1.8V = 1.8V)

| Test Parameter                       |                               | Min | Typ      | Max       | BT Spec.                      | Unit     |
|--------------------------------------|-------------------------------|-----|----------|-----------|-------------------------------|----------|
| Maximum RF Output Power              | GFSK                          | —   | 7        | 7         | 0 ~ +20                       | dBm      |
|                                      | $\pi/4$ -DQPSK                | —   | 7        | 7         |                               |          |
|                                      | 8-DPSK                        | —   | 7        | 7         |                               |          |
| Frequency Range                      |                               | 2.4 | —        | 2.4835    | $2.4 \leq f \leq 2.4835$      | GHz      |
| 20 dB Bandwidth                      |                               | —   | 922      | —         | $\leq 1000$                   | KHz      |
| $\Delta f_{1avg}$ Maximum Modulation |                               | 140 | 157      | 175       | $140 < \Delta f_{1avg} < 175$ | KHz      |
| $\Delta f_{2max}$ Minimum Modulation |                               | 115 | 145      | —         | $\geq 115$                    | KHz      |
| $\Delta f_{2avg}/\Delta f_{1avg}$    |                               | —   | 0.98     | —         | $\geq 0.80$                   | —        |
| Initial Carrier Frequency            |                               | —   | $\pm 18$ | $\pm 75$  | $\leq \pm 75$                 | KHz      |
| Frequency Drift (DH1 packet)         |                               | —   | $\pm 10$ | $\pm 25$  | $\pm 25$                      | KHz      |
| Frequency Drift (DH3 packet)         |                               | —   | $\pm 10$ | $\pm 40$  | $\pm 40$                      | KHz      |
| Frequency Drift (DH5 packet)         |                               | —   | $\pm 10$ | $\pm 40$  | $\pm 40$                      | KHz      |
| Drift rate                           |                               | —   | 10       | 20        | 20                            | KHz/50us |
| EDR $\omega_i$                       |                               | —   | —        | $\pm 75$  | $\leq \pm 75$                 | KHz      |
| EDR $\omega_0$                       |                               | —   | —        | $\pm 10$  | $\leq \pm 10$                 | KHz      |
| EDR ( $\omega_i + \omega_0$ )        |                               | —   | —        | $\pm 75$  | $\leq \pm 75$                 | KHz      |
| RMS DEVM for $\pi/4$ -DQPSK          |                               | —   | —        | $\leq 8$  | $\leq 20$                     | %        |
| RMS DEVM for 8-DPSK                  |                               | —   | —        | $\leq 8$  | $\leq 13$                     | %        |
| Peak DEVM for $\pi/4$ -DQPSK         |                               | —   | —        | $\leq 15$ | $\leq 35$                     | %        |
| Peak DEVM for 8-DPSK                 |                               | —   | —        | $\leq 15$ | $\leq 25$                     | %        |
| 99% DEVM for $\pi/4$ -DQPSK          |                               | —   | —        | $\leq 11$ | —                             | —        |
| 99% DEVM for 8-DPSK                  |                               | —   | —        | $\leq 11$ | —                             | —        |
| EDR In-Band Spurious Emission        | $ M-N  \geq 2.5$ MHz          | —   | -40      | -40       | $< -40$                       | dBm      |
|                                      | $1.5$ MHz $<  M-N  < 2.5$ MHz | —   | -23      | -20       | $\leq -20$                    | dBm      |
|                                      | $1.0$ MHz $<  M-N  < 1.5$ MHz | —   | -29      | -26       | $\leq -26$                    | dBm      |

**Table 17: Basic Rate receiver performance (3.3V, VIO\_1.8V = 1.8V)**

| Test Parameter                        |                                     | Min | Typ | Max | Bluetooth Spec. | Unit |
|---------------------------------------|-------------------------------------|-----|-----|-----|-----------------|------|
| Sensitivity (1DH5)                    | BER ≤ 0.1%                          | —   | -94 | —   | ≤ -70           | dBm  |
| Maximum Input                         | BER ≤ 0.1%                          | —   | —   | -20 | ≥ -20           | dBm  |
| Interference Performance              | Co-Channel                          | —   | 6   | 11  | 11              | dB   |
|                                       | C/I 1 MHz adjacent channel          | —   | -7  | 0   | 0               | dB   |
|                                       | C/I 2 MHz adjacent channel          | —   | -40 | -30 | -30             | dB   |
|                                       | C/I ≥ 3 MHz adjacent channel        | —   | -43 | -40 | -40             | dB   |
|                                       | C/I image channel                   | —   | -20 | -9  | -9              | dB   |
|                                       | C/I 1-MHz adjacent to image channel | —   | -35 | -20 | -20             | dB   |
| Out-of-Band Blocking Performance (CW) | 30-2000MHz                          | —   | -10 | —   | —               | dBm  |
|                                       | 2-2.399GHz                          | —   | -27 | —   | —               | dBm  |
|                                       | 2.484-3GHz                          | —   | -27 | —   | —               | dBm  |
|                                       | 3-12.75GHz                          | —   | -10 | —   | —               | dBm  |

**Table 18: Enhanced Data Rate receiver performance (3.3V, VIO\_1.8V = 1.8V)**

| Test Parameter                      |           | Min | Typ | Max | Bluetooth Spec. | Unit |
|-------------------------------------|-----------|-----|-----|-----|-----------------|------|
| Sensitivity (BER ≤ 0.01%)           | π/4-DQPSK | —   | -93 | —   | ≤ -70           | dBm  |
|                                     | 8-DPSK    | —   | -88 | —   | ≤ -70           | dBm  |
| Maximum Input (BER ≤ 0.1%)          | π/4-DQPSK | —   | —   | -20 | ≥ -20           | dBm  |
|                                     | 8-DPSK    | —   | —   | -20 | ≥ -20           | dBm  |
| C/I Co-Channel (BER ≤ 0.1%)         | π/4-DQPSK | —   | 9   | 13  | ≤ ±13           | dB   |
|                                     | 8-DPSK    | —   | 15  | 21  | ≤ ±21           | dB   |
| C/I 1 MHz adjacent Channel          | π/4-DQPSK | —   | -12 | 0   | ≤ 0             | dB   |
|                                     | 8-DPSK    | —   | -6  | 5   | ≤ 5             | dB   |
| C/I 2 MHz adjacent Channel          | π/4-DQPSK | —   | -40 | -30 | ≤ -30           | dB   |
|                                     | 8-DPSK    | —   | -36 | -25 | ≤ -25           | dB   |
| C/I ≥ 3 MHz adjacent Channel        | π/4-DQPSK | —   | -43 | -40 | ≤ -40           | dB   |
|                                     | 8-DPSK    | —   | -40 | -33 | ≤ -33           | dB   |
| C/I image channel                   | π/4-DQPSK | —   | -20 | -7  | ≤ -7            | dB   |
|                                     | 8-DPSK    | —   | -15 | 0   | ≤ 0             | dB   |
| C/I 1 MHz adjacent to image channel | π/4-DQPSK | —   | -40 | -20 | ≤ -20           | dB   |
|                                     | 8-DPSK    | —   | -30 | -13 | ≤ -13           | dB   |



**Table 19: BLE RF Specifications ( 3.3V, VIO\_1.8V = 1.8V)**

| Parameter                   | Conditions             | Min    | Typ | Max  | Unit |
|-----------------------------|------------------------|--------|-----|------|------|
| Frequency range             | —                      | 2402   | —   | 2480 | MHz  |
| Rx sensitivity <sup>1</sup> | GFSK, PER ≤ 30.8%      | 1 Mbps | -96 | —    | dBm  |
|                             |                        | 2 Mbps | -93 | —    | dBm  |
| Tx power <sup>2</sup>       | —                      | —      | —   | 7    | dBm  |
| Max. Usable Signal          | BLE 1Mbps(PER < 30.8%) | -10    | -   | -    | dBm  |
|                             | BLE 2Mbps(PER < 30.8%) | -10    | -   | -    | KHz  |
| C/I Co-channel              | BLE 1Mbps(PER < 30.8%) | -      | 6   | 21   | dB   |
| C/I 1MHz                    |                        | -      | -7  | 15   | dB   |
| C/I 2MHz                    |                        | -      | -30 | -17  | dB   |
| C/I ≥ 3MHz                  |                        | -      | -33 | -27  | dB   |
| C/I Image channel           | BLE 2Mbps(PER < 30.8%) | -      | -20 | -9   | dB   |
| C/I Image 1MHz              |                        | -      | -30 | -15  | dB   |
| C/I Co-channel              |                        | -      | 9   | 21   | dB   |
| C/I 1MHz                    |                        | -      | -4  | 15   | dB   |
| C/I 2MHz                    | BLE 2Mbps(PER < 30.8%) | -      | -27 | -17  | dB   |
| C/I ≥ 3MHz                  |                        | -      | -30 | -27  | dB   |
| C/I Image channel           |                        | -      | -17 | -9   | dB   |
| C/I Image 1MHz              |                        | -      | -27 | -15  | dB   |
| Out-of-band Blocking        | 30MHz to 2000MHz       | -30    | -   | -    | dBm  |
|                             | 2001MHz to 2339MHz     | -35    | -   | -    | dBm  |
|                             | 2501MHz to 3000MHz     | -35    | -   | -    | dBm  |
|                             | 3001MHz to 12.75GHz    | -30    | -   | -    | dBm  |

**Table 160: Bluetooth transmitter current consumption (3.3V, VIO\_1.8V = 1.8V)**

| Operation Mode     | Data Rate | VBAT Current Consumption (mA) | VIO Current Consumption (mA) |
|--------------------|-----------|-------------------------------|------------------------------|
| Basic Data Rate    | 1DH5      | 94                            | <1                           |
| Enhanced Data Rate | 2DH5      | 93.2                          | <1                           |
|                    | 3DH5      | 92.4                          | <1                           |
| Low-Energy         | 1 Mbps    | 108                           | <1                           |
|                    | 2 Mbps    | 92                            | <1                           |
|                    | 500 Kbps  | 94                            | <1                           |
|                    | 125 Kbps  | 93.2                          | <1                           |

**Notes:**

[1] Dirty Tx is Off.

[2] 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.

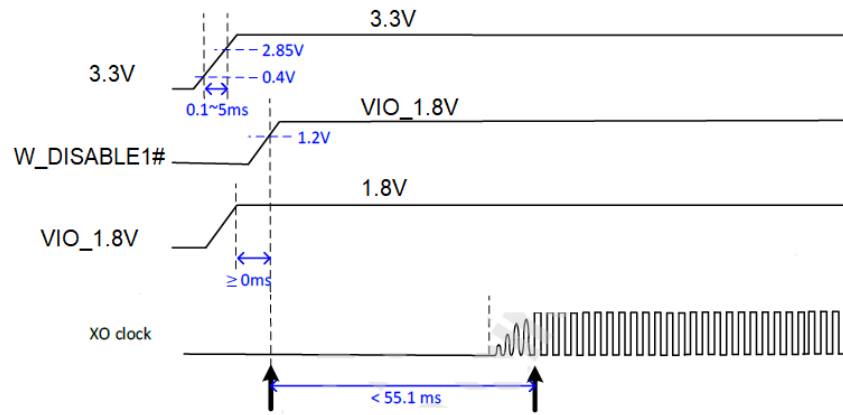
[3] At least 99.9% of all Δf2 maximum frequency values recorded over 10 packets must be greater than 185 KHz.

## 8 POWER-UP SEQUENCE AND TIMING

Sona IF573 has two signals that allow the host to control power consumption by enabling or disabling the Bluetooth, WLAN, and internal regulator block.

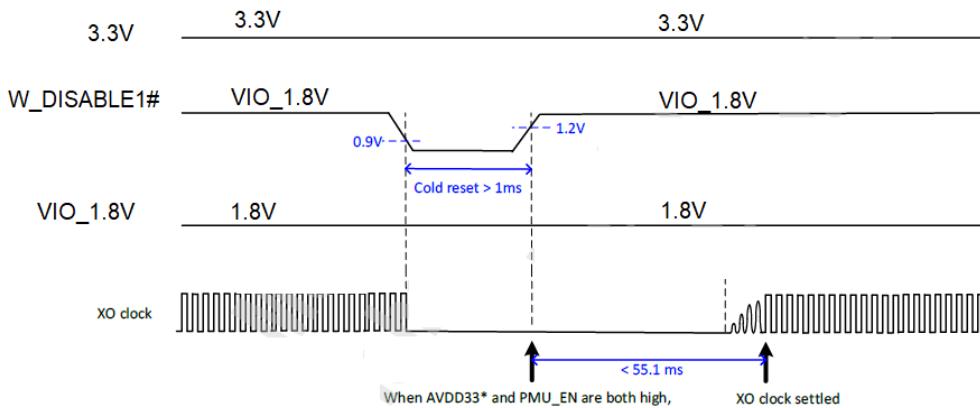
### 8.1 Power On Sequence

The 3.3V voltage and W\_DISABLE1# are in high state, chip will start power-on sequence.



Note: Please keep the 3.3V and VIO\_1.8V power at the same time.

### 8.2 Global Cold Reset



## 9 PIN DEFINITIONS

### 9.1 M.2 1420 Solder-down

Table 30: M.2 1420 pin definitions

| Pin # | Name        | Type | Voltage Ref. | Function  | If Not Used |
|-------|-------------|------|--------------|---|-------------|
| 1     | -           | -    | -            | NC  | NC          |
| 2     | -           | -    | -            | NC  | NC          |
| 3     | -           | -    | -            | NC  | NC          |
| 4     | 3.3V        | PWR  | 3.3V         | Power Supply Input  | -           |
| 5     | 3.3V        | PWR  | 3.3V         | Power Supply Input  | -           |
| 6     | GND         | -    | -            | Ground  | GND         |
| 7     | -           | -    | -            | NC  | NC          |
| 8     | -           | -    | -            | NC  | NC          |
| 9     | -           | -    | -            | NC  | NC          |
| 10    | -           | -    | -            | NC  | NC          |
| 11    | COEX_RXD    | I    | VIO_1.8V     | 3-wire coexistence for Zigbee; Zigbee_ACTIVE  | NC          |
| 12    | COEX_TXD    | O    | VIO_1.8V     | 3-wire coexistence for Zigbee; WLAN_ACTIVE  | NC          |
| 13    | COEX3       | I    | VIO_1.8V     | 3-wire coexistence for Zigbee; Zigbee_Priority  | NC          |
| 14    | -           | -    | -            | NC  | NC          |
| 15    | -           | -    | -            | NC  | NC          |
| 16    | -           | -    | -            | NC  | NC          |
| 17    | GND         | -    | -            | Ground  | GND         |
| 18    | -           | -    | -            | NC  | NC          |
| 19    | -           | -    | -            | NC  | NC          |
| 20    | GND         | -    | -            | Ground  | GND         |
| 21    | -           | -    | -            | NC  | NC          |
| 22    | -           | -    | -            | NC  | NC          |
| 23    | GND         | -    | -            | Ground  | GND         |
| 24    | -           | -    | -            | NC  | NC          |
| 25    | -           | -    | -            | NC  | NC          |
| 26    | GND         | -    | -            | Ground  | GND         |
| 27    | -           | -    | -            | NC  | NC          |
| 28    | W_DISABLE1# | I    | VIO_1.8V     | External 10K PU is needed for normal operation.<br>Active low to disable the Sona MT320 module.<br>W_DISABLE1# should be managed by an actual signal from the Host to have correct global reset.<br>Please see detail timing on section 8.5 | -           |
| 29    | -           | -    | -            | NC  | NC          |

| Pin #     | Name              | Type     | Voltage Ref.    | Function  | If Not Used |
|-----------|-------------------|----------|-----------------|---|-------------|
| 30        | -                 | -        | -               | NC  | NC          |
| 31        | -                 | -        | -               | NC  | NC          |
| 32        | GND               | -        | -               | Ground  | GND         |
| 33        | -                 | -        | -               | NC  | NC          |
| 34        | -                 | -        | -               | NC  | NC          |
| 35        | GND               | -        | -               | Ground  | GND         |
| 36        | -                 | -        | -               | NC  | NC          |
| 37        | -                 | -        | -               | NC  | NC          |
| 38        | GND               | -        | -               | Ground  | GND         |
| 39        | -                 | -        | -               | NC  | NC          |
| 40        | -                 | -        | -               | NC  | NC          |
| 41        | GND               | -        | -               | Ground  | GND         |
| 42        | -                 | -        | -               | NC  | NC          |
| 43        | -                 | -        | -               | NC  | NC          |
| 44        | -                 | -        | -               | NC  | NC          |
| 45        | SDIO_RESET#       | I        | VIO_1.8V        | Host to reset Sona MT320 module, Active Low.<br>External 10K PU is needed for normal operation.   | 10K;PU      |
| 46        | SDIO_WAKE#        | O        | VIO_1.8V        | Wi-Fi to Wake up Host; Active Low.<br>Required pull up on the host side (recommended 15 kΩ to 100 kΩ).  | NC          |
| 47        | SDIO_DATA3        | I/O      | VIO_1.8V        | SDIO Data line 3  | NC          |
| 48        | SDIO_DATA2        | I/O      | VIO_1.8V        | SDIO Data line 2  | NC          |
| 49        | SDIO_DATA1        | I/O      | VIO_1.8V        | SDIO Data line 1  | NC          |
| 50        | SDIO_DATA0        | I/O      | VIO_1.8V        | SDIO Data line 0  | NC          |
| 51        | SDIO_CMD          | I/O      | VIO_1.8V        | SDIO command line   | NC          |
| 52        | SDIO_CLK          | I        | VIO_1.8V        | SDIO Clock Input  | NC          |
| <b>53</b> | <b>UART_WAKE#</b> | <b>O</b> | <b>VIO_1.8V</b> | <b>Bluetooth to Wake up Host. Active Low.<br/>Required pull up on the host side (recommended 15 kΩ to 100 kΩ).</b>  | <b>NC</b>   |
| 54        | -                 | -        | -               | NC  | NC          |
| 55        | -                 | -        | -               | NC  | NC          |
| 56        | -                 | -        | -               | NC  | NC          |
| 57        | -                 | -        | -               | NC  | NC          |
| 58        | PCM_SYNC          | I/O      | VIO_1.8V        | BT_PCM Sync.<br>In Master mode, SONA MT320 generates the BT_PCM_SYNC signal.<br>In Slave mode, the signal is provided by another master on the PCM interface. | NC          |

| Pin #       | Name        | Type | Voltage Ref. | Function  | If Not Used |
|-------------|-------------|------|--------------|---|-------------|
| 59          | PCM_IN      | I    | VIO_1.8V     | BT_PCM data input.  | NC          |
| 60          | PCM_OUT     | O    | VIO_1.8V     | BT_PCM data output  | NC          |
| 61          | PCM_CLK     | I/O  | VIO_1.8V     | BT_PCM Clock.<br>In Master mode, SONA MT320 generates the BT_PCM_CLK signal.<br>In Slave mode, the signal is provided by another master on the PCM interface. | NC          |
| 62          | GND         | -    | -            | Ground  | GND         |
| 63          | W_DISABLE2# | I    | VIO_1.8V     | Signal to reset the Bluetooth. Active Low.<br>External 10K PU for normal operation.   | 10K;PU      |
| 64          | LED_2#      | O    | VIO_1.8V     | LED indicator.  | NC          |
| 65          | LED_1#      | O    | VIO_1.8V     | LED indicator.  | NC          |
| 66          | VIO_1.8V    | PWR  | 1.8V         | 1.8V power supply input for Sona MT320 module.<br><b>Maximum current sink could up to 150mA.</b>  | -           |
| 67          | -           | -    | -            | NC  | NC          |
| 68          | GND         | -    | -            | Ground  | GND         |
| 69          | -           | -    | -            | NC  | NC          |
| 70          | -           | -    | -            | NC  | NC          |
| 71          | GND         | -    | -            | Ground  | GND         |
| 72          | 3.3V        | PWR  | 3.3V         | Power Supply Input  | -           |
| 73          | 3.3V        | PWR  | 3.3V         | Power Supply Input  | -           |
| 74~<br>75   | GND         | -    | -            | Ground  | GND         |
| 76          | VIO_CFG     | O    | -            | M.2 sideband IO voltage indication output pin.<br>This pin is NC on the module that allow host to use the 1.8V sideband signal from the module.               | -           |
| 77~<br>100  | GND         | -    | -            | Ground  | GND         |
| 101~<br>108 | GND         | -    | -            | Ground  | GND         |
| 109         | ANT0        | -    | -            | WLAN RF Antenna 0 pin for SONA MT320 M.2 1420 trace pin variant, <b>Wi-Fi only.</b>   |             |
| 110~<br>112 | GND         | -    | -            | Ground  | GND         |
| 113         | ANT1        | -    | -            | WLAN RF Antenna 1 pin for SONA MT320 M.2 1420 trace pin variant, <b>Wi-Fi and BT sharing.</b>   |             |
| 114~<br>116 | GND         | -    | -            | Ground  | GND         |

## 9.2 M.2 2230 E-Key

Table 17: M.2 2230 E-Key pin definitions

| Pin # | Name        | Type | Volt. Ref. | Function   | If Not Used |
|-------|-------------|------|------------|--|-------------|
| 1     | GND         | -    | -          | Ground   | GND         |
| 2     | 3.3V        | PWR  | 3.3V       | DC supply voltage input for module.  | -           |
| 3     | -           | -    | -          | NC   | NC          |
| 4     | 3.3V        | PWR  | 3.3V       | DC supply voltage input for module.  | -           |
| 5     | -           | -    | -          | NC   | NC          |
| 6     | LED1#       | O    | 3.3V       | LED indicator  | NC          |
| 7     | GND         | -    | -          | Ground   | GND         |
| 8     | PCM_CLK     | I/O  | 1.8V       | PCM clock. Can be master (Output) or slave (Input)   | NC          |
| 9     | SDIO_CLK    | I    | 1.8V       | SDIO clock input   | NC          |
| 10    | PCM_SYNC    | I/O  | 1.8V       | PCM Sync. Can be master (Output) or slave (Input);   | NC          |
| 11    | SDIO_CMD    | I/O  | 1.8V       | SDIO command line  | NC          |
| 12    | PCM_OUT     | O    | 1.8V       | PCM data output.   | NC          |
| 13    | SDIO_DATA0  | I/O  | 1.8V       | SDIO data line 0   | NC          |
| 14    | PCM_IN      | I    | 1.8V       | PCM data input.  | NC          |
| 15    | SDIO_DATA1  | I/O  | 1.8V       | SDIO data line 1   | NC          |
| 16    | LED2#       | O    | 3.3V       | LED indicator  | NC          |
| 17    | SDIO_DATA2  | I/O  | 1.8V       | SDIO data line 2   | NC          |
| 18    | GND         | -    | -          | Ground   | GND         |
| 19    | SDIO_DATA3  | I/O  | 1.8V       | SDIO data line3  | NC          |
| 20    | UART_WAKE#  | O    | 3.3V       | Bluetooth to Wake up Host. Active Low.<br>Required pull up on the host side (recommended 15 kΩ to 100 kΩ). | NC          |
| 21    | SDIO_WAKE#  | O    | 1.8V       | Wi-Fi to Wake up Host; Active Low.<br>Required pull up on the host side (recommended 15 kΩ to 100 kΩ).     | NC          |
| 22    | -           | -    | -          | NC   | NC          |
| 23    | SDIO_RESET# | I    | 1.8V       | Host to reset Sona MT320; Active low.<br>External 10K PU is needed for normal operation.                   | 10K;PU      |
| 32    | -           | -    | -          | NC   | NC          |
| 33    | GND         | -    | -          | Ground   | GND         |
| 34    | -           | -    | -          | NC   | NC          |
| 35    | -           | -    | -          | NC   | NC          |
| 36    | -           | -    | -          | NC   | NC          |
| 37    | -           | -    | -          | NC   | NC          |

| Pin # | Name        | Type | Volt. Ref. | Function  | If Not Used |
|-------|-------------|------|------------|---|-------------|
| 38    | -           | -    | -          | NC  | NC          |
| 39    | GND         | -    | -          | Ground  | GND         |
| 40    | -           | -    | -          | NC  | NC          |
| 41    | -           | -    | -          | NC  | NC          |
| 42    | -           | -    | -          | NC  | NC          |
| 43    | -           | -    | -          | NC  | NC          |
| 44    | COEX3       | I    | 1.8V       | 3-wire coexistence for Zigbee; Zigbee_Priority  | NC          |
| 45    | GND         | -    | -          | Ground  | GND         |
| 46    | COEX_TX     | O    | 1.8V       | 3-wire coexistence for Zigbee; WLAN_ACTIVE  | NC          |
| 47    | -           | -    | -          | NC  | NC          |
| 48    | COEX_RX     | I    | 1.8V       | 3-wire coexistence for Zigbee; Zigbee_ACTIVE  | NC          |
| 49    | -           | -    | -          | NC  | NC          |
| 50    | -           | -    | -          | NC  | -           |
| 51    | GND         | -    | -          | Ground  | GND         |
| 52    | -           | -    | -          | NC  | NC          |
| 53    | -           | -    | -          | NC  | NC          |
| 54    | W_DISABLE2# | I    | 3.3V       | Signal to reset the Bluetooth. Active Low.<br>External 10K PU is needed for normal operation.   | 10K;PU      |
| 55    | -           | -    | -          | NC  | NC          |
| 56    | W_DISABLE1# | I    | 3.3 V      | External 10K PU is must for normal operation.<br>Active low to disable the module.<br>W_DISABLE1# should be managed by an actual signal from the Host to have correct global reset. Please see detail timing on section 8.5 | -           |
| 57    | GND         | -    | -          | Ground  | GND         |
| 58    | -           | -    | -          | NC  | NC          |
| 59    | -           | -    | -          | NC  | NC          |
| 60    | -           | -    | -          | NC  | NC          |
| 61    | -           | -    | -          | NC  | NC          |
| 62    | -           | -    | -          | NC  | NC          |
| 63    | GND         | -    | -          | Ground  | GND         |
| 64    | VIO_1.8V    | -    | -          | NC  | NC          |
| 65    | -           | -    | -          | NC  | NC          |
| 66    | -           | -    | -          | NC  | NC          |
| 67    | -           | -    | -          | NC  | NC          |
| 68    | -           | -    | -          | NC  | NC          |
| 69    | GND         | -    | -          | Ground  | GND         |

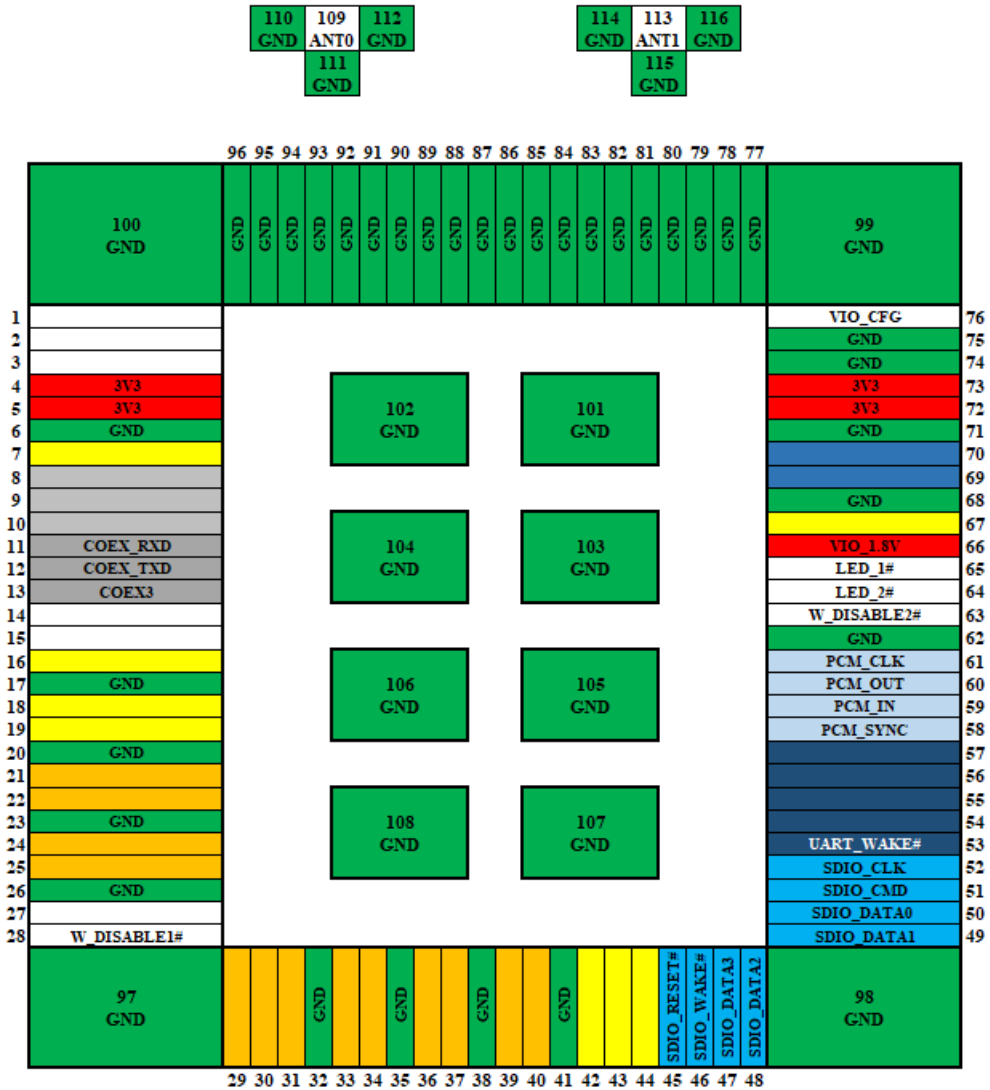
| Pin # | Name | Type | Volt. Ref. | Function                            | If Not Used |
|-------|------|------|------------|-------------------------------------|-------------|
| 70    | -    | -    | -          | NC                                  | NC          |
| 71    | -    | -    | -          | NC                                  | NC          |
| 72    | 3.3V | PWR  | 3.3V       | DC supply voltage input for module. | -           |
| 73    | -    | -    | -          | NC                                  | NC          |
| 74    | 3.3V | PWR  | 3.3V       | DC supply voltage input for module. | -           |
| 75    | GND  | -    | -          | Ground                              | GND         |

## 10 MECHANICAL SPECIFICATIONS

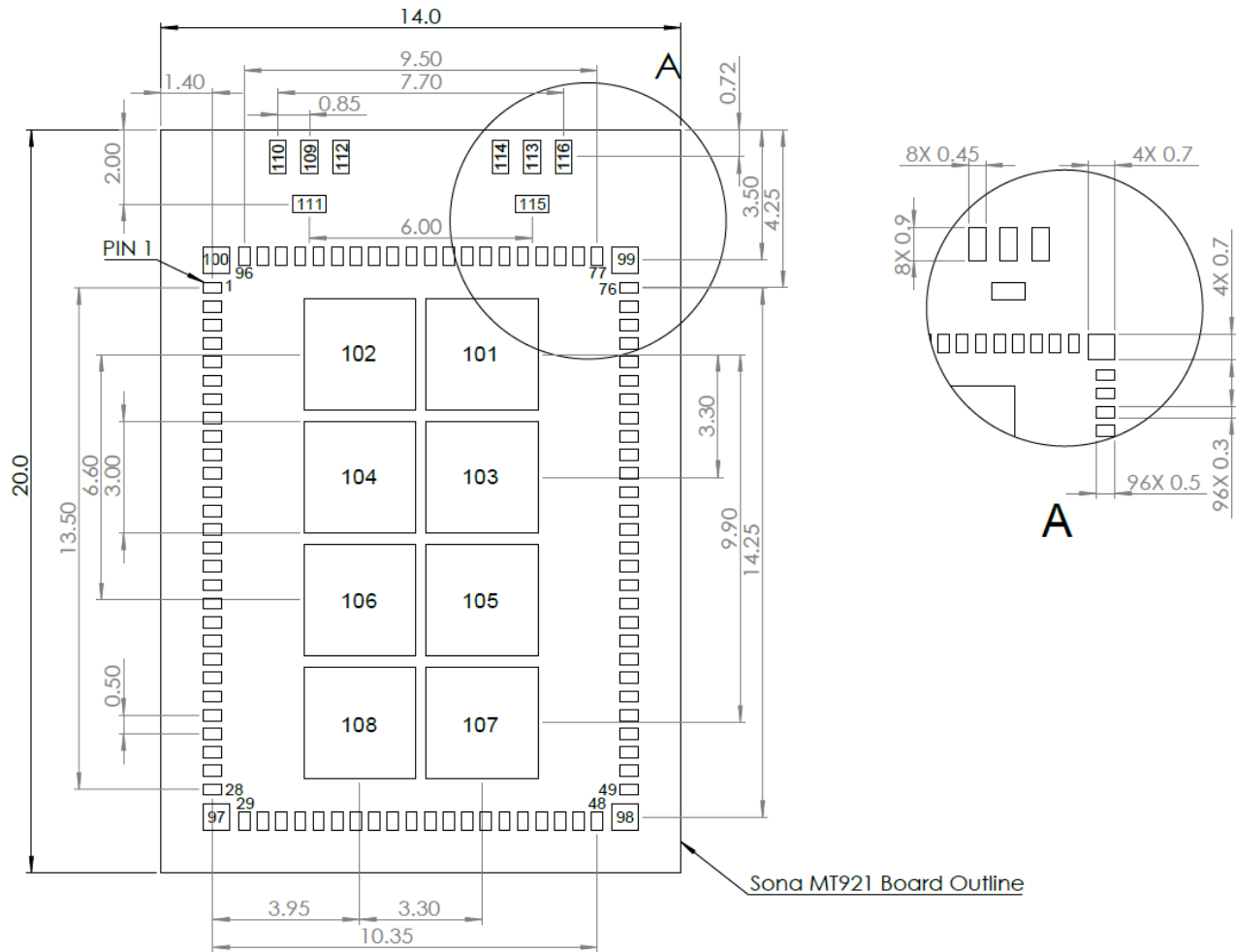
### 10.1 M.2 1420

Detail PCB footprint for the Sona MT320 M.2 1420 is shown in below.





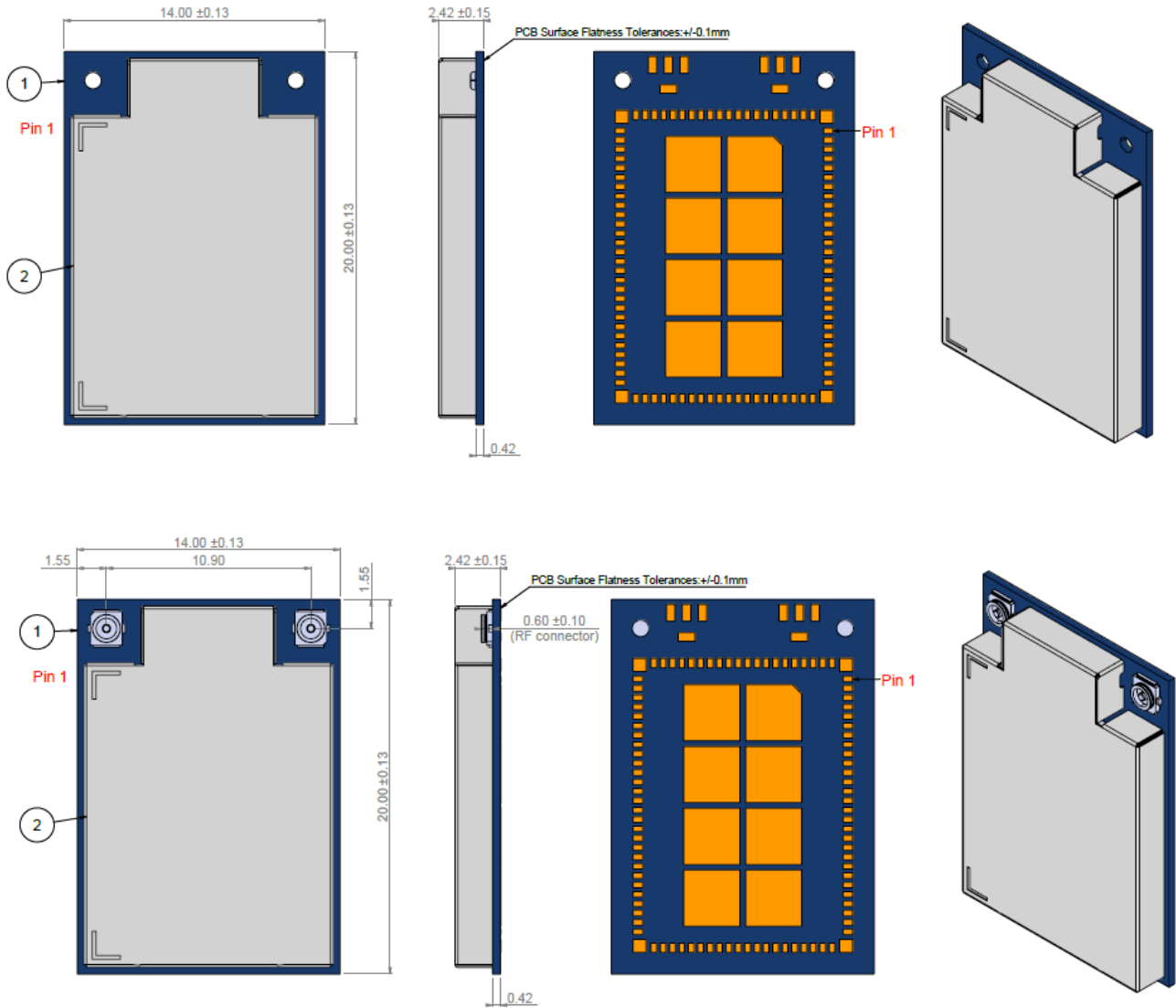
Note: The pin-109 to pin-116 are used for RF trace out when using Sona MT320 M.2 1420 trace pin variant.



TOP VIEW

(This is the recommended PCB footprint)

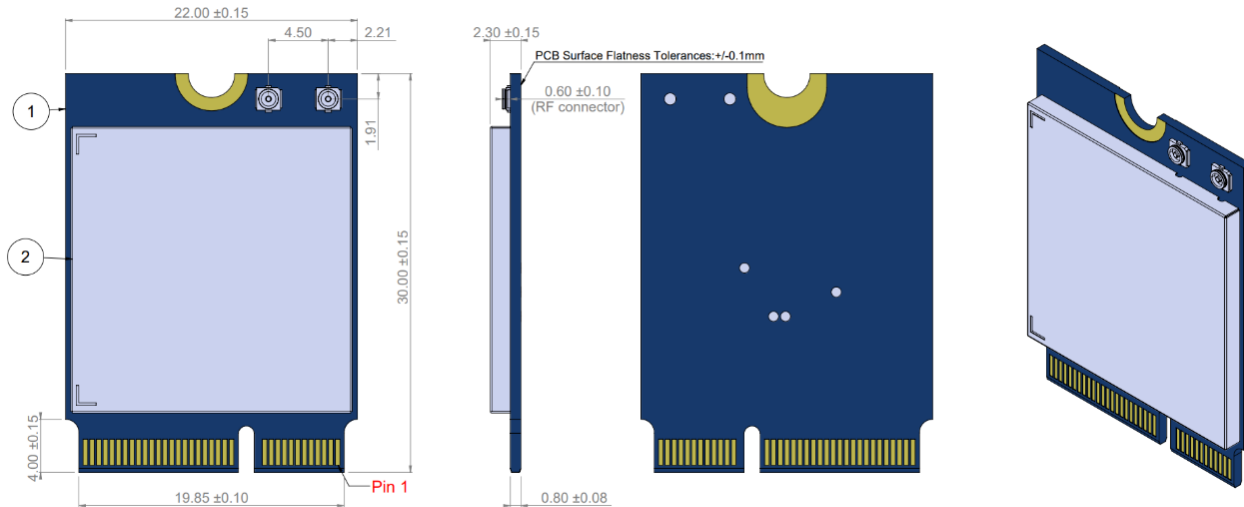
## 11 SONA MT320 MECHANICAL DIMENSION



Mechanical dimensions for the Sona MT320 M.2 1420 module.

## 11.1 M.2 2230 E-Key

Module dimensions of Sona MT320 M.2 2230 E-Key module is 22 x 30 x 2.3 mm. Detailed drawings are shown in [Figure 23](#).



**Figure 3: Sona MT320 M.2 2230**

**Note:** The Wi-Fi MAC address is located on the product label.  
The BT MAC address is the Wi-Fi MAC address plus 1.

## 11.2 M.2 2230 E-Key Mounting

The Sona MT320 M.2 2230 E-Key module connects to the host via a standard PCI EXPRESS M2 connector.

Kyocera's 6411 series provides 1.8mm, 2.3mm and 3.2mm connector heights. JAE's SM3 series provides 1.2mm, 2.15mm, 3.1mm and 4.1mm connector heights.

The Sona MT320 M.2 2230 E-Key module is a single-sided component module so we recommend the connectors listed in [Table 32](#).

**Table 32: Recommended M.2 2230 E-Key Connectors**

| M.2 Key-E Connector          | Connector Height |
|------------------------------|------------------|
| KYOCERA 24-6411-067-101-894E | 2.3 mm           |
| JAE SM3ZS067U310AERxxxx      | 3.1 mm           |

The corresponding standoffs are listed in [Table 33](#).

**Table 33: Recommended M.2 E-Key Standoffs**

| M.2 Key-E Connector          | Stand-off                   |
|------------------------------|-----------------------------|
| KYOCERA 24-6411-067-101-894E | EMI STOP F50M16-041525P1D4M |
| JAE SM3ZS067U310AERxxxx      | JAE SM3ZS067U310-NUT1-Rxxxx |

Detailed layout and stencil opening are shown in [Figure 24](#).

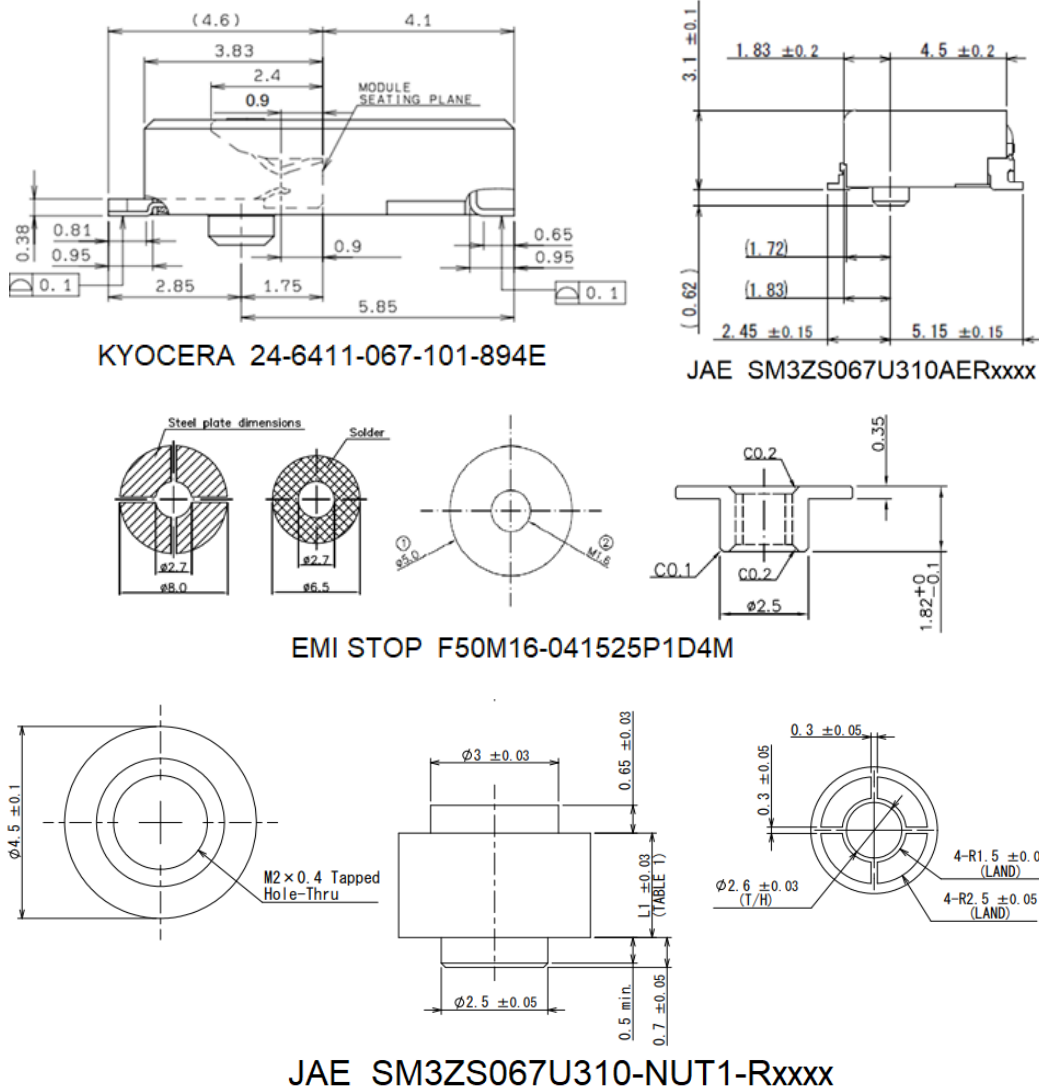
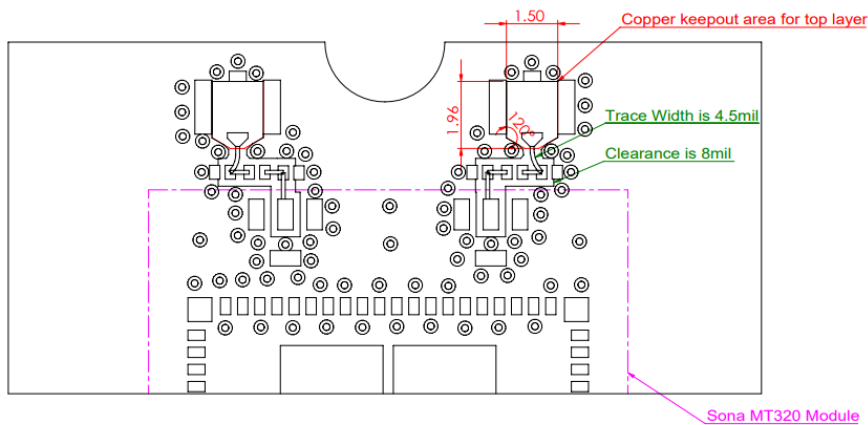


Figure 4: M.2 2230 E-Key connector/standoff mounting

## 12 RF LAYOUT DESIGN GUIDELINES

The following is a list of RF layout design guidelines and recommendations 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.
- 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 10uF/16V/0603 capacitor on EACH 3.3V power pin. Place the capacitor as close as possible to the pin to ensure correct PMU operation.
- 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.
- In order to use Laird MT320 1420 module certification, please follow exactly the same layout and board stack as shown below.



### NOTES:

- Component size is 0201.
- Via size is drill 8mil, pad 16mil.

| Layer | Layer Type         | Layer Structure | Thickness (mil) | DK  | Single-Coplanar (mil)<br>(TraceWidth/ Clearance)<br>50ohm±1-10 |
|-------|--------------------|-----------------|-----------------|-----|--|
|       | Top Solder Mask    |                 | 0.9             | 3.5 |  |
| L1    | Top                | 1 oz<br>PP      | 1.4<br>3        | 4.1 | 4.5/8  |
| L2    | Plane (GND)        | 1 oz<br>Core    | 1.4<br>18       | 4.1 |  |
| L3    | Plane              | 1 oz<br>PP      | 1.4<br>3        | 4.1 |  |
| L4    | Bottom             | 1 oz            | 1.4             |     |  |
|       | Bottom Solder Mask |                 | 0.9             | 3.5 |  |



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|   |   |
|---|---|
| UNLESS OTHERWISE SPECIFIED:<br>DIMENSIONS ARE IN MILLIMETERS<br>TOLERANCES:<br>ANGULAR: M...<br>XX: M...<br>XXX: M... | CAD FILE:                                       |
| DATE: Oct 17, 2023  | INTERPRET GEOMETRIC TOLERANCING PER: ASME 14.5M |
| SHEET 1 OF 1  | SCALE: 2:1                                      |

|  |         |
|--|---------|
| Laird™ CONNECTIVITY                                    |         |
| TITLE:<br>Sona MT320 M.2 Stackup and<br>RF information |         |
| SIZE: DWG. NO. B                                       | REV 1.0 |

## 13 APPLICATION NOTES

### 13.1 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.

## 13.2 Shipping and Labelling

### 13.2.1 Sona MT320 M.2 1420 Solder-Down

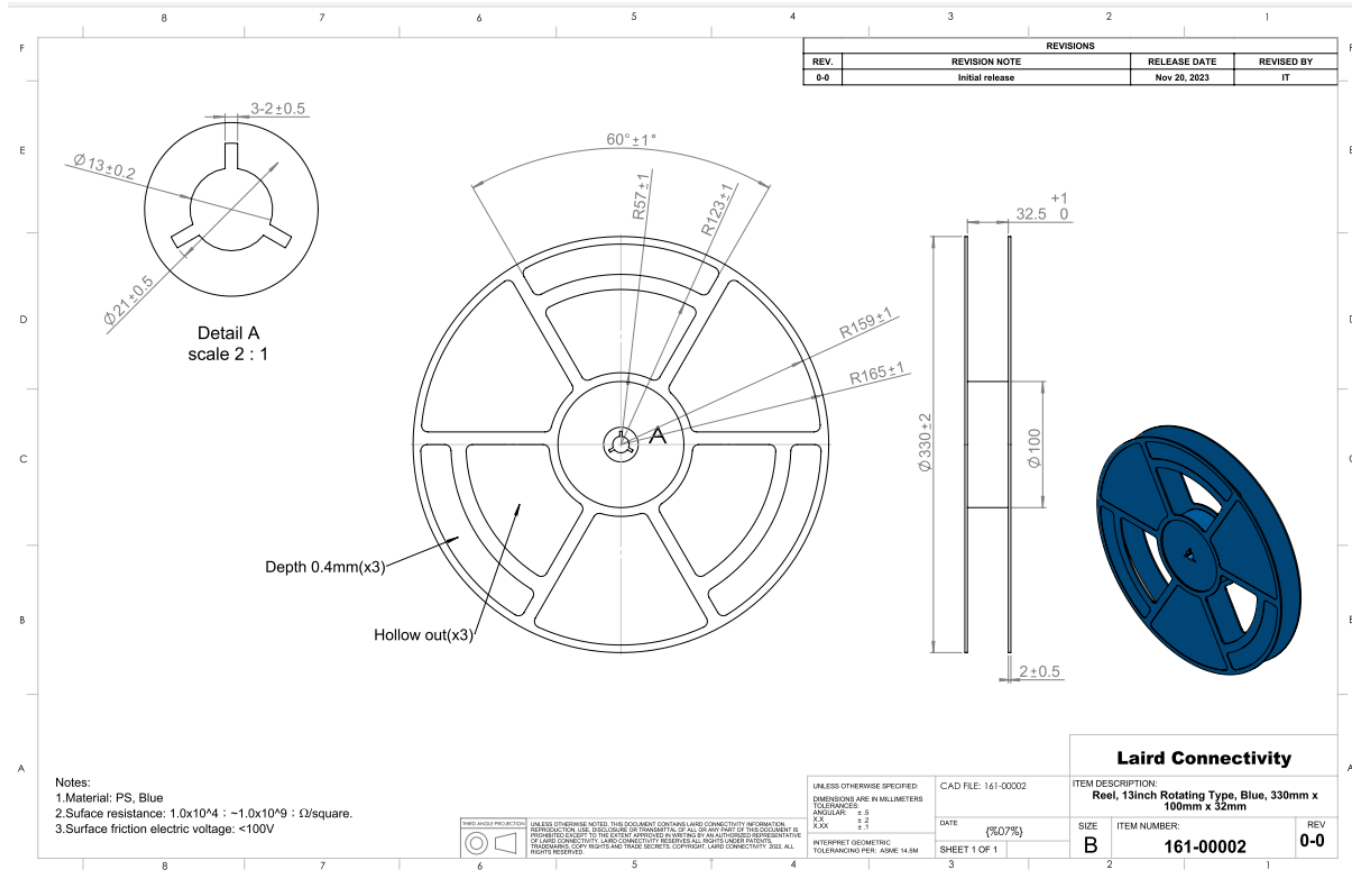
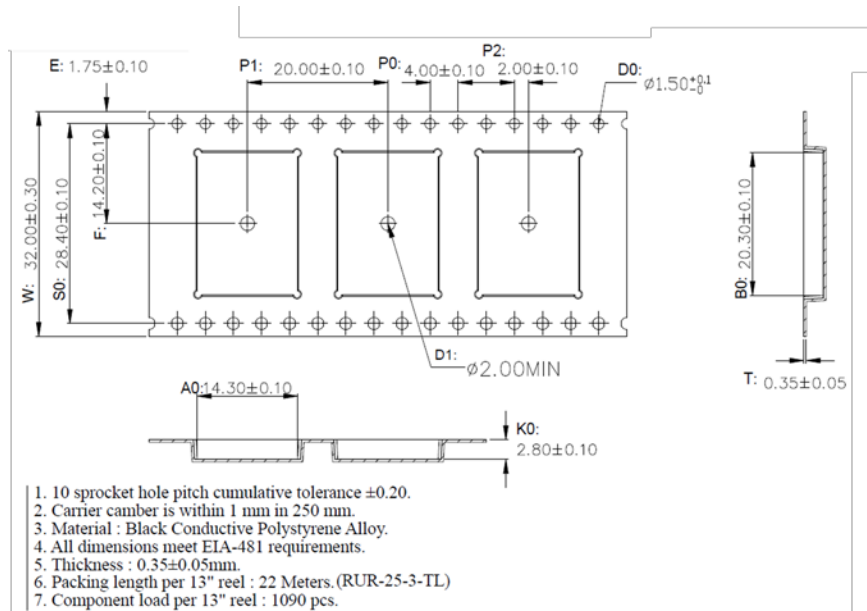


Figure 5: Sona MT320 M.2 1420 Reel specifications, 161-00002



**Figure 6: Sona MT320 M.2 1420 Tape specifications**

There are 1,000 Sona MT320 M.2 1420 modules taped in a reel (and packaged in a pizza box) and five boxes per carton (5,000 modules per carton). Reel, boxes, and carton are labeled with the appropriate labels. See [Figure 27](#) for more information.



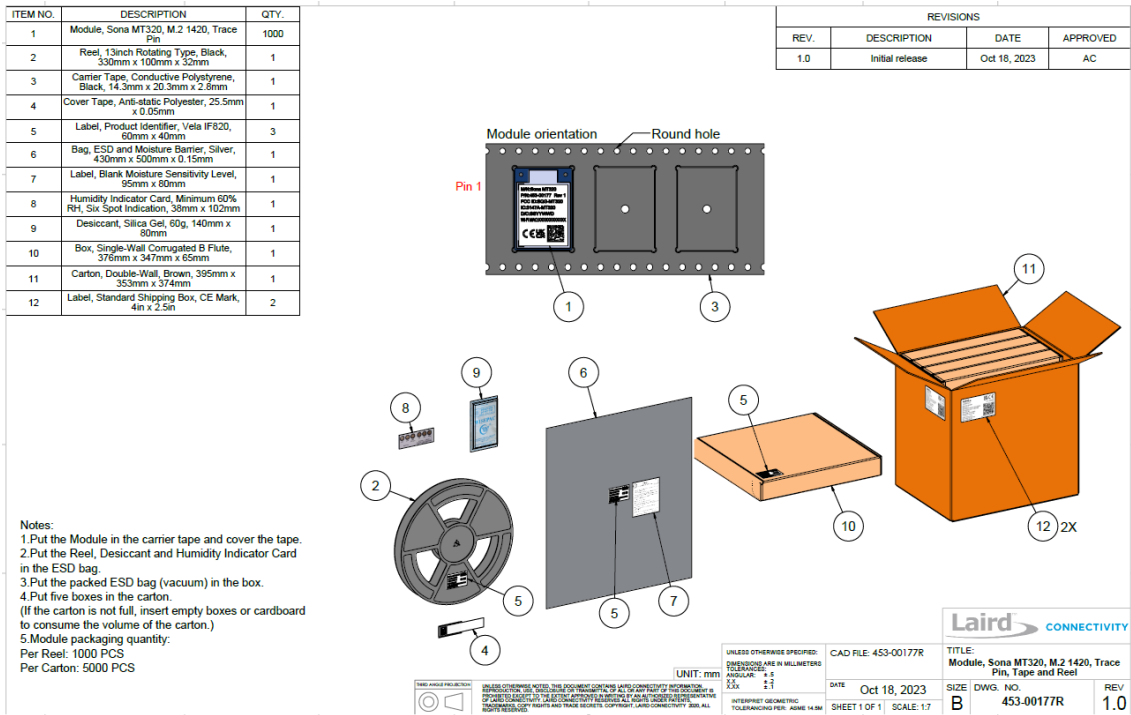
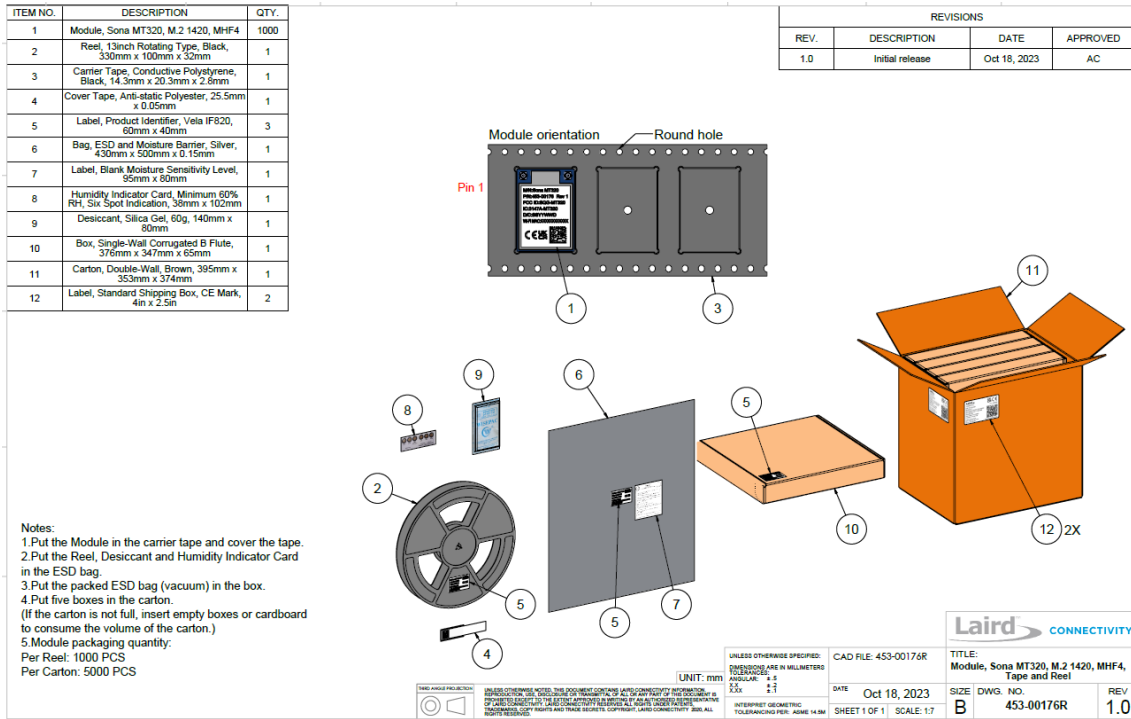


Figure 7: Sona MT320 M.2 1420 packaging processes

The following labels are located on the antistatic bag. The Sona MT320 solder-down modules are classified as MSL4 devices.

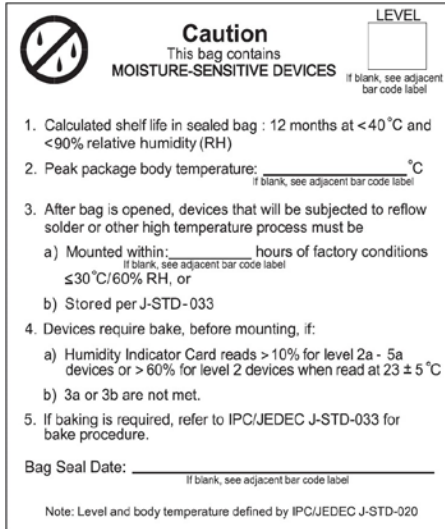


Figure 8: Sona MT320 M.2 1420 Moisture Sensitivity Level Label

The following label is placed on the anti-static bag.



Figure 9: Sona MT320 M.2 1420 Bag and Box Product Identifier Label

The following label is placed on the pizza box.



Figure 10: Sona MT320 Bag and Box Product Identifier Label

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



Figure 11: Sona MT320 M.2 1420 Carton Product Identifier Label

### 13.2.2 Sona MT320 M.2 2230 E-Key Module

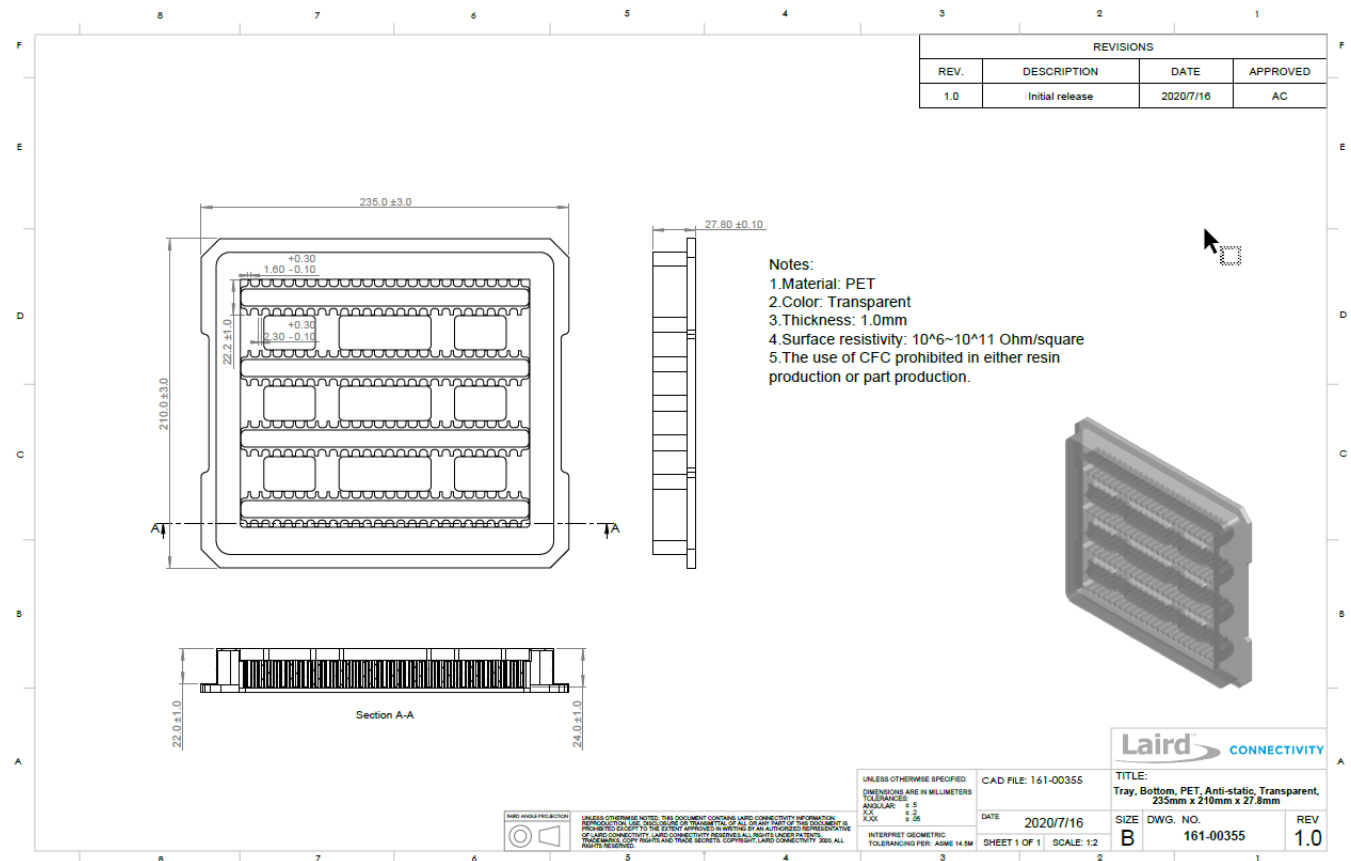


Figure 12: Sona MT320 M.2 2230 Shipping Tray, Bottom, 161-00355

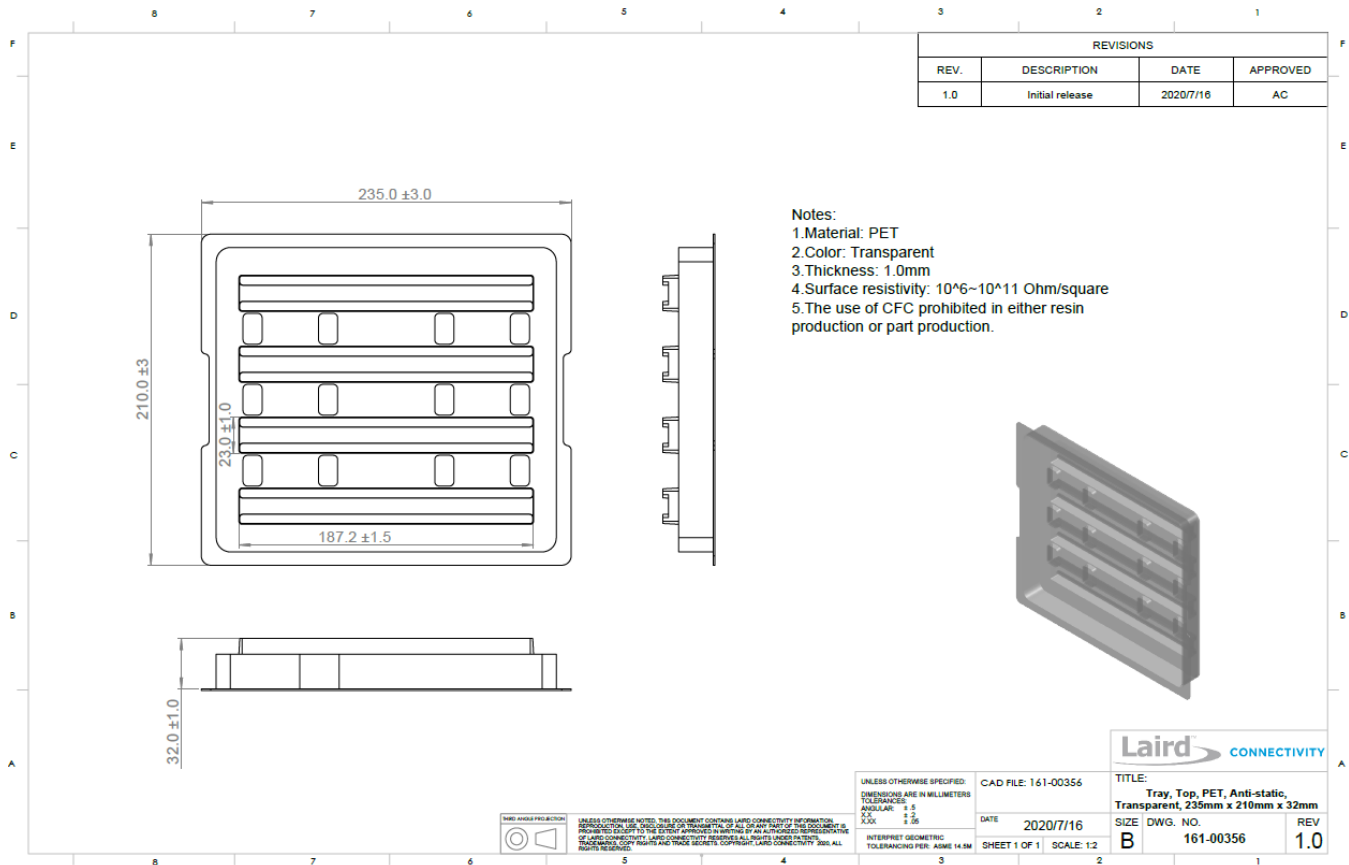


Figure 13: Sona MT320 M.2 2230 Shipping Tray, Top, 161-00356

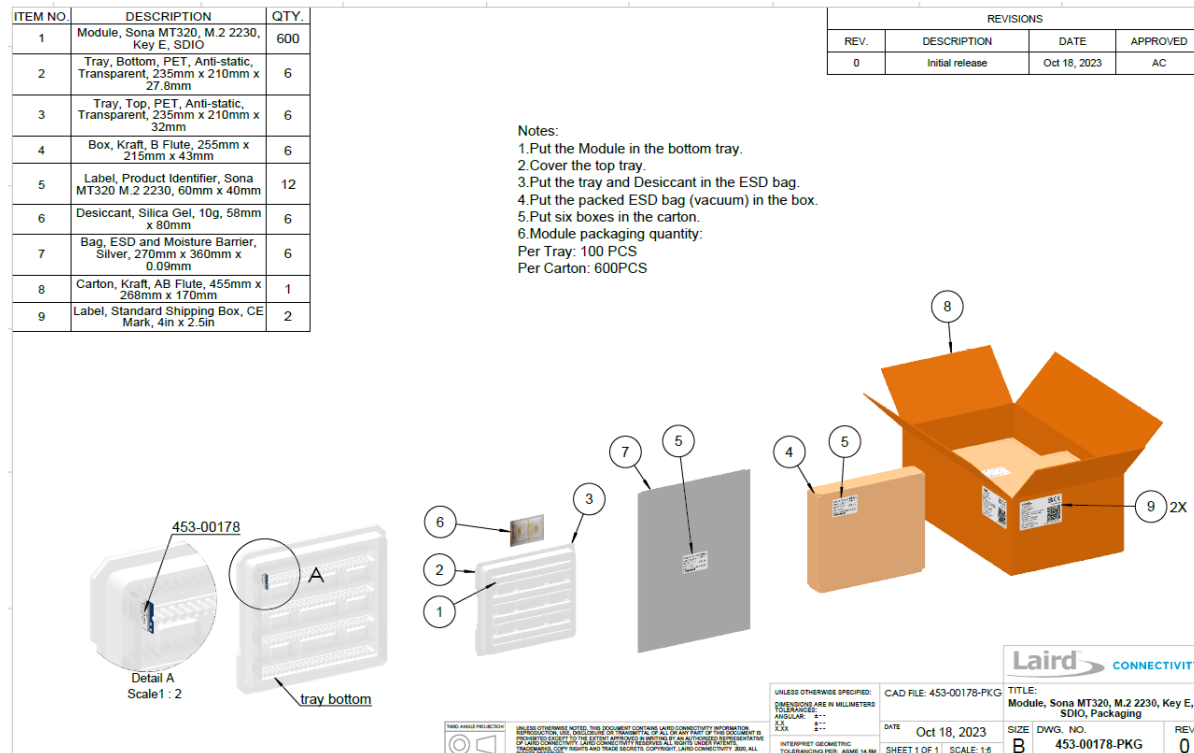


Figure 14: Sona MT320 M.2 2230 Packaging Process, 453-00178-PKG

The following label is placed on the bag and the inner box.



Figure 15: Sona MT320 M.2 2230 Bag and Box Product Identifier Label

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



Figure 16: Sona MT320 M.2 2230 Carton Product Identifier Label

## 13.3 Required Storage Conditions

### 13.3.1 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.

### 13.3.2 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 1<sup>st</sup> reflow:
    - Temperature: 5-25°C
    - Humidity: 60% or less
    - Period: A hours or less after opening
  - Storage conditions following completion of the 1<sup>st</sup> reflow and prior to performing the 2<sup>nd</sup> reflow
    - Temperature: 5-25°C
    - Humidity: 60% or less
    - Period: B hours or less after completion of the 1<sup>st</sup> reflow

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

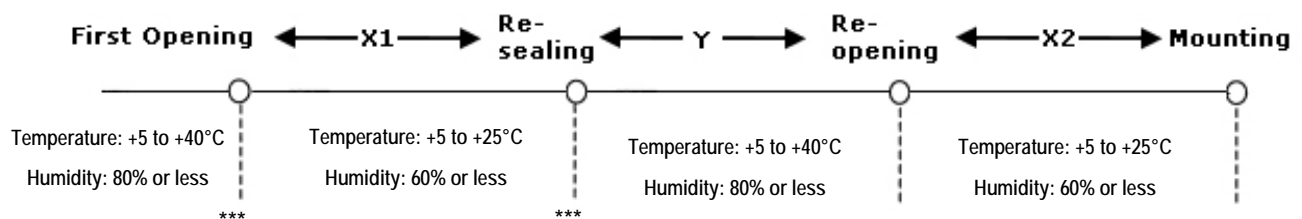
### 13.3.3 Temporary Storage Requirements after Opening

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.

## 13.4 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).

## 14 SURFACE MOUNT CONDITIONS

The following soldering conditions are recommended to ensure device quality.

### 14.1 Recommended Stencil Aperture

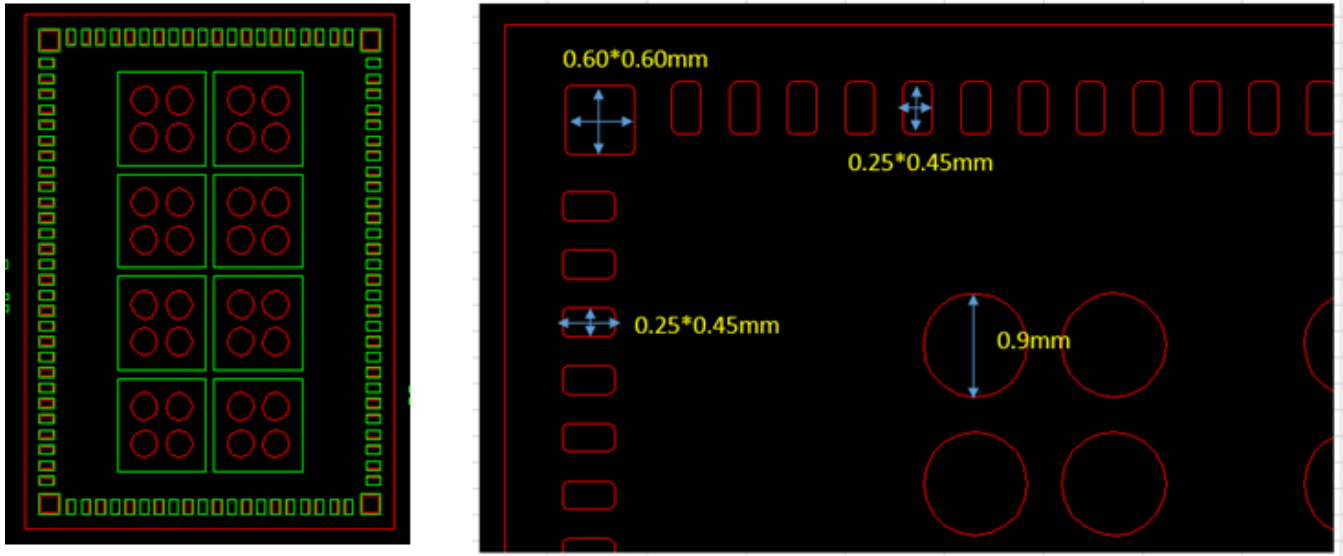


Figure 17: Sona MT320 M.2 1420 stencil aperture

**Note:** The stencil thickness is 0.12mm

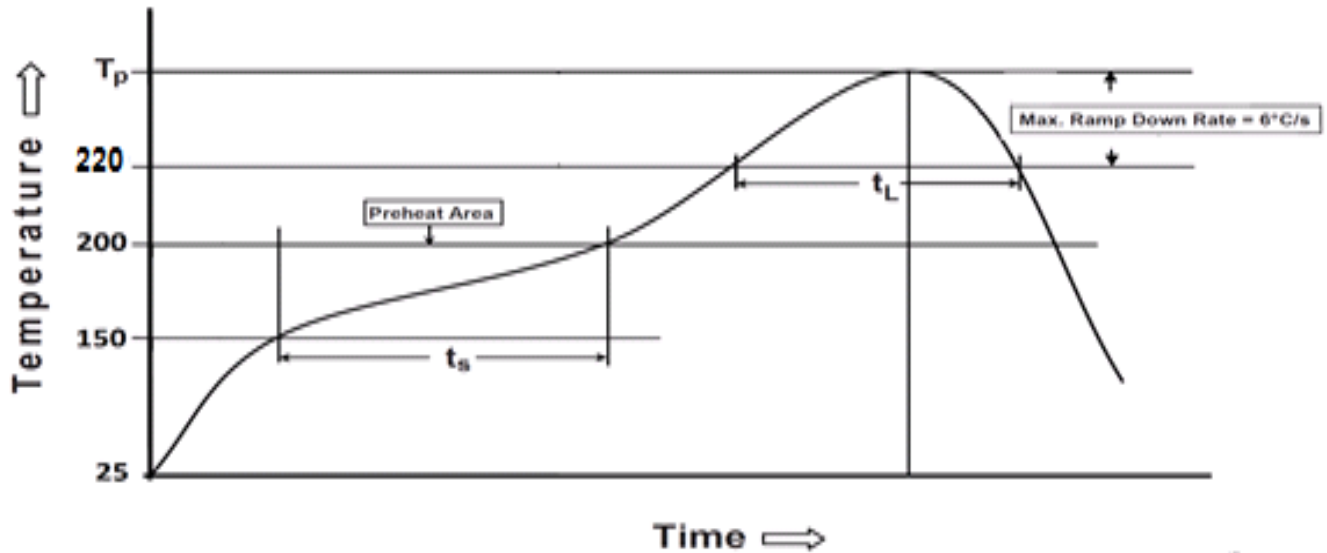
## 14.2 Soldering

**Note:** When soldering, the stencil thickness should be 0.12 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 18: Temperature profile**

- Solder paste alloy: SAC305(Sn96.5 / Ag3.0 / Cu 0.5)
- Pre-heat temperature: 150°C ~ 200°C; Soak time: 60 second ~ 120 second
- Peak temperature: 235°C ~ 250°C
- Time above 220°C: 40 second ~ 90 second
- Optimal cooling rate < 3°C/second
- The oxygen concentration < 2000 ppm

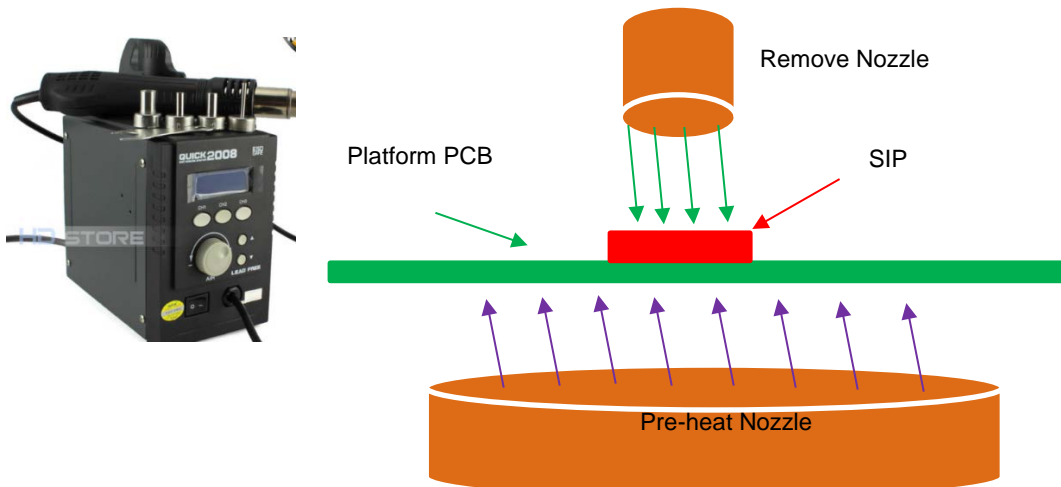


### 14.2.1 Cautions When Removing the M.2 1420 from the Platform for RMA

- Bake the platform before removing the Sona MT320 M.2 1420 module from the platform. Reference [Baking Conditions](#).
- Remove the Sona MT320 M.2 1420 module by using a hot air gun. This process should be carried out by a skilled technician.

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



- Remove the residue solder under the bottom side of device. (note. Alternate module pictured as an example)



(Not accepted for RMA)

**Figure 19: Example M.2 1420 with residue solder on the bottom**



(Accepted for RMA analysis)

**Figure 20: Sona MT320 M.2 1420 module without residue solder**

- Remove and clean the residue flux as needed.

### 14.2.2 Precautions for Use

- Opening/handling/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 Sona MT320 M.2 1420 and M.2 2230 modules are MSL level 4 rated.

## 15 RELIABILITY TEST

The Sona MT320 modules were tested for reliability. Test items and the corresponding standards are shown in [Table 42](#).

### 15.1 Environmental and Mechanical

The following are the followed reliability test procedures.

**Table 18: Sona MT320 M.2 1420 Solder-down Module Reliability Test Items and Standards**

| Test Item  | Specification  | Standard                 | Test Result |
|--|--|--------------------------|-------------|
| Step 1: Pre-conditioning                         | <b>Pre-check:</b> <ol style="list-style-type: none"> <li>Function check (Tools and SOP supplied by customers).</li> <li>Mechanical check.</li> </ol>   | JESD22-A113              | PASS        |
|  | <b>Pre-conditioning:</b> <ol style="list-style-type: none"> <li>Bake: 125°C for 24 hours.</li> <li>Moisture Soak: 30°C/60% RH for 192 hours</li> <li>Not shorter than 15 minutes and not longer than 4 hours after removal from the temperature/humidity chamber, subject the sample to 3 cycles of the reflow.</li> </ol>   |                          |             |
| Step 2: Temperature Cycling Non-operating        | <b>Post-check:</b> <ol style="list-style-type: none"> <li>Function check (Tools and SOP supplied by customers).</li> <li>Mechanical check.</li> <li>Perform inspections of short, open, delamination of DUTs by Optical Microscope (under 40X optical magnification).</li> <li>X-RAY / CSAM (SAT) on any failed samples (Notify customers).</li> <li>Cross-sections analysis based on X-RAY and CSAM results.</li> </ol> | JESD22-A113              | PASS        |
|  | <ol style="list-style-type: none"> <li>Dwell on -40°C for 15 minutes</li> <li>Shock to 85°C with in ramp rate 15 °C/minute</li> <li>Dwell on 85°C for 15 minutes</li> <li>Shock to -40°C with in ramp rate 15 degree C/minute</li> <li>Repeat step 1-4 and stop to check functions at 500/ 700 cycles</li> </ol>   |                          |             |
| Vibration Non-operating Unpackaged device        | <ol style="list-style-type: none"> <li>Vibration Wave Form: Sine Waveform</li> <li>Vibration frequency / Displacement: 20-80 Hz/1.5mm</li> <li>Vibration frequency / Acceleration: 80-2000 Hz/20g</li> <li>Cycle Time: 4 min/cycle</li> <li>Number of Cycles: 4 cycle/axis</li> <li>Vibration Axes: X, Y and Z (Rotate each axis on vertical vibration table)</li> </ol>   | JEDEC 22-B103B (2016)    | PASS        |
| Mechanical Shock Non-operating Unpackaged device | <ol style="list-style-type: none"> <li>Pulse shape: Half-sine waveform</li> <li>Impact acceleration: 1500 g</li> <li>Pulse duration: 0.5 ms</li> <li>Number of shocks: 30 shocks (5 shocks for each face)</li> <li>Orientation: Bottom, top, left, right, front and rear faces</li> </ol>  | JEDEC 22-B110B.01 (2019) | PASS        |

**Table 19: Sona MT320 M.2 2230 E-Key Module Reliability Test Item and Standards**

| Test Item  | Specification   | Standard  | Test Result |
|--|---|---|-------------|
| Thermal Shock  | <ol style="list-style-type: none"> <li>1. Temperature: -40 ~ 85°C</li> <li>2. Ramp time: Less than 10 seconds.</li> <li>3. Dwell Time: 10 minutes</li> <li>4. Number of Cycles: 500 times</li> </ol>  | *JESD22-A106<br>*IEC 60068-2-14 for dwell time and number of cycles | PASS        |
| Vibration<br>Non-operating<br>Unpackaged device        | <ol style="list-style-type: none"> <li>1. Vibration Wave Form: Sine Waveform</li> <li>2. Vibration frequency / Displacement: 20-80 Hz/1.5mm</li> <li>3. Vibration frequency / Acceleration: 80-2000 Hz/20g</li> <li>4. Cycle Time: 4 min/cycle</li> <li>5. Number of Cycles: 4 cycle/axis</li> <li>6. Vibration Axes : X, Y and Z (Rotate each axis on vertical vibration table)</li> </ol> | JEDEC 22-B103B (2016)   | PASS        |
| Mechanical Shock<br>Non-operating<br>Unpackaged device | <ol style="list-style-type: none"> <li>1. Pulse shape: Half-sine waveform</li> <li>2. Impact acceleration: 1500 g</li> <li>3. Pulse duration: 0.5 ms</li> <li>4. Number of shocks: 30 shocks (5 shocks for each face)</li> <li>5. Orientation: Bottom, top, left, right, front and rear faces</li> </ol>  | JEDEC 22-B110B.01 (2019)  | PASS        |

## 15.2 Reliability Prediction

| Test Item                        | Specification  | Standard                        |
|----------------------------------|--|---------------------------------|
| Mean Time Between Failure (MTBF) | <ol style="list-style-type: none"> <li>1. Normal Operating Temperature: 45 °C</li> <li>2. High Temperature: 85 °C</li> </ol> | Telcordia SR-332 Issue 4 (2016) |

| Laird Part Number | Environment                                   | Test Result 45 °C (Hours) |
|-------------------|---|---------------------------|
| 453-00176         | Ground, Fixed, Uncontrolled<br>Ground, Mobile | 5,811,765<br>2,179,412    |

| Laird Part Number | Environment                                   | Test Result 85 °C (Hours) |
|-------------------|---|---------------------------|
| 453-00176         | Ground, Fixed, Uncontrolled<br>Ground, Mobile | 1,391,674<br>521,878      |

| Laird Part Number | Environment                                   | Test Result 45 °C (Hours) |
|-------------------|---|---------------------------|
| 453-00177         | Ground, Fixed, Uncontrolled<br>Ground, Mobile | 7,058,202<br>2,646,826    |

| Laird Part Number | Environment                                   | Test Result 85 °C (Hours) |
|-------------------|---|---------------------------|
| 453-00177         | Ground, Fixed, Uncontrolled<br>Ground, Mobile | 2,177,692<br>816,635      |

| Laird Part Number | Environment                                   | Test Result 45 °C (Hours) |
|-------------------|---|---------------------------|
| 453-00178         | Ground, Fixed, Uncontrolled<br>Ground, Mobile | 3,933,540<br>1,475,077    |

| Laird Part Number | Environment                                   | Test Result 85 °C (Hours) |
|-------------------|---|---------------------------|
| 453-00178         | Ground, Fixed, Uncontrolled<br>Ground, Mobile | 867,635<br>325,363        |



## 16 REGULATORY

**Note:** For complete regulatory information, refer to the Sona MT320 Regulatory Information document which is also available from the TBD link

The Sona MT320 holds current certifications in the following countries:

| Country/Region | Regulatory ID |
|----------------|---------------|
| USA (FCC)      | SQG-MT320     |
| EU             | N/A           |
| UKCA           | N/A           |
| Canada (ISED)  | 3147A-MT320   |
| Japan (MIC)    | N/A           |
| Australia      | N/A           |
| New Zealand    | N/A           |

### 16.1 FCC Regulatory

#### 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.

**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

## 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



### 1.1.3 Antenna Details

| Ant. No. | Manufacturer       | Model                     | Part Number           | Type       | Connector | Gain (dBi) |      |
|----------|--------------------|---------------------------|-----------------------|------------|-----------|------------|------|
|          |                    |                           |                       |            |           | 2.4GHz     | 5GHz |
| 1        | Laird Connectivity | FlexMIMO 6E               | EFD2471A3S-10<br>MH4L | PIFA       | MHF4L     | 2.2        | 3.8  |
| 2        | Laird Connectivity | FlexPIFA 6E               | EFB2471A3S-10<br>MH4L | PIFA       | MHF4L     | 2.2        | 3.9  |
| 3        | Laird Connectivity | Mini NanoBlade Flex 6 GHz | EMF2471A3S-10<br>MH4L | PCB Dipole | MHF4L     | 2.4        | 4.4  |
| 4        | Joymax Electronics | Dipole 6E                 | TWX-100BRS3B          | Dipole     | RP-SMA    | 2          | 4    |

#### Label and Compliance Information

Product manufacturers need to provide a physical or e-label stating  
"Contains FCC ID: SQG-MT320" with finished product

#### Information on Test Modes and Additional Testing Requirements

Test tool: QA tool

#### 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

## 16.2 Industry Canada Regulatory

### Industry Canada statement:

*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-MT320] 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.

Le présent émetteur radio [IC: 3147A-MT320] 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.

### 1.1.3 Antenna Details

| Ant. No. | Manufacturer       | Model                     | Part Number           | Type       | Connector | Gain (dBi) |      |
|----------|--------------------|---------------------------|-----------------------|------------|-----------|------------|------|
|          |                    |                           |                       |            |           | 2.4GHz     | 5GHz |
| 1        | Laird Connectivity | FlexMIMO 6E               | EFD2471A3S-10<br>MH4L | PIFA       | MHF4L     | 2.2        | 3.8  |
| 2        | Laird Connectivity | FlexPIFA 6E               | EFB2471A3S-10<br>MH4L | PIFA       | MHF4L     | 2.2        | 3.9  |
| 3        | Laird Connectivity | Mini NanoBlade Flex 6 GHz | EMF2471A3S-10<br>MH4L | PCB Dipole | MHF4L     | 2.4        | 4.4  |
| 4        | Joymax Electronics | Dipole 6E                 | TWX-100BRS3B          | Dipole     | RP-SMA    | 2          | 4    |

## Radiation Exposure Statement:

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

### Déclaration d'exposition aux radiations:

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

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

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

As long as 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.

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

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

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

## IMPORTANT NOTE:

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

The final end product must be labeled in a visible area with the following: "Contains IC: 3147A-MT320".

## Plaque signalétique du produit final

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 3147A-MT320".

## 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.

## 16.3 Certified Antennas

The Sona MT320 module was tested with antennas listed in the following table. The OEM can choose a different manufacturer's antenna but must make sure it is of same type and that the gain is lesser than or equal to the antenna that is approved for use.

| Manufacturer                       | Model                        | Laird Connectivity<br>Part Number | Type       | Connector              | Peak Gain |         |
|------------------------------------|------------------------------|-----------------------------------|------------|------------------------|-----------|---------|
|                                    |                              |                                   |            |                        | 2.4 GHz   | 5 GHz   |
| Laird Connectivity                 | FlexMIMO 6E                  | EFD2471A3S-10MH4L                 | PIFA       | MHF4L                  | 2.2 dBi   | 3.8 dBi |
| Laird Connectivity                 | FlexPIFA 6E                  | EFB2471A3S-10MH4L                 | PIFA       | MHF4L                  | 2.2 dBi   | 3.9 dBi |
| Laird Connectivity                 | Mini NanoBlade<br>Flex 6 GHz | EMF2471A3S-10MH4L                 | PCB Dipole | MHF4L                  | 2.4 dBi   | 4.4 dBi |
| JOYMAX <a href="#">Electronics</a> | Dipole 6E                    | <a href="#">TWX-100BRS3B</a>      | Dipole     | <a href="#">RP-SMA</a> | 2 dBi     | 4.0 dBi |

## 17 BLUETOOTH SIG QUALIFICATION

### 17.1 Overview

The Sona MT320 Series module is listed on the Bluetooth SIG website as a qualified Controller Subsystem.

| Design Name | Owner                 | Declaration ID | Link to listing on the SIG website |
|-------------|-----------------------|----------------|------------------------------------|
| Sona MT320  | Laird<br>Connectivity | TBD            |                                    |

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](http://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 view this document):

[https://www.bluetooth.org/DocMan/handlers/DownloadDoc.ashx?doc\\_id=283698&vId=317486](https://www.bluetooth.org/DocMan/handlers/DownloadDoc.ashx?doc_id=283698&vId=317486)

### 17.2 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](https://www.bluetooth.org/tpg/QLI_SDoc.cfm)

---

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

---

2. In step 1, select the option, New Listing and Reference a Qualified Design.
3. Enter D057578 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>

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

## 18 ADDITIONAL INFORMATION

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

|                   |  |
|-------------------|--|
| Headquarters      | Laird Connectivity<br>50 S. Main St. Suite 1100<br>Akron, OH 44308 USA                             |
| Phone             | Americas: +1-800-492-2320<br>Europe: +44-1628-858-940<br>Hong Kong: +852-2762-4823                 |
| Website           | <a href="http://www.lairdconnect.com/">www.lairdconnect.com/</a>                                   |
| Technical Support | <a href="http://www.lairdconnect.com/resources/support">www.lairdconnect.com/resources/support</a> |
| Sales Contact     | <a href="http://www.lairdconnect.com/contact">www.lairdconnect.com/contact</a>                     |

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

Laird Connectivity's products are subject to standard [Terms & Conditions](#).

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

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