Batch: A2 Roll No.: 16010322014
Experiment / assignment / tutorial No. 8
Grade: AA / AB / BB / BC / CC / CD /DD

Signature of the Staff In-charge with date

TITLE: Design of Rectangular Waveguide and find different modes of propagation.

AIM: To Design Rectangular Waveguide for given specifications using CST microwave studio and observe the following:

1. Port signal plots
2. S-Parameters
3. E-field distribution and modes
4. Power flow

OUTCOME: Analyse and design microwave transmission lines and matching circuits.

Design statement: Design Rectangular Waveguide for frequency of fo = 4 GHz.

Select WR229 WG with following specifications:
Frequency range: 3.3 – 4.9 GHz
fc = 2.57GHz
Broader Dimension (a) = 58 mm
Shorter Dimension (b) = 29 mm
Length of WG = 100 mm
Material : Vacuum

Theoretical calculations:

Find cut-off frequency assuming TE10 mode.

for TE10 mode :

$\lambda c = 2a$

$\lambda c = 2 \times 58\,mm$

$= 116\,mm$

$= 0.116\,m$

$\therefore f = \frac{c}{\lambda} = \frac{3 \times 10^9}{0.116} = 2.58\,GHz$

Result:

Frequency 4 GHz

Parameter	Simulated Results
Port Signal Delay	0.39628 0.2472 nS
S11	-116 dB
S21	0.001 -152.24 dB
Mode(TE)	TM11, TE10

Frequency 5.34 GHz

Parameter	Simulated Results
Port Signal Delay	0.957 ~~0.3012 n~~S
S11	-110.95 ~~-198.865~~ dB
S21	-0.007 ~~-165.86~~ dB
Modes (TE)	TE10, TE~~20~~21, TE11

Frequency 7 GHz

Parameter	Simulated Results
Port Signal Delay	0.757 ~~0.47 n~~S
S11	-122.05 ~~-116.84~~ dB
S21	-0.015 ~~-161.75~~ dB
Modes (TE)	TE10, TE20, TE11, TE01

Attach all simulation results with proper titles.

Conclusion:

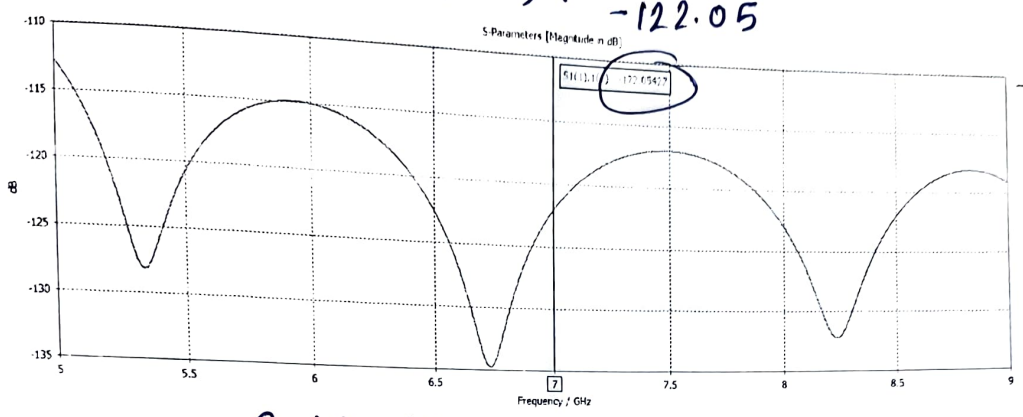
(Compare results at different frequencies)

In this experiment, we have designed a Rectangular waveguide using CST microwave studio & observed the Port signal Plots, S parameters, and Electric field distribution at different frequencies. We have observed that Port signal delay and numbes of modes increase with increase in Frequency.

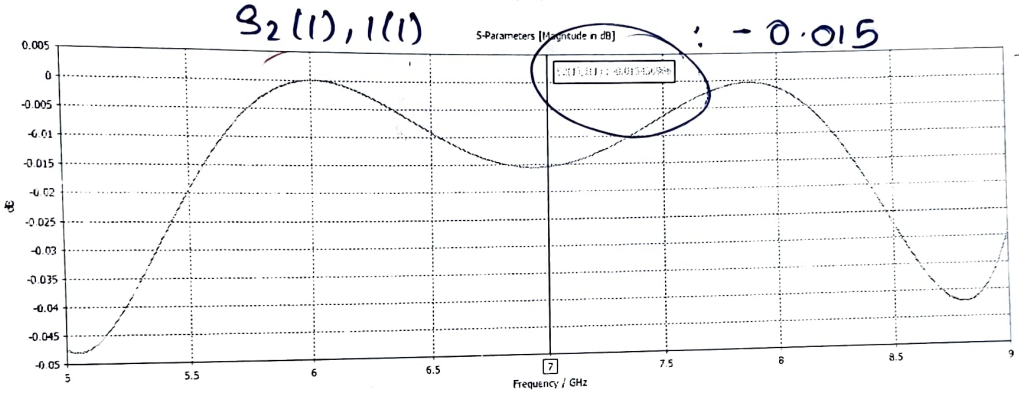
Signature of faculty in-charge

S11

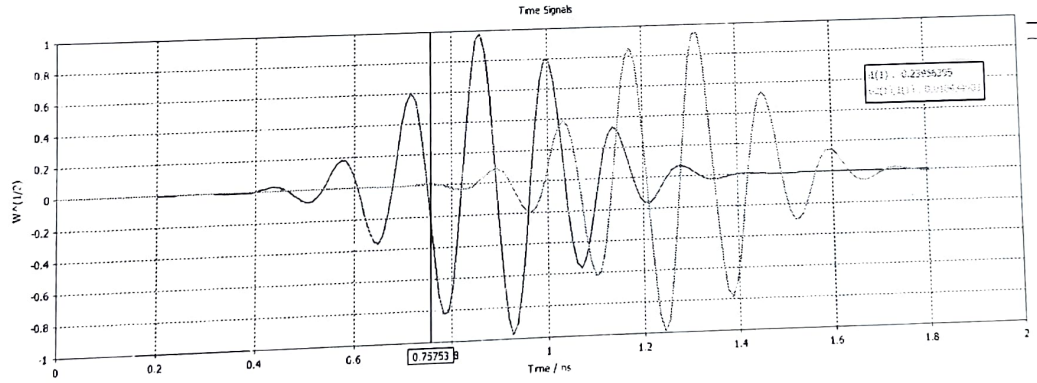
$S_1(1),1(1)$: -122.05



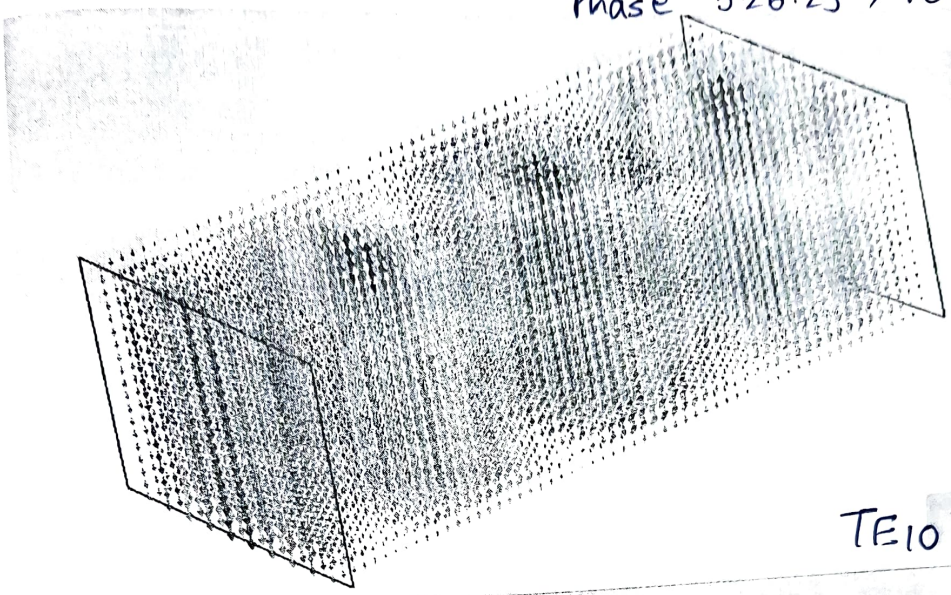
$S_2(1),1(1)$: -0.015



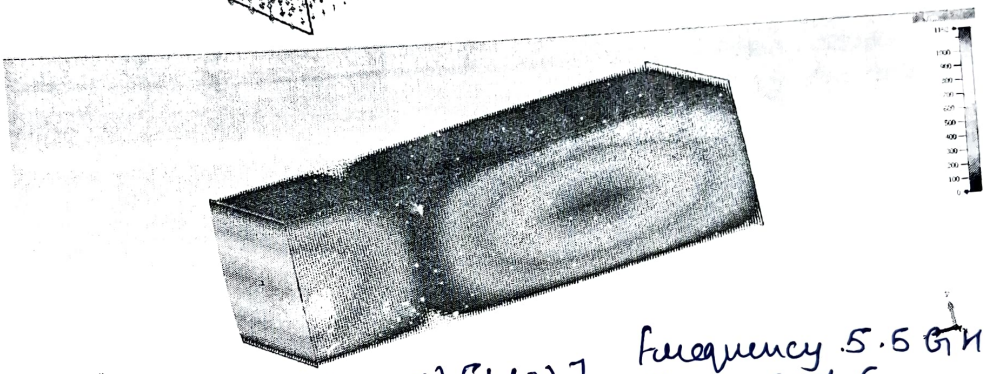
Port SIgnals



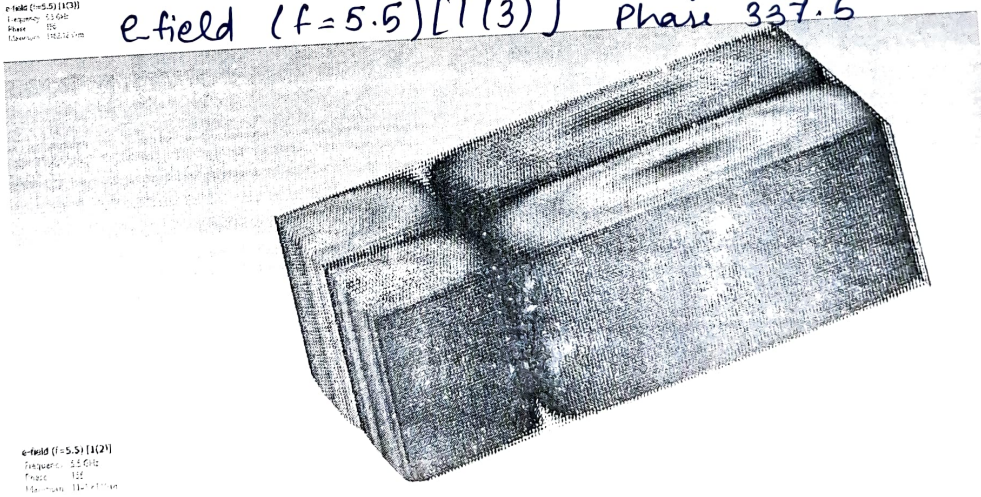
e-field (f=4) [1(1)] Frequency 4GHz
Phase 326.25, TE mode 10



TE10



e-field (f=5.5) [1(3)] Frequency 5.5 GHz
Phase 337.5

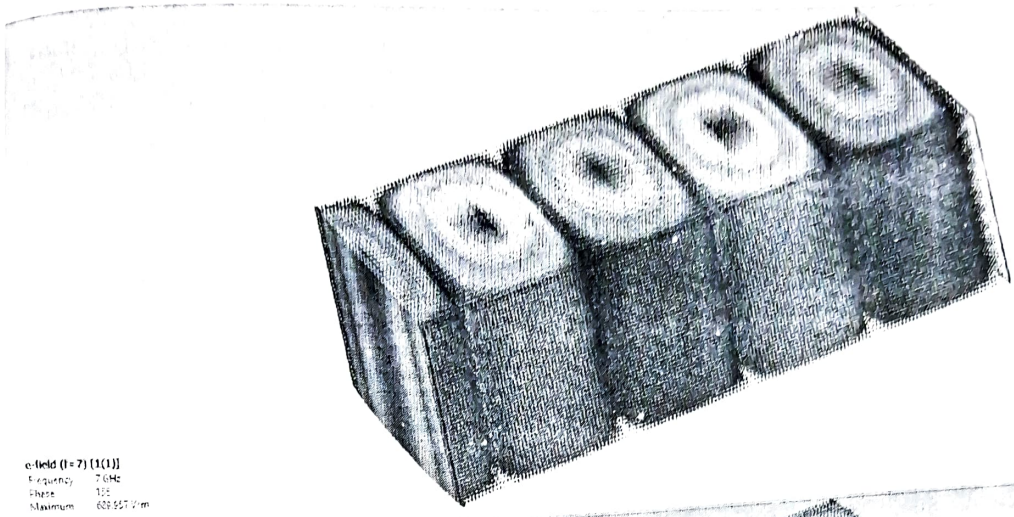


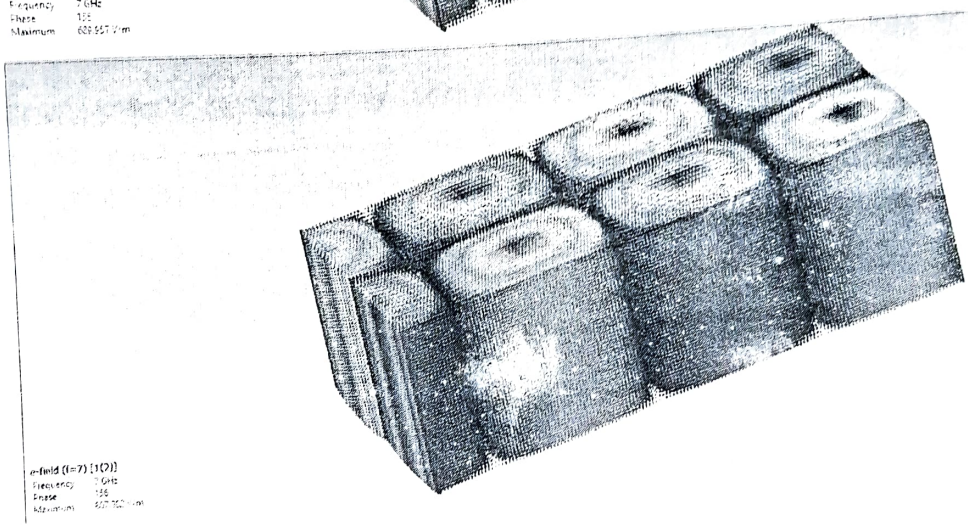
e-field (f=5.5) [1(2)] TE21

Frequency 5.5 GHz
Phase 78.75

e-field (f=7) [1(1)]
Frequency 7GHz

TE11 mode





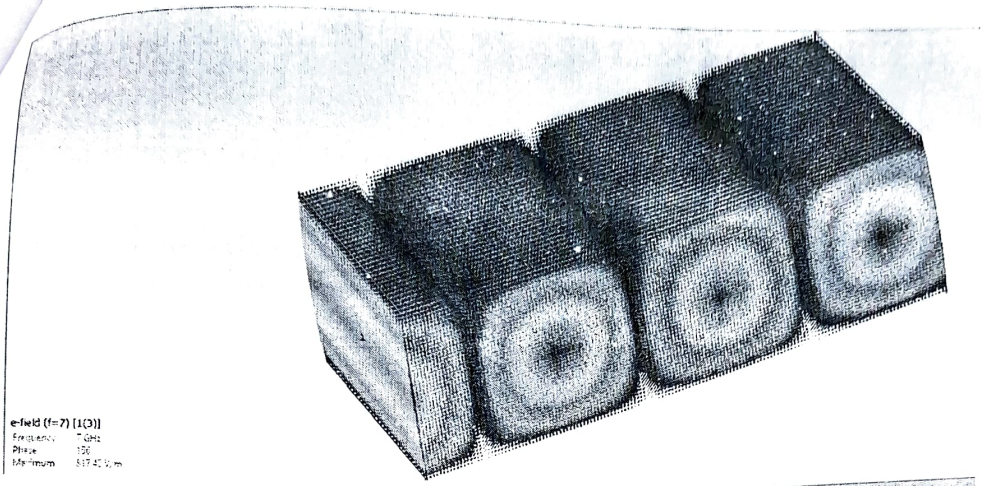
e-field (f=7) [1(2)]
Frequency 7GHz

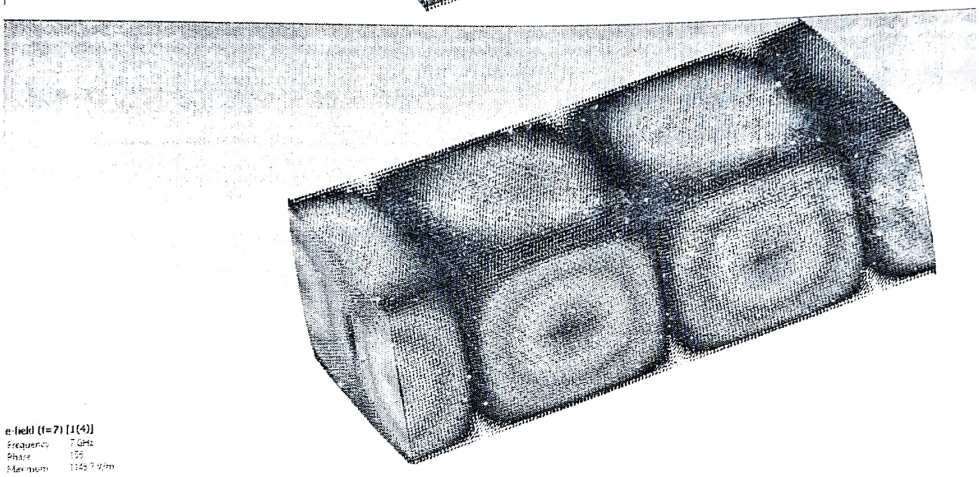
TE21 mode

e-field (f=7) [1(3)]

Frequency 7GHz

TE11 mode





e-field (f=7) [1(4)] TE11 Mode

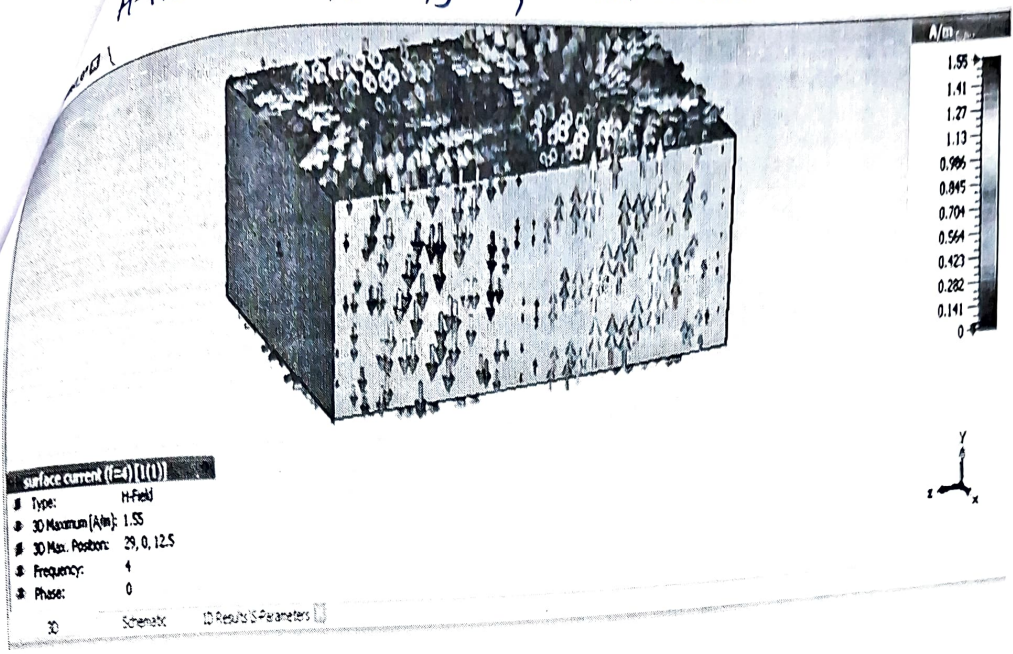
Frequency 7GHz

λ = 42.8275mm

Phase = 168.75°

Surface Current

H-field (f=4) [1(1)] , TM11 mode



f = 4, power (f=4) [1(1)] , e-field