

1 – 8 GHz Component-Less Bias Tee

TC4 - Microwave Components and Transmission Line Structures

Introduction:

Bias tees are essential in numerous RF components and systems such as amplifiers. Advancements on lumped element fabrications have made it easier to fabricate bias tees at higher frequencies. The size, cost, and possibly performance of passive components however, can be a limiting factor in designing those bias tees.

In this competition, participants (students) are asked to present a bias tee based on RF design, rather than technology selection. No passive components are allowed (i.e no RLC components); only RF structures on a single layer PCB.

Design Specifications and Rules:

The project should be the result of the student's best effort. The judges will be asked to verify during the evaluation period that the following specifications and rules are followed:

1. The design will be fabricated on a single patterned layer PCB. The bottom layer can either be solid ground or without copper If the team chooses so. Thru hole vias are allowed.
2. Two SMA female connectors need to be used on the board for testing purposes. One for the RF input and another for the RF + DC output
3. The DC port shall be made with two 0.1' pins
4. There needs to be a DC short between the bias pad and the RF + DC output
5. There needs to be a DC open between the bias pad and the RF input

Evaluation Process:

The design will be judged based on the trade-off between bandwidth (BW) and total area as follows:

$$Score = \frac{BW^2(GHz)}{Area(mm^2)}$$

The bandwidth will consist of the area where $|S_{11}| < -10dB$, $|S_{22}| < -10dB$ and $|S_{21}| > -3dB$ (all three conditions must be satisfied simultaneously) between 1 – 8 GHz.

The team with the highest score wins.

Example: A design achieves the criteria above within 1.5 – 3.8 GHz, and PCB dimensions are 12mm x 60mm

$$\text{Score} = (3.8 - 1.5)^2 / (12 \times 60) = 0.00734$$

How to Participate:

Competing teams will be required to register to the IMS Student Design Competition according to the rules posted on the IMS-2024 homepage.

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