Experiment No. - 1

Aim - To Design and Simulate Rectangular Waveguide

Software Required – CST studio

Theory-

Electromagnetic waves propagating in open space travel out in all directions. The power intensity of these waves decreases as the distance increases - it is proportional to the power of the source divided by the square of the distance. The waveguide operates by confining the electromagnetic wave inside a metallic structure so that it does not spread out, and losses resulting from this effect are eliminated. In electromagnetic , the term waveguide may refer to any linear structure that guides electromagnetic waves between two endpoints. Typically a waveguide is thought of as a transmission line comprising a hollow conducting tube, which may be rectangular or circular within which electromagnetic waves are propagated. Unlike coaxial cable, there is no centre conductor within the waveguide. Signals propagate within the confines of the metallic walls that act as boundaries. The signal is confined by total internal reflection from the walls of the waveguide. Waveguides are used principally at frequencies in the microwave range. Waveguides will only carry or propagate signals above a certain frequency, known as the cut-off frequency. Below this the waveguide is not able to carry the signals. The cut-off frequency of the waveguide depends upon its dimensions.

Rectangular Waveguide: - A rectangular waveguide is a hollow metallic tube with a rectangular cross section. The conducting walls of the waveguide confine the electromagnetic fields and thereby guide the electromagnetic wave. The rectangular

$$f_{c_{mn}} = \frac{1}{2\sqrt{\mu\varepsilon}}\sqrt{\left(\frac{m}{a}\right)^2 + \left(\frac{n}{b}\right)^2}$$

waveguide is basically characterized by its dimensions i.e., length a and breadth b.

Modes:-Waveguide propagation modes depend on the operating wavelength and polarization and the shape and size of the guide. The modes of the waveguide are typically classified into following types:

- TE modes (Transverse Electric) have no electric field component in the direction of propagation.
- TM modes (Transverse Magnetic) have no magnetic field component in the direction of propagation.
- TEM modes (Transverse Electromagnetic) have neither electric nor magnetic field component in the direction of propagation.

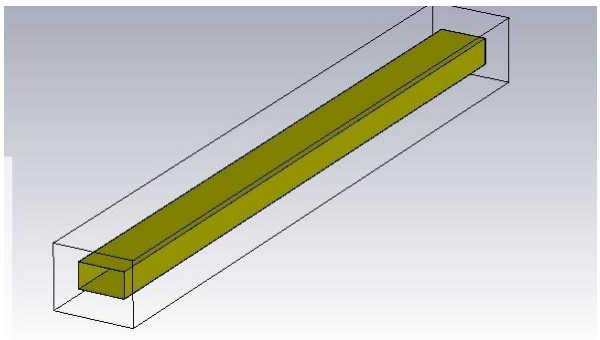
Parameters Values (in mm)

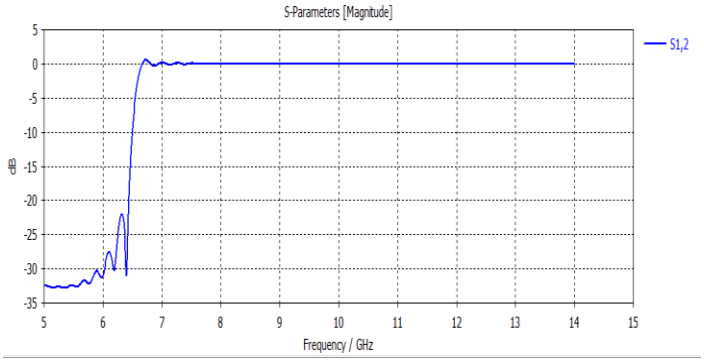
Inner substrate	Length	7.112
	Width	3.556
	Height	100
Outer substrate	Length	7.2
	Width	3.6
	Height	100

Table.1,Proposed Antenna Dimensions

Parameters	Values
Width (a)	22.89 mm
Height (b)	10.16 mm
Cutoff Frequency (fc)	6.56 GHz

Design and Result:





Cconclusion-

As Shown in Graph S11 and S21 is near Zero Means Complete Signal is transmitted from Port 1 to Port 2 and the S11 is having below -60 dB signal is 106 times Weaker than the transmitted Signal so the All the Signal is Transmitted not Reflect the Input Port.