

2.4GHz Niche Chip Antenna



AANI-NI-0245

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1.0 x 0.5 x 0.5 mm
RoHS/RoHS II Compliant
MSL Level = 1

Description

This patented 2.4 GHz chip antenna delivers exceptional value with its very low-cost, low-profile design optimized for high-volume consumer applications. Covering 2400 - 2500 MHz for Bluetooth®, ZigBee, Thread, Matter, and Wi-Fi protocols, it achieves impressive > 85% efficiency with low return loss (< -10 dB). The PCB edge-mount integration enables seamless placement in space-constrained hearables, wearables, and smart home devices. This RoHS-compliant, MSL Level 1 component provides reliable wireless connectivity for Bluetooth® / Wi-Fi Modules and intelligent lighting systems.



Features

- Patented Niche Technology
- Frequency Range: 2400 - 2500 MHz
- Very Low Cost & Low Profile
- Peak Gain: 3.6 dBi
- High Efficiency: > 85%
- Low Return Loss: < -10 dB
- Linear Polarization
- Surface Mount (SMD)
- Integration: PCB Edge Mounting
- [RoHS Compliant | MSL Level 1](#)

Applications

- Bluetooth®/ ZigBee / Thread/ Matter/Wi-Fi
- CGM & Biosensors
- BT/Wi-Fi Modules
- Shelf Tags & Smart Labels
- Hearables & Wearables
- Smart Home & Smart Building
- Smart Metering
- Intelligent Lighting

Ordering Information

Part Number	Description
AANI-NI-0245	2.4GHz Niche Chip Antenna on Cut Tape
AANI-NI-0245-T	2.4GHz Niche Chip Antenna on Tape & Reel

Note: Other options not listed may be available upon request via [Abracon online support](#)



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Electrical Specification

Parameter	Specification	Unit
Operating Frequency	2400 - 2500	MHz
Return Loss	< -10	dB
VSWR	≤ 2	:1
Peak Gain	3.6	dBi
Minimum Total Efficiency	-1.1 (78.0)	dB (%)
Average Total Efficiency	-0.7 (85.7)	dB (%)
Maximum Total Efficiency	-0.5 (89.3)	dB (%)
Polarization	Linear	-
Impedance	50	Ω
Radiation Pattern	Omni-directional	-
Input Power	≤ 2.0	W

Note: All measurements were conducted on the evaluation board in free space. Performance will vary depending on the ground plane, application, and environment.

Mechanical Specification

Parameter	Specification
Antenna Dimension	1.0 x 0.5 x 0.5 mm
Evaluation board Dimension	50 x 20 mm
Clearance Dimensions	6 x 4 mm
Mounting Type	Surface Mount
Mounting Location	PCB Edge Mounting
Material(s)	Ceramic

Environmental Specification

Parameter	Specification
Operating & Storage Temperature (Unpackaged Component)	-55°C ~ +125°C
Storage Temperature in Packaging	+5°C ~ +40°C
Packaging Storage Relative Humidity	70% (Max.)
MSL Level	1
RoHS Complaint	Yes



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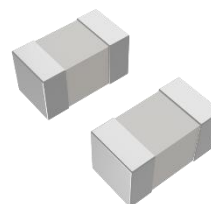
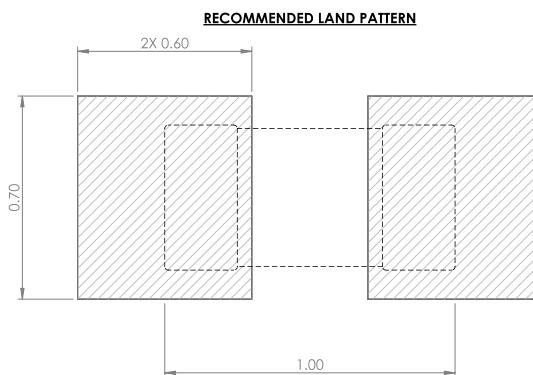
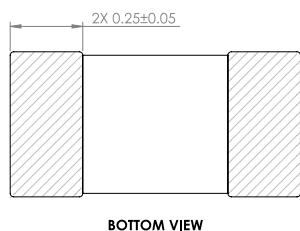
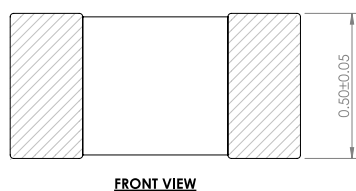
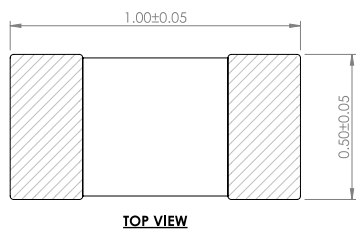


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MSL Level = 1

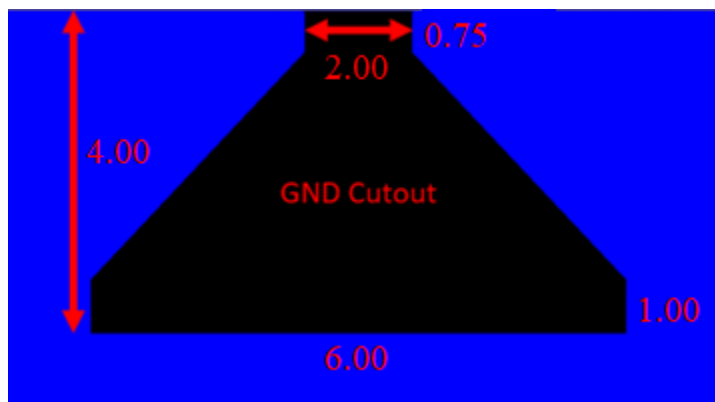
Product Dimensions & Recommended Land Pattern



Unit : mm

PCB Clearance Dimensions

The triangular EVB clearance is 6 by 4 mm in size, see dimensions in millimeters below.



Unit : mm



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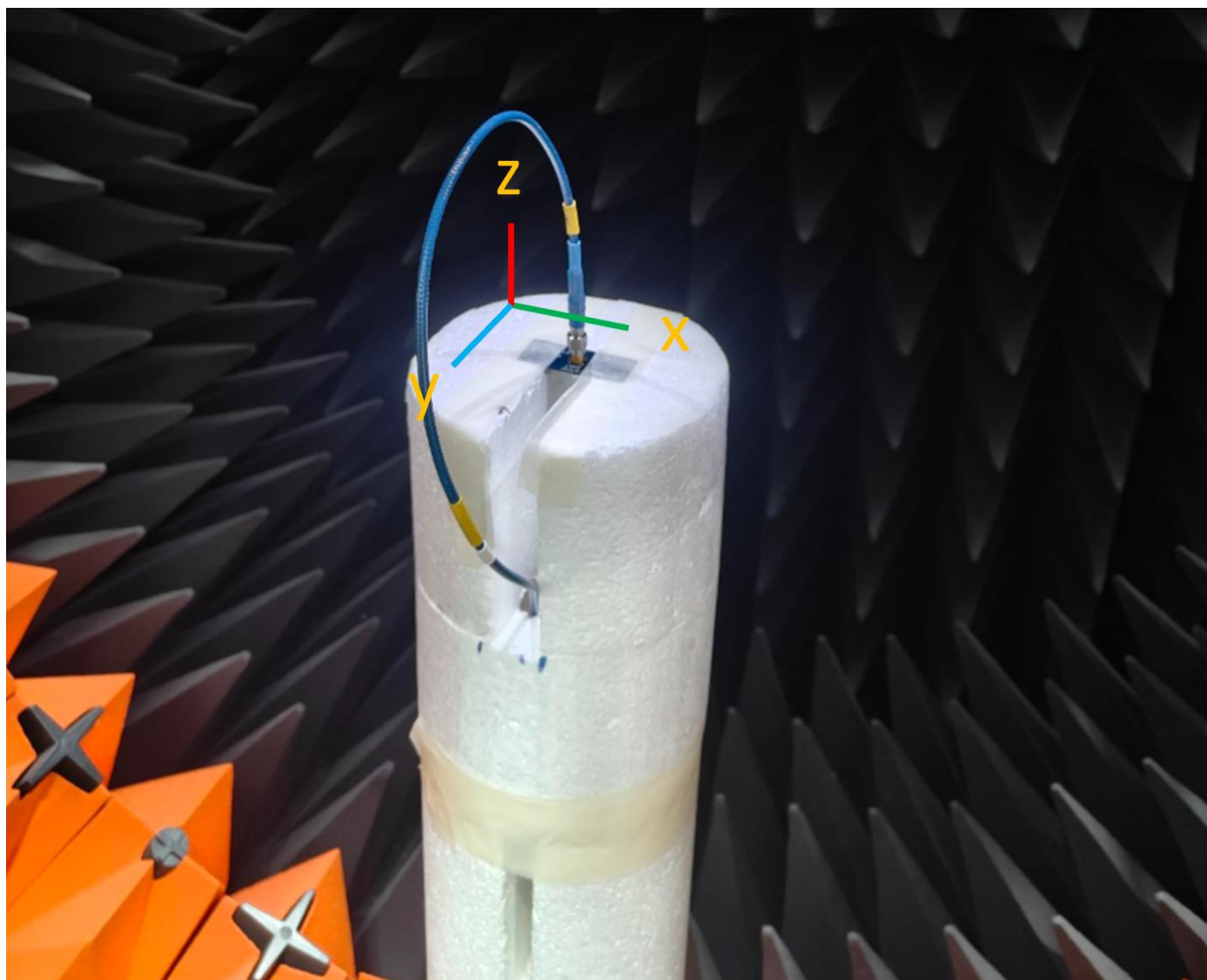


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Measurement Setup photo



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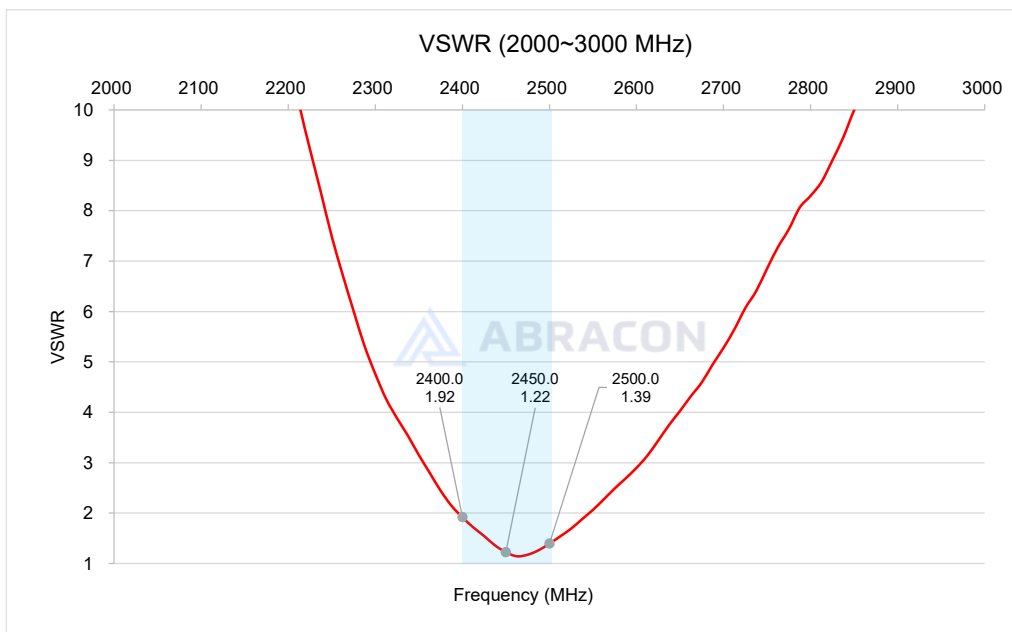
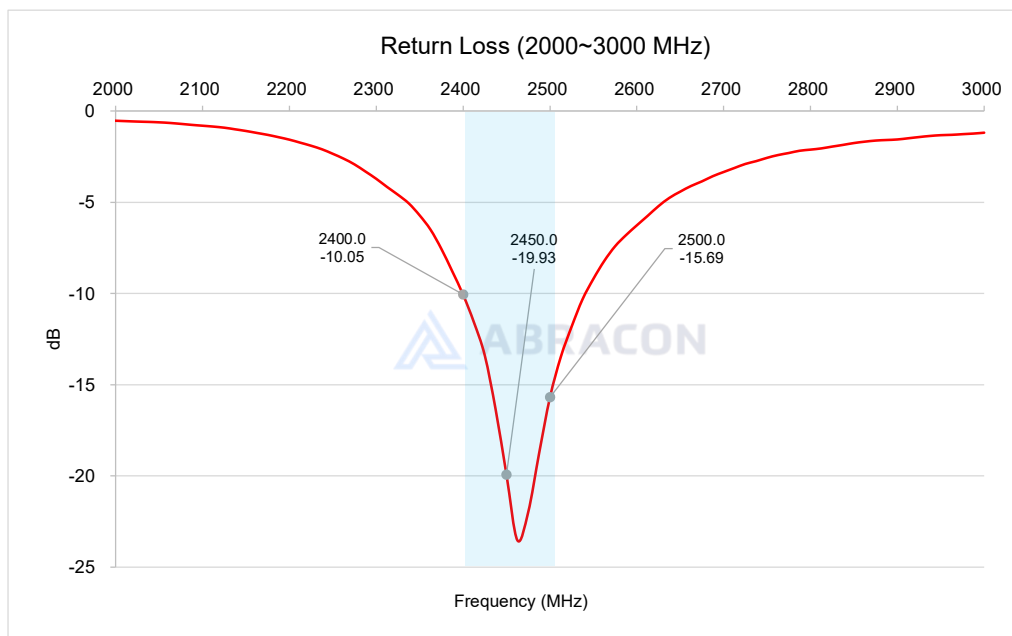


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Reflection Characteristics – Return Loss & VSWR



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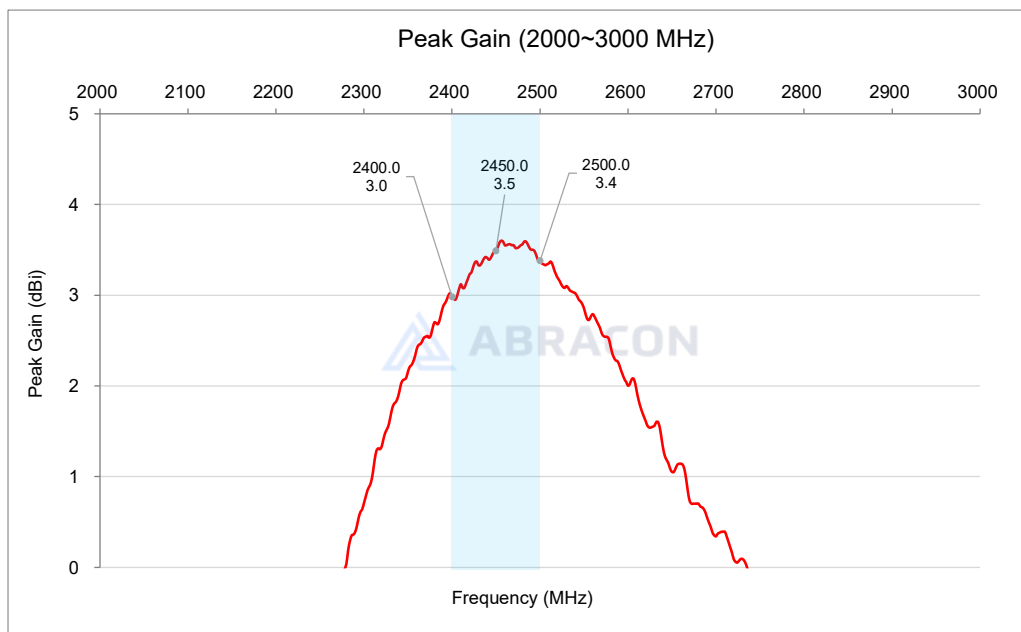


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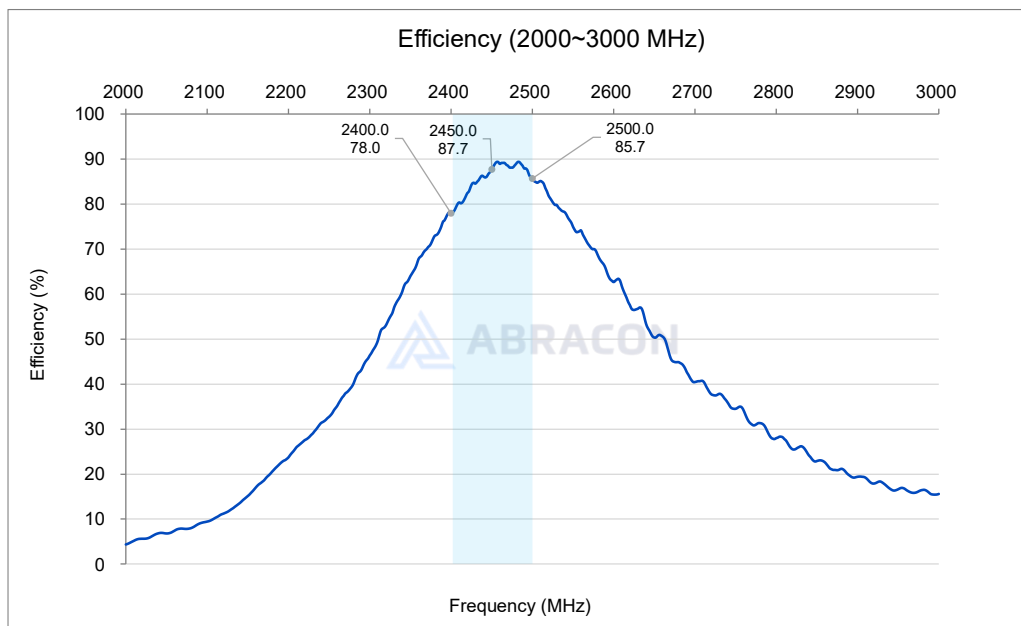


1.0 x 0.5 x 0.5 mm
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Radiation Characteristics – Peak Gain



Radiation Characteristics – Total Efficiency (%)



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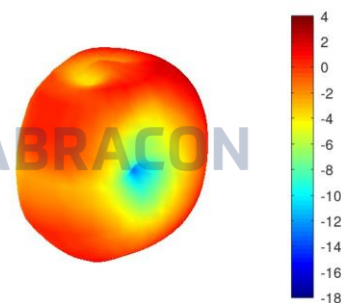
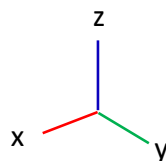
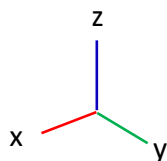
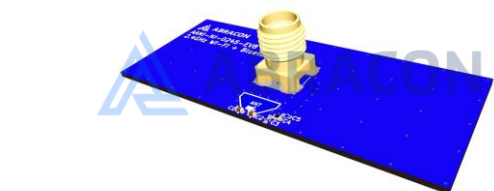
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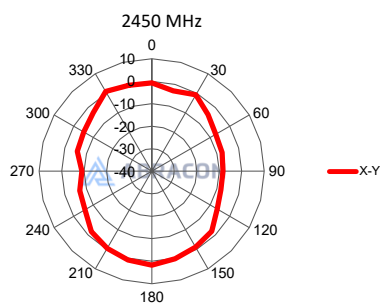
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RoHS/RoHS II Compliant
MSL Level = 1

Radiation Characteristics – 3D & 2D pattern

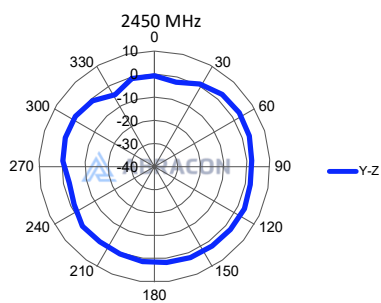
2450MHz



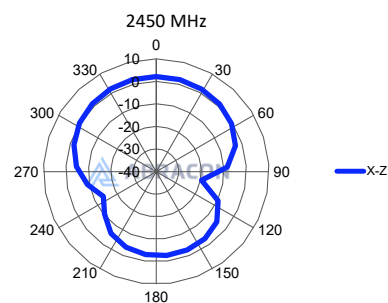
XY plane



YZ plane



XZ plane



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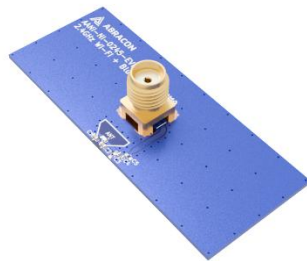
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1.0 x 0.5 x 0.5 mm
RoHS/RoHS II Compliant
MSL Level = 1

Evaluation Board Outline & Matching Circuit

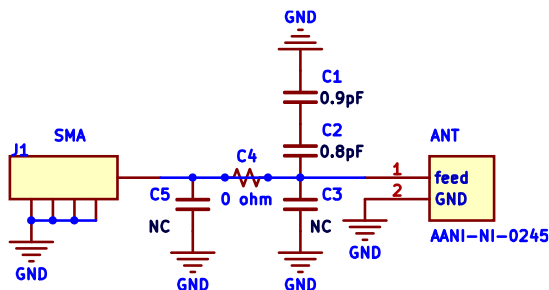
The evaluation board (Abracon AANI-NI-0245-EVB) is developed to simplify antenna testing and evaluation. It is sized 50 mm (L) x 20 mm (W) and includes an SMA connector. The purpose is to give a reference design for an optimal antenna implementation. The evaluation board can also be used to test other implementations by cutting and soldering the PCB into any device.



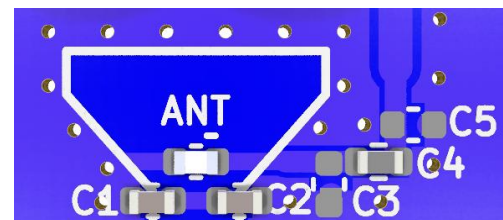
The evaluation board has a matching circuit implemented next to the antenna. This is aimed at enabling optimization possibilities for the user. The component positions are sized for 0402 (1005 metric) SMD components.

The antenna requires a matching circuit to fine-tune the resonant frequency and achieve optimal balance. The evaluation board is pre-tuned for optimal performance in the 2.4 - 2.5 GHz range using the components listed below (equivalents may be used):

Schematic



Layout



Component	Description	Manufacturer	Part Number	QTY
ANT	2.4GHz Niche Chip Antenna	Abracon	AANI-NI-0245	1
C1	0.9 pF (0402 / 1005 Metric)	-	-	1
C2	0.8 pF (0402 / 1005 Metric)	-	-	1
C4	0 ohm (0402 / 1005 Metric)	KOA Speer	RK73Z1ETTP	1
C3, C5	NC	-	-	-

**However, it is common that the resonant frequency will shift during implementation in an arbitrary device. Therefore, this matching may be changed with other values/components/brands for compensation of such effects.



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EVB Layer Stack up

Number	Name	Type	Material	Thickness (mm)	Weight (oz)	Dk	Orientation	Copper Orientation
	Top Overlay	Overlay						
	Top Solder	Solder Mask	Solder Resist	0.01		3.5		
1	Top Layer	Signal		0.035	1		Top	Above
	Dielectric 1	Dielectric	FR-4	0.71		4.8		
2	Bottom Layer	Signal		0.035	1		Bottom	Below
	Bottom Solder	Solder Mask	Solder Resist	0.01		3.5		
	Bottom Overlay	Overlay						

Transmission Line

The transmission line should be kept as short as possible and be designed to have a characteristic impedance of 50Ω. Abracon recommends using a Co-Planar Waveguide with Ground (CPWG), which dimensions can be derived by any trusted calculator, using the correct input for PCB materials and layer stack-up.

For details on PCB layout and reference design, please reach out to [Abracon online support](#).



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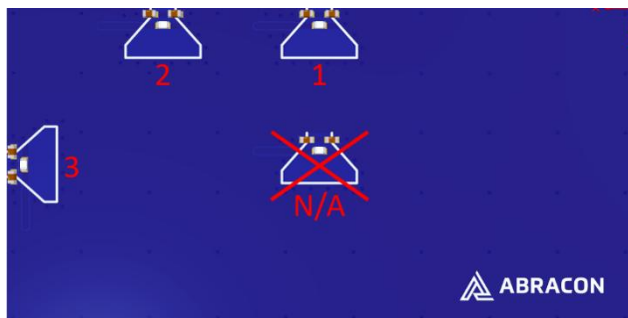


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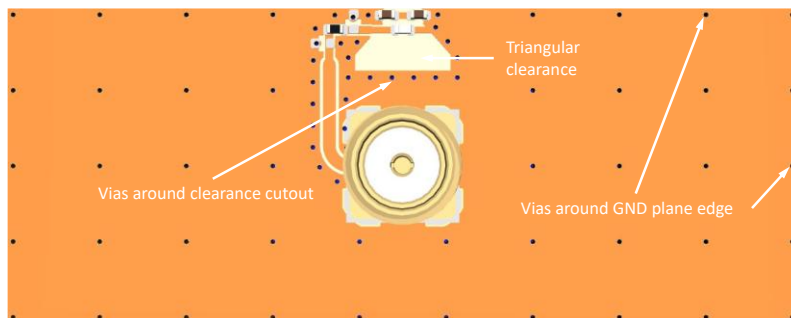
General Implementation Guidelines

The antenna can be positioned in different ways, although there are some positions which are more beneficial. The left picture shows a typical PCB with examples on different antenna positions. The optimal position is option 1. Options 2 and 3 are also possible. The antenna must be placed along the PCB edge, i.e., it cannot be placed in the middle.

Antenna Positions:



Triangular clearance cutout & via-structure:



The triangular clearance needs to go through all the layers in the PCB stack up, meaning that there cannot be copper on any layer in this triangular area. It is also recommended to have a good via-structure around the antenna and the edge of the ground plane, see the right image above.

If other electrical components are positioned in the surrounding area of the clearance cutout, some impact on the antenna tuning and radiated performance may be expected. It is recommended that such components are distributed below a topographical slope that starts on PCB level at the clearance cutout and slowly increases the height. In other words, small electrical components may be mounted close to the antenna if they do not enter the triangular clearance cutout. This is a space-efficient solution which usually has low influence on the performance.

It shall also be highlighted that plastic and metal parts in the near proximity of antennas may influence the antenna tuning and/or performance. This aspect should be noted as a general guideline for all antennas. The effects are difficult to estimate without detailed information, but it is common that plastic housing above the antenna shifts the resonant frequency down. It is recommended to measure the antenna in the actual device after implementation and to implement a matching network on the antenna feed to adjust for the potential frequency shift.

The niche antenna shows great performance when potted compared to other antenna solutions and has also shown good performance in proximity of metal and other harsh antenna environments.

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Reflow Profile [JEDEC J-STD-020]

Solder paste: Sn/3.0Ag/0.5Cu

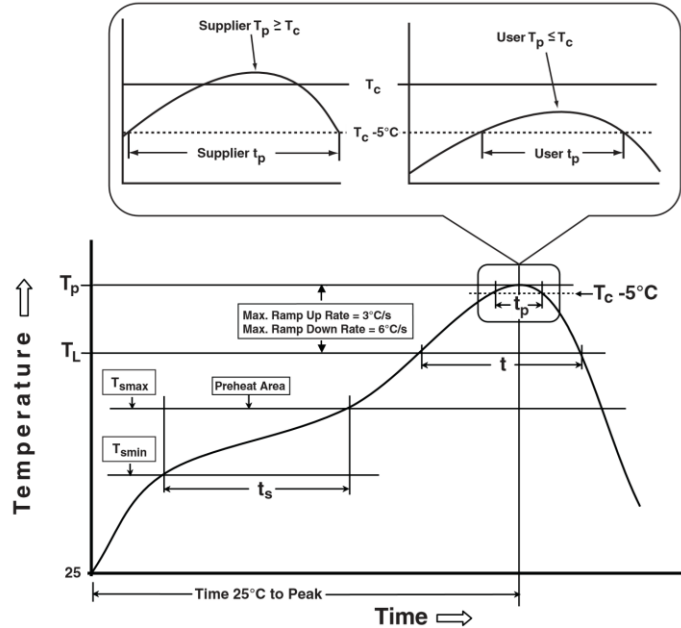


Table 1

SnPb Eutectic Process

Classification Temperatures (T_c)

Package Thickness	Volume mm ³ <350	Volume mm ³ ≥350
<2.5mm	235°C	220°C
≥2.5mm	220°C	220°C

Table 2

Pb-Free Process

Classification Temperatures (T_c)

Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6mm	260°C	260°C	260°C
1.6mm - 2.5mm	260°C	250°C	245°C
>2.5mm	250°C	245°C	245°C

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat / soak		
Temperature minimum (T_{smin})	100°C	150°C
Temperature maximum (T_{smax})	150°C	200°C
Time (T_{smin} to T_{smax}) (t_s)	60 – 120 sec.	60 – 90 sec.
Average ramp-up rate (T_{smax} to T_p)	3°C/sec. max	3°C/sec. max
Liquidous temperature (T_L)	183°C	217°C
Time at Liquidous (T_L)	60 – 150 sec.	60 – 150 sec.
Peak package body temperature (T_p)*	See Table 1	See Table 2
Time (T_p)** within 5°C of the specified classification temperature (T_c)	20 sec.	10 sec.
Ramp-down rate (T_p to T_{smax})	6°C/sec. max	6°C/sec. max
Time 25°C to peak temperature	6 min. max	8 min. max
Reflow cycles	2 max	2 max

*Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.

**Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.

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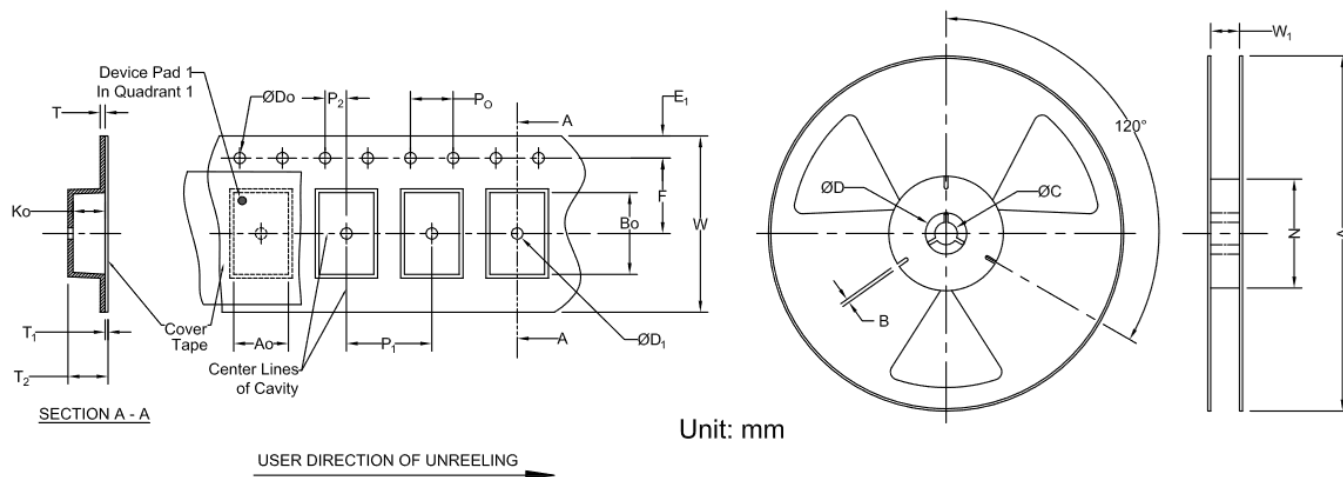
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Packaging

Tape & Reel dimensions:



Carrier Tape Specifications (mm)

Do	K ₀	E ₁	P ₀	F	P ₁	P ₂	W	A ₀	B ₀	Reel Qty
1.55 ± 0.05	0.8 max.	1.75 ± 0.1	4.0 ± 0.1	3.5 ± 0.05	2.0 ± 0.05	2.0 ± 0.05	8.0 ± 0.1	0.37 ± 0.1	0.67 ± 0.1	10,000

Reel Specifications (mm)

A	W ₁	N	B	C	D
178 ± 2.0	10.0 ± 1.5	50 min.	3.0	13 ± 0.5	21 ± 0.8

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