Anten'it Microwave Training Kit

TEACHING PASSIVE MICROWAVE COMPONENT DESIGN IN MICROWAVE LABORATORY LECTURES

Anten'it Microwave Training Kit is designed for microwave laboratory lectures and microwave training centers. Different from all other training kits, Anten'it Microwave Training Kit has an ability to teach design of passive microwave components to students in time-limited laboratory classes. The block based microwave design methodology provides students to design their own microwave components during the microwave laboratory lectures. Experiment sheets include short practical information about passive microwave components and the design procedure with Anten'it.

The microwave experiments that are included in Anten'it Microwave Training Kit are given below:

1. Rectangular Waveguide and Attenuator Design Experiment

2. Impedance Matching Circuit Design with Lumped Elements

3. Impedance Matching Circuit Design with Microstrip Stubs & λ/4 Transformer

4. Microstrip Power Dividers Design Experiment (3 Types of Dividers)

5. Microstrip Quadrature 90° Coupler Design Experiment

6. Filter Designs with Lumped Elements (All four types of filters)

7. Microstrip Bandpass and Bandstop Filter Design Experiment (via Stubs)

8. Microstrip Stepped Impedance Low Pass Filter Design Experiment

9. Microstrip 180 degree Hybrid Coupler Design Experiment

10. Waveguide Iris Filter Design Experiment (*Advanced)

11. Waveguide Post Filter Design Experiment (*Advanced)

A standard microwave training kit includes six of these experiments with the numbers: 2, 3, 4, 5, 6, 7.

In addition to the standard microwave training kit, these kits are also customizable. Lecturers can select the microwave experiments from the list and teach only the microwave component types they would like to.

Each component has an example CAD file that can be imported to a simulation tool if the lecturer prefers to use a simulation tool.

*Advanced experiments are for project based learning combining the simulation and hardware experience which is appropriate for master and PHD level education.

A Typical Microwave Design Experiment Procedure with Anten'it Microwave Training Kit

Read the chapter from a microwave textbook or lecture notes

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Read the theoretical background information in the experiment sheets

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Read how to design the microwave component with Anten'it Microwave Training Kit

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Start the experiment with initial calculations, build the component with the initial calculations

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Measure S-parameters via a network analyzer

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Iterate the component by adding or removing cells to reach the target frequency

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Design and build the other component in the experiment

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Measure S-parameters

↓

Iterate the design

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Design, build, measure and iterate the other component in the experiment

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Compare the results of the components and compare with theory

Theoretical Background Behind Anten'it Kits

HARDWARE MESH CELLS

Electromagnetic simulation tools include CAD interfaces. When the designers draw a solid structure in the CAD interface, simulation programs discretize the solid structure into small pieces called "mesh cells". Maxwell equations are calculated within each mesh cell by using numerical methods such as method of moments (MOM), finite-difference time-domain (FDTD), finite element method (FEM) etc. Each numerical method uses different mesh cell shapes.

FDTD type of simulation programs use cubic mesh cells. In order to get accurate results, the mesh cell dimensions are selected lower than λ/10.

Anten'it Microwave Training Kit uses brick-type hardware cells. Brick types of mesh cells are very similar to cubic shapes. There are two resolutions in this kit. One of them is 4 mm (length) X 4 mm (width) X 3 mm (height) and the other one is 1.5 mm height with the same length and width. The largest dimension 4 mm corresponds to λ/12.5 at 6 GHz. 6 GHz is the highest frequency of Anten'it kits. Microstrip experiments are at lower frequencies (up to 3 GHz) and waveguide experiments are at higher frequencies (3-6 GHz).

The hardware mesh cells provide students to design their microwave components directly in front of a network analyzer. They can start their design with calculations and iterate by adding or removing the blocks (bricks). Then, they reach the target design frequency.

STANDARD MICROWAVE TRAINING KIT

Standard Anten'it Microwave Training Kit includes 6 passive microwave component design experiments. Each experiment box includes one or more microwave components. There are experiment boxes including all filter types in an experiment or 3 different power divider types; T-junction, Wilkinson and resistive power dividers. Students can compare the results of different types of components. Ground planes are in a different box (yellow). Connectors are already mounted on the ground planes. There are cables, adaptors and removing tools within the kit. There is also a spare parts box within the kit. This box includes metal and dielectric cells. If you lose the blocks, you can add the ones in the spare parts box to the experiment boxes. There is no network analyser or software in the kit. The frequency of microstrip microwave components is up to 3 GHz.

There are 3D CAD models and CST Studio files of each component. If you prefer to combine the experiments with the simulation tools, you can import the models to any simulation program and see the results in the simulation environment.

Anten'it can be ordered via distributors in www.antenit.com or sales@antenit.com
Anten'it is a patent pending product of Antenom Antenna Technologies