TOWERS & MASTS

In Engineering terms, a tower is a self supporting structure while a Mast is supported by stays or guys.

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(2) The different types of Comm. towers are based upon their structural actions, their cross-section, the type of section used and on the placement of tower.

The three common types of towers that are used today in wireless communication are

(i) self supporting Tower

(ii) Monopole and

(iii) guyed Towers.

(i) SELF-SUPPORTING TOWER:- The towers that are supported on ground or on building

A self supporting tower (freestanding tower) is constructed without guy wires.

Though the weight of these towers are more, they require less base area. Most of the TV, MW, power transmission, and flood Light towers are self-supporting towers

(ii) MONOPOLE TOWER

Monopoles are hollow tapered poles made of galvanized steel. It is a single self-supporting pole, and is generally placed over roofs of high raised buildings, when number of antennae required is

) less or height of tower required is less than 9m.

Note The height of these structures will not exceed 200 feet.

(iii) GUYED TOWERS

A guyed Tower is a light-to heavy weight Communication towers Constructed with straight rods aligned in a triangular form, but supported with wires at all angles. Guyed Towers are especially tall, reaching heights as high as 2,000 feets, and are typically used to hold antennas high off the ground allowing for greater signal strength and cell reception.

A guyed tower is ideal for most Communication needs, including Wireless internet, Cellular and antenna radio towers -

(A) CLASSIFICATION OF TOWERS

(i) Classification based on Cross-section of tower
Towers can be classified based on their cross section, into square, rectangular, triangular, delta, hexagonal and polygonal towers.

(ii) Classification based on type of material sections
Classification based on the sections used for fabrication, towers, are classified into angular and hybrid towers (with tubular and angle bracings)

(iii) Based on Placement of Tower
Based on this placement, Communication towers are classified as follows:
(a) Green field tower and (b) Roof top tower

(iv) Based on the number of Segments
The towers are classified based on the number of segments as:
(a) Three slope tower
(b) Two slope tower
(c) Single slope tower
(d) Straight tower

Contents of Waveguides
1. Introduction
2. Types
3. Mode of Propagation
4. Parameters
5. Advantages
6. Disadvantages

TOPIC 2

WAVEGUIDES

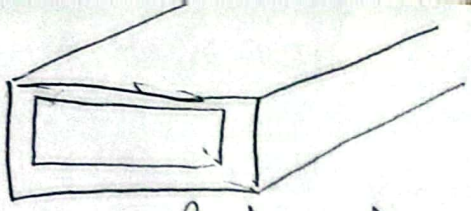
A waveguide is a physical structure that supports the transmission of electromagnetic waves by confining them within a specific path. Unlike traditional transmission lines, which propagate electromagnetic waves in an unbounded medium, waveguides use their shape and dimensions to guide and control the propagation of waves. It consists of a hollow metallic or dielectric tube or channel that confines and directs the propagation of electromagnetic waves.

TYPES OF WAVEGUIDES

There are five types of waveguides. They are

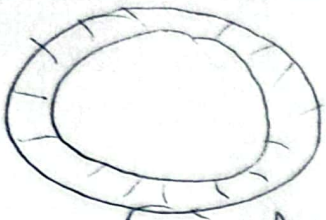
(I) Rectangular waveguide
(II) Circular ✓✓
(III) Elliptical ✓✓
(IV) Single ridged ✓✓
(V) Double-ridged ✓✓

(i)



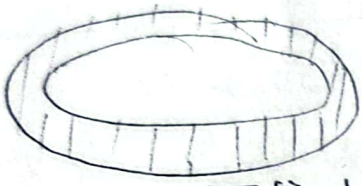
Rectangular waveguide

(ii)



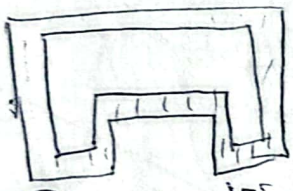
Circular Waveguide

(iii)



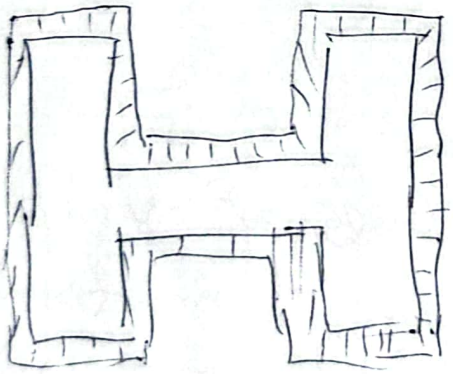
Elliptical waveguide

(iv)



Single ridged waveguide

(v)



Double ridged waveguide

The above shown are the types of waveguides which are made hollows in the center and made up of copp walls. These have a thin lining of Au or Ag on the inner surface

THE MAIN CHARACTERISTICS OF A WAVEGUIDE Are:

(i) The tube wall provides distributed inductance
(ii) The empty space between the tube walls provide distributed capacitance
(iii) These are bulky and expensive

MODE OF PROPAGATION IN A WAVEGUIDE

When an electromagnetic wave is transmitted through a waveguide, two field components that oscillate mutually perpendicular to each other are seen. One is electric field and the other is a magnetic field.

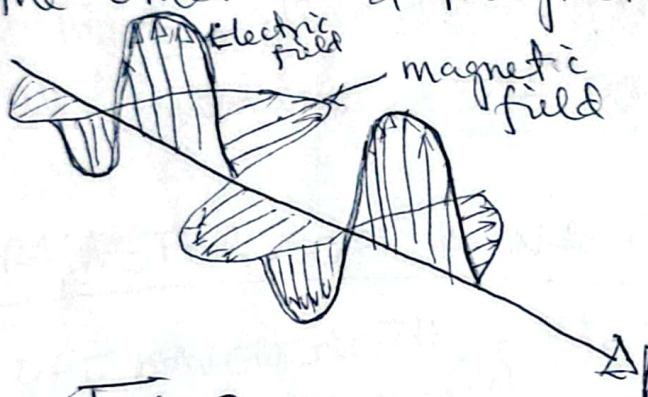


Fig 2

This figure represent the Propagation of an electromagnetic waves in the Z direction with the two components.

The propagation of wave inside the waveguide originates basically 2 modes. However, overally basically 3 modes exist, which areas follows

(i) TRANSVERSE ELECTRO MAGNETIC (TEM) WAVES: In this case both E_z and H_z are zero. An example of this is a plane electromagnetic wave which has both electric and magnetic field perpendicular to the propagation direction.

(ii) TRANSVERSE ELECTRIC (TE) WAVES: This contain no electric field component in the z-direction. However, the magnetic field contains a z-component.

(iii) TRANSVERSE MAGNETIC (TM) WAVES contains no magnetic field component in the z-direction. However, the electric field contains a z-component.

PARAMETERS OF A WAVEGUIDE

(a) CUT-OFF WAVELENGTH:- Is the maximum signal wavelength of the transmitted signal that can be propagated within the waveguide without any attenuation.

(b) GROUP VELOCITY:- Is the velocity with which wave propagates inside the waveguide.

(c) PHASE VELOCITY:- It is the velocity with which the transmitted wave changes its phase during propagation.

(d) WAVE IMPEDANCE (known as characteristic impedance) Is the ratio of the transverse electric field to that of the transverse magnetic field during wave propagation at any point inside the waveguide.

Advantages of a Waveguide

(a) Waveguides are easy to manufacture
(b) They can handle very large signal power (in Kilowatts)
(c) Power loss is very negligible in waveguides
(d) They offer very low loss (low value of alpha — attenuation)
(e) The microwave energy, when travels through the waveguide, experiences lower losses than a coaxial cable.

DISADVANTAGES OF WAVEGUIDES

(1) Its installation and manufacturing cost is high
(2) Waveguides are generally rigid in nature and hence sometimes causes difficulty in applications where tube flexibility is required.
(3) It is somewhat large in size and bulkier as compared to other transmission lines.