EXP NO: 5 CHARACTERISTICS OF FILTERS, MICROSTRIP PATCH ANTENNA AND PARALLEL LINE COUPLER

5.1 OBJECTIVE

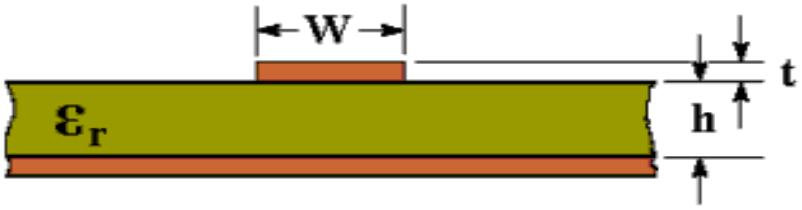
To Study the characteristics of microstrip filters, microstrip patch antenna and parallel line coupler

5.2 HARDWAREREEQUIRED

C-Band source, 5 dB attenuator, Test jig, Detector, Active filter, coupler, CRO

5.3 INTRODUCTION

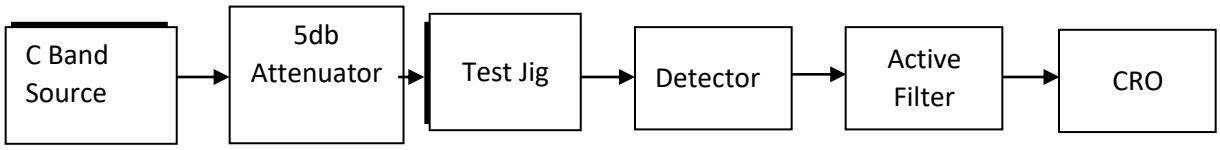
Microstrip is a type of electrical transmission line which can be fabricated using printed circuit board technology, and is used to convey microwave-frequency signals. It consists of a conducting strip separated from a ground plane by a dielectric layer known as the substrate. Microstrip line is used to carry Electro-Magnetic Waves (EM waves) or microwave frequency signals. It is used to design and fabricate RF and microwave components such as directional coupler, power divider/combiner, filter, antenna, MMIC etc. Microstrip lines are also used in high-speed digital PCB designs, where signals need to be routed from one part of the assembly to another with minimal distortion, and avoiding high cross-talk and radiation. Microstrip line will have low to high radiation, will support 20 to 120 ohm impedance, supports Q factor of about 250. Difficult to mount chip in shunt mode but easy in series mode. The RF/microwave product made using microstrip line is less expensive and lighter in weight compare to its waveguide counterpart. Usually FR-4 dielectric substrate is used as PCB for microstrip based etching due to its low cost.



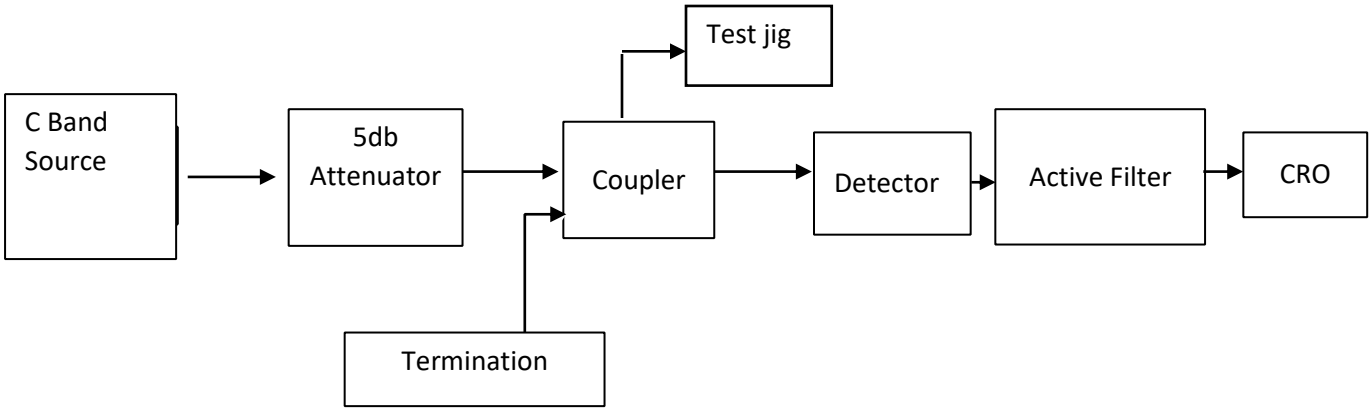
Microstrip

Block Diagram

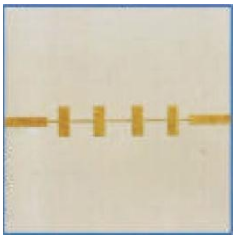
Using Filters



Using Patch



1. Low Pass Filter: It passes all the signals between zero frequency to some limit called the cut-off frequency and attenuates other higher frequencies.



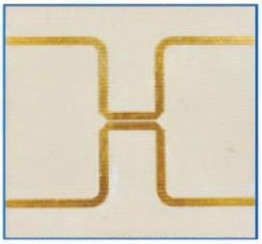
Specification:

The cut off frequency : 5±0.2 GHz

Insertion loss : 3±0.2 dB

Return Loss : 15±0.5 dB

1. **Parallel Coupled Line Coupler** :It consists of two close and parallel transmission lines and the coupled power depends on the separation between two lines.

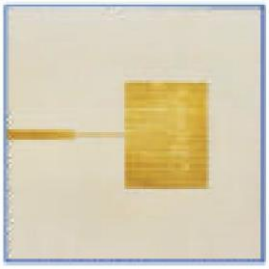


Specifications:

Operating frequency 5+0.2 GHz

Insertion Loss (At Through port)	:	1±05 dB
Coupling	:	15±1.0dB
Isolation	:	23±2dB
Directivity	:	12±2dB
Return Loss(Through)	:	20±2db

Patch Antenna It radiates the microwave signal in the space or receives the microwave signal from the space. Two types of patch antennas are available: one is quarter wave transformer fed and another one is the inset fed.



Specifications:	**Transformer fed**
Operating frequency:	5±0.2 GHz
Return Loss	13±1.0 dB

5.4 PRELAB QUESTION

1. Define Active and Passive filter,
2. Draw the frequency response curve of Band Pass Filter.
3. Calculate the value of capacitor to give cutoff frequency of f_L of 1 KHz with resistor value of 10 KΩ.
4. Write any four feeding method for microstrip patch antenna.
5. What is anechoic chamber?

5.5 EXPERIMENT

5.5.1 PROCEDURE

1. Assemble the kit as shown in the Figure.
2. Connect the 9 pin cable between power supply and detector
3. Connect power cords to the DC power supply and Active filter.
4. Connect 5-db attenuator to the source.
5. Connect RF cable between source jig and detector.
6. Set the desire frequency of the source using tuning knob of DC power supply.
7. Place Microstrip line in the Jig to set the reference voltage level (usually 10V) using gain control knob of the C-band Source(back panel)

8. Take out Microstrip line from the jig and place the component to be tested(LPF, Patch antenna and parallel line coupler).
9. Note down the voltage level as seen in the CRO.
10. Repeat steps 8-11 for other frequencies.
11. Use Db conversion Formula to convert the ration in dB.

$$dB = 20Log(V_{out}/V_{in})$$

12. Plot the graph power VS frequency.

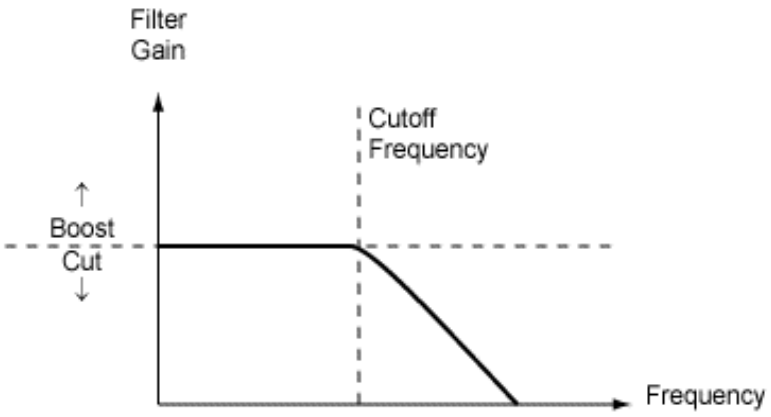
5.5.2 TABULATION

INPUT VOLTAGE V_T=

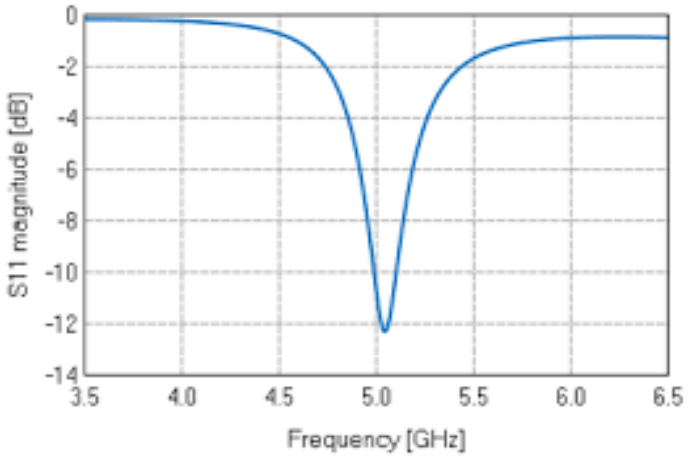
S.No	DC Voltage	Frequency	O/P of source using micro strip line	O/P of source after component is placed (V_{out}) V	Gain in dB dB = 20 log (V_{out} /V_{in})
1.		4.0			
2.		4.2			
3.		4.4			
4.		4.5			
5.		4.8			
6.		5.0			
7.		5.2			
8.		5.4			
9.		5.5			
10.		5.8			

MODEL GRAPH

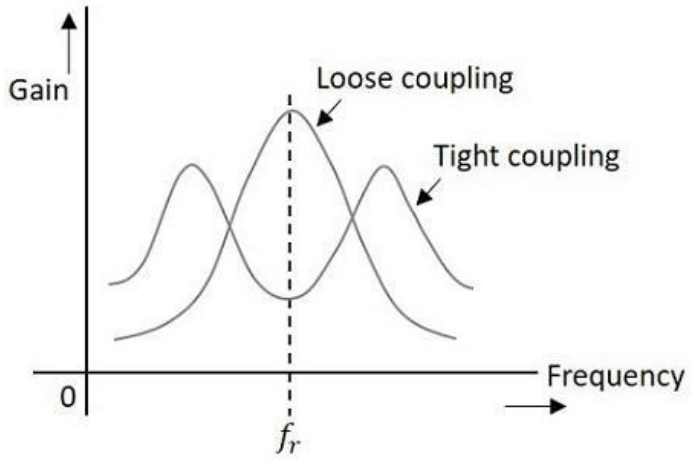
1. Low pass filter



2. Microstrip antenna



2. Parallel line coupler



5.6 POST LAB QUESTIONS

1. What are the methods of analysis of microstrip patch antenna.
2. Write the s-matrix for hybrid ring.
3. Draw the symbol of power divider.
4. Define coupling factor.
5.What is an isotropic radiator?

5.7 RESULT

Thus the characteristics of microstrip filters, microstrip patch antenna and parallel line coupler are studied