

DATASHEET

# Inpai

SR4L099 • lamiiANT®



## Features

- Antenna for cellular 4G/LTE applications
- Has high efficiency on a 100mm PCB size
- Placement at left corner on long side of PCB
- Suitable for small form factor (SFF) devices using the AT&T network
- High performance: DFI (Designed For Integration)
- Evaluation PCB size: 100x40mm

## 1. Description

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- A SMD antenna for fitting onto a PCB. The antenna operates on the most common 4G bands: LTE 700, GSM850, GSM900, DCS1800, PCS1900, WCDMA2100, LTE B7 (2500-2690MHz), and LTE B40 (2300 – 2400MHz). It is optimised for use on the AT&T network with small form factor devices.

## 2. Application

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- Telematics tracking devices
- Pet Trackers
- Bike Trackers
- M2M (Machine to Machine) / Remote monitoring
- POS (Point of Sale) terminals
- Small sensors for IoT (Internet of Things)
- Drone communications

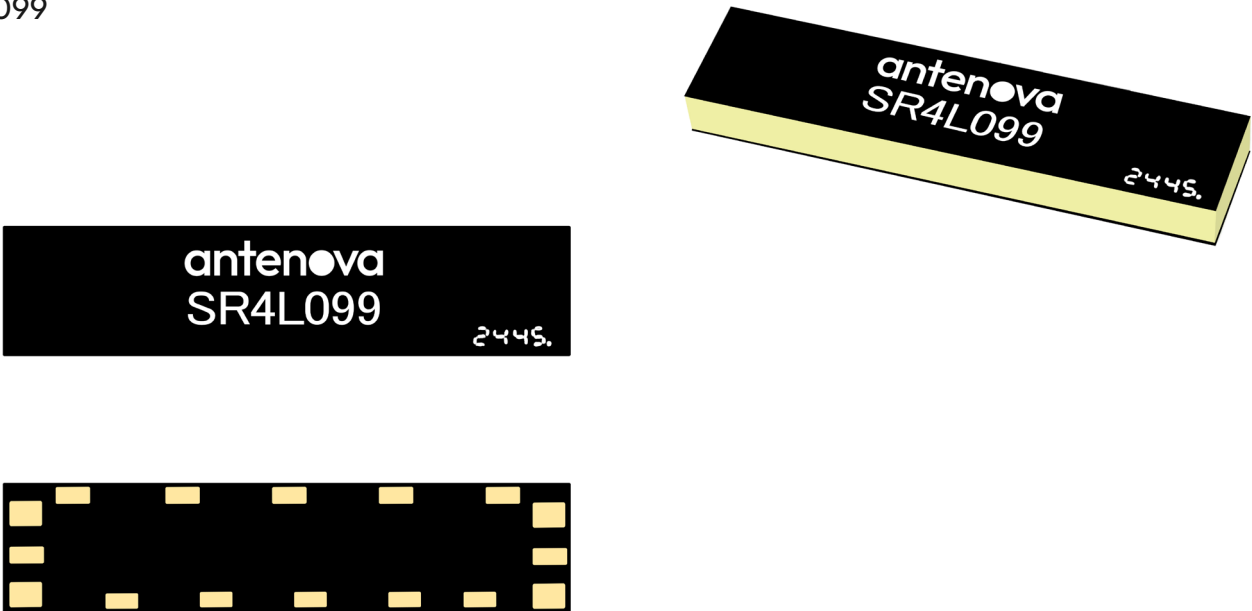
## 3. General data

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Frequency	698-960MHz 1710-2170MHz 2300-2400MHz 2500-2690MHz
Polarization	Linear
Operating Temperature	-40°C to 140°C
Environmental Condition Test	ISO16750-4 5.1.1.1/5.1.2.1/5.3.2
Impedance With Matching	50 $\Omega$
Weight	<2g
Antenna Type	SMD
Dimensions	35.0 x 8.0 x 3.3 (mm)

## 4. Part number

Inpai  
SR4L099



## 5. RF characteristics

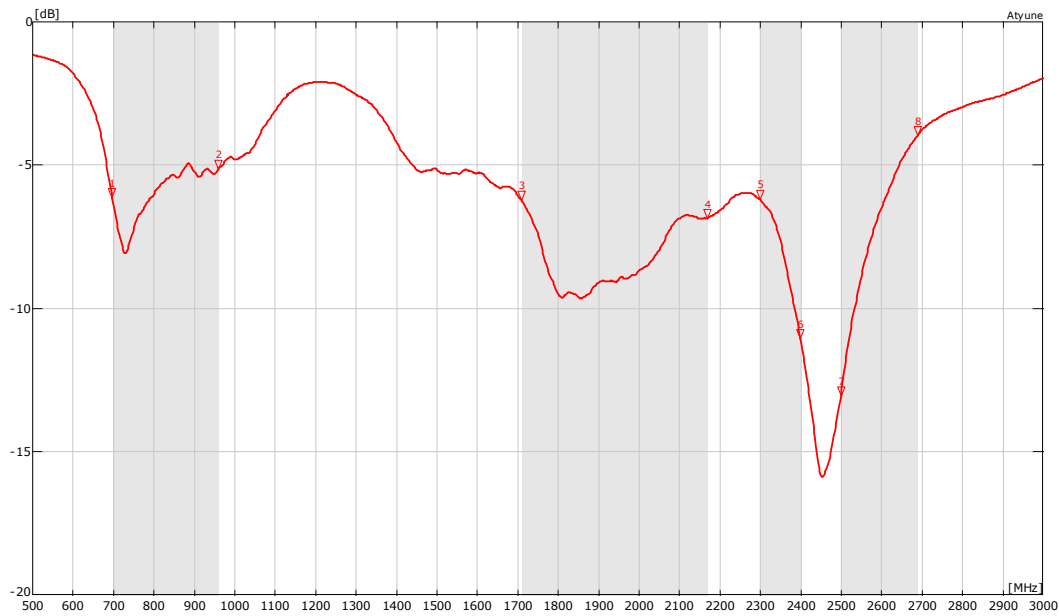
### 5.1. Cable assembly

Frequency	698-960MHz	1710-2170MHz	2300-2400MHz	2500-2690MHz
Peak Gain	0.15dBi	3.1dBi	3.58dBi	3.73dBi
Average Gain	-3.12dB	-2.11dB	-1.63dB	-2.59dB
Average Efficiency	48.75%	61.45%	68.68%	55.03%
Maximum Return Loss	-5.1dB	-6.2dB	-6.1dB	-3.9dB
Maximum VSWR	3.5:1	2.9:1	2.9:1	4.4:1

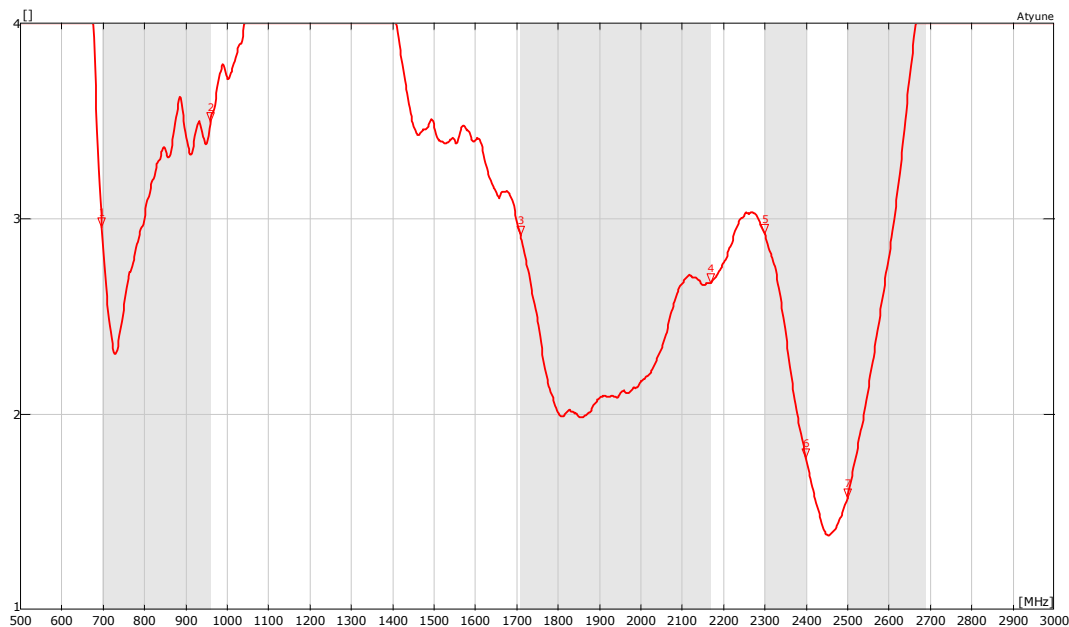
All data measured on Antenova’s evaluation PCB Part No. SR4L099-EVB-1

## 6. RF performance

### 6.1. Return loss



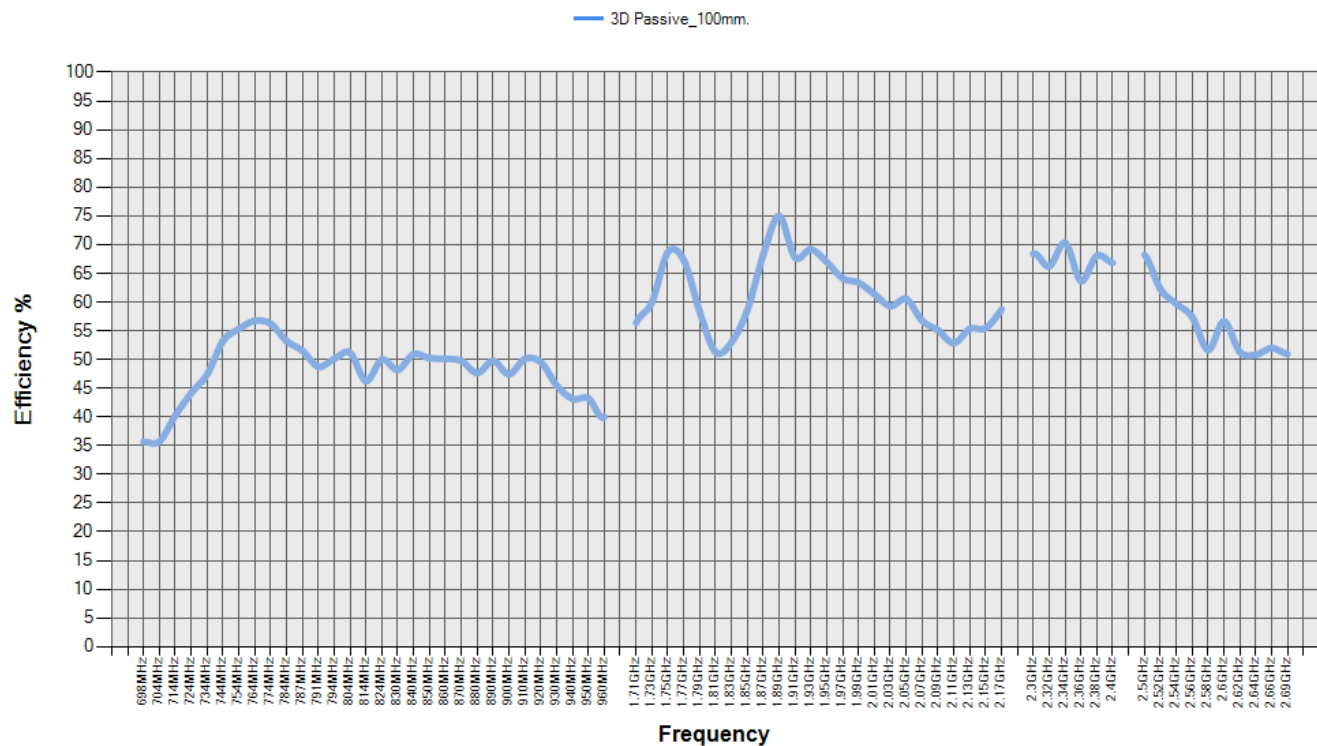
### 6.2. VSWR



All data measured on Antenova's evaluation PCB  
Part No. SR4L099-EVB-1

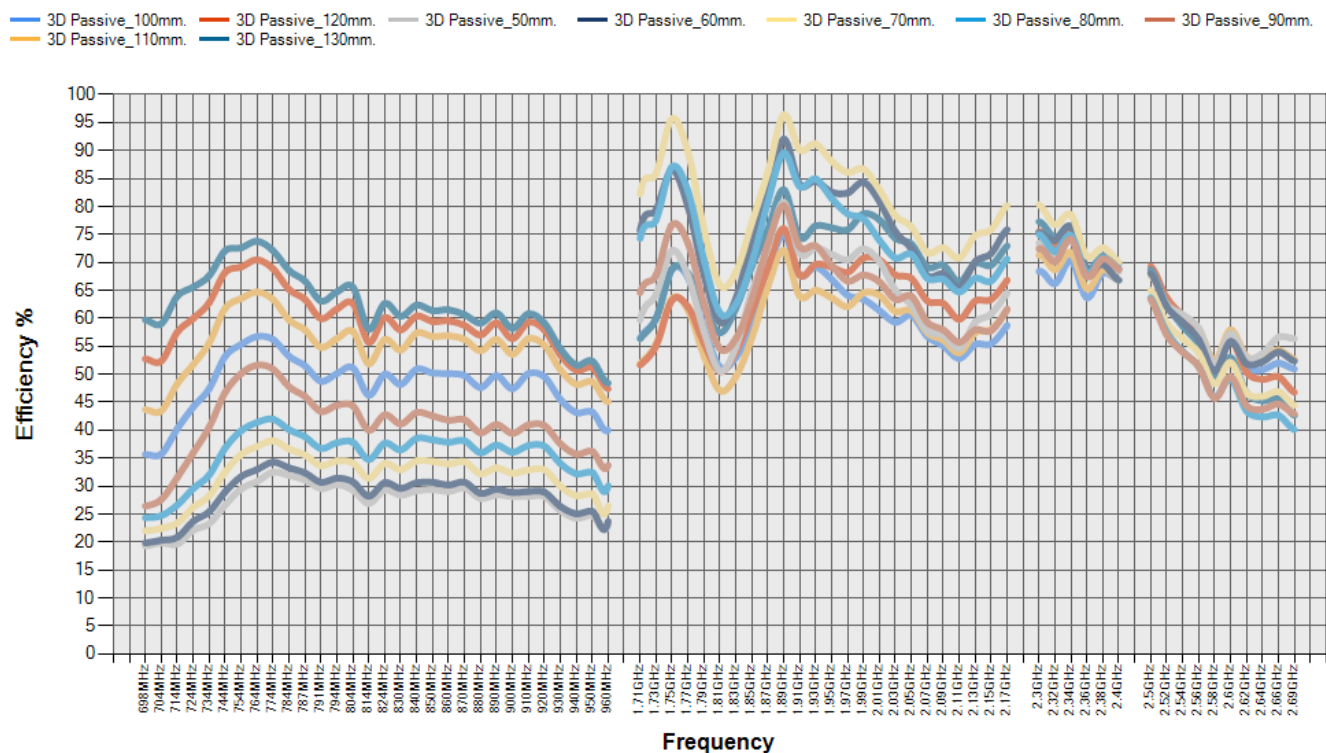
## 6.3. Efficiency

### 6.3.1. Efficiency in PCB 100mm



All data measured on Antenna's evaluation PCB  
Part No. SR4LO99-EVB-1

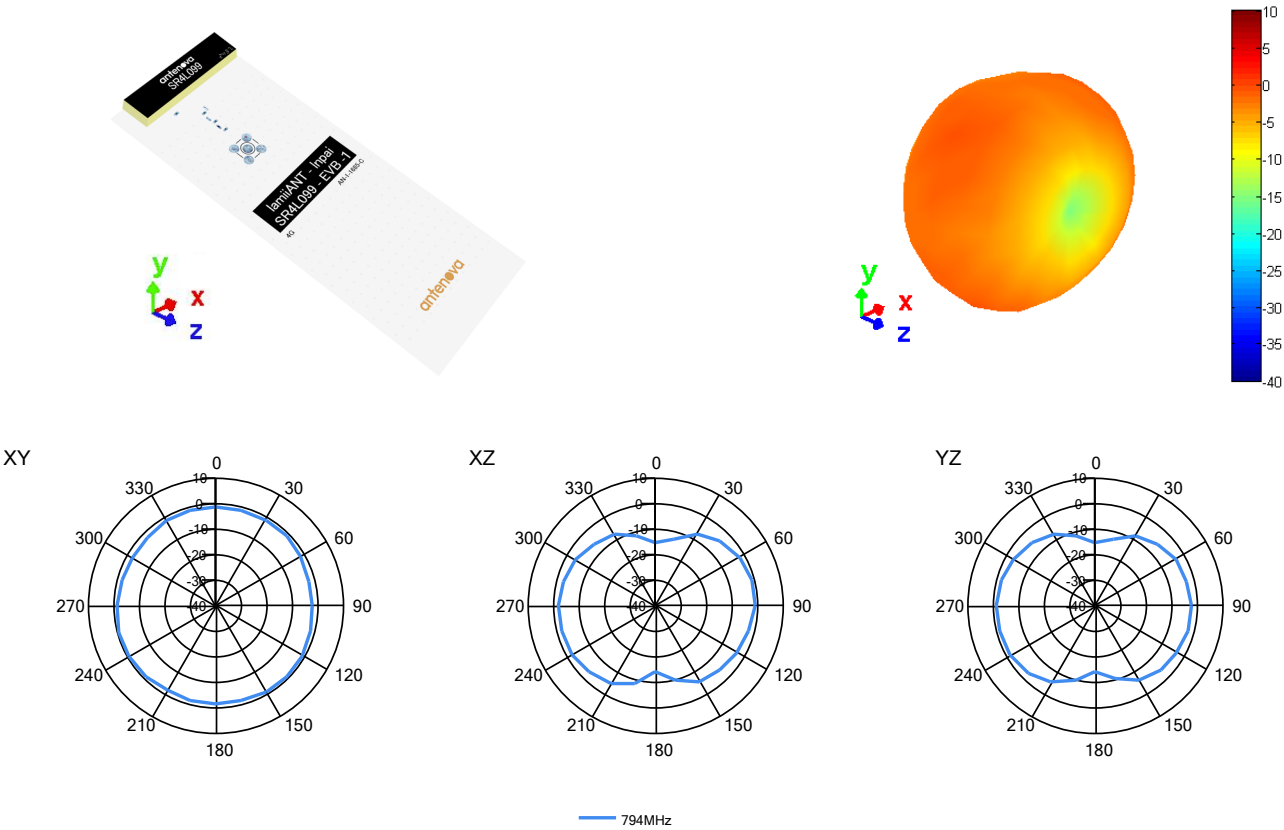
### 6.3.2. Efficiency in different PCB length



6.4. Antenna Pattern

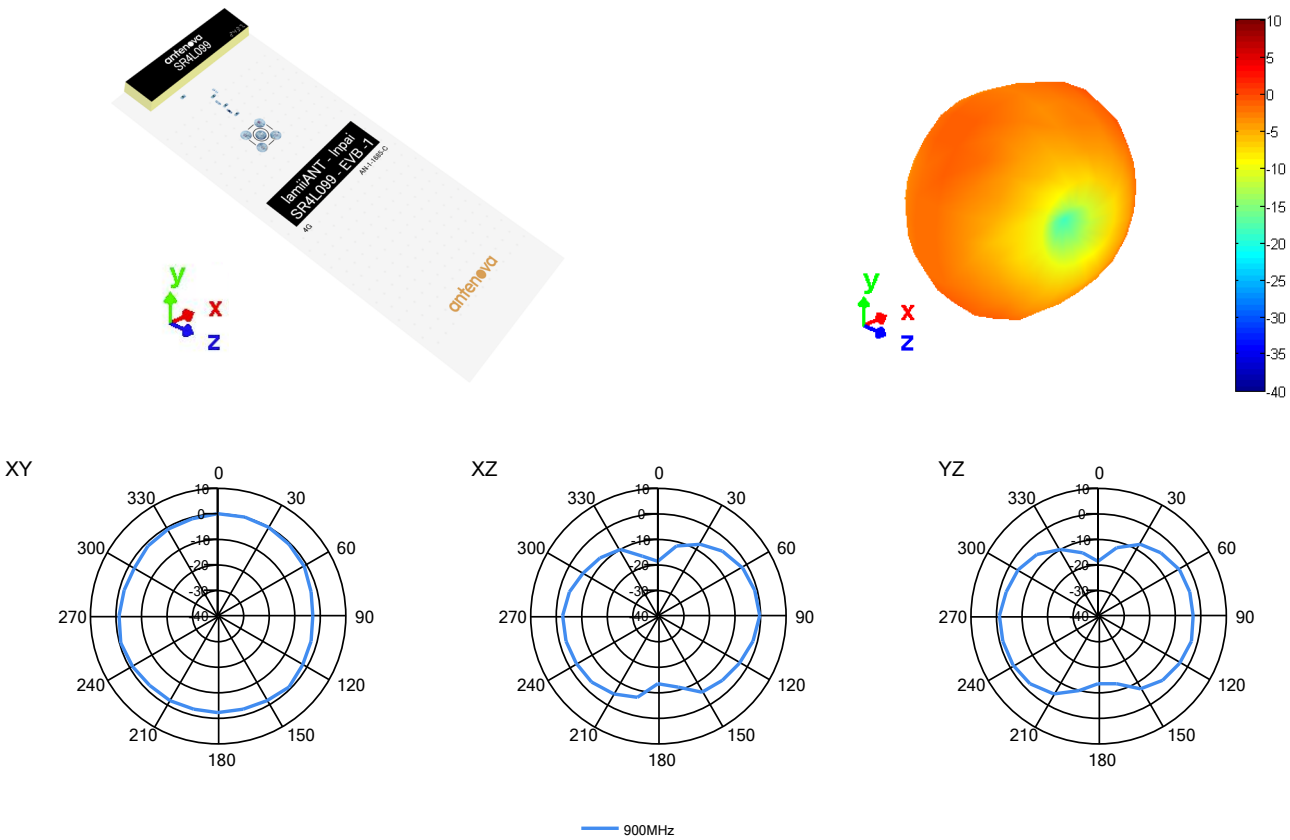
6.4.1. 794MHZ

3D pattern at 794MHz



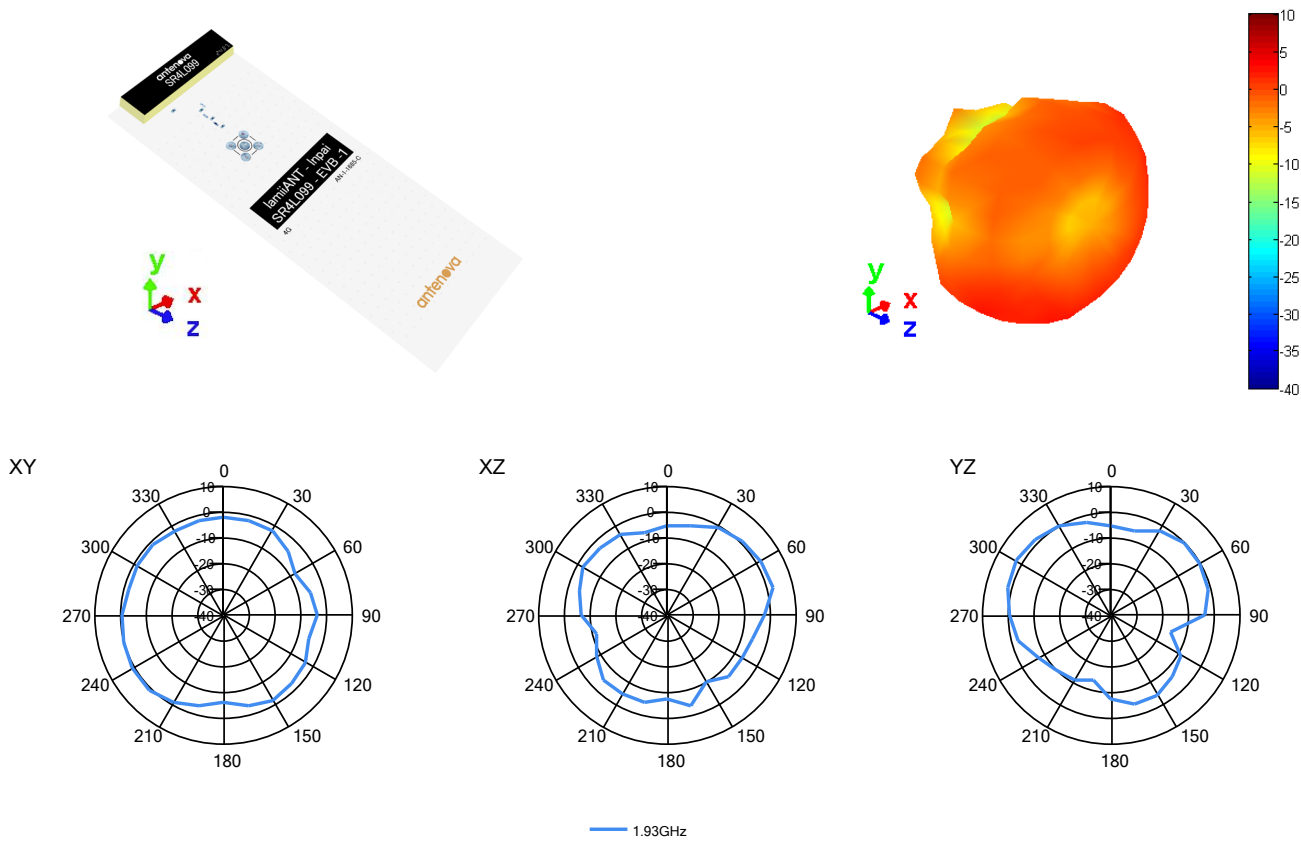
6.4.2. 900MHZ

3D pattern at 900MHz



6.4.3. 1930MHZ

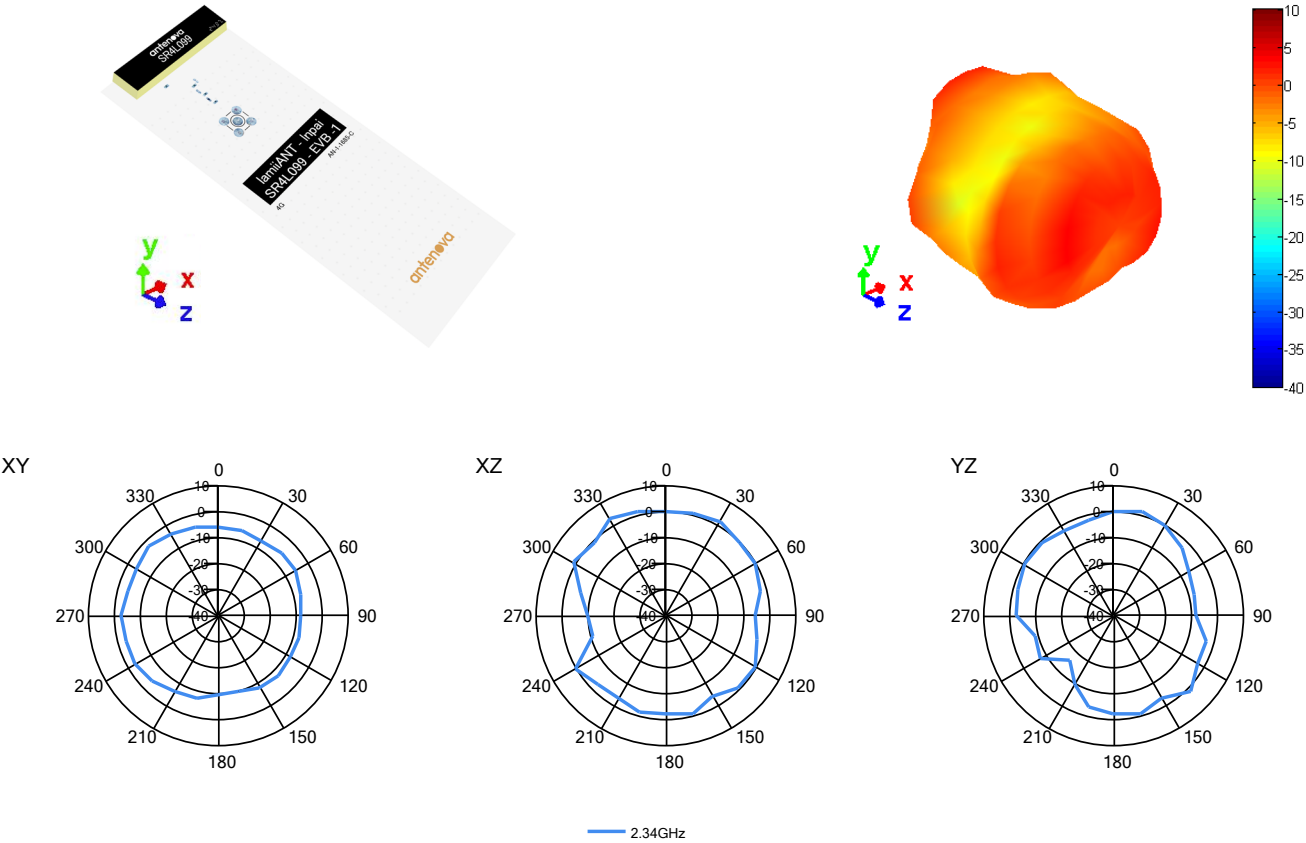
3D pattern at 1930MHz





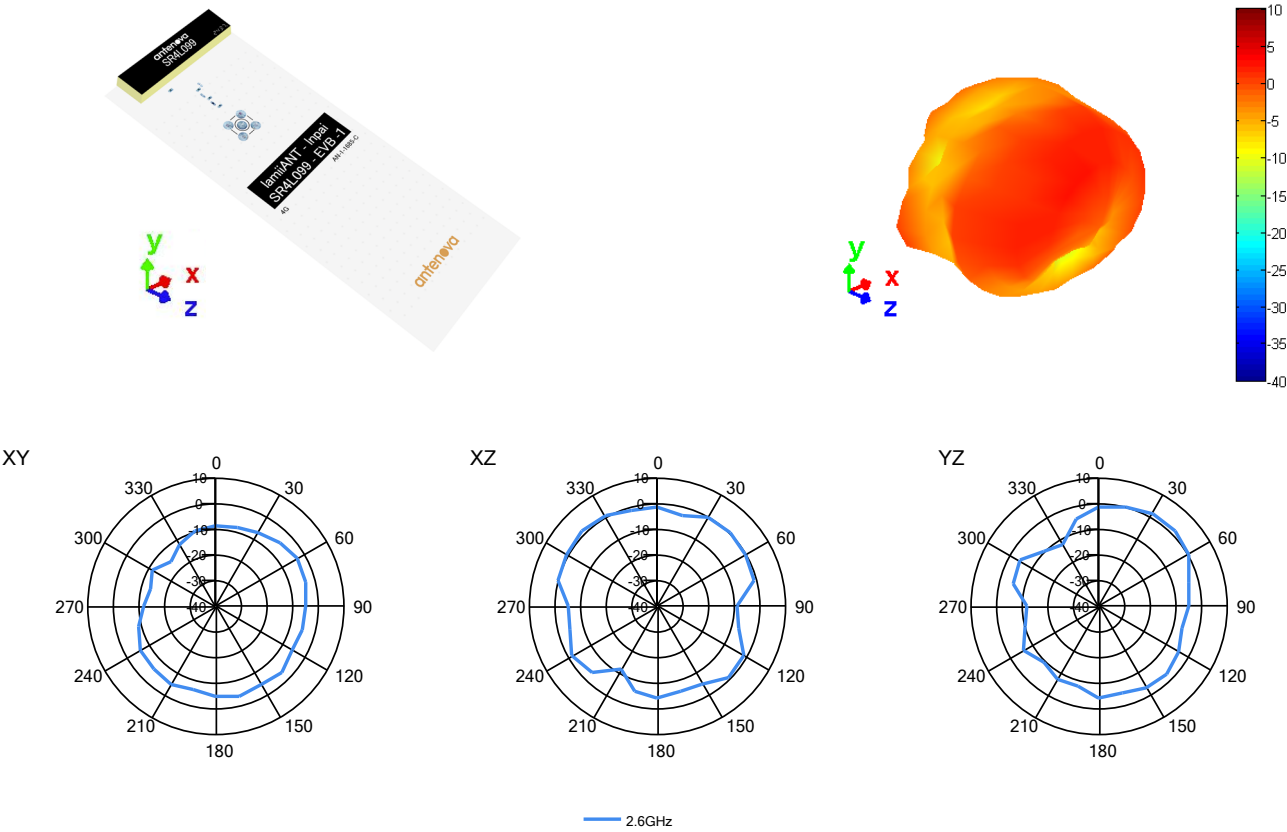
6.4.4. 2340MHZ

3D pattern at 2340MHz



6.4.5. 2600MHZ

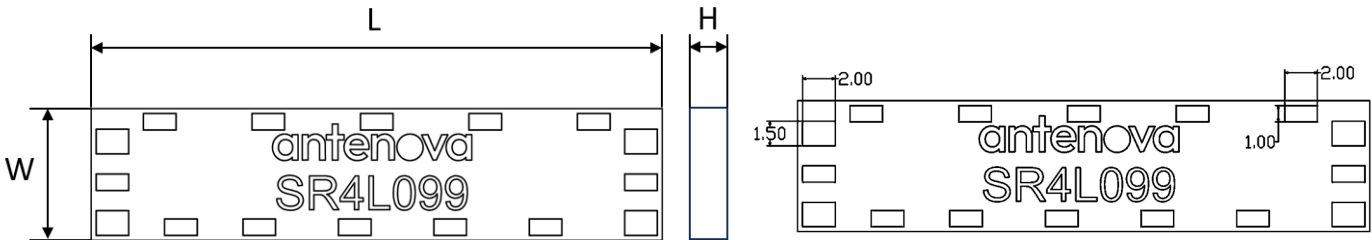
3D pattern at 2600MHz



## 7. Antenna dimensions

### 7.1.Dimensions Assembled

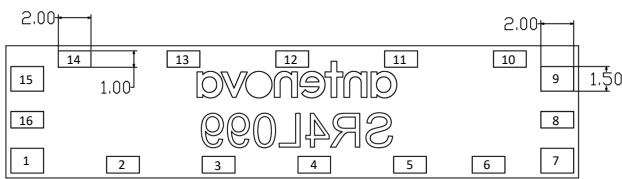
Top view



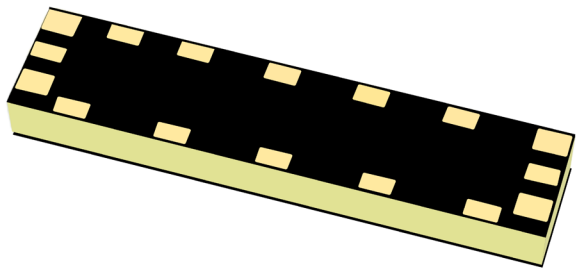
L	W	M
Length	Width	Height
35.0 ± 0.1	8.0 ± 0.1	3.3 ± 0.1

All dimensions in (mm)

Bottom view



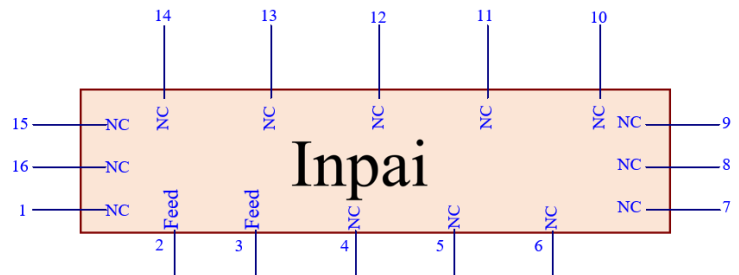
1 • 7 • 9 • 15 copper pads: 1.5 x 2.0 (mm)  
Others copper pads: 1.0 x 2.0 (mm)



## 8. Schematic symbol and pin definition

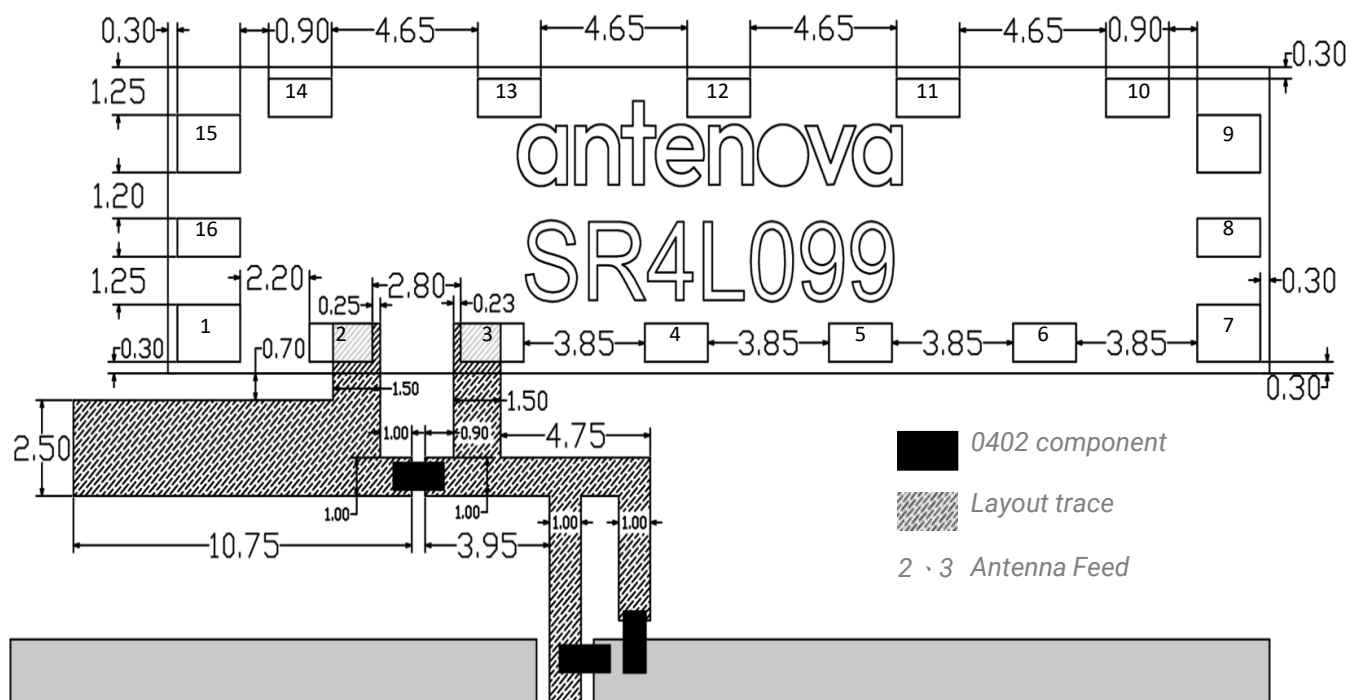
The circuit symbol for the antenna is shown below. The antenna has 16 pins  
With 2、3 as functional. All other pins are for mechanical strength.

Pin	Description
2、3	Feed
Others	Not used (Mechanical only)



## 9. Host PCB footprint

The recommended host PCB footprint is below.



1、7、9、15 copper pads: 1.5 x 2.0 (mm)

Others copper pads: 1.0 x 2.0 (mm)

## 10. Electrical interface

### 10.1. Transmission line

All transmission lines should be designed to have a characteristic impedance of  $50\Omega$

- The length of each transmission lines should be kept to a minimum
- All other parts of the RF system like transceivers, power amplifiers, etc, should also be designed to have a  $50\Omega$  impedance

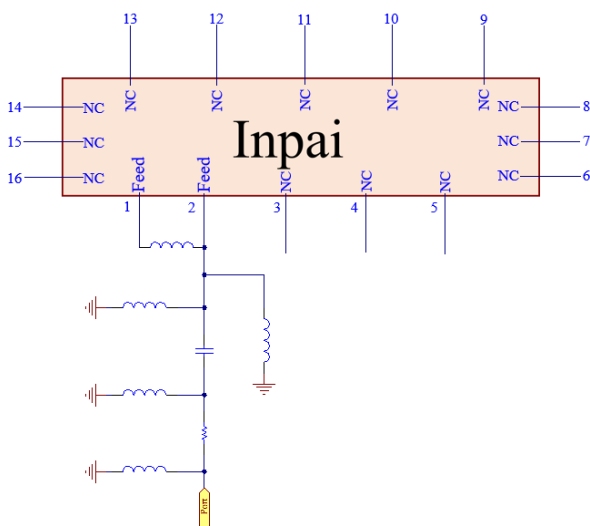
A co-planar transmission line can be designed using an online transmission line calculator tool, such as:

<https://blog.antenova.com/rf-transmission-line-calculator>

The PCB thickness, copper thickness and substrate dielectric constant are entered, then the tool calculates the transmission line width and gaps on either side of the track to give a  $50\Omega$  impedance.

### 10.2 Matching circuit

The antenna requires a matching circuit that must be optimized for each product. The matching circuit will require up to **seven** components and the following circuit should be designed into the host PCB. Not all components may be required but should be included as a precaution. The matching network should be placed close to the antenna feed to ensure it is optionally effective in tuning the antenna.



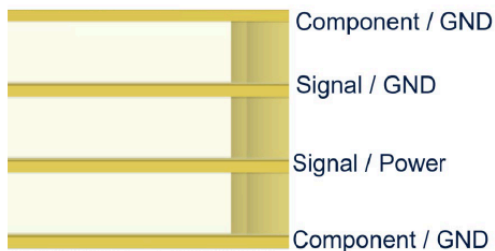
## 11. Antenna integration guide

We recommend the following during the design phase to maximise antenna performance and minimize noise:

- Minimum 4 layer PCB
- Route signals and power internally where possible
- Flood all layers with ground
- Knit ground on all layers together with plenty of vias

Follow placement guidance carefully. Antenova provide technical support to help you with your design, and also provide design assistance on PTCRB certification.

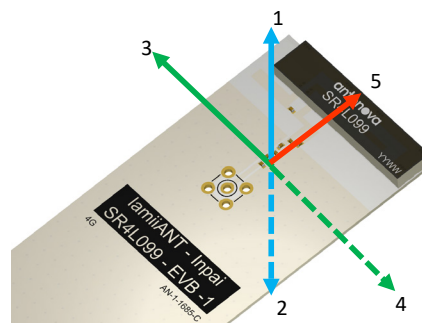
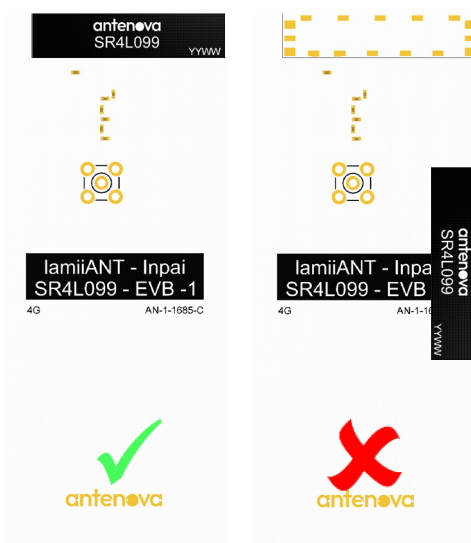
Register for an account on <https://ask.antenova.com/> to access technical support.



### 11.1 Antenna placement

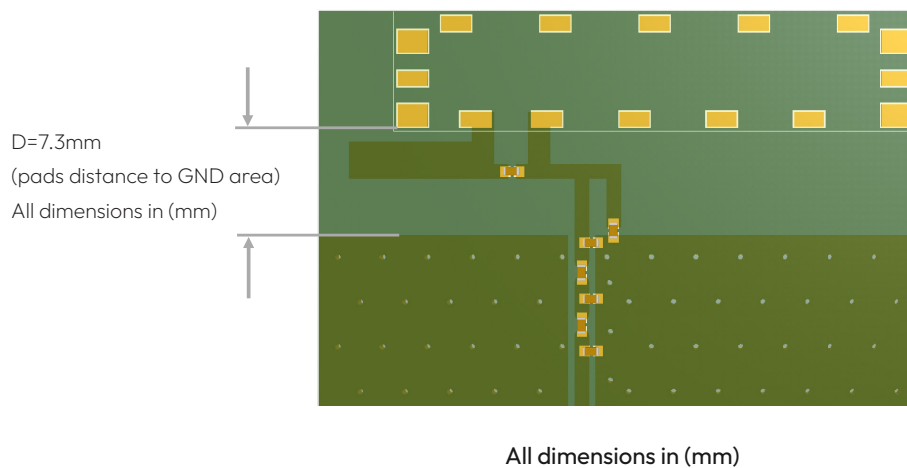
The antenna requires clearance ideally in 5 spatial directions in antenna area as shown below.

The Antenova placement tool can be used to advise on antenna placement, see: <https://blog.antenova.com/>



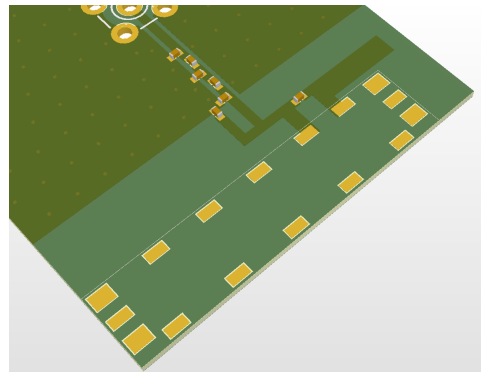
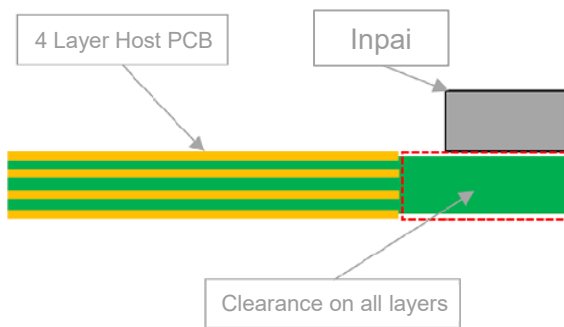
## 11.2 Host PCB Layout

The host PCB must be designed using the PCB footprint shown with the correct clearances. An example of the PCB layout shows the antenna footprint. Please note this clearance area is critical to the performance of the antenna and must be applied through all layers of the PCB.

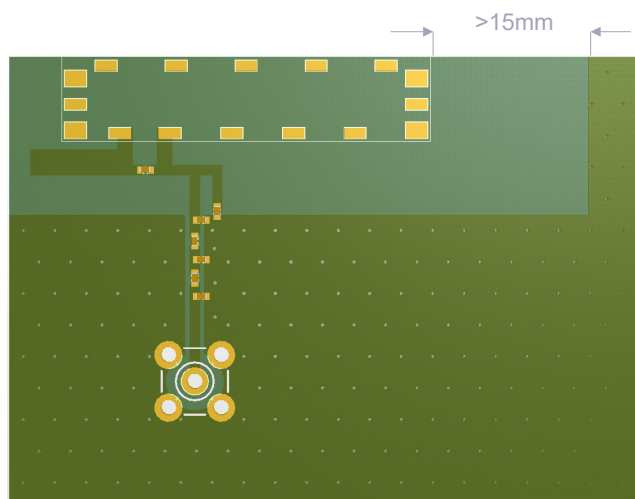


## 11.3 Host PCB Clearance

The host PCB must be designed using the PCB footprint shown with the correct clearances. An example of the PCB layout shows the antenna footprint. Please note this clearance area is critical to the performance of the antenna and must be applied through all layers of the PCB.



The Inpai antenna is placed on the left-hand corner of the host PCB following the drawing showing the exact placement of the antenna. It is important to not have any tracks or ground plane on both sides of the antenna, the antenna performance will be diminished if there are any tracks inside the clearance area (apart from the tracks shown in the drawing).



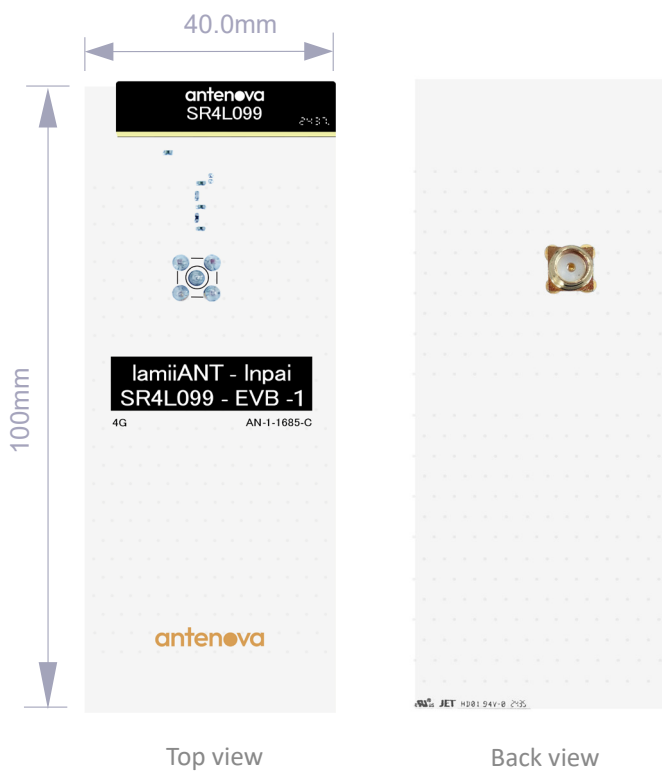
Left side  
Placement



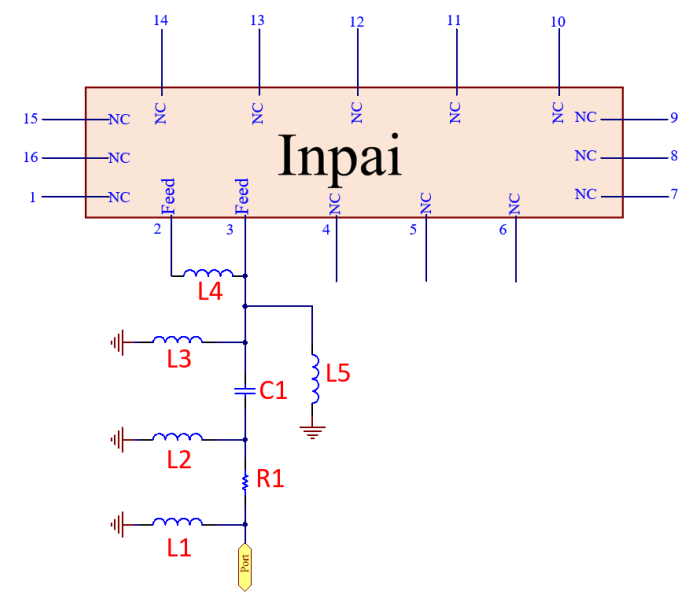
## 12. Reference board

A reference board is used for evaluating the antenna SR4L099 and it includes a SMA female connector. (part number SR4L099-EVB-1)

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



12.1 Reference board matching circuit



Designato	Type	Value	Description
L1	Inductor	47nH	Murata LQG15HS series
L2	Inductor	27nH	Murata LQG15HS series
L3	Inductor	8.2nH	Murata LQG15HS series
L4	Inductor	3.9nH	Murata LQG15HS series
L5	Not Fitted		
C1	Capacitor	2.4pF	Murata GJM15 series
R1	Resistor	0 ohm	Non-specific (0402)

## 13. Soldering

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This antenna is suitable for lead free soldering. The reflow profile should be adjusted to suit the device, oven and solder paste, while observing the following conditions:

- For leaded soldering, the maximum temperature should not exceed 240°C.
- For lead free soldering, a maximum temperature of 255 °C for no more than 20 seconds is permitted.
- The antenna should not be exposed to temperatures exceeding 120 °C more than 3 times during the soldering process.

## 14. Hazardous material regulation conformance

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The antenna has been tested to conform to RoHS and REACH requirements. A certificate of conformance is available from Antenova's website.

## 15. Packaging

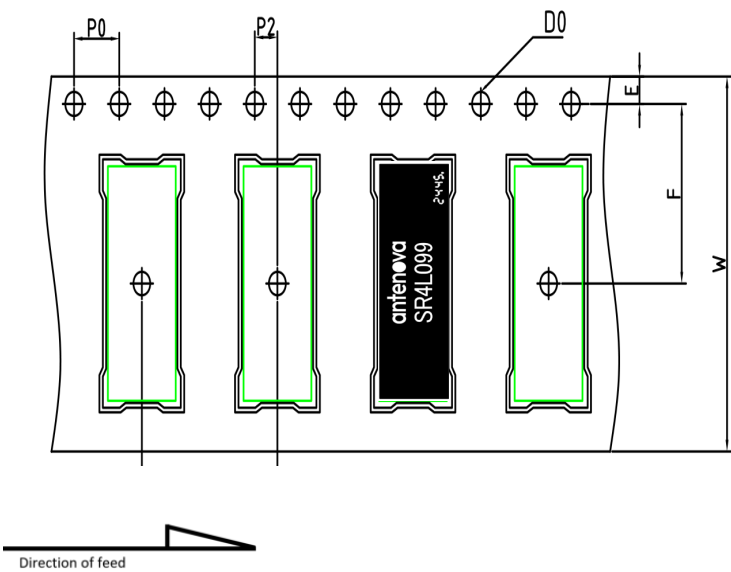
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TEMPERATURE	-10°C to 40°C
HUMIDITY	Less than 75% RH
SHELF LIFE	24 Months
STORAGE PLACE	Away from corrosive gas and direct sunlight
PACKAGING	Reels should be stored in unopened sealed manufacturer's plastic packaging.
MSL LEVEL	1

Note: Storage of open reels of antennas is not recommended due to possible oxidization of pads on antennas. If short term storage is necessary, then it is highly recommended that the bag containing the antenna reel is re-sealed and stored in conditions as described in the table above .

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

15.2 Tape characteristics



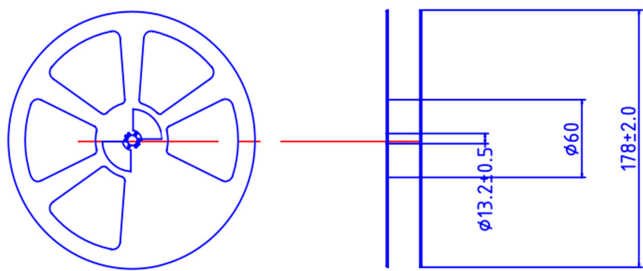
P0	P1	P2	D0
4.00 ± 0.1	12.00 ± 0.1	2.00 ± 0.1	1.50 ± 0.1

E	F	W
1.75 ± 0.1	26.20 ± 0.15	56.00 ± 0.3

All dimensions in (mm)

Quantity	Leading space	Trailing space
1000 pcs / reel	25 blank antenna holders	25 blank antenna holders

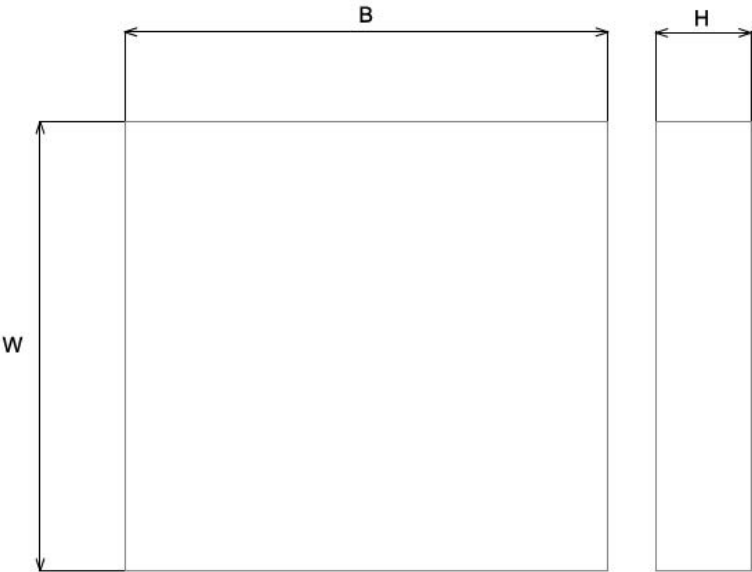
15.3 Reel Dimensions



Reel	Type	Color	Size	Hub
Dimension	PS	BLACK	Ø178	Ø60

All dimensions in (mm)

15.4 Box Dimensions



Width (W)	Breadth (B)	Height (H)
350mm	355mm	70mm

## 15.5 Bag properties

Reels are supplied in protective plastic packaging.

## 15.6. Reel label information



## 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

1.02 release JAN 3 2025

# 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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