

DATASHEET

# M20047-1

M20047-1 • GNSSNOVA®



## Features

- SMD Active GNSS antenna (GPS/GLONASS/GALILEO/BEIDOU)
- SAW filter on board
- Ultra-small SMD package; 7.0 x 7.0 x 0.9mm
- 1.5 to 3.3V supply
- Low power consumption

# 1. Description

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A compact Active GNSS antenna using a high performance LNA with SAW for optimum performance. The M20047-1 operates from a 1.5 – 3.3V supply with low power consumption. The active antenna has the SAW filter after the LNA, this minimises the overall noise, so that weaker signals can be tracked.

# 2. Applications

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- Wearable devices
- Portable devices
- Asset tracking / Personal safety
- Sport cameras / Equipment
- Smart watches
- Navigation devices

# 3. Part number

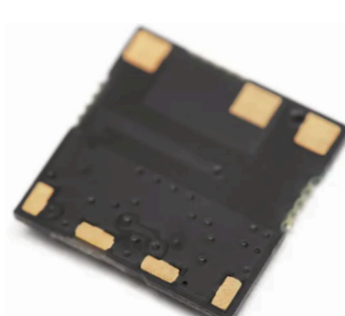
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M20047-1

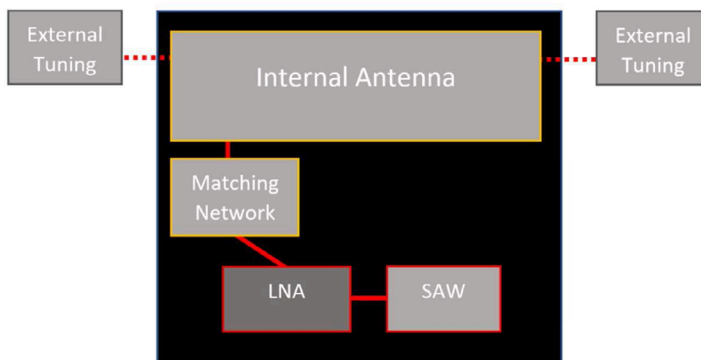
Top view



Bottom view



## 4. Functional block diagram



## 5. Active antenna specifications

### 5.1. Absolute maximum ratings

| Symbol           | Parameter              | Min  | Max | Unit |
|------------------|------------------------|------|-----|------|
| V <sub>CC</sub>  | Main supply voltage    | -0.3 | 3.6 | V    |
| RF <sub>IN</sub> | Maximum RF input power | N/A  | 0.0 | dBm  |
| T <sub>STG</sub> | Storage temperature    | -40  | +85 | °C   |
| T <sub>OP</sub>  | Operating temperature  | -40  | +85 | °C   |

Exposure to absolute ratings may adversely affect reliability and may cause permanent damage

### 5.2. Recommended operating conditions

| Symbol          | Parameter             | Min | Typ | Max | Unit |
|-----------------|-----------------------|-----|-----|-----|------|
| V <sub>CC</sub> | Main supply voltage   | 1.5 | -   | 3.3 | V    |
| T <sub>OP</sub> | Operating temperature | -40 | -   | +85 | °C   |

### 5.3. DC electrical characteristics

Conditions: V<sub>CC</sub> = 2.8V, T<sub>OP</sub> = 25 °C

| Symbol               | Parameter                | TYP | UNIT |
|----------------------|--------------------------|-----|------|
| I <sub>CC(ACQ)</sub> | Supply current (on mode) | 2.6 | mA   |

## 5.4. RF specifications

Conditions: VCC = 2.8V, TOP = 25 °C, Freq = 1575.420MHz

| Symbol              | Parameter                | TYP  | UNIT |
|---------------------|--------------------------|------|------|
| Gain <sub>LNA</sub> | LNA Insertion power gain | 18.5 | dB   |
| NF 0.9 dB           | Noise Figure             | -40  | dB   |
| ANT <sub>RL</sub>   | Antenna return loss      | <-10 | dB   |
| ANT <sub>EFF</sub>  | Antenna total efficiency | 65   | %    |

Note: All data based on Antenna EVB-1

## 5.5. Band rejection

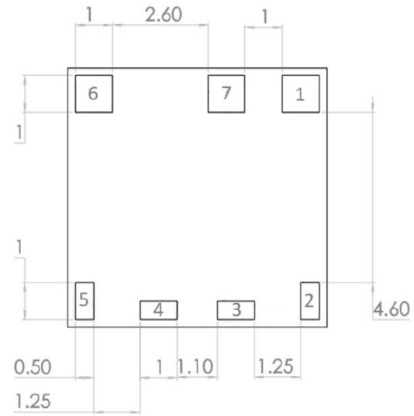
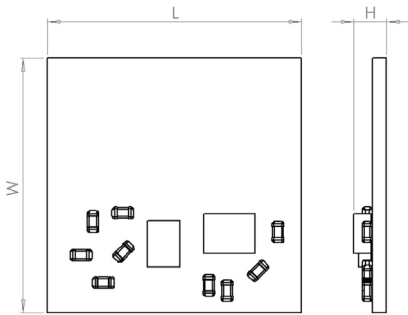
| Frequency | Parameter          | TYP | UNIT |
|-----------|--------------------|-----|------|
| 698-798   | LTE700             | 53  | dB   |
| 824-849   | Cellular CDMA      | 54  | dB   |
| 869-894   | GSM850             | 55  | dB   |
| 880-915   | GSM900             | 55  | dB   |
| 1710-1785 | GSM1800/DCS        | 40  | dB   |
| 1850-1910 | GSM1900/PCS        | 43  | dB   |
| 1920-1980 | WCDMA              | 38  | dB   |
| 2400-2492 | WLAN, BT and WiMAX | 33  | dB   |
| 2500-2690 | LTE2600            | 33  | dB   |

Note: Does not include antenna rejection.

## 5.6. Mechanical specifications

| Parameter                                      | TYP                                  | Unit |
|--|--------------------------------------|------|
| Active antenna exterior dimensions (L x W x H) | 7.0 (±0.1) x 7.0 (±0.1) x 0.9 (±0.2) | mm   |
| Active antenna support and connection          | Surface mounted (SMD)                | -    |
| Active antenna mass                            | ≤0.2                                 | g    |

## 6. Module dimension

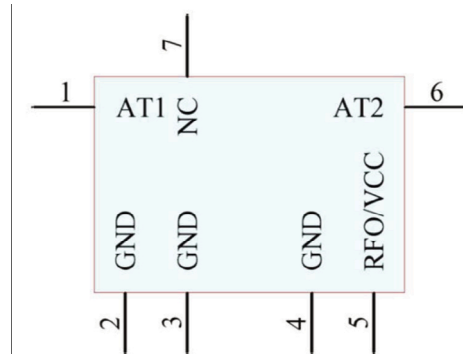


| L        | W        | H        |
|----------|----------|----------|
| Length   | Width    | Height   |
| 7.0 ±0.1 | 7.0 ±0.1 | 0.9 ±0.2 |

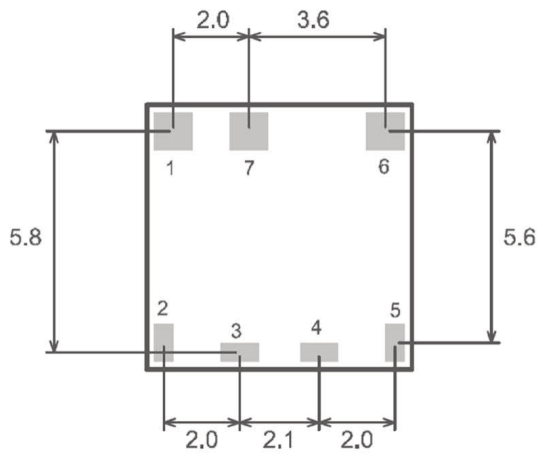
All dimensions in (mm)

## 7. Schematic symbol and pin definition

| Pin | Designator | Description                         |
|-----|------------|-------------------------------------|
| 1   | AT1        | Antenna tuning left side            |
| 2   | GND        | Ground connection                   |
| 3   | GND        | Ground connection                   |
| 4   | GND        | Ground connection                   |
| 5   | RFO/VCC    | RF signal output / DC voltage input |
| 6   | AT2        | Antenna tuning right side           |
| 7   | NC         | Not connected                       |



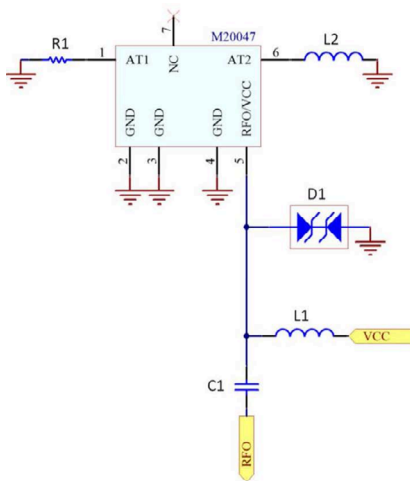
## 8. Host PCB footprint



All dimensions in (mm)

## 9. Active antenna application

### 9.1. Reference schematic

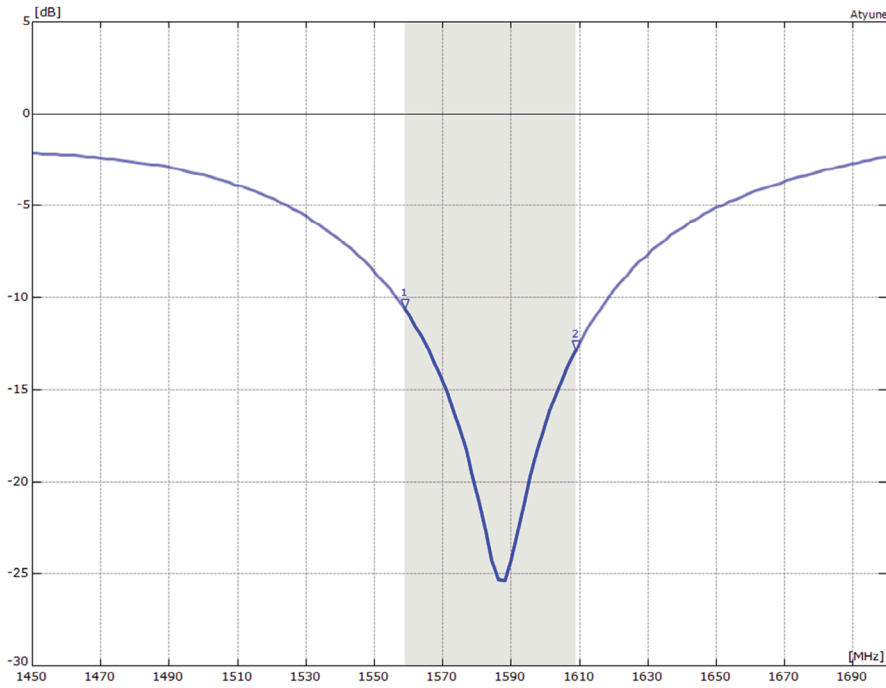


#### Bill of Material

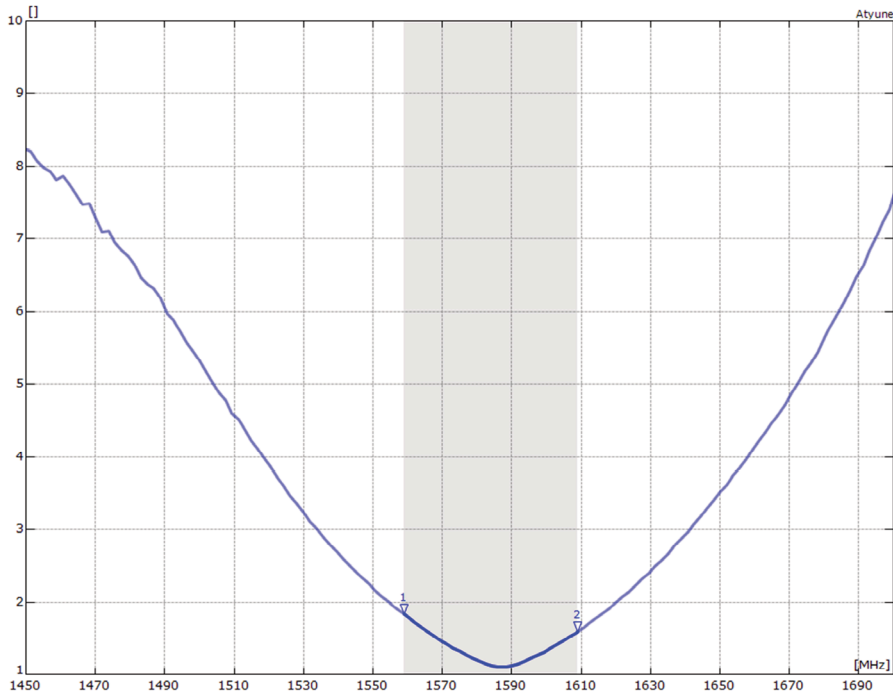
| Designator | Value          | Description/Comments                         | Quantity |
|------------|----------------|--|----------|
| D1         | ESD diode      | TVS 20kV ESD protection (Non-specific)       | 1        |
| L1         | 47nH inductor  | RF choke                                     | 1        |
| C1         | 22pF capacitor | DC blocking capacitor                        | 1        |
| L2         | 1.8nH inductor | Antenna tuning (value dependent on host PCB) | 1        |
| R1         | 0 ohm          | For additional antenna tuning                | 1        |

## 9.2. Active antenna performance

### 9.2.1. Antenna return loss



### 9.2.2. Antenna VSWR

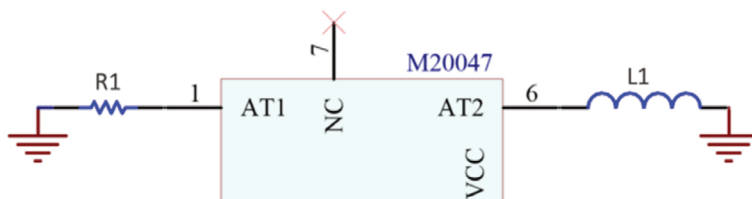


### 9.3. External matching

The M20047-1 active antenna uses external matching circuit components on the host PCB to fine-tune the antenna to each specific application. This “external matching” allows compensating for the detuning of the antenna caused by various components that can be close to the M20047-1 in the actual application (plastic case, battery, speakers, etc).

The external matching must be placed on the host PCB as close as possible to the active antenna pads AT1(Pad1) and AT2 (Pad6), respectively. A single matching component for each pin is required. A perfect GND plane connecting for each matching component is needed. For multi-layer PCB, an individual GND via should be placed close to the matching component as possible.

Schematic: See below based on Antenna EVB-1: AT1 uses a 0ohm resistor and AT2 uses a 1.8nH inductor to tune the antenna. Provision must be made for these components in as they will be required to optimise the antenna performance for your PCB – please see the Antenna website Support (Services) section for details on how we can support you to select these components.



#### Type of Matching Components:

- Capacitors: Use 0402, COG components

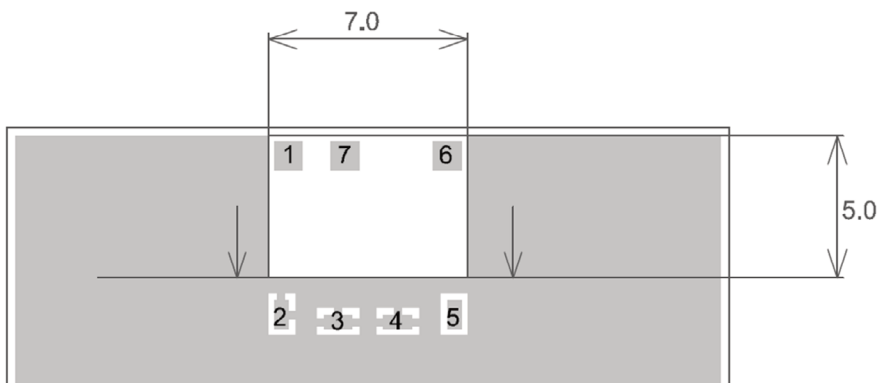
#### Inductors:

- High-Q, wire wound inductors in 0402 sizes are recommended for maximum performance, e.g. Murata LQW15 series.
- Good quality multi-layer type inductors (e.g. Murata LQG15 series) can also be used as a lower cost alternative.

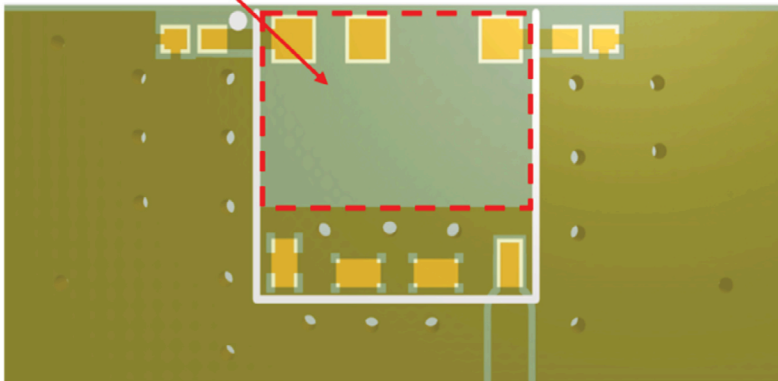
## 9.4. Antenna clearance

The M20047-1 active antenna requires a clearance on the host PCB to operate. The clearance means that no ground or tracks of any kind can be placed within this area. This clearance area also needs to be applied through the entire PCB stack up. The minimum area needed for clearance is 7.0mm x 5.0mm.

Top view of M20047-1 host PCB footprint



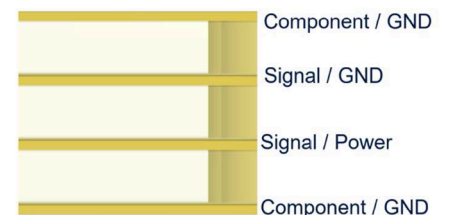
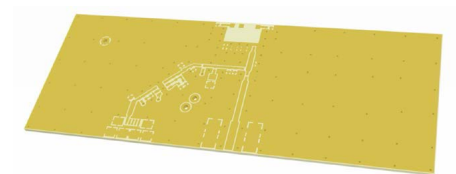
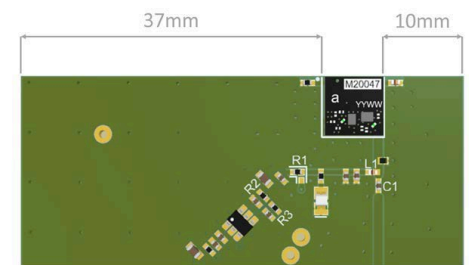
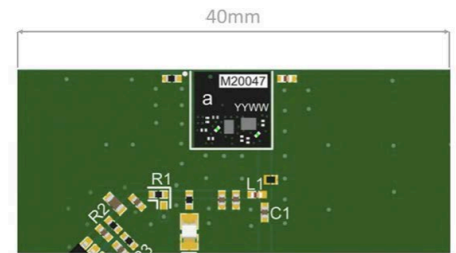
Clearance area critical for antenna performance



## 9.5. Module placement guidelines

For the M20047-1 active antenna, care must be taken when defining the placement of the module on the host PCB. Here are some guidelines that should be used when deciding the position of the module.

- The active antenna top edge should be placed almost level with the centre of the LONG edge of the host PCB.
- The edge of the host PCB that the active antenna is to be placed should be a minimum of 40mm in length. Shorter PCB lengths may be possible, depending on your device and performance requirements, please visit [ask.antenova.com](http://ask.antenova.com) for more detailed guidance.
- Central placement of the active antenna is advised. However, an offset placement is also possible.
- For an offset closer to the PCB edge to the right side of the active antenna, a minimum of 10mm distance is required to the edge of the host PCB (see example, right, based on the EVK).
- The active antenna uses the host PCB ground to effectively radiate. As such, a GND plane must be placed on the host PCB on at least one layer.
- In this example, the only area void of GND is the antenna keep-out area. The solder mask is removed to make the copper visible.
- An ideal stack-up for a host PCB would be to use the top and bottom layers as GND planes, while using the internal layers for any signal and power planes. This not only helps the GPS antenna to perform effectively, but also helps to reduce any potential noise issues that can be associated with mixed signal PCB's.
- The example on the right shows a 4-layer host PCB. For GND layer, all available space should not be used for signal trace routing or component placement.

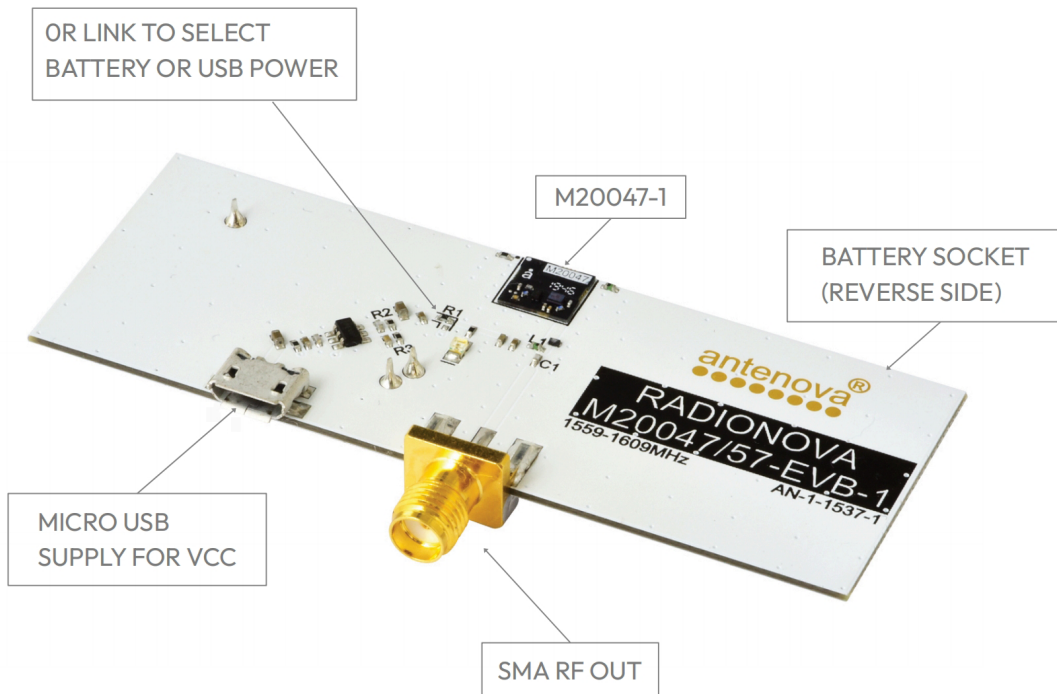
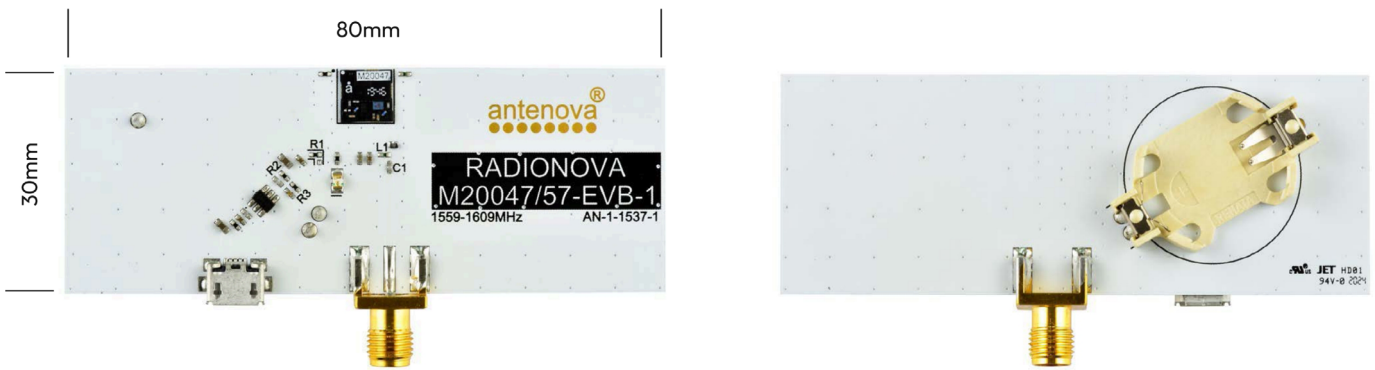


# 10. Evaluation kit

## 10.1. Reference schematic

The EVK is a single PCB that contains the M20047-1 active antenna and required components to run on a PC via a USB cable and Antenova software. Evaluation kits are available on request. Please contact Antenova for more information. (Part number: M20047-EVB-1).

To order a reference board please see [antenova.com](http://antenova.com)



# 11. Reflow soldering

## 11.1. Placement

Typical placement systems used for any BGA/LGA package are acceptable.

Recommended nozzle diameter for placement: 5mm

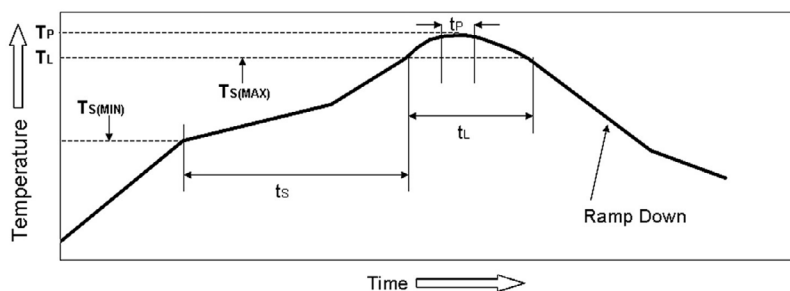
## 11.2. Soldering paste

Use of “No Clean” soldering paste is strongly recommended, as it does not require cleaning after the soldering process has taken place. An example of suitable soldering paste is Alpha OM350.

## 11.3. Soldering

The recommended soldering profile for M20047-1 active antenna is shown below. However, it is the responsibility of the Contract Manufacturer to determine the exact reflow profile used, taking into consideration the parameters of the host PCB, solder paste used, etc.

| PROFILE FEATURE                                       |                                  | PB-FREE SOLDER |
|---|----------------------------------|----------------|
| Pre-Heat  | Temperature ( $T_s$ ) Min        | 130°C          |
|   | Temperature ( $T_s$ ) Max        | 220°C          |
|   | Time ( $t_s$ )                   | <150s          |
| Reflow  | Liquidus Temperature - ( $T_l$ ) | 220°C          |
|   | Time ( $t_l$ )                   | 45-90s         |
| Peak Package Body Temperature ( $T_p$ )               |                                  | 245°C          |
| Time within 5°C of peak temp ( $t_p$ )                |                                  | 30s            |
| Average Ramp up rate - $T_s(\text{max})$ to ( $T_p$ ) |                                  | 3°C/s          |
| Ramp Down Rate  |                                  | 6°C/s max      |



The Pb Free Process-Package Peak Reflow Temperature is 260°C.

Exceeding the maximum soldering temperature could permanently damage the module.

## 11.4. Multiple soldering

The M20047-1 active antenna can be submitted up to 2 reflow soldering processes.

Upside-down soldering is acceptable but it is recommended that the Contract Manufacturer qualify the process before mass production. The second reflow must take place within the recommended floor life limit (MSL3). Please contact Antenova for further information.

## 11.5. Hand soldering

Hand-soldering and rework of the M20047-1 active antenna is acceptable, however care must be taken to avoid short circuits due to the small size of the module pads.

## 12. Quality and environmental specifications

| TEST                        | STANDARD  | PARAMETERS   |
|-----------------------------|---|--|
| PCB inspection              | IPC-6012B, Class 2. Qualification and Performance Specification for Rigid Printed Boards - Jan 2007 |  |
| Assembly inspection         | IPC-A-610-D, Class 2 "Acceptability of electronic assemblies"                                       |  |
| Temperature range           | ISO16750-3  | -30 °C, +25 °C, +85 °C, operating  |
| Moisture/Reflow sensitivity | IPC/JEDEC J-STD-020D.1  | MSL3   |
| Storage (Dry Pack)          | IPC/JEDEC J-STD-033C  | MSL3   |
| Solderability               | EN/IEC 60068-2-58 Test Td   | More than 90% of the electrode should be covered by solder. Solder temperature 245 °C ± 5 °C |

Moisture sensitivity:

Antenova ships all devices dry packed in tape on reel with desiccant and moisture level indicator sealed in an airtight package. If on receiving the goods the moisture indicator is pink in colour or a puncture of the airtight seal packaging is observed, then follow J-STD-033 "Handling and Use of Moisture/Reflow Sensitive Surface Mount Devices".

## 14. Packaging

### 14.1. Optimal storage conditions

Hand-soldering and rework of the M20047-1 active antenna is acceptable, however care must be taken to avoid short circuits due to the small size of the module pads.

|               |   |
|---------------|---|
| TEMPERATURE   | -10°C to 40°C   |
| HUMIDITY      | Less than 75% RH  |
| SHELF LIFE    | 24 Months   |
| STORAGE PLACE | Away from corrosive gas and direct sunlight                                 |
| PACKAGING     | Reels should be stored in unopened sealed manufacturer's plastic packaging. |
| MSL LEVEL     | 3   |

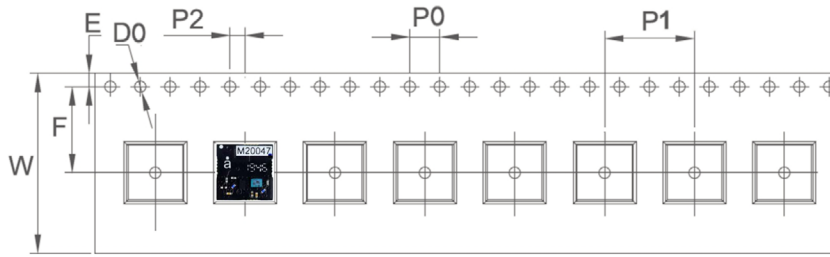
**Note:**

The M20047-1 antenna meet MSL Level 3 of the JEDEC specification J-STD-020D - 168 hours Floor Life (out of bag)  $\leq 30$  °C/60% RH.

If the stated floor life expires prior to reflow process then follow J-STD-033 "Handling and Use of Moisture/Reflow Sensitive Surface Mount Devices".

The shelf life of the antenna is 2 years provided the factory seal on the package has not been broken.

## 14.2. Tape characteristics



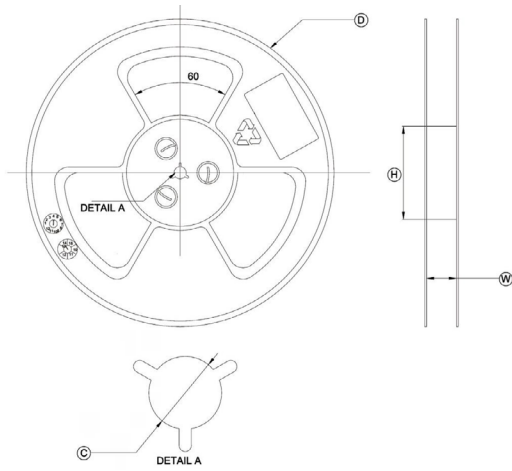
| P0         | P1          | P2         | D0         |
|------------|-------------|------------|------------|
| 4.00 ± 0.1 | 12.00 ± 0.1 | 2.00 ± 0.1 | 1.55 ± 0.1 |

| E          | F           | W           |
|------------|-------------|-------------|
| 1.75 ± 0.1 | 11.50 ± 0.1 | 24.00 ± 0.3 |

All dimensions in (mm)

| QUANTITY        | LEADING SPACE           | TRAILING SPACE          |
|-----------------|-------------------------|-------------------------|
| 1000 pcs / reel | 50 blank module holders | 50 blank module holders |

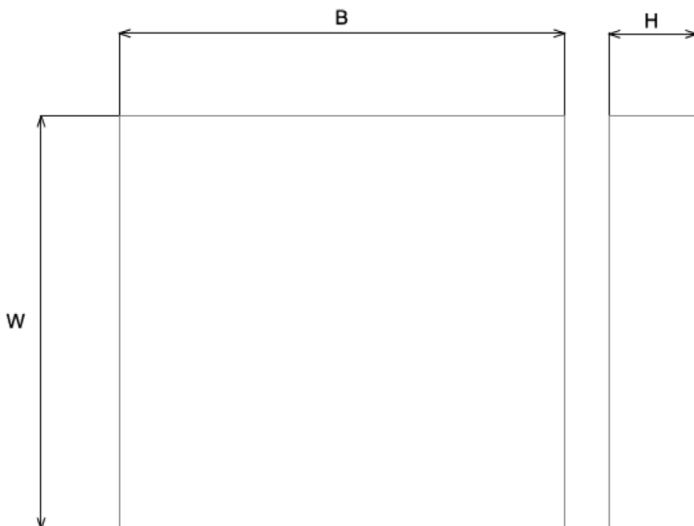
### 14.3. Reel dimensions



| D           | C          | H           | W          |
|-------------|------------|-------------|------------|
| 330.0 ± 2.0 | 13.3 ± 0.3 | 100.0 ± 3.0 | 24.5 ± 0.2 |

All dimensions in (mm)

### 14.4. Box dimensions



| Width (W) | Breadth (B) | Height (H) |
|-----------|-------------|------------|
| 340mm     | 339mm       | 53mm       |

## 14.5. Bag properties

Reels are supplied in protective plastic packaging.

## 14.6. Reel label information



## Quality statements

### Quality statements

Antenova's products conform to REACH and RoHS legislation. For our statements regarding these and other quality standards, please see [antenova.com](http://antenova.com).



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## Datasheet version

3.01 released 18th May 2026

## Antenna design, integration and test resources

Product designers – the details contained in this datasheet will help you to complete your embedded antenna design. Please follow our technical advice carefully to obtain optimum antenna performance.

We aim to support our customers to create high performance wireless products. You will find a wealth of design resources, calculators and case studies to aid your design on our website.

Antenova's design laboratories are equipped with the latest antenna design tools and test chambers. We provide antenna design, test and technical integration services to help you complete your design and obtain the required certifications.

If you cannot find the antenna you require in our product range, please contact us to discuss creating a custom antenna to meet your exact requirements.

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