DDPP 2163 Propagation Systems

Microwave Devices and Antenna

Waveguides Components

Passive Components

- Using waveguides require some passive components that are used with feed-lines.
- Typical passive components include:
  - Bends, Twist and Tees
  - Tuners
  - Cavity Resonators

Bends and Twists

- Bends - to change the *direction* of wave propagation.
- Twist - to change the *polarization* of wave propagations.
- E-plane bend – to change the direction of electric-field lines
- H-plane bend – to change the direction of magnetic-field lines.

Types of Bends

- H-bend
- E-bend
- Waveguide twist

Bends and Tees

- These components change the shape and size of a waveguide.
- Anything that changes the shape or size of a waveguide has an effect on the electric and magnetic fields inside.
- As long as bends or twists are gradual, the effect is minimized.

Types of tees

- Tees are used to allow one line to branch into two or to combine two signals.
- There are three **(3) types** of Tee:
    1. H-plane tee – Shunt tee
    2. E-plane tee – Series tee
    3. Hybrid tee - Magic tee

Tees

- Hybrid tee is a combination of E-plane and H-plane tee
- It can provide an isolation between signal.
- If two in-phase and equal signals are fed to port A and B, cancellation will be in port D but reinforcement in port C. Similarly, if energy is fed to port C, energy appears at port A and B but not port D.

E-Plane Tee (WR-28)

E-Plane Tee (WR-28)

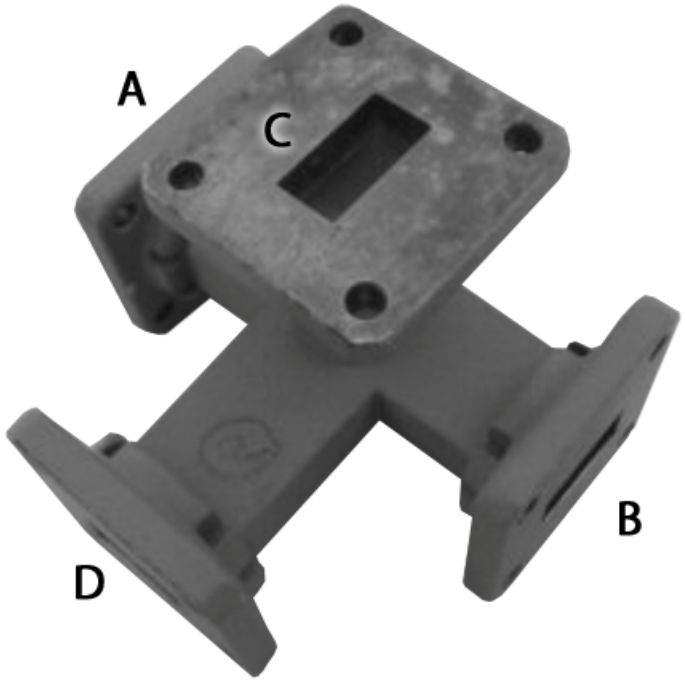
- If a signal is applied to port C, the output will appear at port A and B but half the power and the same phase.
- If two input waves at port A and B are in phase, the output at port C is additive and in phase

H-Plane Tee (WR-28)

- Input at port D has an equal output at port A and B but 180^0 out of phase

H-Plane Tee (WR-28)

Hybrid tee (WR-62)



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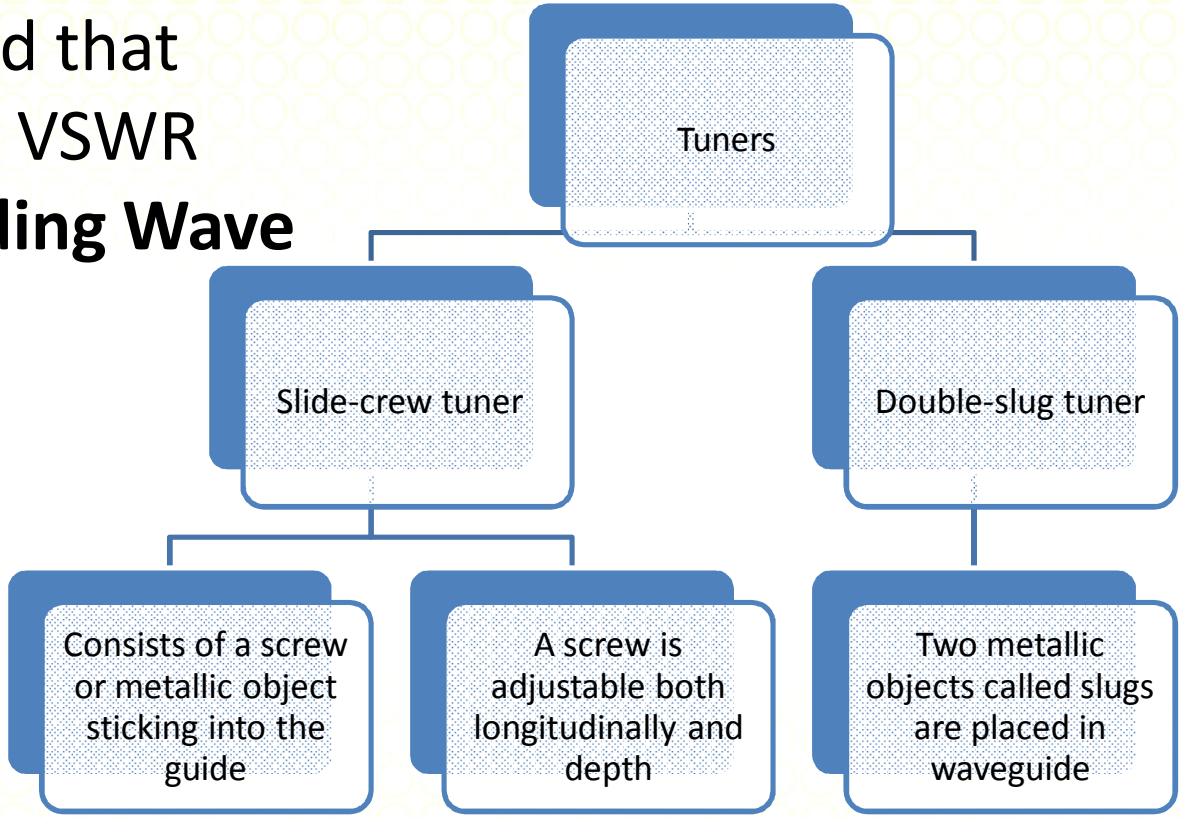
Tuners

- To match a load that can minimised VSWR (**Voltage Standing Wave Ratio)**



Cavity Resonators

- A cavity resonator is designed to be resonant with the signal being transmitted.
- Waves are in phase with the incident signal.
- The ***Q*** for resonant cavities is very high.
- Cavities are tuned by changing their size.
- Resonant cavities are found in many microwave devices, such as the **magnetron** and **klystron.**

Circulators and Isolators

- Isolators and circulators are microwave components that generally use *ferrites* (a strange magnetic properties) in their operation.
- An **isolator** is a device that allows a signal to pass in only one direction. It is greatly attenuated in other direction.
- A **circulator** is a device that allows the separation of signals.
- Allows a signal introduced at any port in counterclockwise rotation.

WR42
Isolator

WR42
Circulator

Coupling waveguide

- THREE basic methods of coupling energy into and out of waveguide:

1. Probe coupling
   - Using a probe that resembles a quarter wavelength monopole antenna
2. Loop coupling
   - Using a loop to launch the wave
3. Aperture Coupling
   - Putting a hole in the waveguide

END