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Experiment No:

Title: - Study of microwave components and equipment.

Instruments & Components: -

Flanges, Twisted wave guide, wave guide tees, Directional Coupler, Attenuator, Isolators, Circulators, Matched terminator, Slide screw tuner, Slotted Section, Tunable probe, Horn antennas, Movable Short, Detector mount

Theory: -

A pipe with any sort of cross- section that could be used as a wave guide or system of conductors for carrying electromagnetic wave is called a wave guide in which the waves are truly guided.

- (1) **FLANGES:** - Flanges are used to couple sections of wave guide components. These flanges are designed to have not only mechanical strength but also desirable electric characteristics.
- (2) **TWISTED WAVEGUIDE:** - If a change in polarization direction is required, twisted section may be used. It is also called rotator.
- (3) **WAVE GUIDE TEE:** - Tees are junctions which are required to combine or split two signals in a wave guide. Different type of tees are:
 - (a) **H - PLANE TEE:** - All the arm of the H- plane Tee lies in the plane of the magnetic field which divides among the arm. This is thus a current or parallel junction.
 - (b) **E- PLANE TEE:** - It lies in the plane of electric field. It is voltage or series junction. In this signal is divided in to two parts having same magnitude but in opposite phase.
 - (c) **MAGIC TEE:** - If another arm is added to either of the T-junction. Then a hybrid T-junction or magic tee is obtained. The arm three or four is connected to arm 1&2 but not to each other.
- (4) **DIRECTION COUPLER:** - The power delivered to a load or an antenna can be Measured using sampling technique in which a known fraction of the power is Measured so that the total may be calculated. A number of coupling units used for such purpose are known as directional coupler.

(5) ATTENUATORS: - It consists of a resistive wane inside the wave guide to absorb microwave power according to its position w.r.t side wall of the waveguide. Attenuation will be maximum if the wane is placed at center

Fixed Attenuators: In this the position of resistive wane is fixed, it absorbs constant amount of power.

Variable Attenuators: - In this the position of resistive wane can be changed with the help of micrometer.

(6) ISOLATORS: - Ferrite is used as the main material in isolator. Isolator is a microwave device which allows RF energy to pass through in one direction with very little loss, while RF power in the reverse direction is absorbed.

(7) CIRCULATORS: - A microwave circulator is a multi-port junction device where the power may flow in the direction from 1 to 2, 2 to 3, & so on...

(8) MATCHED TERMINATION: - A termination producing no reflected wave at any transverse section of the wave guide. It absorbs all the incident wave. This is also equivalent to connecting the line with its characteristic impedance.

(9) SLOTTED SECTION: - A length of wave guide in which a non-radiating slot is cut on the broader side. This is used to measure the VSWR.

(10) SLIDE SCREW TUNER: - A screw or probe inserted at the top of wave guide (parallel to E) to develop susceptance the magnitude & sign of which is controlled by depth of penetration of screw and it can be moved along the length of wave guide.

(11) H – PLANE BEND: - An H-plane bend is a piece of wave guide smoothly bends in a plane parallel to magnetic field for the dominant mode (Hard bend).

(12) E – PLANE BEND: - An E-plane bend is a piece of wave guide smoothly bends in a plane of electric field (Easy bend).

(13) HORN ANTENNAS: - The components which radiates & intercept EM energy is of course the antenna. The open-ended wave guide, in which the open end is flared so that it looks like a horn, is called horn antenna. There are several types of horns – Sectional E-plane horn, Sectional H- plane horn and Pyramidal horn.

(14) MOVABLE SHORT: - It is adjustable load which moves along the length of wave guide and adjusted to get SWR.

Precautions:

1. Handle all components with care and do not allow any damage to take place.
2. Do not rub/scratch the inner polished surfaces of the components with any sharp edged body.
3. If demonstrating any assembly of components, ensure that there is no cross threading and proper tightening.

Conclusion: