868MHz Chip Antenna with Small Ground Clearance

AANI-CH-0211

Request Samples | Check Inventory

12 x 4 x 1.6 mm
RoHS/RoHS II Compliant
MSL Level = 1

Description

This compact 868 MHz chip antenna is engineered for Sub-GHz LPWA networks, providing reliable connectivity for LoRa, Sigfox, Wi-SUN, and Wi-Fi HaLow applications. Measuring 12 x 4 x 1.6 mm with PCB corner mounting, it delivers optimized performance with 2.4 dBi peak gain, 66% average efficiency, and low return loss (≤ -8.7 dB). Its linear polarization and SMD design ensure easy integration into space-constrained IoT devices. This RoHS-compliant, MSL Level 1 antenna supports smart metering, agricultural sensing, irrigation systems, and emerging protocols like Amazon Sidewalk where robust long-range communication in the 868 MHz band is essential.

Features

- Form Factor: 12 x 4 x 1.6 mm
- Low Return Loss: ≤ -8.7 dB
- Peak Gain: 2.4 dBi
- Average Total Efficiency: 66%
- Small GND Clearance: 17 x 15 mm
- Linear Polarization
- Surface Mount (SMD)
- Integration: PCB Conner Mounting
- RoHS Compliant | MSL Level 1

Applications

- LPWA / LoRa / Sigfox / Wi-SUN
- Wi-Fi HaLow (IEEE 802.11ah)
- Zigbee (Sub-GHz) & W-MBUS
- Amazon Sidewalk
- Smart Metering Solutions
- Smart Irrigation Systems
- Agriculture/Environment Sensing

Ordering Information

Part Number	Description
AANI-CH-0211	868MHz Chip Antenna with Small Ground Clearance on Cut Tape
AANI-CH-0211-T	868MHz Chip Antenna with Small Ground Clearance 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	858 - 878			MHz
Ground Plane Length	60	90	120	mm
Return Loss	≤ -7.49	≤ -9.40	≤ -8.76	dB
VSWR	≤ 2.46	≤ 2.02	≤ 2.15	:1
Peak Gain	0.6	0.7	2.4	dBi
Minimum Total Efficiency	-4.19 (38.1)	-3.22 (47.6)	-2.17 (60.7)	dB (%)
Average Total Efficiency	-3.82 (41.5)	-2.85 (52.0)	-1.79 (66.3)	dB (%)
Maximum Total Efficiency	-3.64 (43.3)	-2.66 (54.2)	-1.63 (68.7)	dB (%)
Polarization	Linear			-
Impedance	50			Ω
Radiation Pattern	Omni-directional			-
Input Power	≤ 3.0			W

Note: All measurements were performed using the evaluation board in a free-space environment. Actual performance may vary depending on factors such as the ground plane, specific application, and surrounding environment.

Mechanical Specification

Parameter	Specification
Antenna Dimension	12 x 4 x 1.6 mm
Evaluation Board Dimension	120 x 50 mm
Recommended Ground Clearance for Antenna	17 x 15 mm
Mounting Type	Surface Mount
Mounting Location	PCB Conner Mounting
Material(s)	Ceramic
Additional Resources	Download STEP File, Package Drawing, 3D PDF

Environmental Specification

Parameter	Specification
Operating and Storage Temperature (individual chip without packing)	-40^0C ~ $+85^0$C
Packaging Storage Temperature	-10^0C ~ $+40^0$C
Packaging Storage Relative Humidity	70% (Max.)
MSL Level	1
RoHS Complaint	Yes

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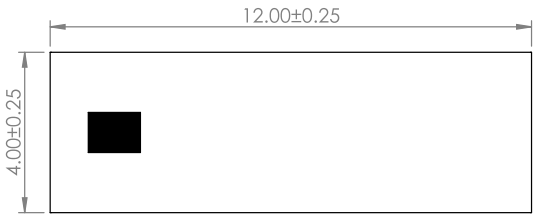
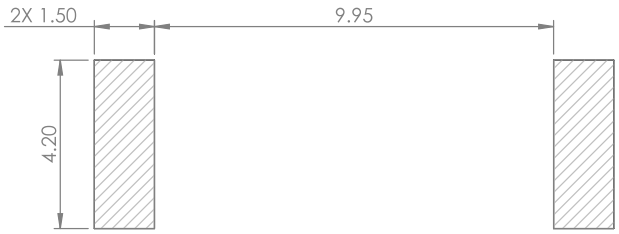
Product Dimensions & Recommended Land Pattern



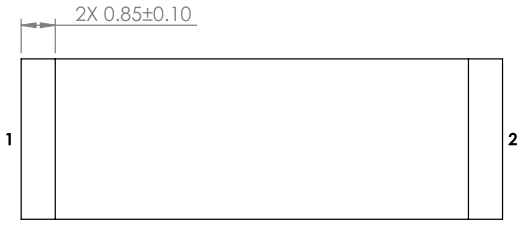
TOP VIEW

RECOMMENDED LAND PATTERN

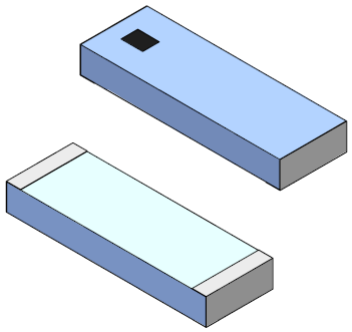


FRONT VIEW

Pin #	Function
1	INPUT
2	NC



BOTTOM VIEW



Unit : mm

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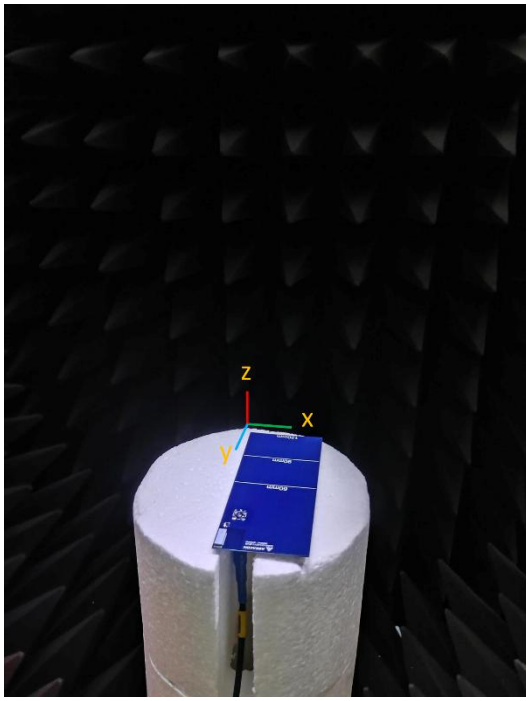
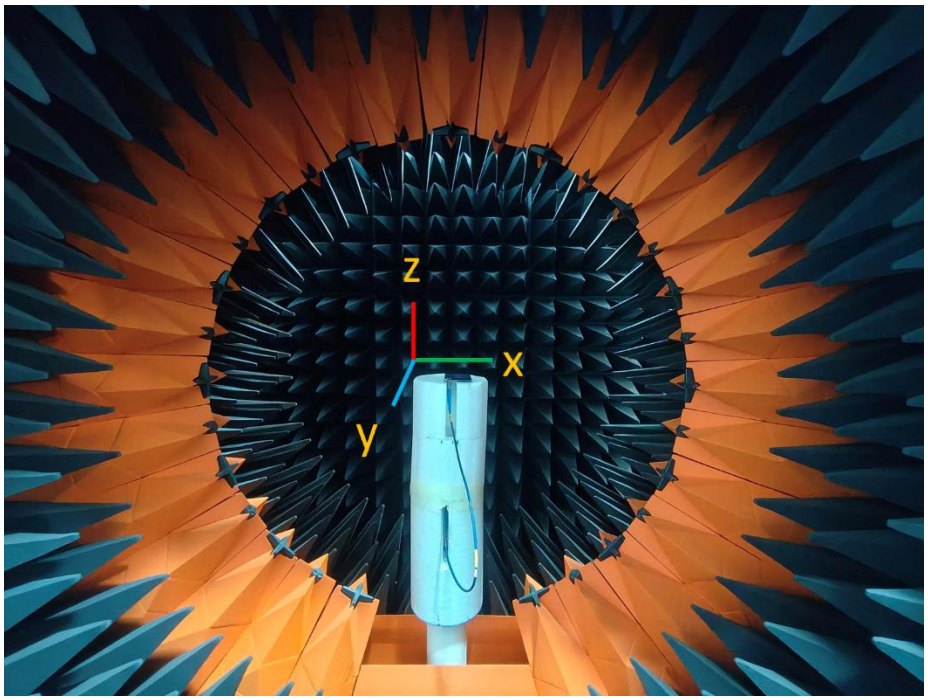
Measurement Setup

The radiation measurements were all done in an anechoic chamber with the antenna implemented on its evaluation board (Abracon AANI-CH-0211-EVB).





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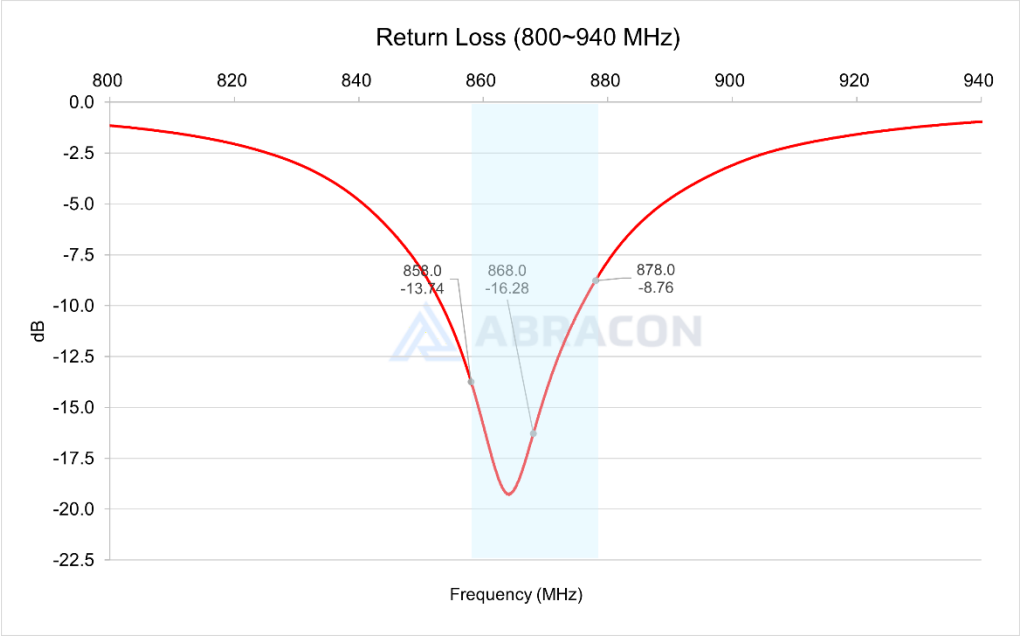
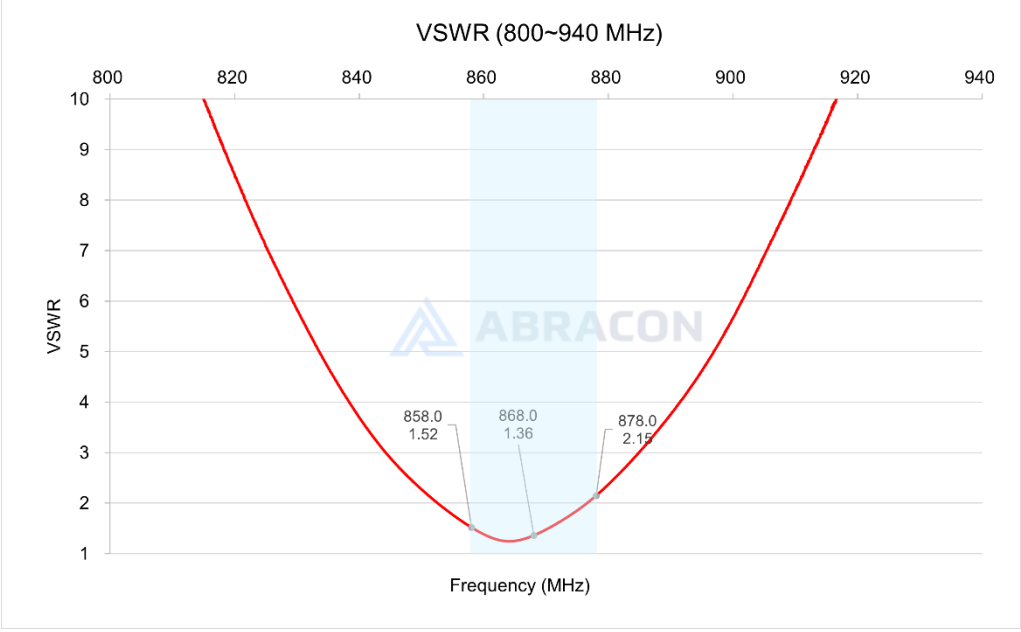
Reflection Characteristics – Return Loss & VSWR @ 120mm Ground Plane Length





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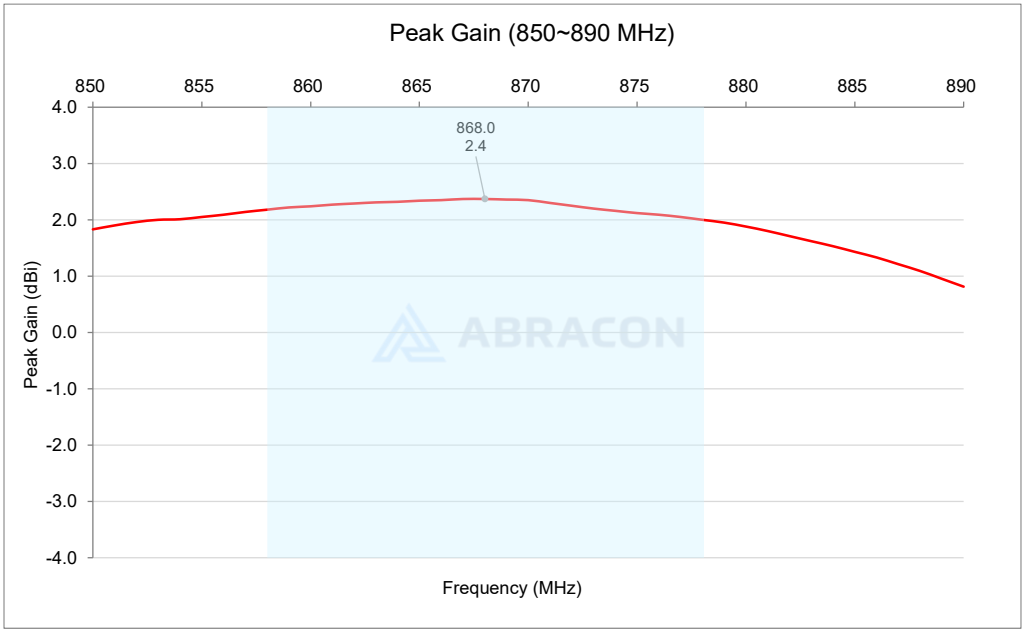
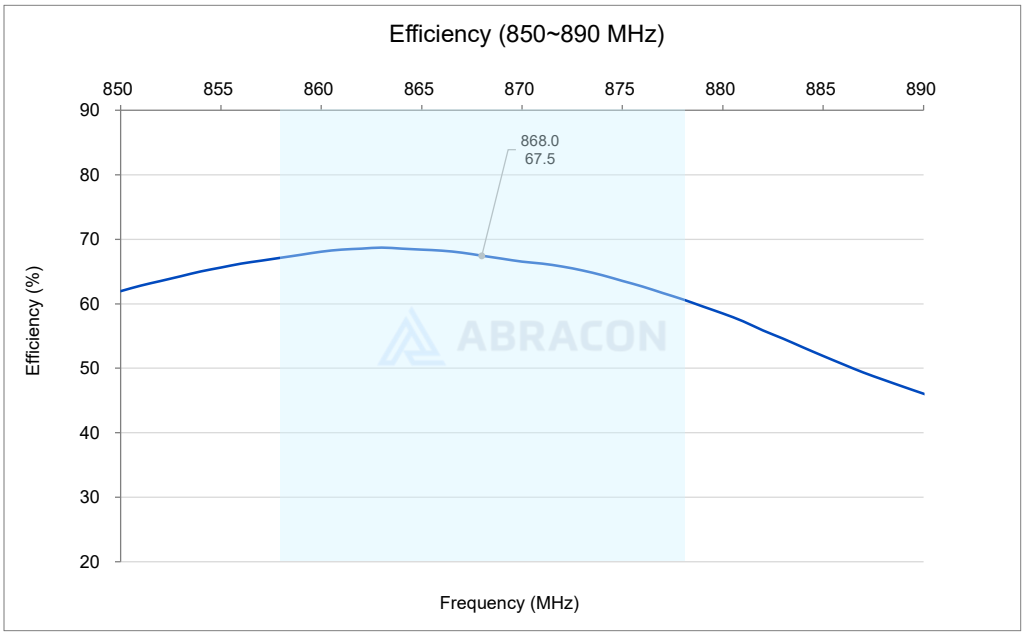
MSL Level = 1

Radiation Characteristics – Peak Gain @ 120mm Ground Plane Length



Radiation Characteristics – Total Efficiency (%) @ 120mm Ground Plane Length



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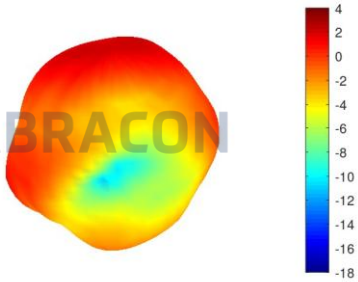
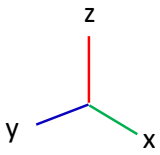
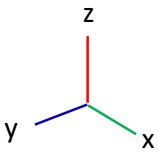
Radiation Characteristics – 3D & 2D pattern @ 120mm Ground Plane Length

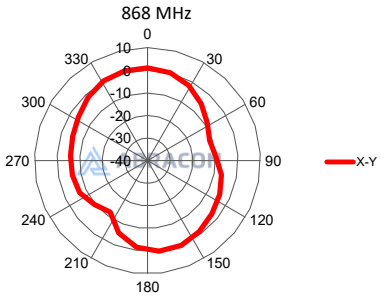
868MHz



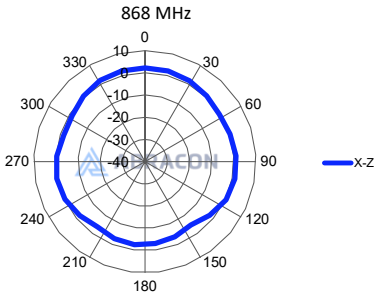




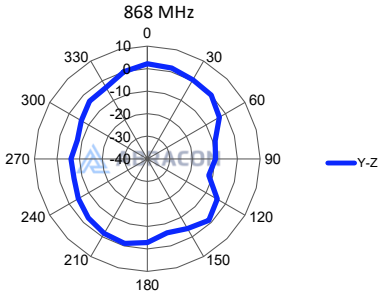
XY plane



YZ plane



XZ plane



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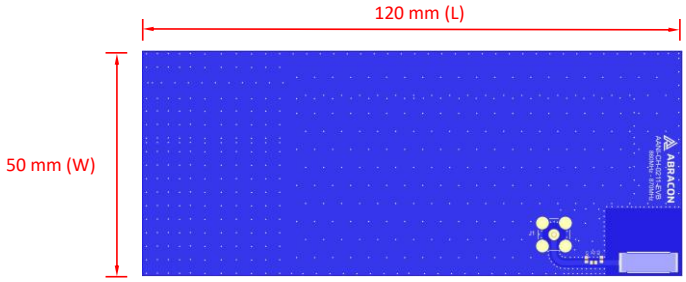
Evaluation Board Outline & Matching Circuit

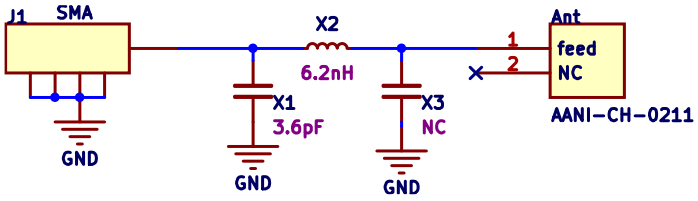
The evaluation board (Abracon AANI-CH-0211-EVB) is developed to simplify antenna testing and evaluation. It has a size of 120 mm (L) x 50 mm (W) and includes an SMA connector. The purpose is to give a reference design for an optimal antenna implementation. The evaluation board can also be used to test other implementations by cutting and soldering the PCB into any device.



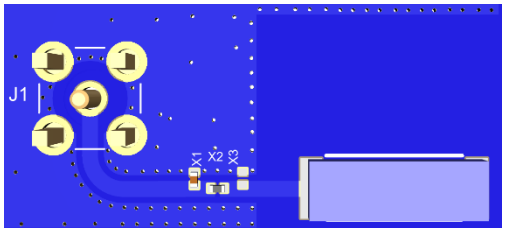
The evaluation board has a matching circuit implemented next to the antenna. This is aimed to enable optimization possibilities for the user. The component positions are sized for 0402 (1005 metric) SMD components.

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 858 – 878 MHz range using the components listed below (equivalents may be used):

Schematic



Layout



Component	Description	Manufacturer	Part Number	QTY
Ant.	868MHz Chip Antenna with Small Ground Clearance	Abracon	AANI-CH-0211	1
X1	3.6pF Capacitor (0402 / 1005 Metric)	Murata	GJM1555C1H3R6BB01	1
X2	6.2nH Inductor (0402 / 1005 Metric)	Abracon	AIMC-0402HQ-6N2B-T	1
X3	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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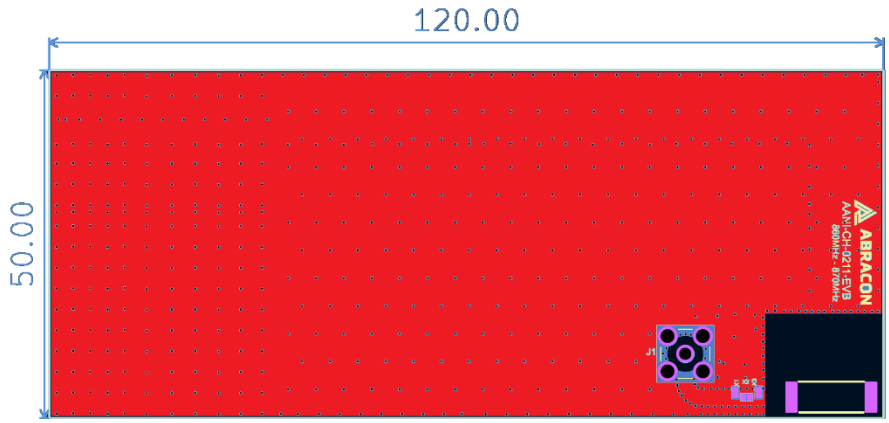
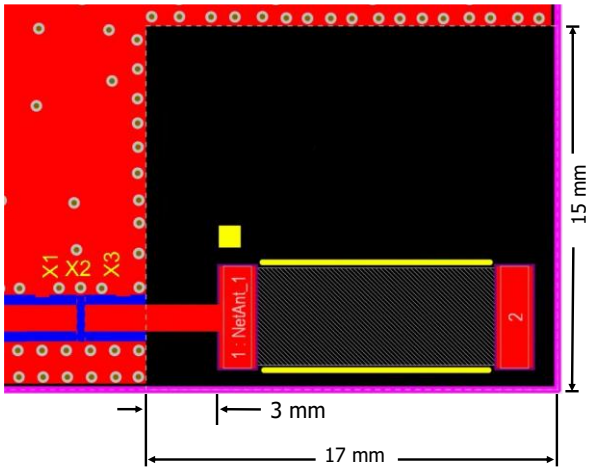
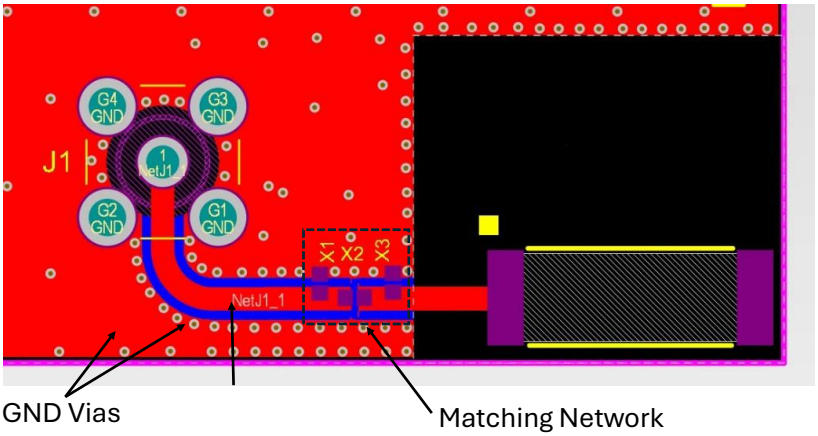
Recommended PCB Layout

If there are several layers in the PCB, there is an advantage to add vias for smooth interconnection of the ground areas to avoid splits in the ground plane. It is also important that ground clearance is respected through all layers of the PCB. It is recommended to implement a matching network to optimize the antenna impedance in your application.



Detailed view of the antenna footprint and ground clearance area:





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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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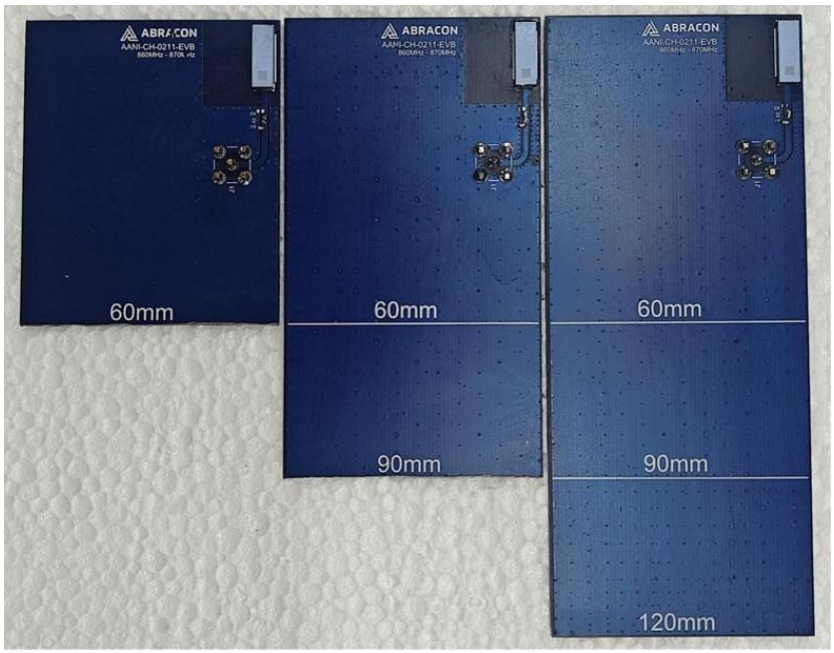
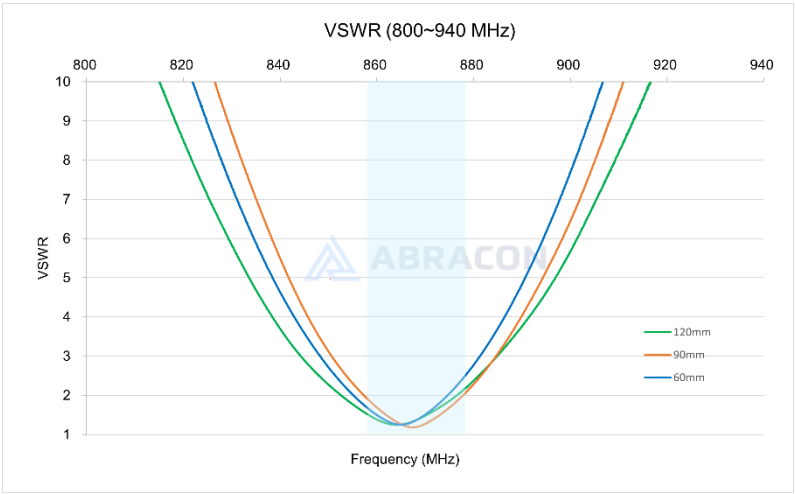
Performance Variation on Different Ground Plane Lengths & Matching Components



Component	60mm	90mm	120mm
X1	3.6pF	3.6pF	3.6pF
X2	2.9nH	7.5nH	6.2nH
X3	NC	NC	NC

Abracon shares the antenna performance for different ground plane lengths as below:

VSWR



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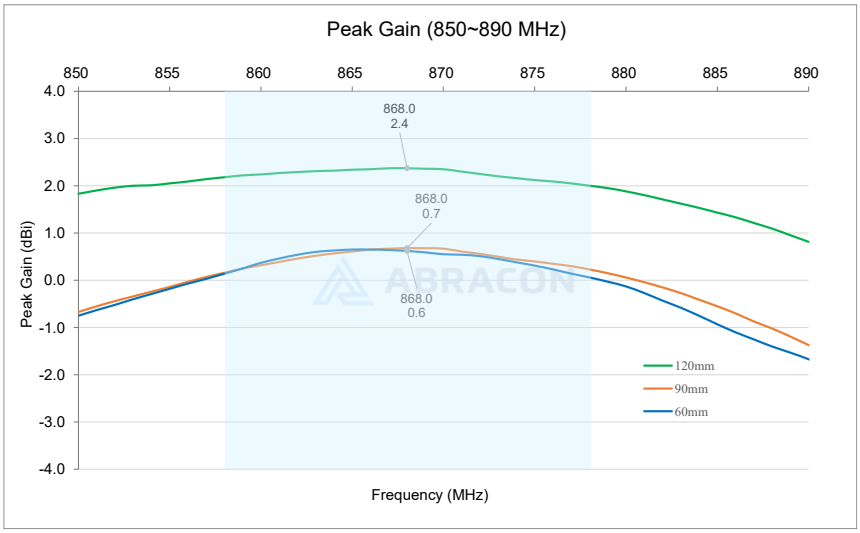
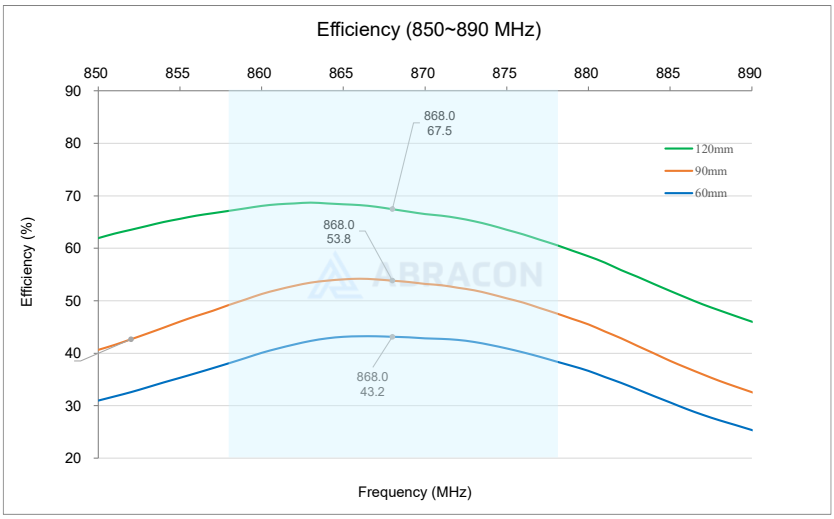
Peak Gain



Efficiency



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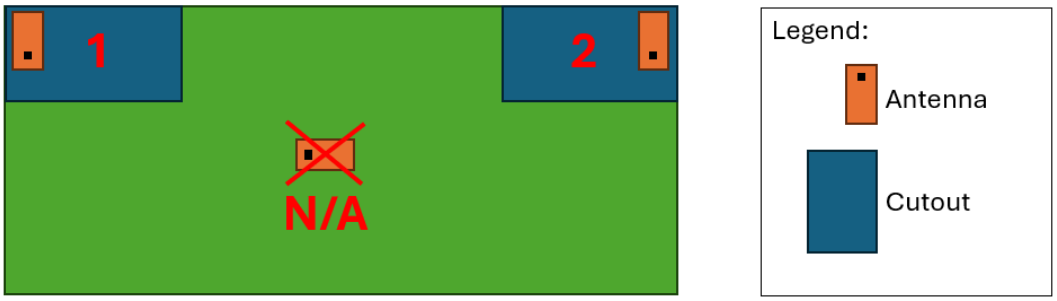
General Implementation Guidelines

The antenna can be positioned in different ways, although there are some positions which are more beneficial. The illustration below shows a typical PCB with examples on two different antenna positions:

- The optimal position is usually option 1 or 2
- The antenna must be placed along the PCB edge, i.e., it cannot be placed in the middle (see “N/A”).



The rectangular copper cutout in the footprint must extend through all layers of the PCB stack-up, ensuring there is **no copper on any layer in this area**. Additionally, a robust via structure around the cutout and along the edge of the ground plane is highly recommended for optimal performance.

Plastic and metal parts near the antenna can significantly affect tuning and performance. For example, a plastic housing above the antenna often shifts the resonant frequency downward. Because these effects are difficult to predict without detailed design information, antenna performance should be measured in the final device after implementation. To offset possible frequency shifts, a matching network on the antenna feed is recommended.

Another general consideration for surface-mounted antennas relates to PCB population. Electrical components placed near the antenna may impact its tuning and radiation performance. To mitigate this, components in the surrounding area should be positioned below a topographical slope. This slope should begin at the PCB level near the antenna's designated keep-out zone and gradually increase in height as distance from the antenna grows.

For technical assistance, please contact Abracon online support through our online support platform.

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Reflow Profile [JEDEC J-STD-020]

Solder paste: Sn/3.0Ag/0.5Cu

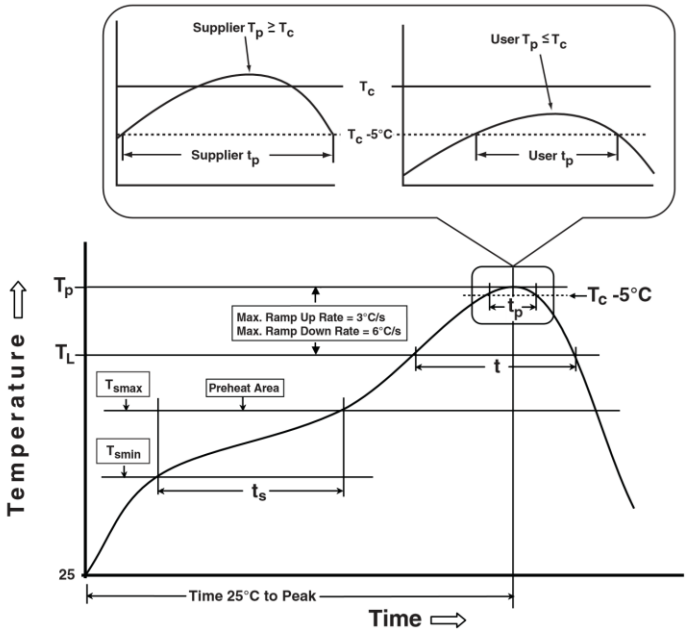

Table 1

SnPb Eutectic Process Classification Temperatures (T_c)		
Package Thickness	**Volume mm³ <350**	**Volume mm³ ≧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 mm³ <350**	**Volume mm³ 350-2000**	**Volume mm³ >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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Phone: 512-371-6159 | Fax: 512-351-8858
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868MHz Chip Antenna with Small Ground Clearance

AANI-CH-0211

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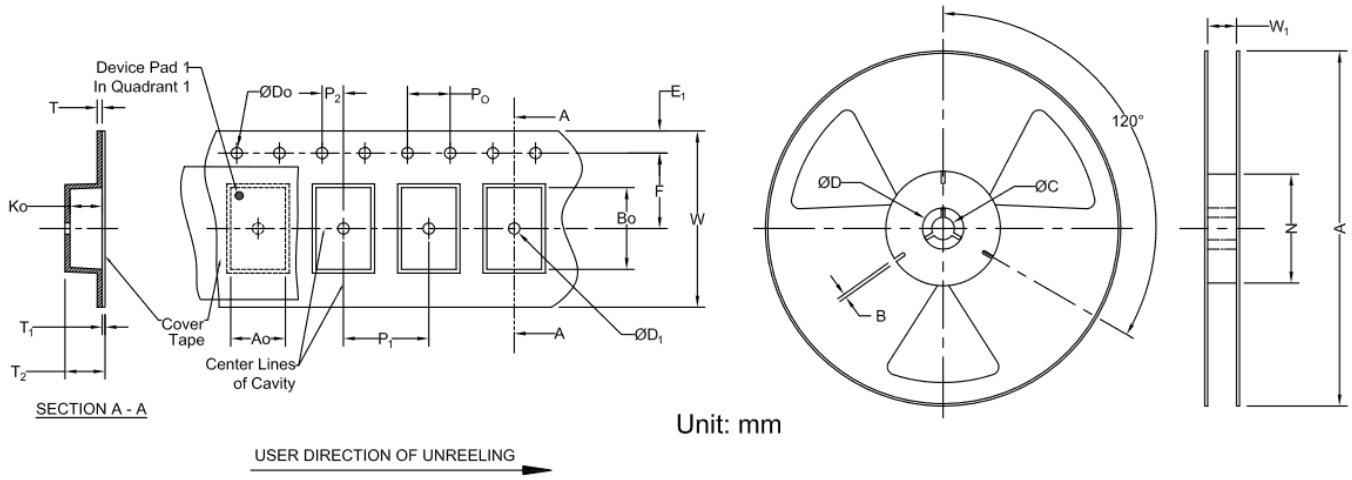
12 x 4 x 1.6 mm
RoHS/RoHS II Compliant
MSL Level = 1

Packaging

Tape & Reel dimensions:



Carrier Tape Specifications (mm)											
D_0, D_1	K_0	T	E_1	P_0	F	P_1	P_2	W	A_0	B_0	Reel Qty
1.50 + 0.1	1.9 ± 0.1	0.3 ± 0.05	1.75 ± 0.1	4.0 ± 0.1	11.5 ± 0.1	8.0 ± 0.1	2.0 ± 0.1	24.0 ± 0.3	4.25 ± 0.1	12.3 ± 0.1	3,000

Reel Specifications (mm)			
A	W_1	N	C
330	24.0 ± 2.0	100	13 ± 0.5

ATTENTION: Abracon LLC's products are Commercial-Off-The-Shelf ('COTS'), which are designed, intended, and validated for use in commercial, industrial, and automotive applications. The customer is responsible for testing and verifying the performance of an Abracon solution to meet their system-level requirements.

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