TAOGLAS

Datasheet

Wideband 5G Ceramic SMD Antenna

Part No:
PA.176.A

Description:

High-Band 5G Ceramic SMD Antenna covering 1.7-6GHz

Features:

Patent Pending Ceramic Antenna

Covering 1.7 - 6GHz

High Efficiency across all cellular High-Bands

Small Footprint

Dimensions: 20 x 10 x 3mm

Surface Mount Distribution (SMD) - Supplied on Tape & Reel

Manufactured in our IATF16949 Certified Facility

CE Certified, RoHS & REACH Compliant

CE

1. Introduction

The PA.176.A is a patent-pending, 5G/4G high-band cellular SMD antenna designed especially for direct mount on a device's PCB. It provides very high efficiency across multiple cellular bands, operating between 1.7 - 6GHz, in an extremely small form factor. The shape and compact size of just 20*10*3mm, allows the PA.176.A to be easily integrated solution for mounting on the edge of the device's PCB. It is lightweight and is the perfect antenna for mounting on a PCB where space may be limited, as the keep out area for other electronic components, is minimal. Using SMD (on-board) antennas saves on assembly, cable, and connector costs. SMD antennas also lead to higher integration yield rates, higher transmit power and higher sensitivity.

Typical cellular applications include:

- Telematic Control and On-board Diagnostic Units
- Wireless Medical Devices
- First Responder and Public Safety Devices
- UAV's and Robotics
- Media and Smart Home

Care should be taken to the follow layout instructions provided in Section 6 of this datasheet and in placing antenna on the edge of board with adequate clearance to metal. Minimum ground-plane requirements must be met to achieve targeted efficiencies. The PA.176.A is manufactured in Taoglas' IATF16949 Certified Facility and is suitable for automotive applications.

Taoglas provides optimization services for matching, and active TRP, TIS and RSE testing. Integration files for the PA.176.A can be downloaded from the product page on the website. For further information or additional support please contact your regional Taoglas customer support team.

2. Specifications

Electrical								
Band	**Frequency (MHz)**	**Efficiency (%)**	**Average Gain (dB)**	**Peak Gain (dBi)**	**VSWR**	**Impedance**	**Polarization**	**Radiation Pattern**
4G/3G Band 3,4,9,25,35,66	1710~1880	77	-1.5	3	<3:1	50 Ω	Linear	Omni
4G/3G Band 1,2,3,9,25,35,39	1850~1990	72	-1.6	3.3				
4G/3G Band 1,2,4,23,25	1920~2170	72	-1.4	3.8				
4G/3G Band 7,30,38,40,41	2300~2690	65	-1.6	4.5				
5G/4G Band 22,42,78	3300~3500	55	-2.5	3.7				
5G/4G Band 22,42,43,48,77,78,79	3200~4650	58	-2.4	3.6				
Greater than 5GHz	5150~5925	64	-2	2.8				

*Results on 60mm EVB

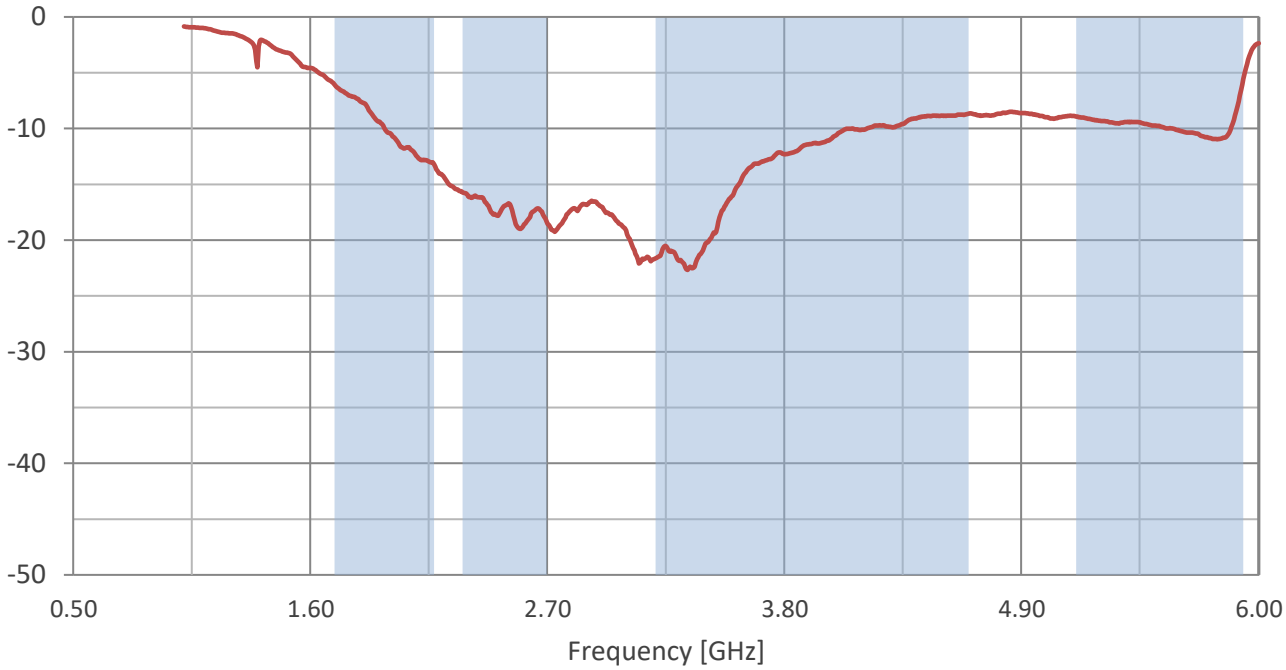
Mechanical	
Dimension	20*10*3 mm
Material	Ceramic
Termination	Ag (environmental Pb free) - Solder Pad
EVB Connector	SMA-Female
Weight	1.8g
Environmental	
Temperature Range	-40°C to 85°C
Moisture Sensitivity	Level 3

5G/4G Bands			
Band Number	5GNR / FR1 / LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / TD-SCDMA		
	Uplink	**Downlink**	**Covered**
1	UL: 1920 to 1980	DL: 2110 to 2170	✓
2	UL: 1850 to 1910	DL: 1930 to 1990	✓
3	UL: 1710 to 1785	DL: 1805 to 1880	✓
4	UL: 1710 to 1755	DL: 2110 to 2155	✓
5	UL: 824 to 849	DL: 869 to 894	✘
7	UL: 2500 to 2570	DL:2620 to 2690	✓
8	UL: 880 to 915	DL: 925 to 960	✘
9	UL: 1749.9 to 1784.9	DL: 1844.9 to 1879.9	✓
11	UL: 1427.9 to 1447.9	DL: 1475.9 to 1495.9	✓
12	UL: 699 to 716	DL: 729 to 746	✘
13	UL: 777 to 787	DL: 746 to 756	✘
14	UL: 788 to 798	DL: 758 to 768	✘
17	UL: 704 to 716	DL: 734 to 746	✘
18	UL: 815 to 830	DL: 860 to 875	✘
19	UL: 830 to 845	DL: 875 to 890	✘
20	UL: 832 to 862	DL: 791 to 821	✘
21	UL: 1447.9 to 1462.9	DL: 1495.9 to 1510.9	✓
22	UL: 3410 to 3490	DL: 3510 to 3590	✓
23	UL:2000 to 2020	DL: 2180 to 2200	✓
24	UL:1625.5 to 1660.5	DL: 1525 to 1559	✓
25	UL: 1850 to 1915	DL: 1930 to 1995	✓
26	UL: 814 to 849	DL: 859 to 894	✘
27	UL: 807 to 824	DL: 852 to 869	✘
28	UL: 703 to 748	DL: 758 to 803	✘
29	UL: -	DL: 717 to 728	✘
30	UL: 2305 to 2315	DL: 2350 to 2360	✓
31	UL: 452.5 to 457.5	DL: 462.5 to 467.5	✘
32	UL: -	DL: 1452 - 1496	✓
35	1850 to 1910		✓
38	2570 to 2620		✓
39	1880 to 1920		✓
40	2300 to 2400		✓
41	2496 to 2690		✓
42	3400 to 3600		✓
43	3600 to 3800		✓
48	3550 to 3700		✓
66	UL: 1710-1780	DL: 2110-2200	✓
71	617 to 698		✘
74/75/76	1427 to 1518		✘
77	3300 to 4200		✓
78	3300 to 3800		✓
79	4400 to 5000		✓
126	410 to 430		✘

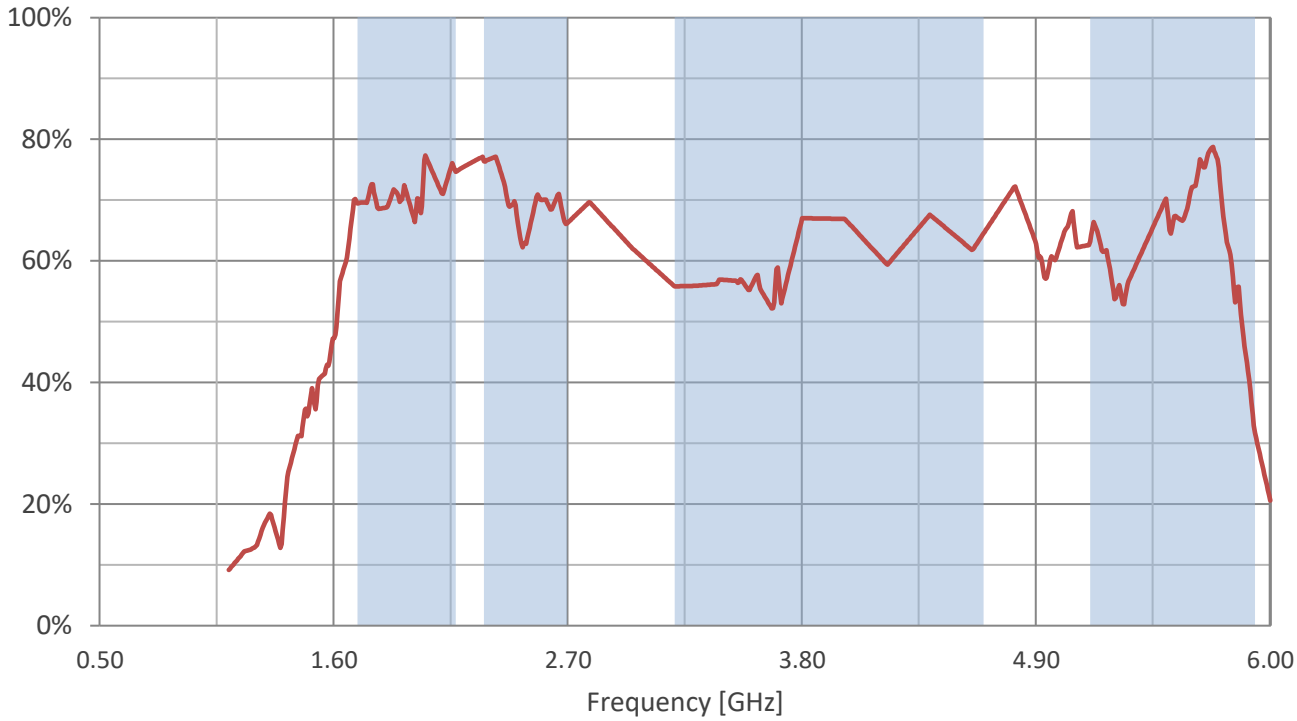
*Covered bands represent those with greater than 20% efficiency

3. Antenna Characteristics

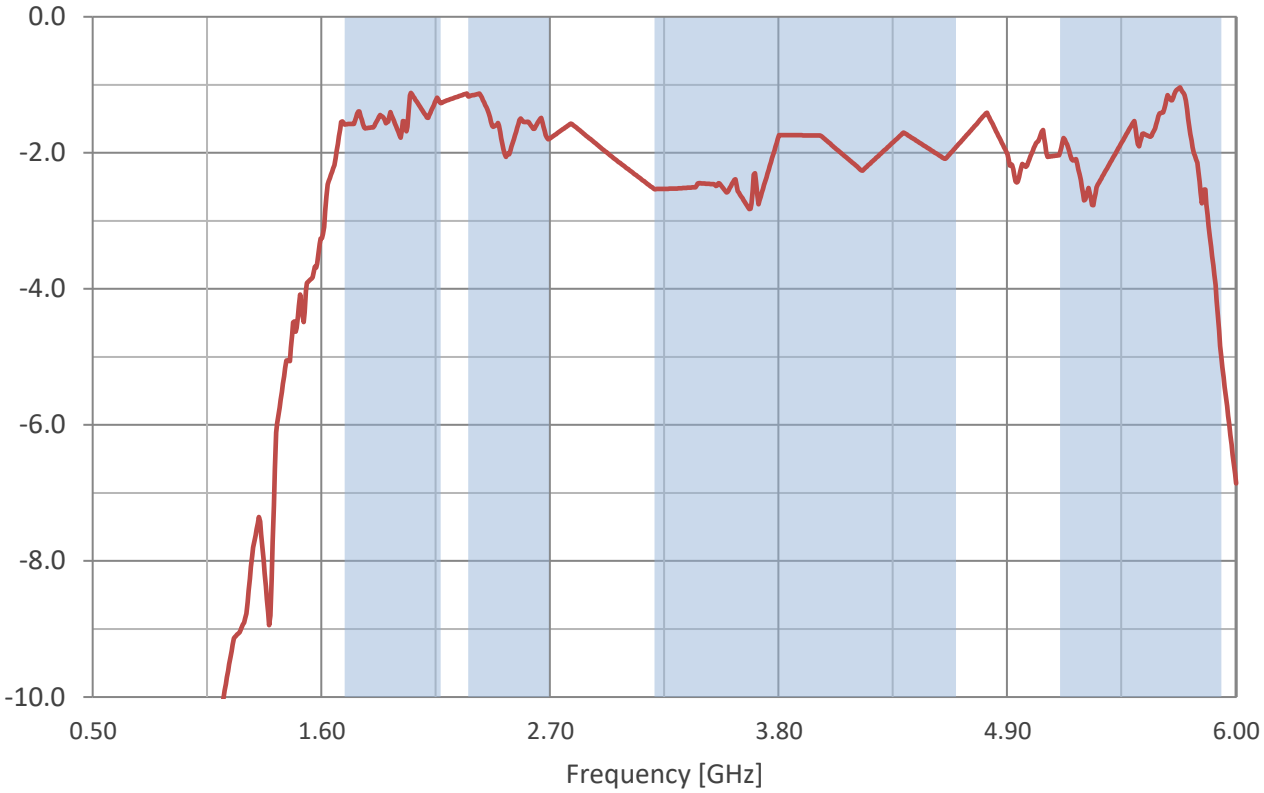
3.1 Return Loss



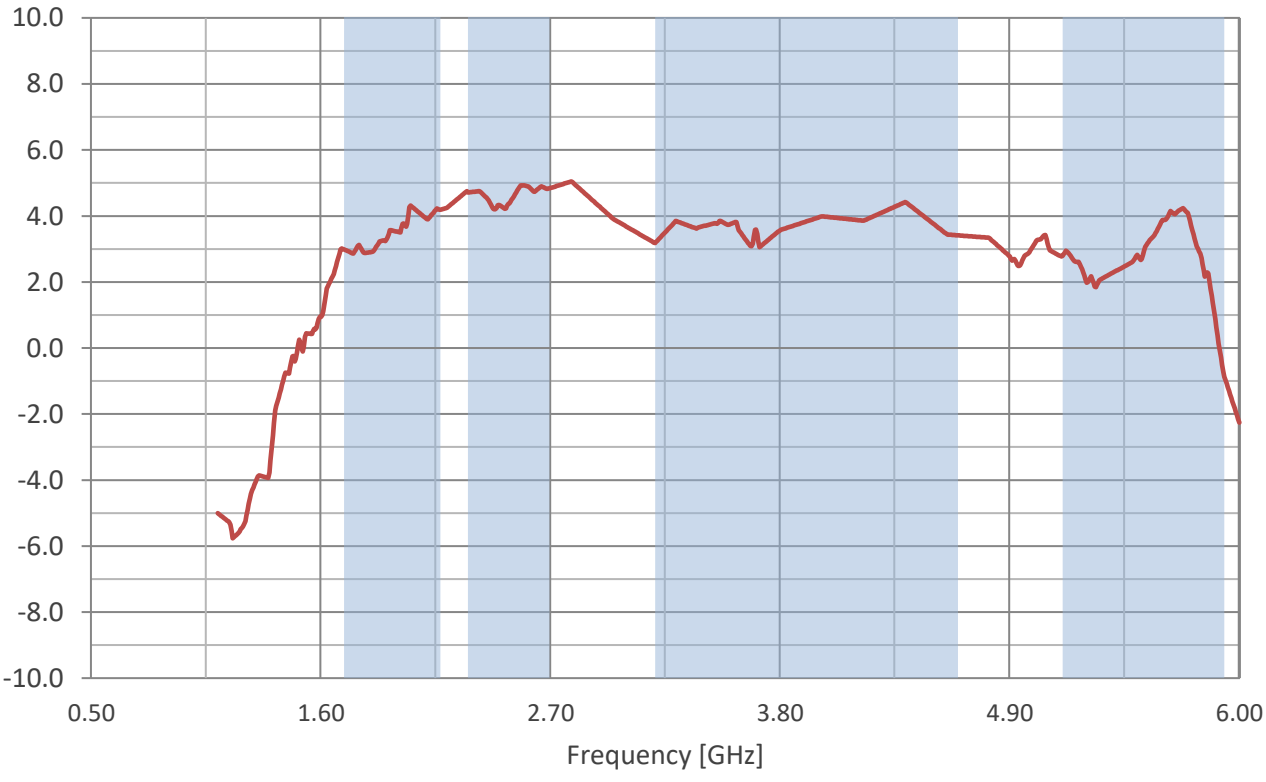
3.2 Efficiency



3.3 Average Gain

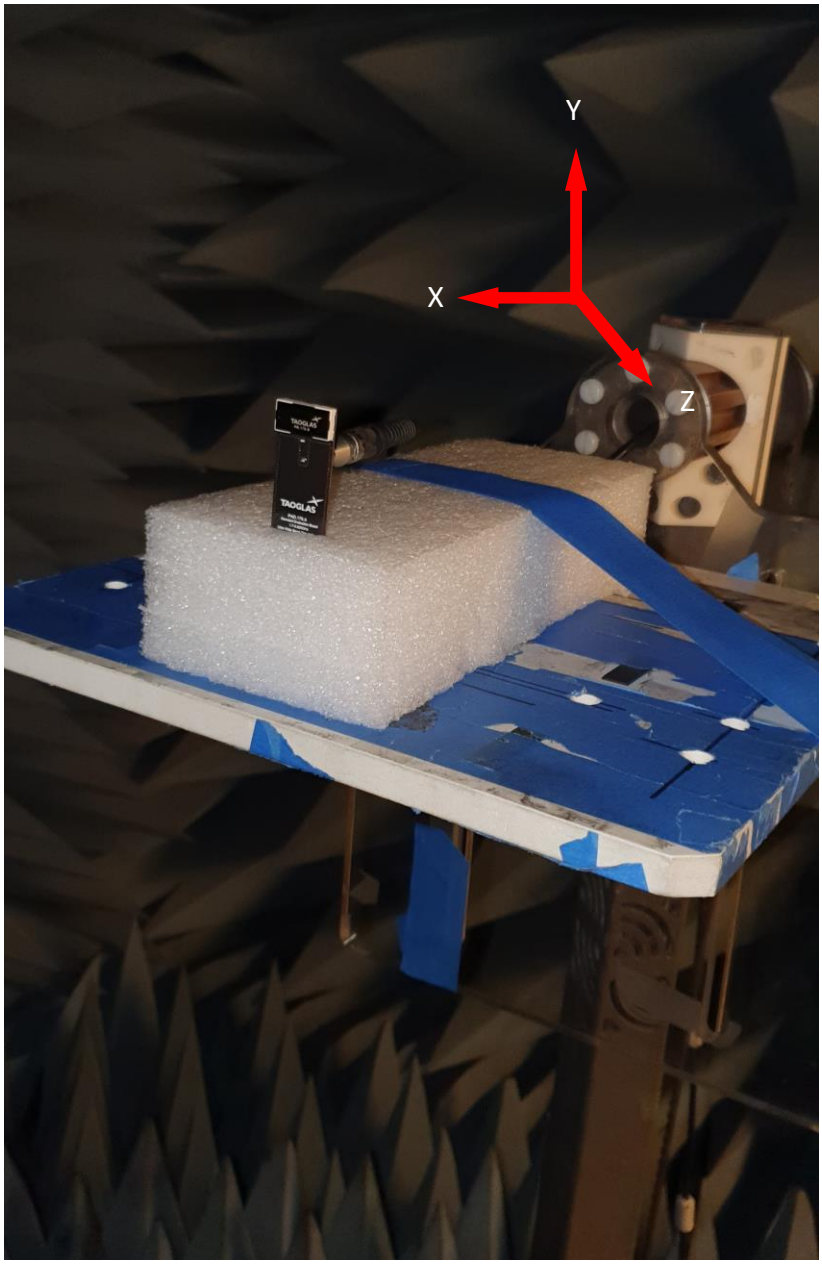


3.4 Peak Gain



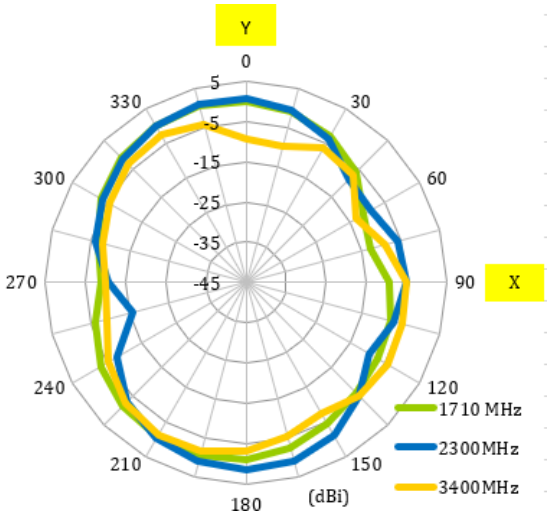
4. Radiation Patterns

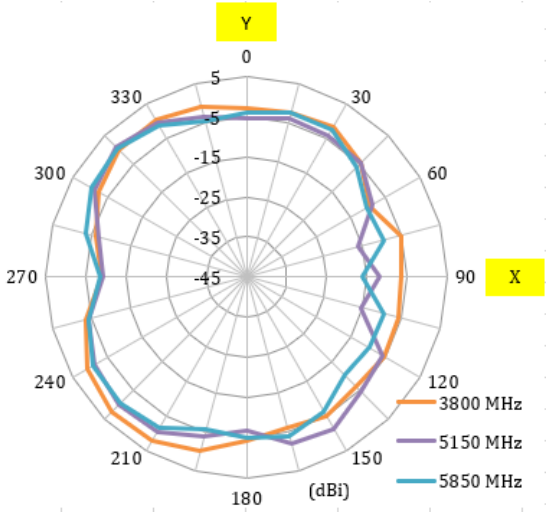
4.1 Test Setup – On Evaluation Board PAD.176.A



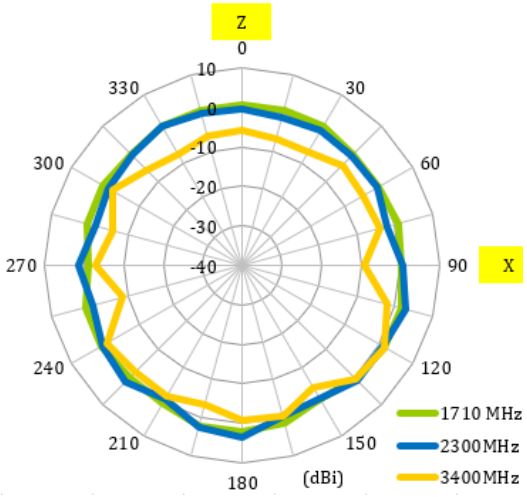
4.2 2D Radiation Patterns (Measured on 60*20mm EVB)

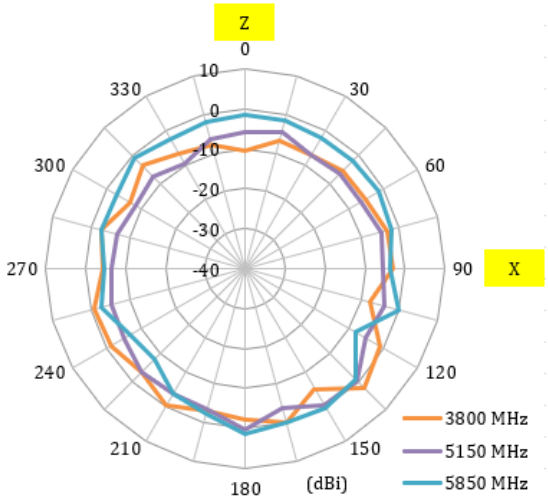
XY Plane



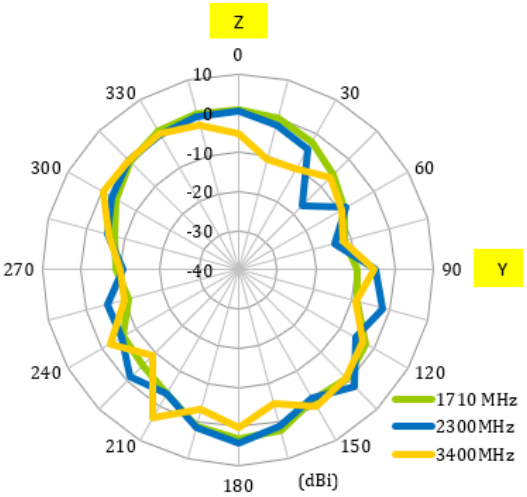


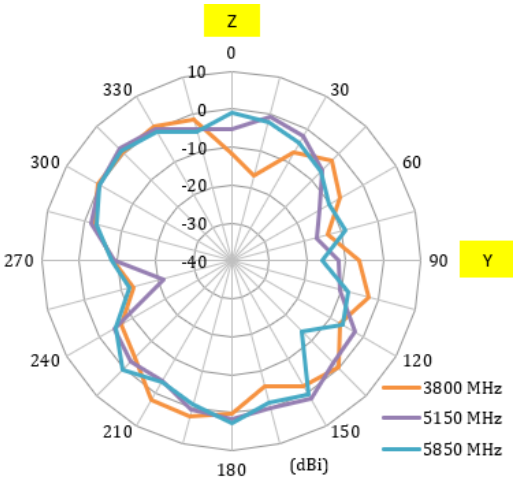
XZ Plane



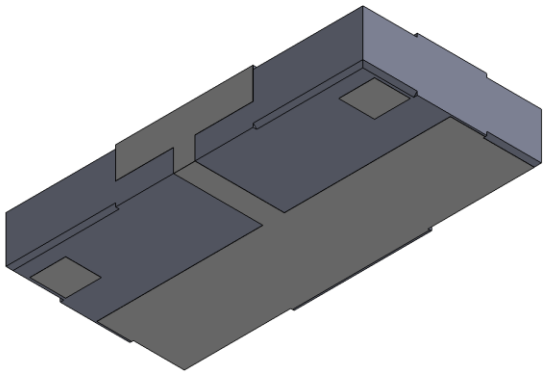


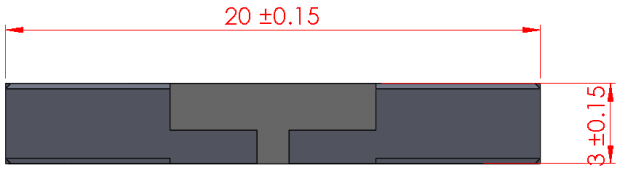
YZ Plane

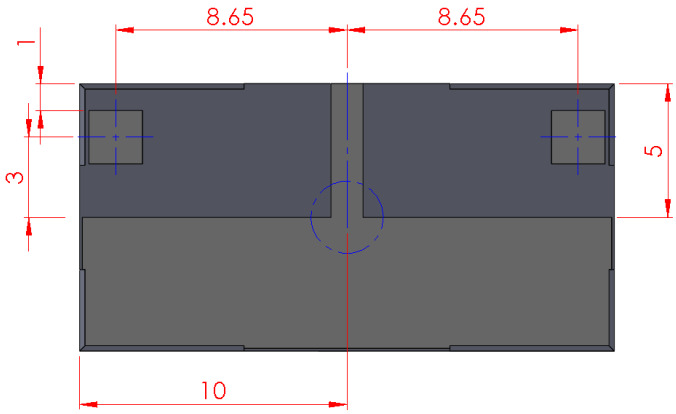




5. Mechanical Drawing (Units: mm)





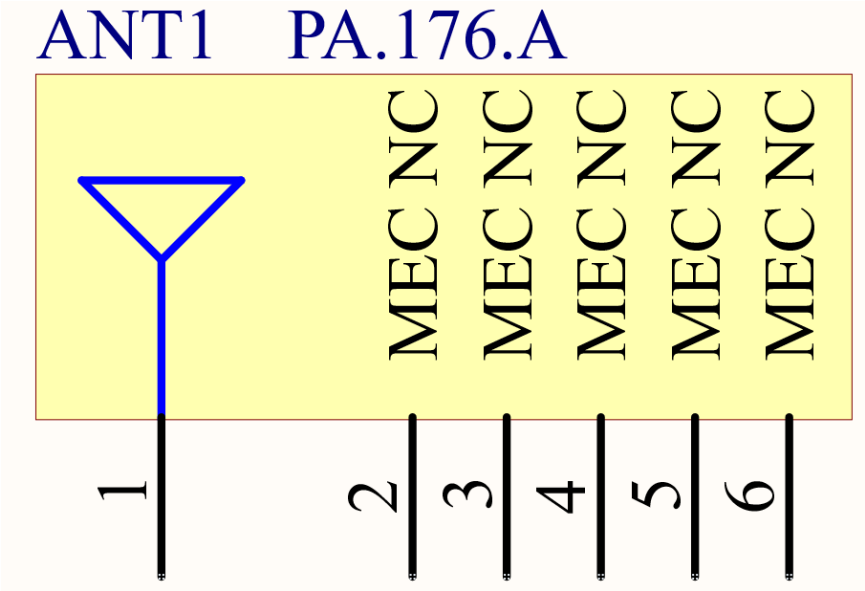


6. Antenna Integration Guide

6.1 Schematic Symbol and Pin Definition

The circuit symbol for the antenna is shown below. The antenna has 6 pins with only one pin (Pin 1) as functional. Pins 2, 3, 4, 5 and 6 are for mechanical strength.

Pin	Description
1	RF Feed
2, 3, 4, 5, 6	Mechanical, Not Connected



Please note you can download the design files, 3D model, 2D drawings and CST simulation files from the website here:

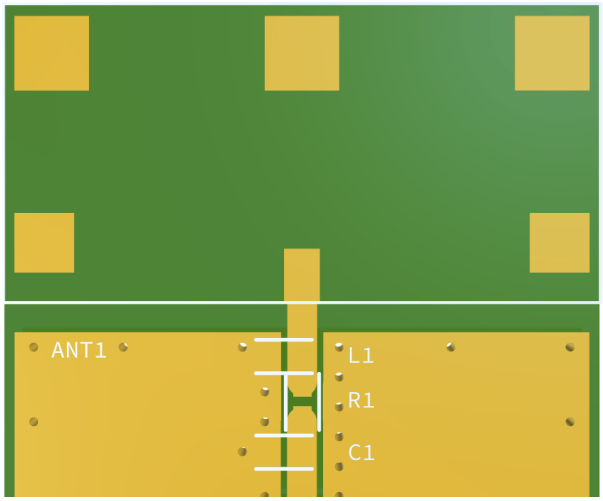
https://www.taoglas.com/product/5g-4g-wideband-cellular-smd-antenna/

6.2 Antenna Integration

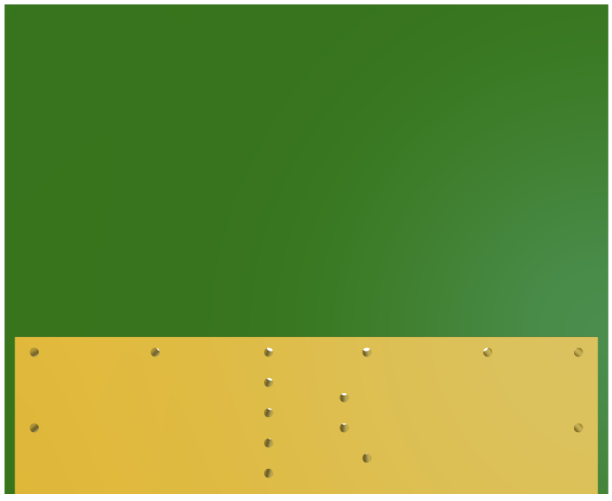
The antenna should ideally be placed on the PCB's shortest side to take advantage of the ground plane. Optimized matching components can be placed as shown.

6.3 PCB Layout

The footprint and clearance on the PCB must meet the antenna specification indicated below. An example of the PCB layout shows the antenna footprint with the recommended keep out area. Note the placement of the optimized components. The Pi-Matching network of L1 / R1 / C1 are placed within the ground plane. R1 and C1 are optional components but it is recommended to include these pads in case they are needed. For the evaluation board L1 is 5.6nH, R1 is 0 Ohm and C1 is Not Fitted. Please see Section 6.7 for further information. After the matching components the transmission line can be connected directly to the radio module.



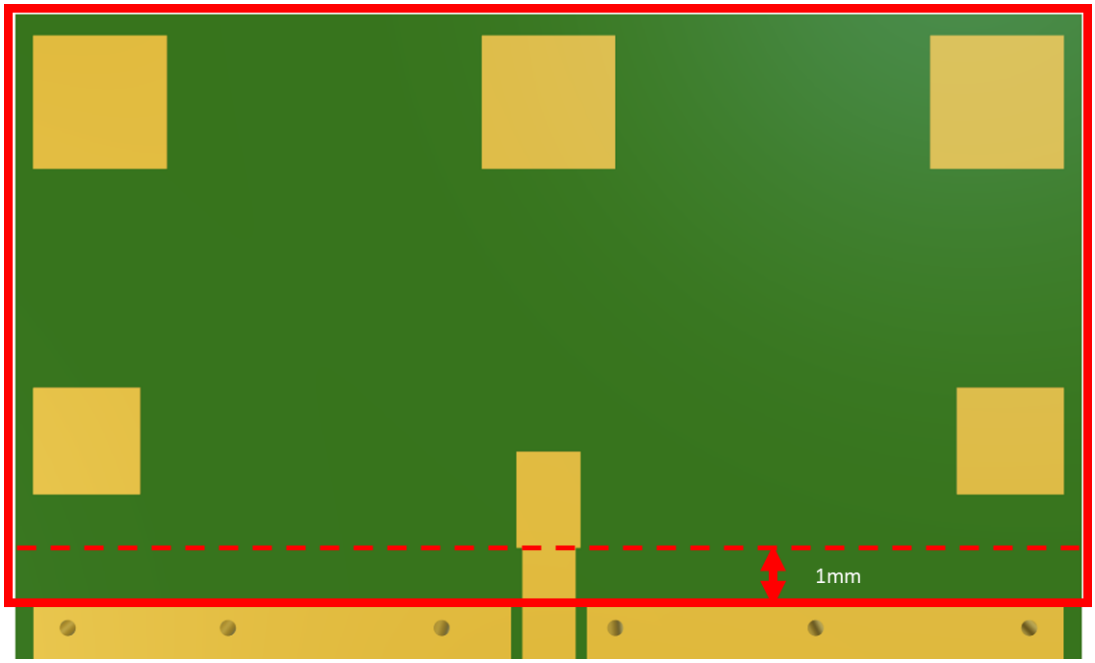
Topside



Bottom Side

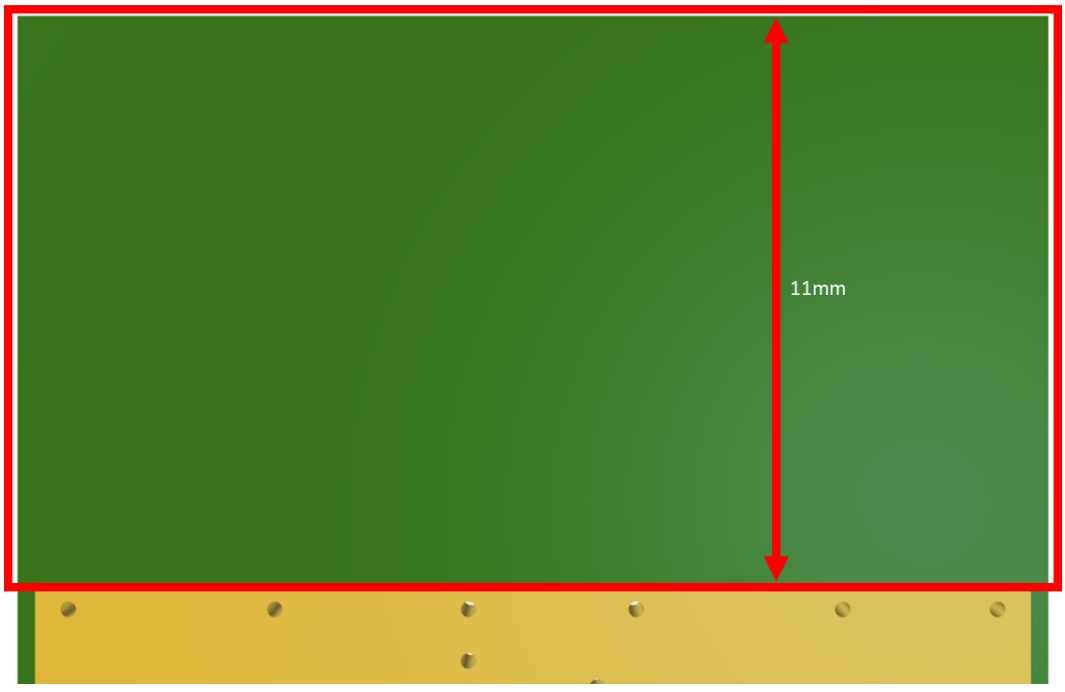
6.4 PCB Keep Out

Below shows the antenna footprint and clearance through ALL layers on the PCB. Only the antenna mechanical pads and connections to feed are present within this keep out area (marked RED). The keep out area extends to 1mm from the antenna feed pad to the ground area. This clearance area includes the bottom side and ALL internal layers on the PCB.



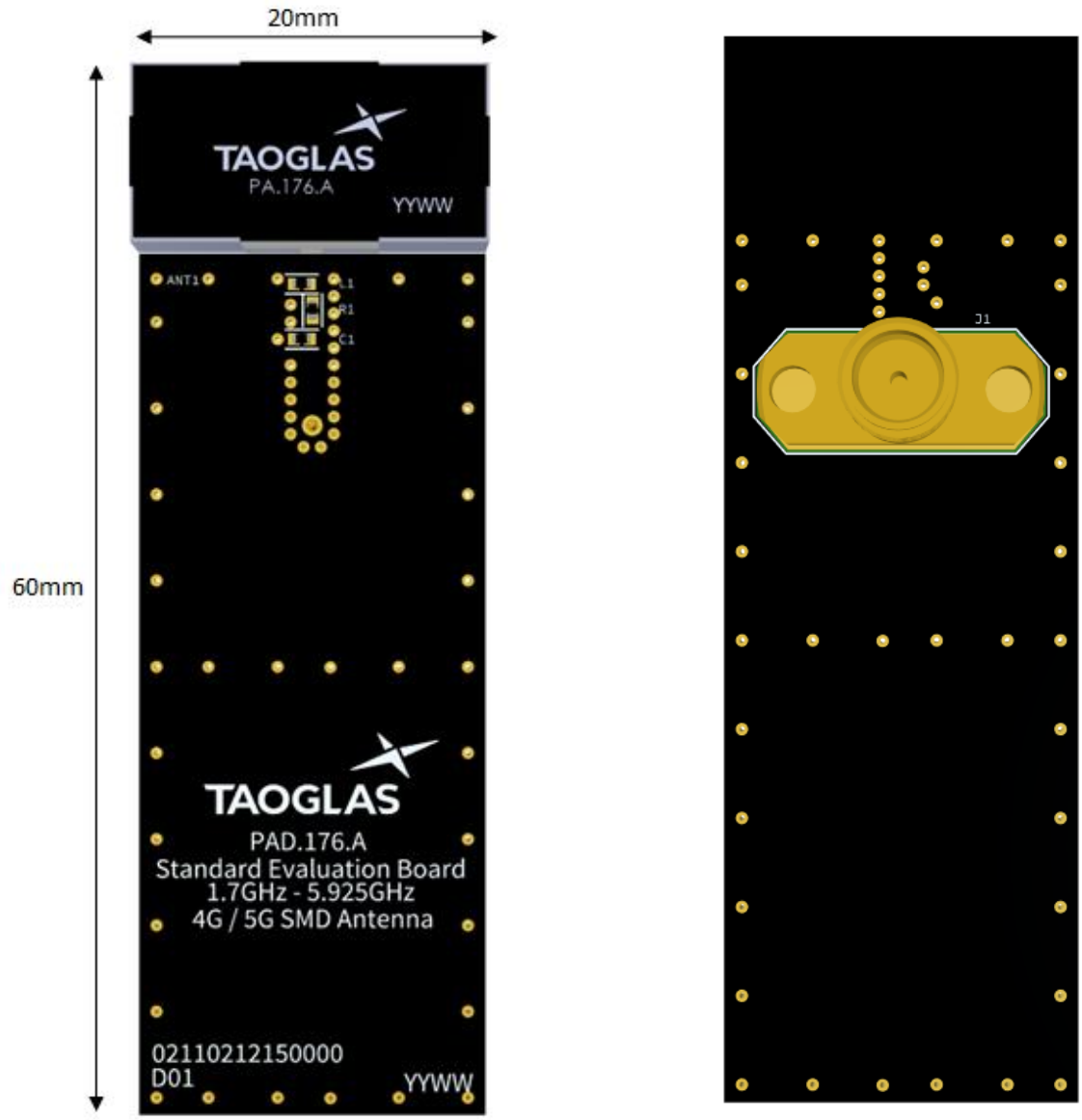
Topside

The image below, shows the underside of the PCB and the keep out area, indicated in RED. The keep out area extends to 11mm from the edge of the PCB covering the ground area. All layers must follow this clearance rule.



Underside

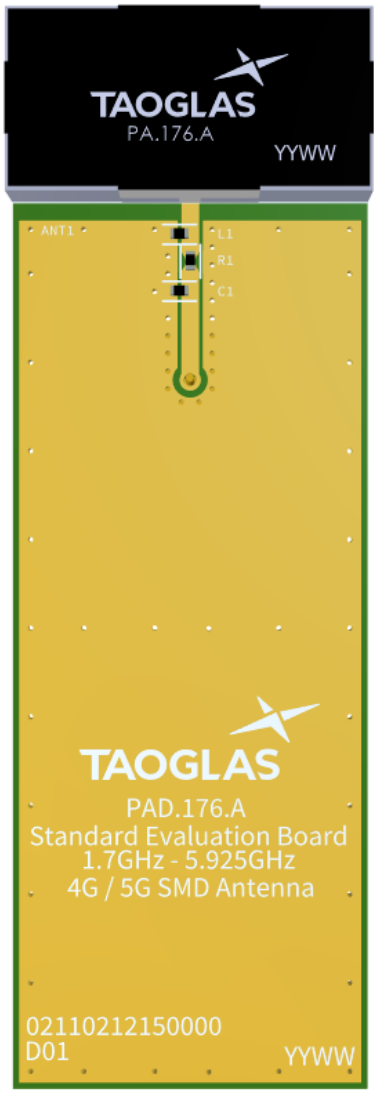
6.5 Evaluation Board



Topside Bottom Side

This evaluation board is a 2-layer stack-up. Please ensure a 50 Ohm transmission line is used in the design.

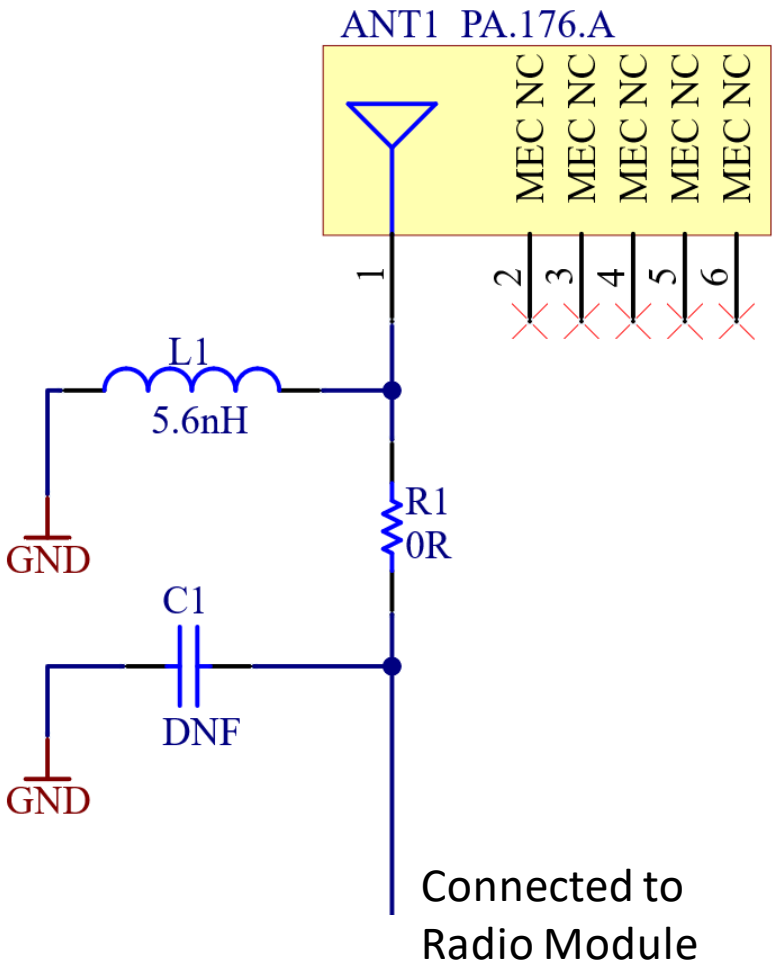
6.6 Evaluation Board Ground Plane Length



Ground Plane Length
49mm

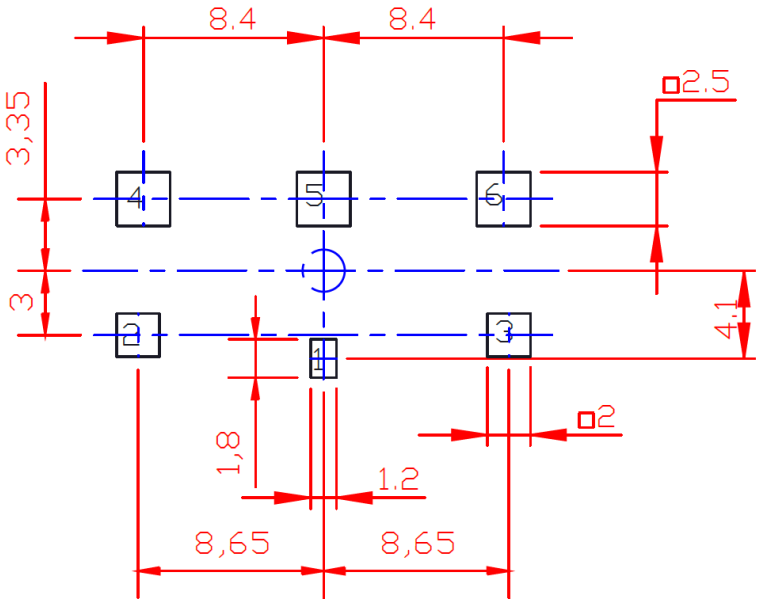
6.7 Evaluation Board Matching Circuit

A matching component (L1) in parallel with the PA.176.A is required for the antenna to have optimal performance on the evaluation board, located inside the ground plane in the space specified in the above images. Additional matching components may be necessary for your device, so we recommend incorporating extra component footprints, forming a “pi” network, between the radio module and the edge of the ground plane.



Designator	Type	Value	Description
L1	Inductor	5.6nH	Murata LQG15HS series
R1	Resistor	0 Ohms	Yageo RC0402 series
C1	capacitor	Not Fitted	

6.8 PCB Footprint Information



PCB FOOTPRINT
SCALE 2:1

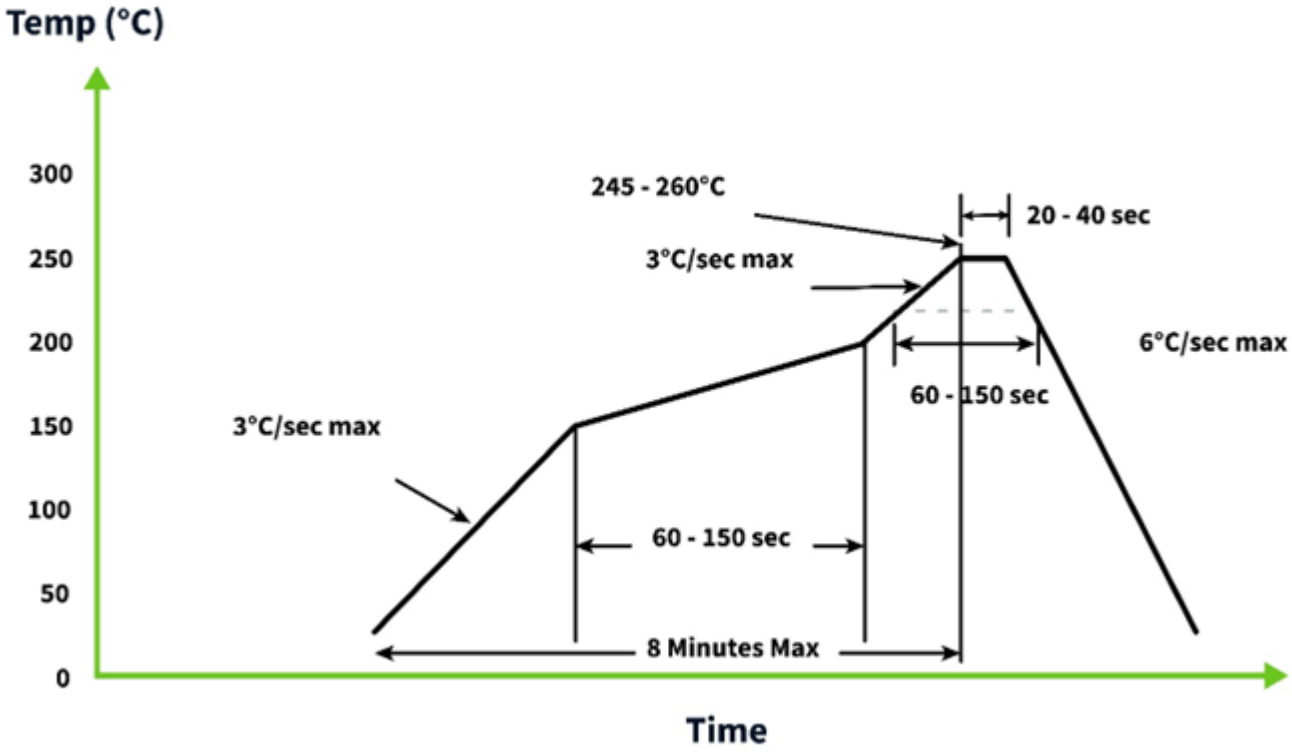
PIN:	DESCRIPTION:
1	Feed (50 ohm)
2,3,4,5,6	NC

Notes:

1. Pad 1 is connected to 50 ohm transmission line.
2. Pads 4,5 and 6 are the same size.
3. Pads 2 and 3 are the same size.
4. For PCB solder mark, allow for an area 0.1mm larger than the pads shown.
5. For PCB paste, allow for 90% coverage of the pad sizes shown.

7. Solder Reflow Profile

The PA.176.A can be assembled by following the recommended soldering temperatures are as follows:



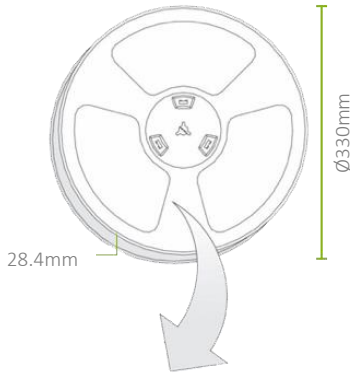
*Temperatures listed within a tolerance of +/- 10º C

Smaller components are typically mounted on the first pass, however, we do advise mounting the PA.176.A when placing larger components on the board during subsequent reflows.

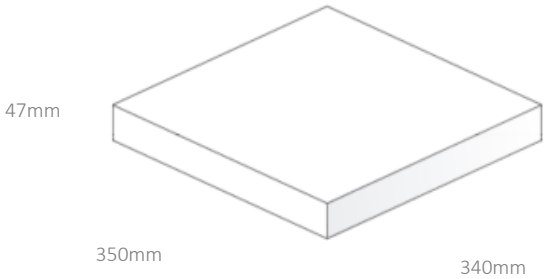
Note: Soldering flux classified ROL0 under IPC J-STD-004 is recommended.

8. Packaging

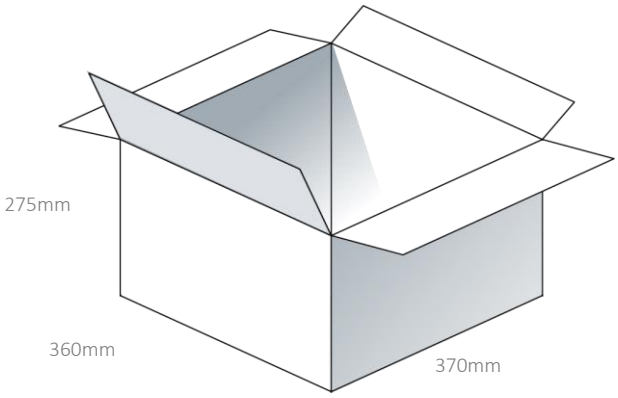
1000pcs PA.176.A per Tape & Reel
Dimensions - Ø330*28.4
Weight - 1Kg



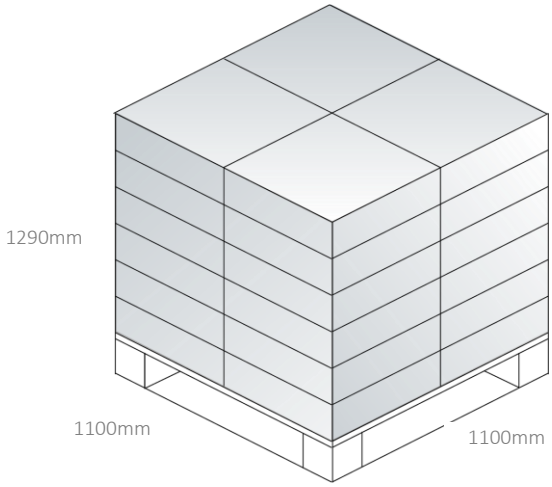
1000pcs PA.176.A per carton
Dimensions - 350*340*47mm
Weight - 1.2Kg



6000pcs PA.176.A per carton
Dimensions - 360*370*275mm
Weight - 6.8Kg



Pallet Dimensions:
1100*1100*1300mm
36 Cartons Per Pallet
9 Cartons Per Layer, 4 Layers



Changelog for the datasheet

SPE-20-8-041 – PA.176.A

Revision: C (Current Version)	
Date:	2023-10-25
Changes:	Added Solder Reflow Profile
Changes Made by:	Cesar Sousa

Revision: B	
Date:	2020-11-05
Changes:	Specifications table amended
Changes Made by:	Dan Cantwell

Revision: A (Original First Release)	
Date:	2020-06-12
Notes:	Initial Release
Author:	Jack Conroy

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