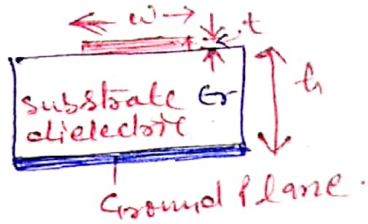
Microstrip line.

① Microstrip line is an unsymmetrical that is nothing but a parallel plate transmission line having dielectric substrate whose one face is ground and other (top face) has a thin conducting strip of certain width w and thickness t.

② Top ground plane is not present in microstrip as compared to strip line.

③. Some times a coverplate is used for shilding purpose but it is kept much farther away than the ground plane so as not to affect the microstrip field lines.



Advantages

① Fabrication costs would be lower than stripline, wave guide, coaxial.

② Due to planar nature of microstrip structure, both packaged/unpacked semiconductor ~~strip~~ chip can be attached to the microstrip elements.

formulae - width, Length, freq'

Given data - fr, Er, h

③ Easy access to top surface to mount active and passive devices and also for minor adjustment.

limitations

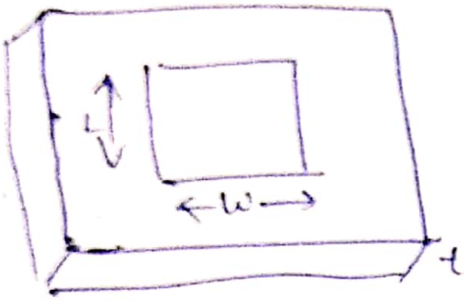
① Due to openness of the microstrip structure they have higher radiation loss or interference due to near by conductor. can be reduced by thin substrate with high dielectric constants.

PTO.

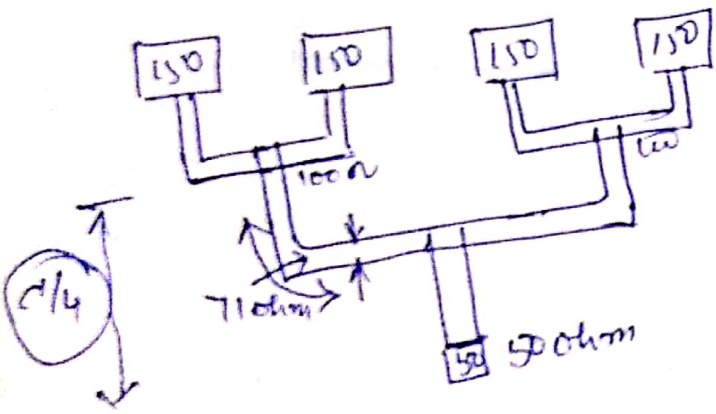
feed — Direct — ustrip line feed, coaxial feed.
— Non Direct — Proximity feed, aperture coupled.

RT Duroid
Ferrite
Alumina
...

Slot line



① **Biggest Adv. of Mstrip Antenna**
is the impedance matching, Power division ~~and~~ or Power Combination and easy to implement
Can be used in Array antenns.



$$Z_0 = \sqrt{100 \times 50} = \boxed{71 \text{ ohm}}$$

then $Z_0 = \sqrt{150 \times 100}$

$$= \boxed{122 \text{ ohm.}}$$

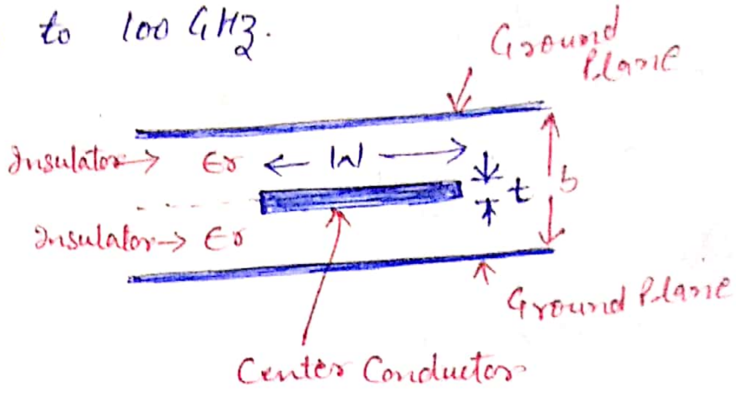
② Another imp adv. is that it ~~Adv.~~ Can produce circular polarization.

Strip lines

1. Strip lines are modification of two wire transmission lines and Coaxial lines.

2. widely used at freq. 100 MHz to 100 GHz.

3. Strip line consists of a central thin conducting strip of width W which is greater than its thickness t.



- Placed inside the low-loss dielectric (ε_r) substrate of thickness b/2 b/w two wide ground plates.

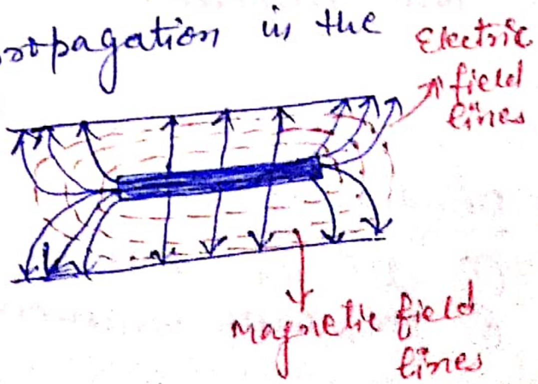
5. usually the thickness of the metallic central conductor and the metallic ground planes are the same.

6. Dominant mode for stripline is a TEM mode and field are confined with in the transmission line with no radiation losses.

7. The width of the ground planes is atleast five times greater than the spacing b/w the plates there by avoiding any vertical side walls at the two transverse ends.

8. Practically no fringing effect after a certain distance from the edge of the center conductor.

9. For $b < \lambda/2$ there will be no propagation in the transverse direction.



fringing effects :

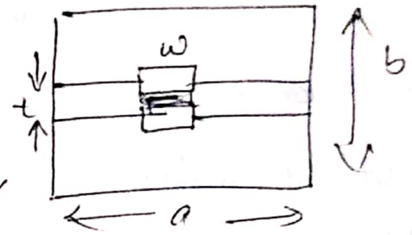
① Bcz dimension of patch are finite along the length and width, the fields at the edges of the patch undergo fringing.

② The amount of fringing is a fx of dimension of patch and height of the substrate.

③

Stripline types

2 types — ① suspended strip line
② off set strip line



Suspended Stripline — when Central conductor is ~~at~~ exact at half of the distance b/w two plates Grounds. ~~of~~ or may vary. (updown)

offset strip line. — when central conductor is not exactly at mid of the width of the ground plane [Left right].

Advantages

⇒ TEM Tr. line media.

⇒ Better B.w.

⇒ No lower cut off freq as w/G.

⇒ Non Dispersive. — At different freq if there is different behaviour then it is called dispersive. But strip line is non dispersive. so it is advantages"

Disadvantage

① 2nd Ground plane.
② strip width narrower for given Zo.

ckt is not accessible during development for adjustment and tuning and difficult to mount discrete and active components (like transistor, diode, circulator chip resistor and capacitor).

(iii) Design eqn. are divided into high impedance region and low impedance region determined by the ratio of w to (b-t).

The impedance of a strip line is inversally proportional to the ratio of the width w of the inner conductor to the distance b between the ground planes

High impedance region

$$\frac{w}{b-t} \leq 0.35 \quad \text{and} \quad \frac{t}{b} \leq 0.25$$

then

$$Z_0 = \frac{60}{\sqrt{\epsilon_r}} \ln\left[\frac{4b}{\pi d}\right] \Omega$$

d - diameter of the circular conductor eq. to the rectangular conductor of the strip line with width w and thickness t

$$d = \frac{w}{2}\left[1 + \frac{t\left[1 + \ln\left(\frac{4\pi w}{t}\right) + 0.51\pi\left(\frac{t}{w}\right)^2\right]}{\pi w}\right]$$

Low Impedance Region

$$\frac{w}{b-t} > 0.35$$

$$Z_0 = \frac{94.15}{\sqrt{\epsilon_r}\left(\frac{w}{bA} + B\right)} \Omega$$

where $A = 1 - \frac{t}{b}$ and

$$B = \frac{1}{\pi}\left[\frac{2}{A}\ln\left(1+\frac{1}{A}\right) - \left(\frac{1}{A}-1\right)\ln\left(\frac{1}{A^2}-1\right)\right]$$

Velocity of propagation for the strip line

$$V = \frac{c}{\sqrt{\epsilon_r}} \ m/s.$$

⇒ and wavelength of the EM signal on the strip line is

$$\lambda = \frac{V}{f} = \frac{c}{\sqrt{\epsilon_r} \cdot f} \ m.$$

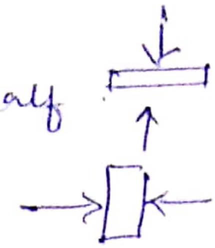
Z_0 vs (w/b) ratio is used for determining the width of the conductor.

Applications: Aircraft, spacecraft, satellite and missile applications where size, cost, weight, performance, easy of installation

Strip line

In Short

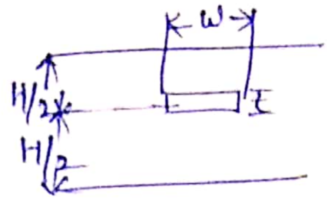
Suspended strip line – exactly at half



offset " – Not exactly

Imp

1. TEM Tr. line media.
2. Better B.W
3. No lower cut off freq. as w/G.



DisAdvantages

1. 2nd Ground plane.
2. Strip width narrower for given Zo

At diff. freq. if there is different behavior than it is called Dispersive. But Stripline is non dispersive so it is Advantage.

eq. for Impedance

$$Z_0 = \frac{60}{\sqrt{\epsilon_r}} \ln\left[\frac{4H}{0.67\pi W\left(0.8 + t/D\right)}\right]$$

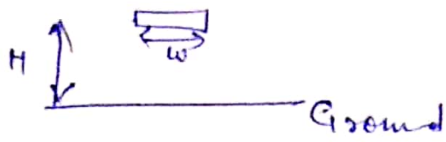
Microstrip line

– upper Ground plane is not there.

Planar Tr. line

Imp TEM not exist

TEM → quasi TEM



$$\epsilon_e = \frac{\epsilon_r+1}{2} + \frac{\epsilon_r-1}{2}\left[\left(1+12\left(\frac{H}{W}\right)\right)^{-1/2} + 0.04\left(1-\left(\frac{W}{H}\right)\right)^2\right]$$

Two cases. $\frac{W}{H} < 1$

$\frac{W}{H} > 1$

$$\epsilon_e = \frac{\epsilon_r+1}{2} + \frac{\epsilon_r-1}{2}\left(1+12\left(\frac{H}{W}\right)\right)^{-1/2} \text{ for } \frac{W}{H} > 1$$

$$Z_0 = \frac{60}{\sqrt{\epsilon_{eff}}} \ln\left(8\frac{H}{W} + 0.25\frac{W}{H}\right)\Omega \quad \left[\frac{W}{H} < 1\right]$$

$Z_0 = \frac{120\pi}{\ldots}$