

High Frequency Ceramic Solutions

2.4 GHz SMD, Above Metal, Low Profile Mini Chip Antenna,

P/N 2450AT42E010B

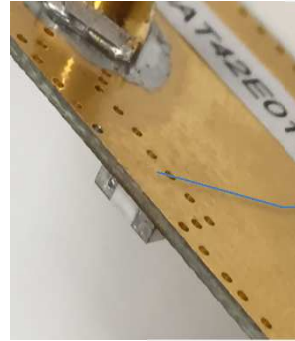
This antenna must have metal underneath in order to function properly

Detail Specification: 2/21/2020

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General Specifications

| | | |
|--|--|-----------------|
| Part Number | 2450AT42E010B | |
| Frequency (MHz) | 2400 - 2480 | |
| Return Loss (dB) | Tuning Version1 | Tuning Version2 |
| | 2.7 min. | 4.5 min. |
| Peak Gain (dBi typ.) | -1.0 (YZ-V) | -1.2 (YZ-V) |
| Impedance | 50 Ω | |
| Power Capacity | 2W max. (CW) | |
| Q'ty/Reel (pcs) | 2,000 | |
| Operating Temp | -40 to +85°C | |
| Recommended Storage Conditions and Period for unused T&R Product | +5 to +35°C | |
| | Humidity 45 - 75% RH 18 months max. | |



Zero Clearance!

Antenna mounts directly above or below the metal layer of PCB. No antenna clearance required ever again!

Total average radiated efficiency on PCB feature on "Mounting Considerations 1" (orderable EVB p/n: 2450AT42E010B-EB1SMA) is ~35%

This antenna was designed in mind for small coin cell, wearable, IoT, 2.4 BLE, 802.11, ISM, Zigbee, etc. applications in close-range networks where metal or a battery/display covers the entire length or side of the PCB or encasement must be present directly under the antenna and there's no room for usual/typical antenna metal clearance.

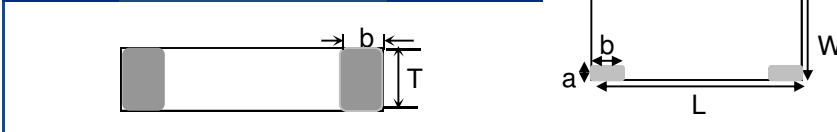
This antenna is specifically designed for PCBs that have 1 - 2 mm of total thickness

Part Number Explanation

| | | | | | |
|------------|---------------|-----------------|--|----------------------|--|
| P/N Suffix | Packing Style | Bulk | Suffix = S | e.g.. 2450AT42E010BS | |
| | | T & R | Suffix = E | e.g.. 2450AT42E010BE | |
| | EVB P/N | Tuning Version1 | 2450AT42E010B-EB1SMA (comes with 1 female SMA connector) | | |
| | | Tuning Version2 | 2450AT42E010B-EB2SMA (comes with 1 female SMA connector) | | |

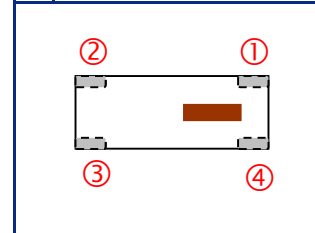
Mechanical Specifications

| | In | mm |
|---|-------------------|-----------------|
| L | 0.197 \pm 0.008 | 5.00 \pm 0.20 |
| W | 0.079 \pm 0.008 | 2.00 \pm 0.20 |
| T | 0.059 \pm 0.008 | 1.50 \pm 0.20 |
| a | 0.020 \pm 0.008 | 0.50 \pm 0.20 |
| b | 0.059 \pm 0.008 | 1.50 \pm 0.20 |
| C | 0.012 max | 0.30 max |



Terminal Configuration

| | |
|---|-----------------|
| 1 | Feeding Point |
| 2 | NC ¹ |
| 3 | GND |
| 4 | GND |



¹Make sure to have Pin 2 soldered to its PCB land pad but **not** connected to GND or input, it must be NC (or floating).

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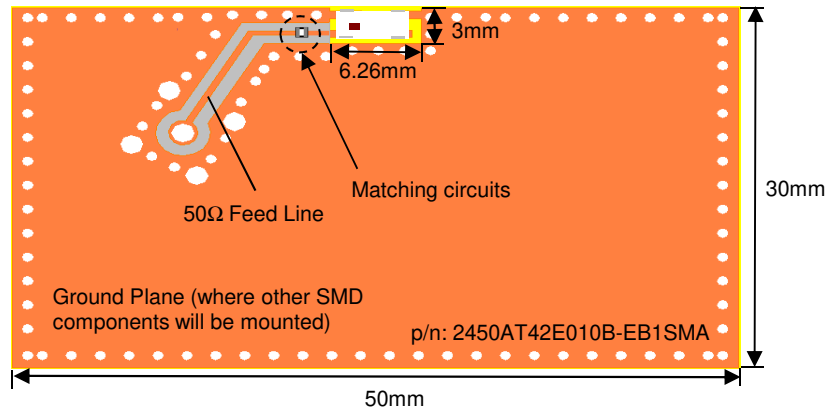
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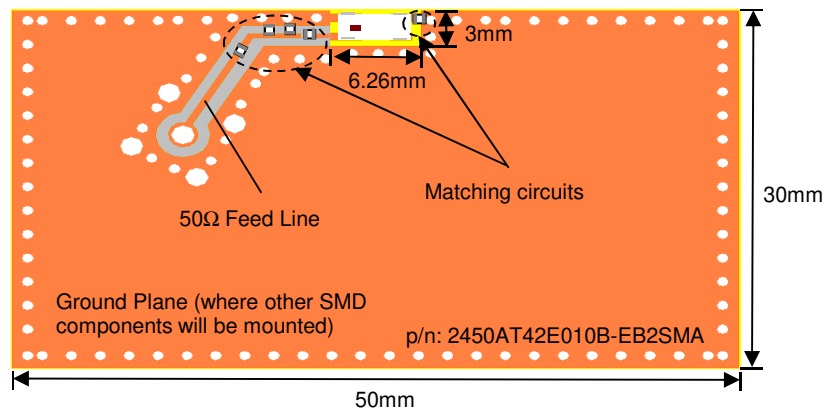
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Mounting Considerations 1

Tuning Version1



Tuning Version2



To order a pre-tuned 50Ω EVB with a female SMA connector you see here

Click here: <https://www.johansontechnology.com/request-a-sample>

Reference p/n: 2450AT42E010B-EB1SMA / 2450AT42E010B-EB2SMA

Need help designing the antenna in? Use our antenna design services! <https://www.johansontechnology.com/pcb-antenna-services>
2 Free layout reviews and if you need us to tune and characterize the antenna on your design (anechoic chamber) we can do that too (lab fee may apply for the latter).

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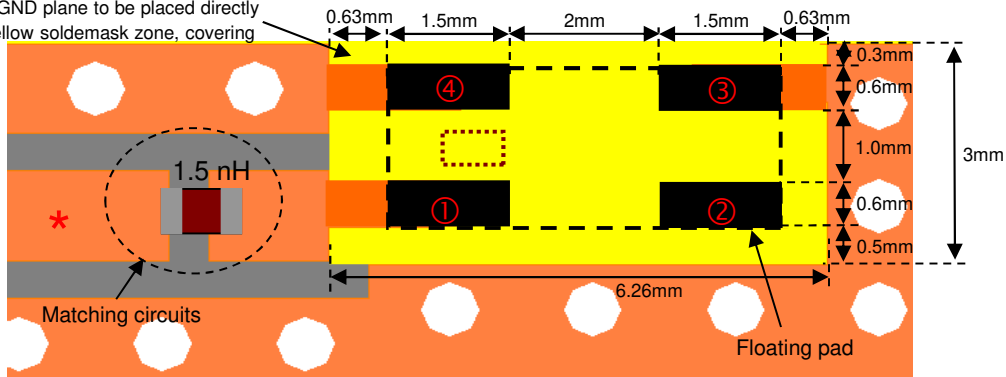
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Mounting Considerations on EVB1&2 - Detail

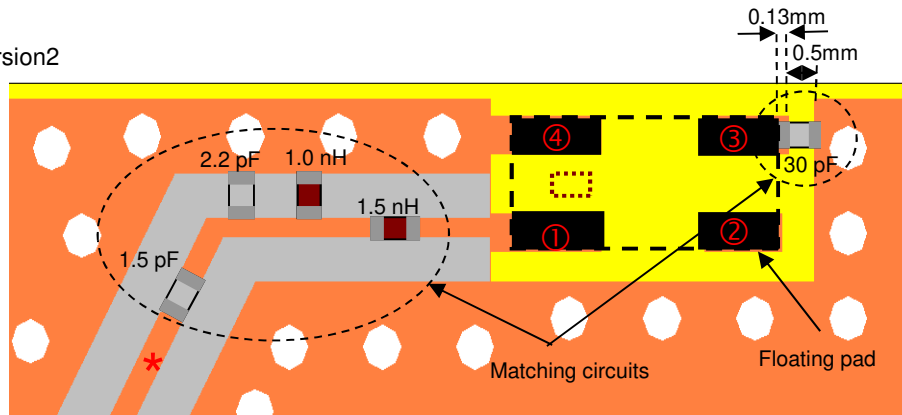
The exact geometry of the detail below on your PCB is crucial for the proper performance of the antenna.

Tuning Version1

Metal bottom GND plane to be placed directly underneath yellow soldermask zone, covering entire area.



Tuning Version2



Want the layout file? Send us a message at:
<https://www.johansontechnology.com/ask-a-question>

Component values of matching circuit will be different, depending on PCB layout.

*Line width should be designed to match 50ohm characteristic impedance, depending on PCB material and thickness., A coplanar waveguide trace is recommended for best results.

For this particular antenna It is recommended that the designer leave available slots for the matching network, even if all slots won't be used, this will prepare the PCB for the unpredictable final mass production version of the matching circuit. The antenna matching network values above are used when antenna is mounted on Johanson's evaluation board. The matching values on client's PCB will be different.

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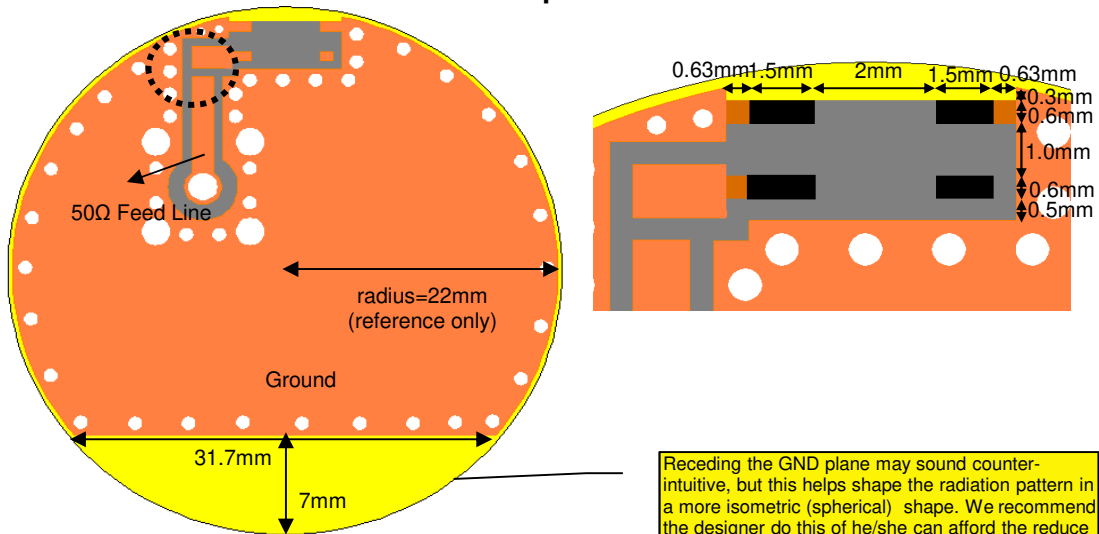
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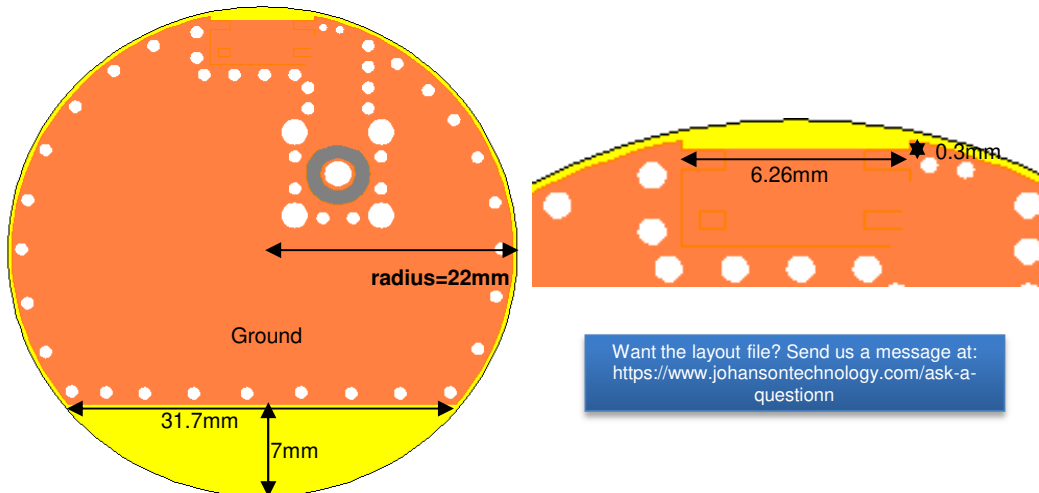
Mounting Considerations 2 - Circular PCB Environments (coin cell type)

Top View



Receding the GND plane may sound counter-intuitive, but this helps shape the radiation pattern in a more isometric (spherical) shape. We recommend the designer do this if he/she can afford the reduce SMT space, but not mandated.

Bottom View



Want the layout file? Send us a message at: <https://www.johansontechnology.com/ask-a-question>

Note: There's no orderable EVB available for the above "Mounting Considerations 2" reference design

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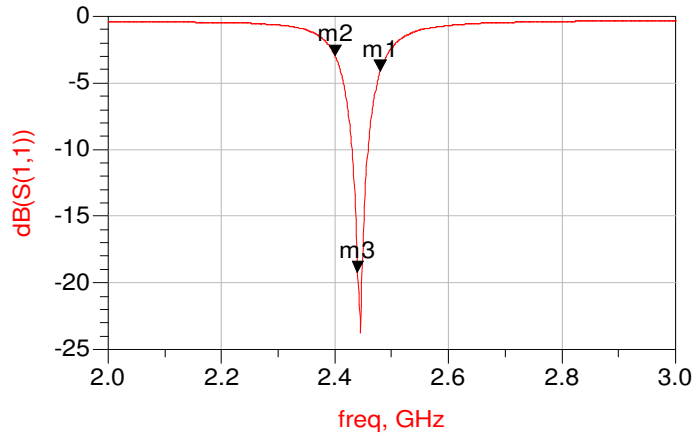
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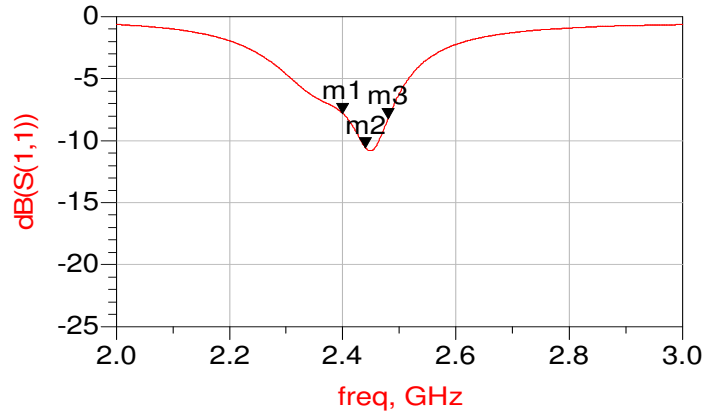
Typical Electrical Characteristics (T=25 °C) Return Loss

Tuning Version1



| | | |
|-------------------|--------------------|-------------------|
| m2 | m3 | m1 |
| freq=2.400GHz | freq=2.440GHz | freq=2.480GHz |
| dB(S(1,1))=-2.951 | dB(S(1,1))=-19.219 | dB(S(1,1))=-4.100 |

Tuning Version2



| | | |
|-------------------|--------------------|-------------------|
| m1 | m2 | m3 |
| freq=2.400GHz | freq=2.440GHz | freq=2.480GHz |
| dB(S(1,1))=-7.785 | dB(S(1,1))=-10.579 | dB(S(1,1))=-8.225 |

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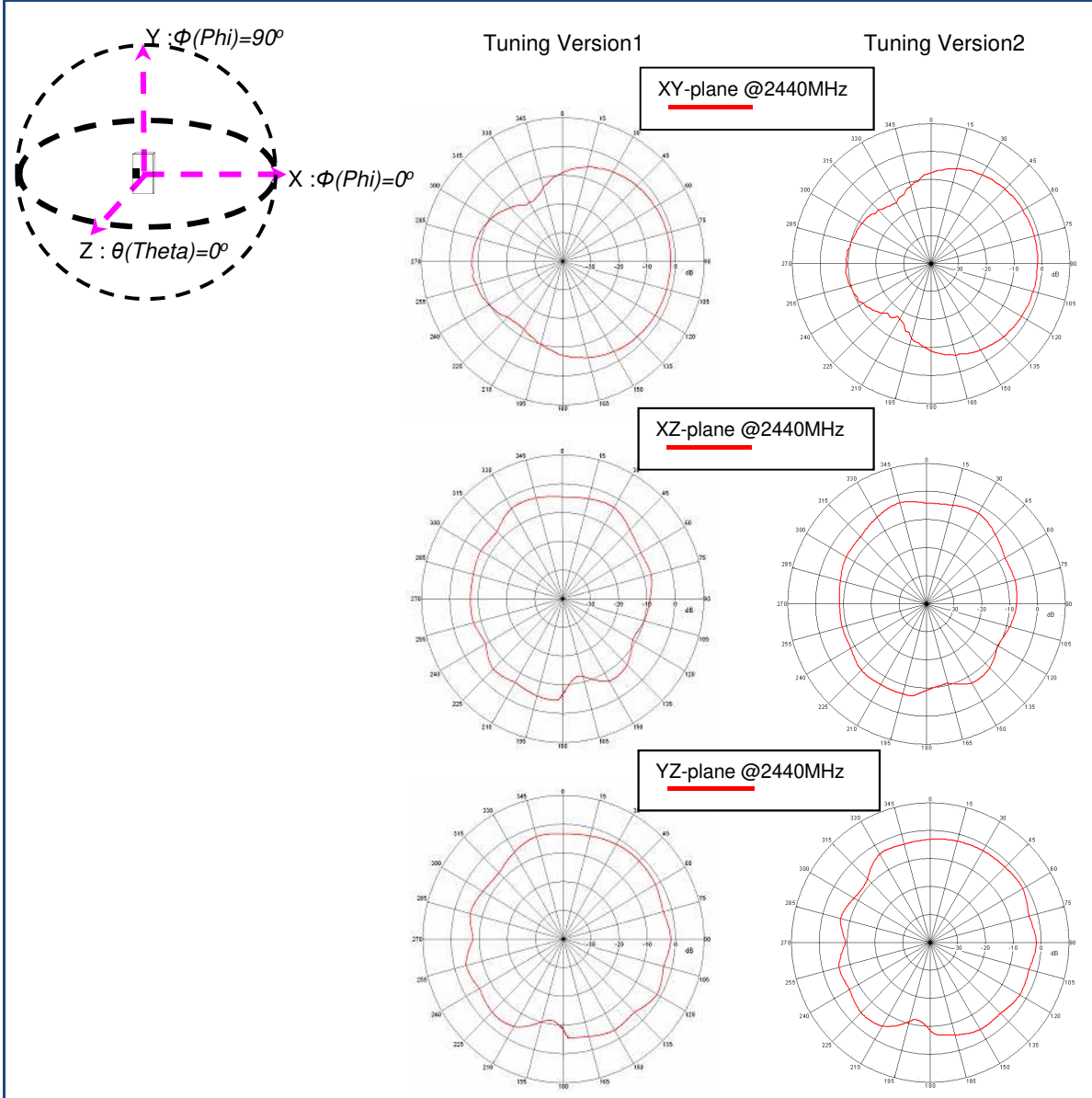
P/N 2450AT42E010B

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Typical Electrical Characteristics (T=25 °C) Radiation Patterns@2.44GHz



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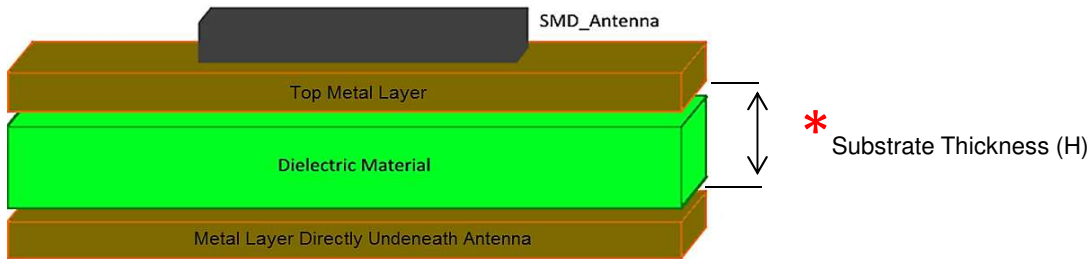
Detail Specification: 2/21/2020

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How To Choose The Correct Antenna Variant

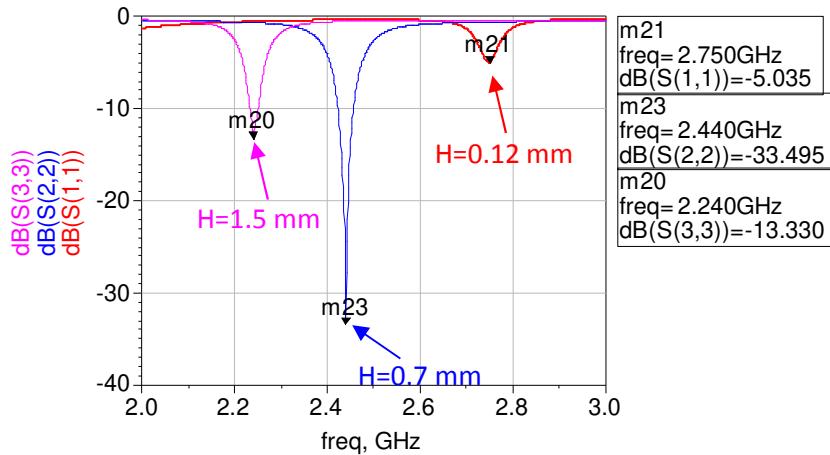
We offer 2 other resonating variants of this antenna since the antenna's efficiency is largely affected by the thickness of the PCB's substrate. This allows a more robust design to fit your PCB. The disparity between antenna variations are internal only; variations are identical in dimension and solder footprint.

Refer to the diagram below to understand what is meant by substrate thickness.



* For PCBs consisting of multiple layers, the thickness (H) is limited only to the metal layer immediately below 'Top Metal Layer.'

The below plot demonstrates the effect that substrate thickness has on the antenna's performance.



As you can see, there is a direct correlation between substrate thickness (H) and the resonant frequency. This is, in part, due to the natural capacitive loading effect and resonating frequency of the PCB itself. Our antenna variants were developed to counter this effect.

Note: "H" substrate thickness of <0.25mm (10mil) is not recommended. The component will still work and radiate, just not optimally.

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How To Choose The Correct Antenna Variant

Refer to the table below for substrate thickness and the corresponding antenna variation.

| PCB Substrate Thickness | Recommended JTI PN |
|-------------------------|--------------------|
| ≤ 1.0mm | 2450AT42E0100 |
| 1.0mm - 2.0mm | 2450AT42E010B |
| ≥ 2.0mm | 2450AT42E010C |

Typical Efficiency Values @ 2.44GHz for various scenarios for a 30x50mm PCB

The following efficiency values represent performance on a 30x50mm EVB like on page 2. Please note that antenna efficiency varies widely with board layout, size and surroundings.

| PCB Substrate Thickness (H) | Simulated Antenna Efficiency(%) @ 2.44GHz | | |
|-----------------------------|---|---------------|---------------|
| | 2450AT42E0100 | 2450AT42E010B | 2450AT42E010C |
| H = 0.12 mm | 1.95% | 1.02% | 0.93% |
| H = 0.7 mm | 29.20% | 9.30% | 2.30% |
| H = 1.5 mm | 23.30% | 41.90% | 13.80% |
| H = 2.5 mm | 21.60% | 34.20% | 38.40% |

We encourage you to use a relatively thick dielectric layer below antenna, as we have seen a direct correlation between substrate thickness and antenna performance.

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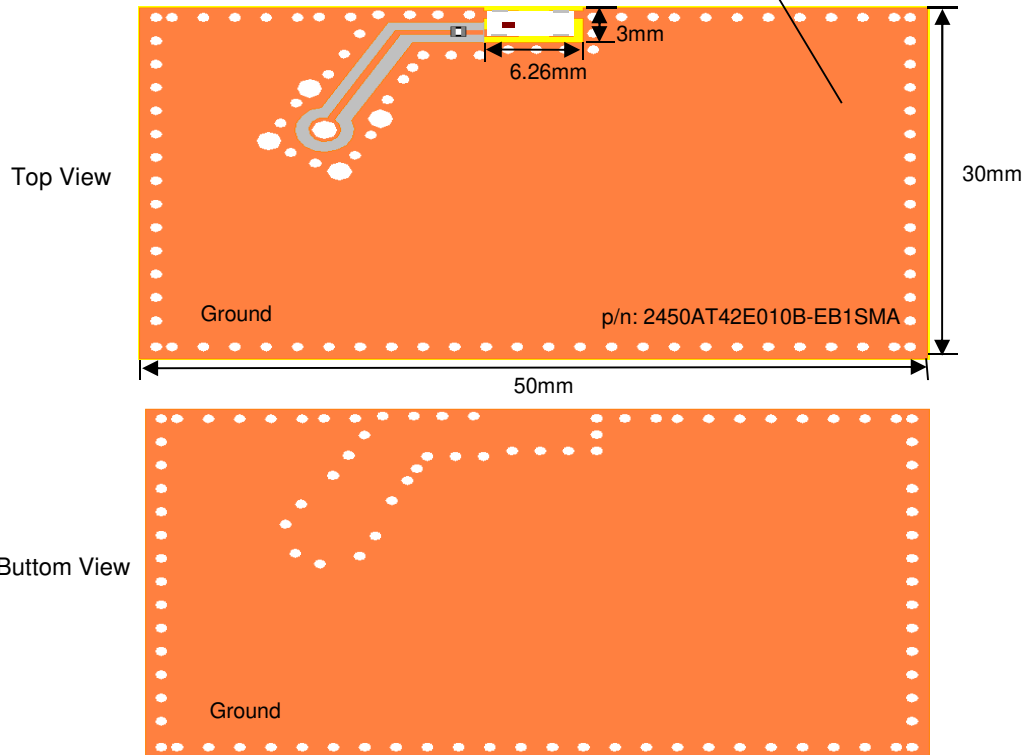
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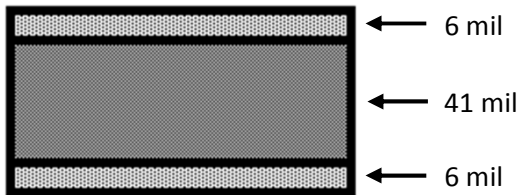
Mounting Considerations 3 - Recommendations when using 2450AT42E010B

Recommendations when using 2450AT42E010B

We have found that the best performance can be gained when using the 2450AT42E010B with a 4-layer PCB with a total thickness approximately 1.5mm thick.



The 2450AT42E010B 4-layer evaluation board has the following stackup:



To order a pre-tuned 50Ω EVB with a female SMA connector, click here: <https://www.johansontechnology.com/request-a-sample>

Reference p/n: 2450AT42E010B-EB1SMA / 2450AT42E010B-EB2SMA

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Antenna layout review, tuning, and characterization services

<https://www.johansontechnology.com/ipc-antenna-services>

More SMD Chip Antennas at:

<https://www.johansontechnology.com/antennas>

Soldering Information

<https://www.johansontechnology.com/ipcsoldering-profile>

Antenna layout and tuning techniques (How to obtain the new antenna matching values)

<https://www.johansontechnology.com/tuning>

Packaging information

<http://www.johansontechnology.com/tape-reel-packaging>

RoHS Compliance

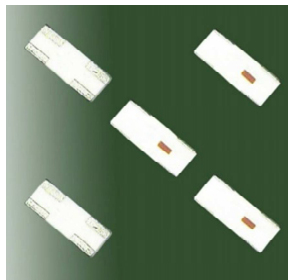
<https://www.johansontechnology.com/rohs-compliance>

MSL Info

<https://www.johansontechnology.com/msl-rating>

P/N Explanation and Breakdown

<https://www.johansontechnology.com/ipc-pn-explained>



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