# High Frequency Ceramic Solutions

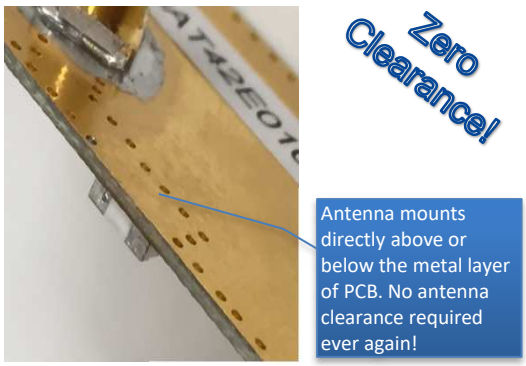
**2.4 GHz SMD, Above Metal, Low Profile Mini Chip Antenna** **P/N 2450AT42E010B**

**This antenna will generally have a metal layer directly underneath for proper operation, exceptions may apply.**

Detail Specification: 10/28/2021 

## General Specifications

| | | |
|---|---|---|
| **Part Number** | 2450AT42E010B | |
| **Frequency (MHz)** | 2400 - 2480 | |
| **Return Loss (dB)** | EVB1* | EVB2* |
| | 2.7 min. | 3.5 min. |
| **Peak Gain (dBi typ.)** | -1.0 (YZ-V) | -1.0 (YZ-V) |
| **Average Gain (dBi typ.)** | -3.5 (YZ-V) | -5.0 (YZ-V) |
| **Impedance (Ω)** | 50 | |
| **Power Capacity (W)** | 2 max. (CW) | |
| **Reel Quantity (pcs./reel)** | 2,000 | |
| **Operating Temp** | -40 to +85°C | |
| **Recommended Storage Conditions and Period for unused Product on T&R** | +5 to +35°C<br>Humidity 45 - 75% RH<br>18 months max. | |




*Evaluation boards 1 and 2 are meant to demonstrate the difference in performance achievable with different substrate thicknesses.

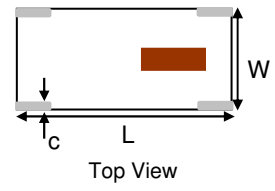
This antenna was designed in mind for small coin cell, wearable, IoT, 2.4 BLE, 802.11, ISM, Zigbee, etc. applications in close-range networks where metal or a battery/display covers the entire length or side of the PCB or encasement must be present directly under the antenna and there's no room for usual/typical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

## Part Number Explanation

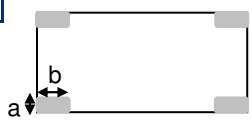
| | | | | |
|---|---|---|---|---|
| **P/N Suffix** | **Packing Style** | Bulk (loose pcs.) | Suffix = S | E.g. 2450AT42E010BS |
| | | T & R | Suffix = E | E.g. 2450AT42E010BE |
| | **Evaluation Board 1** | 2450AT42E010B-EB1SMA (comes with 1 female SMA connector) | | |
| | **Evaluation Board 2** | 2450AT42E010B-EB2SMA (comes with 1 female SMA connector) | | |

## Mechanical Specifications

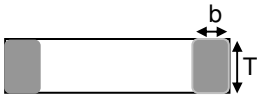
| | In | mm |
|---|---|---|
| **L** | 0.197 ± 0.008 | 5.00 ± 0.20 |
| **W** | 0.079 ± 0.008 | 2.00 ± 0.20 |
| **T** | 0.059 ± 0.008 | 1.50 ± 0.20 |
| **a** | 0.020 ± 0.008 | 0.50 ± 0.20 |
| **b** | 0.059 ± 0.008 | 1.50 ± 0.20 |
| **C** | 0.012 max | 0.30 max |



Top View



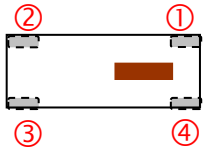
Bottom View



Side View

## Terminal Configuration

| | |
|---|---|
| **1** | Feeding Point |
| **2** | NC[1] |
| **3** | GND |
| **4** | GND |




[1]Make 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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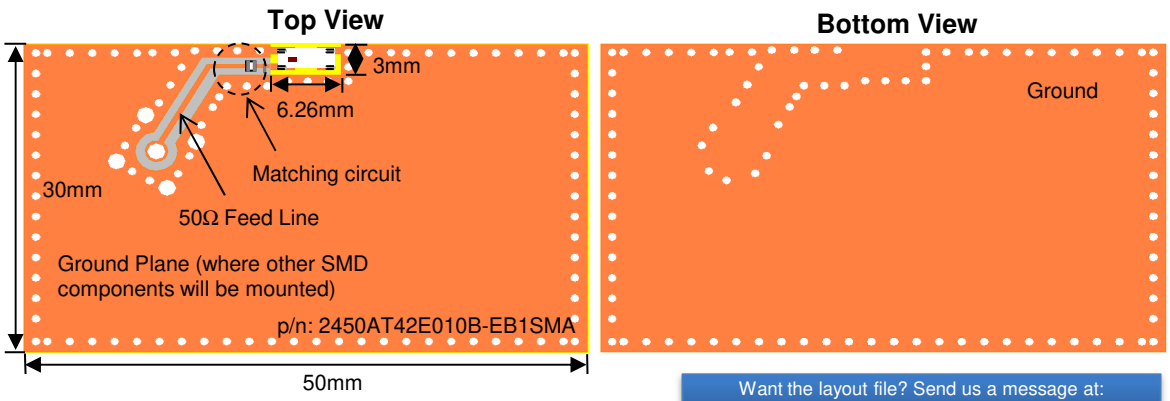
## Mounting Consideration 1: Evaluation Board 1 (Thickness = 1.5mm)

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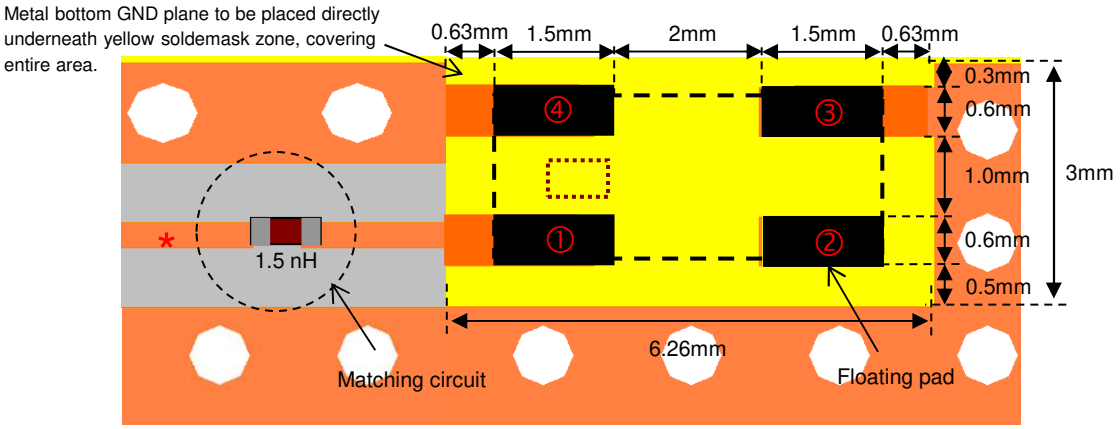
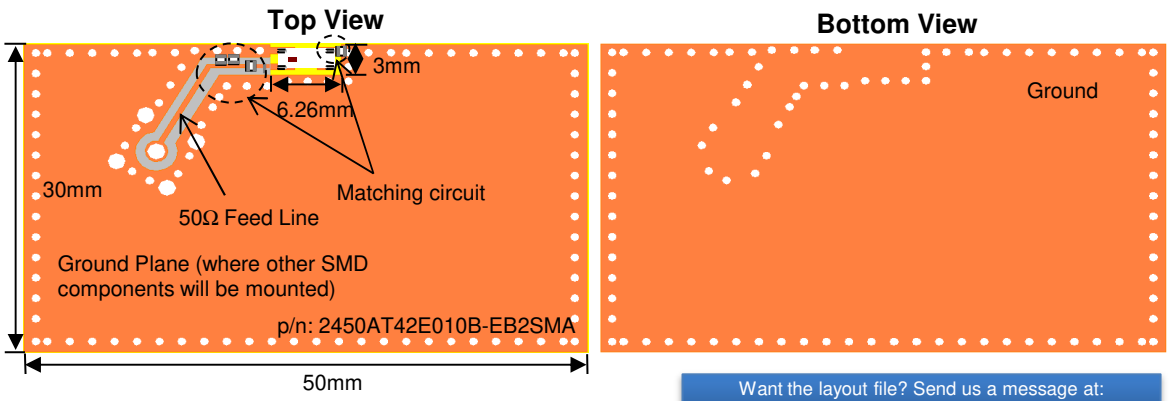



*Line width should be designed to match 50ohm characteristic impedance, depending on PCB material and thickness. A coplanar waveguide trace is recommended for best results.

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.

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**

## Mounting Consideration 1: Evaluation Board 2 (Thickness = 2.5mm)

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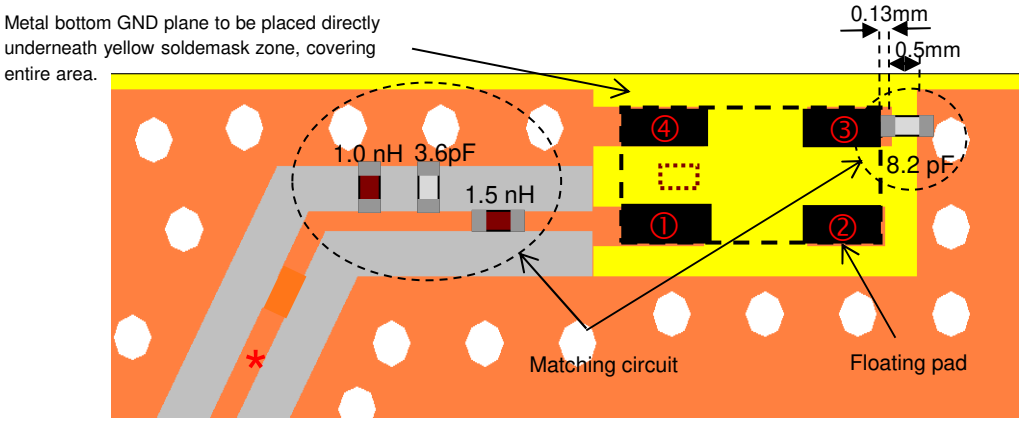


*Line width should be designed to match 50ohm characteristic impedance, depending on PCB material and thickness. A coplanar waveguide trace is recommended for best results.

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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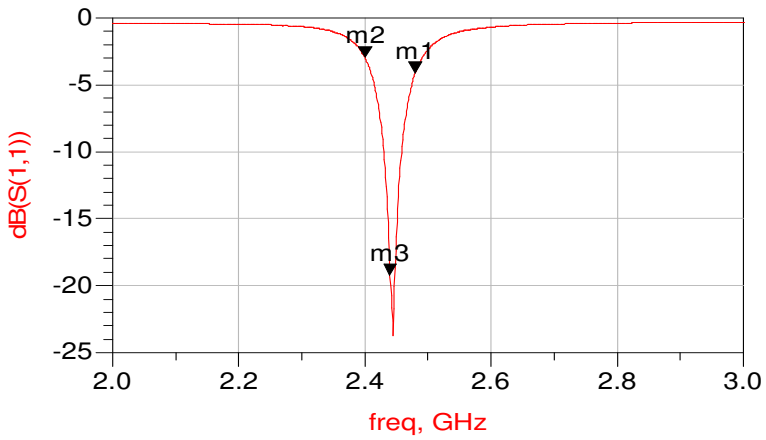
https://www.johansontechnology.com/request-a-sample
**Reference p/n: 2450AT42E010B-EB2SMA**

## Typical Electrical Characteristics (T=25 °C)

**Evaluation Board 1 (Antenna Efficiency: 18%@ 2.4GHz ; 38%@2.44GHz ; 21%@2.48GHz)**

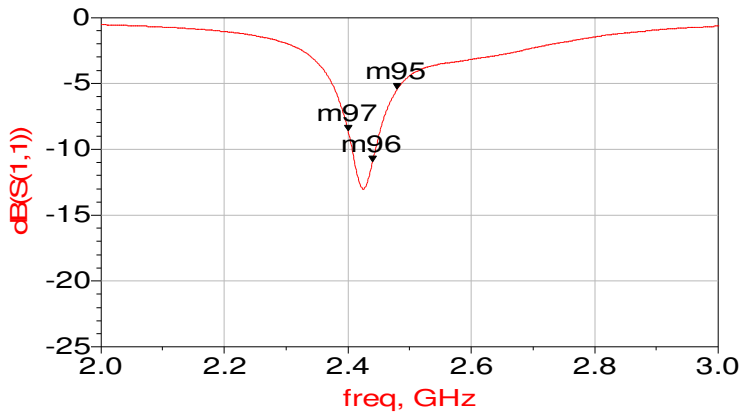
**Return Loss**




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

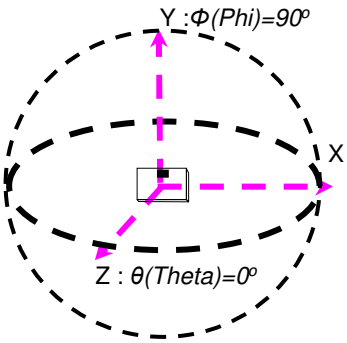
**Evaluation Board 2 (Antenna Efficiency: 27%@ 2.4GHz ; 42%@2.44GHz ; 27%@2.48GHz)**

**Return Loss**



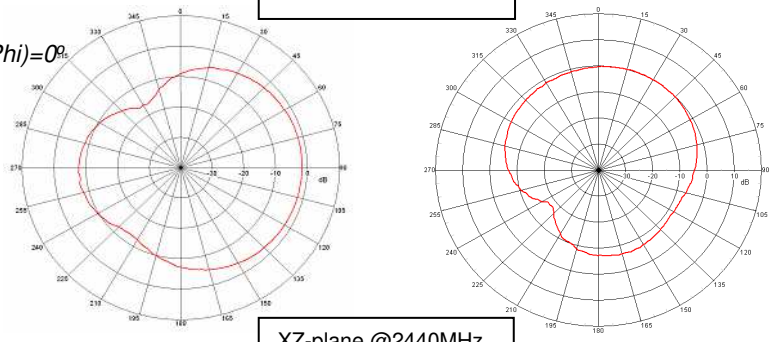

| | | |
|---|---|---|
| m97<br>freq=2.400GHz<br>dB(S(1,1))=-8.572 | m96<br>freq=2.440GHz<br>dB(S(1,1))=-10.958 | m95<br>freq=2.480GHz<br>dB(S(1,1))=-5.426 |

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

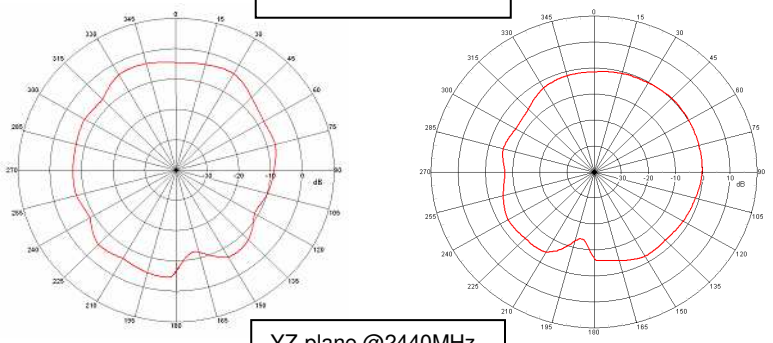



**Evaluation Board 1** **Evaluation Board 2**

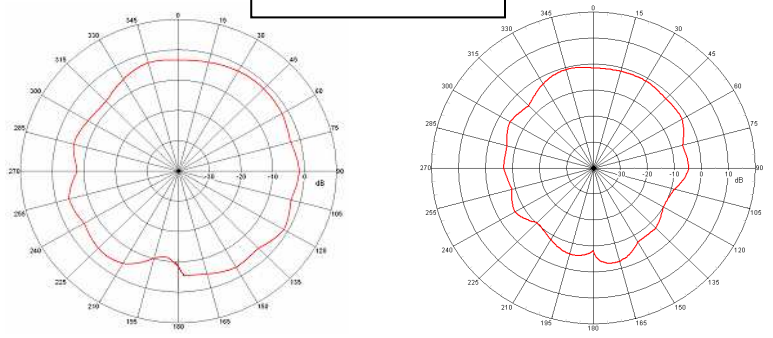
XY-plane @2440MHz



XZ-plane @2440MHz



YZ-plane @2440MHz



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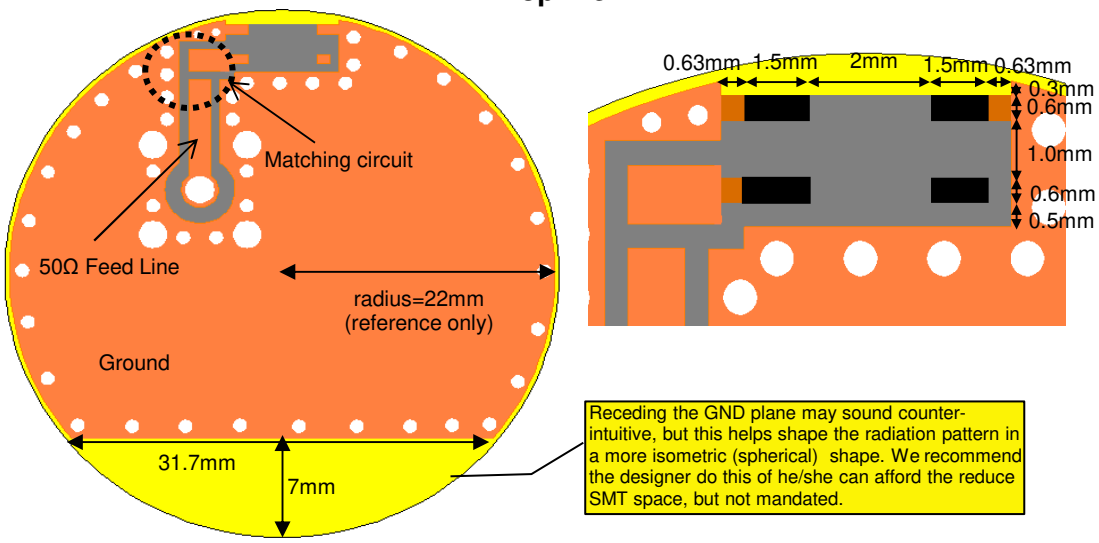
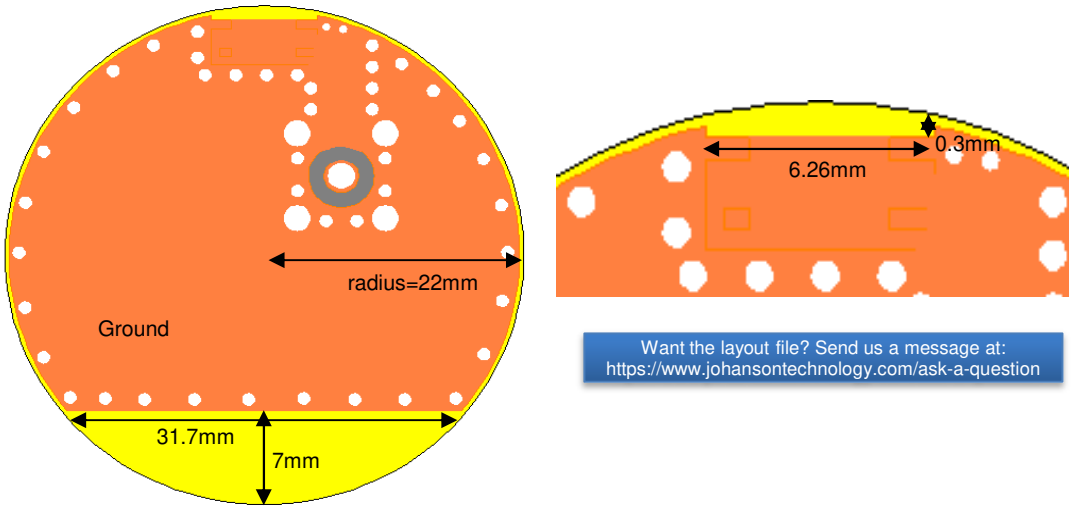
## Mounting Considerations 2 - Circular PCB Environments (coin cell type)

### Top View




### Bottom View




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

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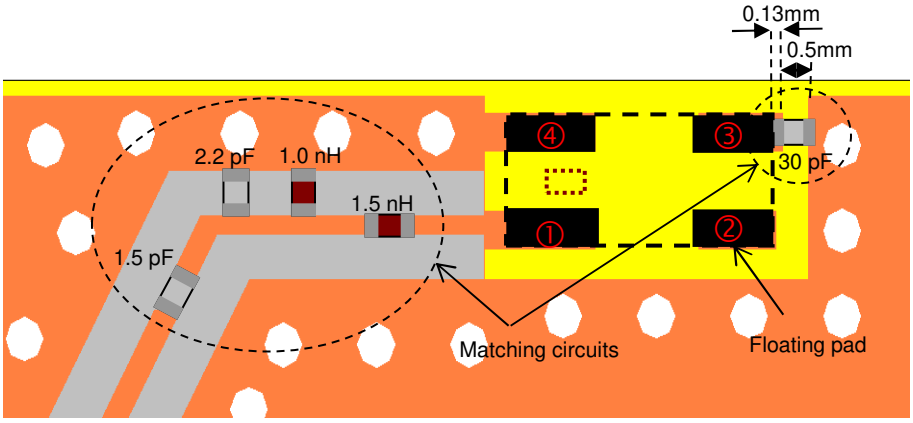
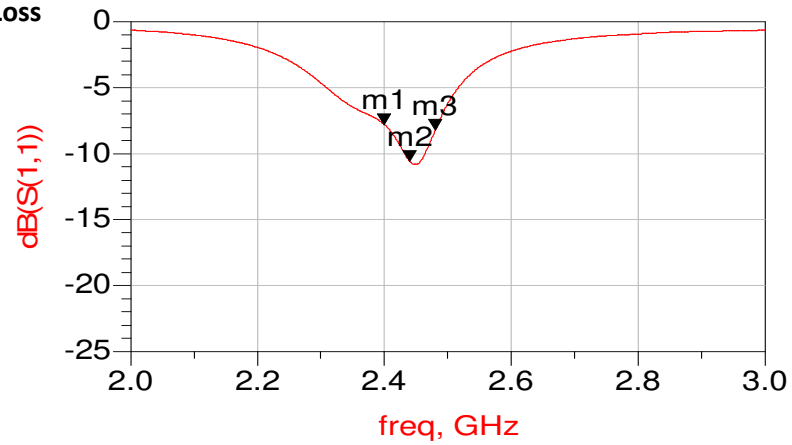
## Wider Tuning Example

By re-tuning our Evaluation Board 1, return loss can be improved over the bandwidth as a whole. An additional tuning element is placed between antenna pin 3 and GND.




**(Antenna Efficiency: 22%@ 2.4GHz ; 31%@2.44GHz ; 20%@2.48GHz)**

**Return Loss**



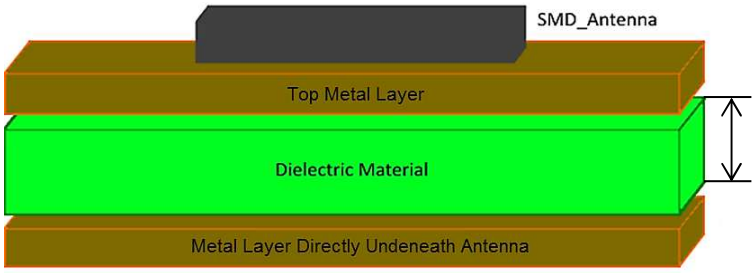

| m1 | m2 | m3 |
|---|---|---|
| freq=2.400GHz<br>dB(S(1,1))=-7.785 | freq=2.440GHz<br>dB(S(1,1))=-10.579 | freq=2.480GHz<br>dB(S(1,1))=-8.225 |

Note: This only serves as an example and is not an order-able evaluation board.

## How To Choose The Correct Antenna Variant

Since the antenna's efficiency is largely affected by the thickness of the PCB's substrate, we offer another variant of this antenna. This allows a more robist design to fit your PCB. The disparity between antenna variations are internal only; variations are identical in dimension and footprint-compatible.

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




*For PCBs consisting of multiple layers, the thickness (H) is limited distance between the metal layer immediately below the antenna.

| PCB Substrate Thickness | Recommended JTI PN |
|---|---|
| ≤ 1.0mm | 2450AT42E010**0** |
| 1.0mm - 2.0mm | 2450AT42E010**B** |

## 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) | Antenna Efficiency @ 2.44GHz | |
|---|---|---|
| | 2450AT42E0100 | 2450AT42E010B |
| H = 0.12 mm | 1.95% | 1.02% |
| H = 0.7 mm | 29.20% | 9.30% |
| H = 1.5 mm | 23.30% | 38.00% |
| H = 2.5 mm | 21.60% | 42.00% |

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

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|---|
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| **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** |
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| https://www.johansontechnology.com/rohs-compliance |

| **MSL Info** |
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| https://www.johansontechnology.com/msl-rating |

| **P/N Explanation and Breakdown** |
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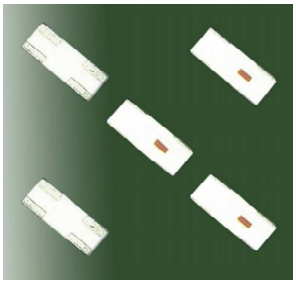
| https://www.johansontechnology.com/ipc-pn-explained |



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