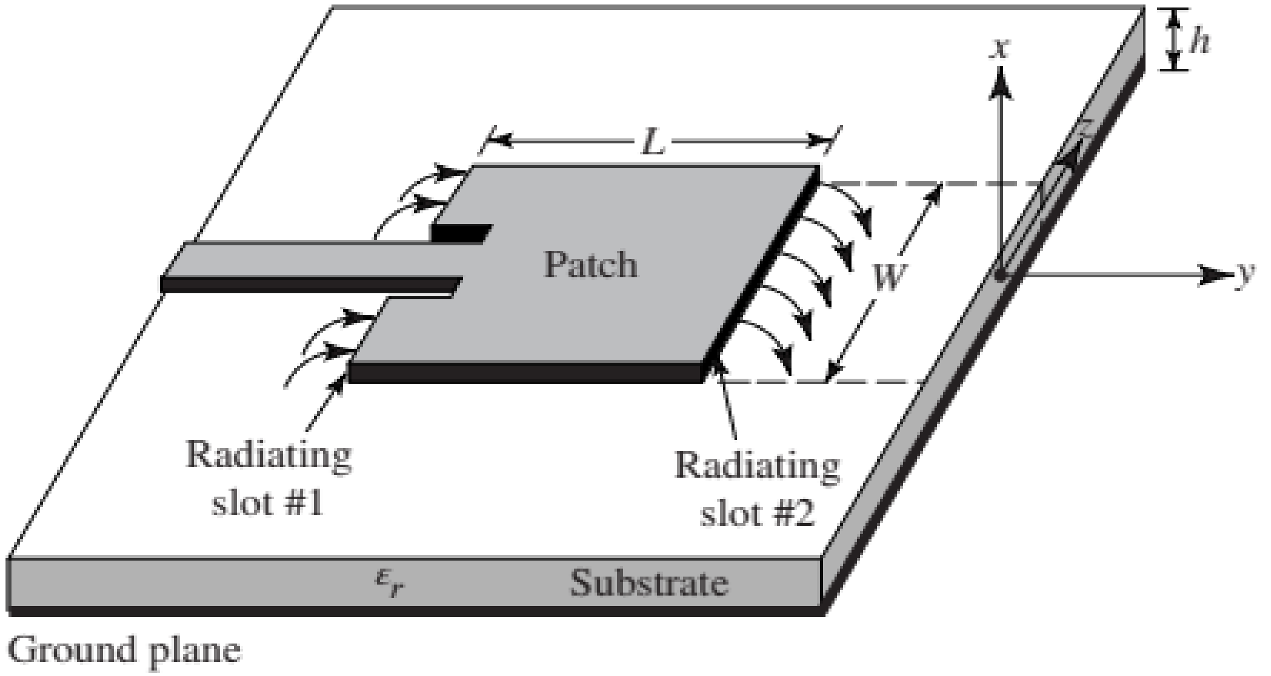
RMSA



(a) Microstrip antenna

(b) Side view

Advantages

- Light weight, low volume, low profile, planar configuration, which can be made conformal
- Low fabrication cost and ease of mass production
- Linear and circular polarizations are possible
- Dual frequency antennas can be easily realized
- Feed lines and matching network can be easily integrated with antenna structure

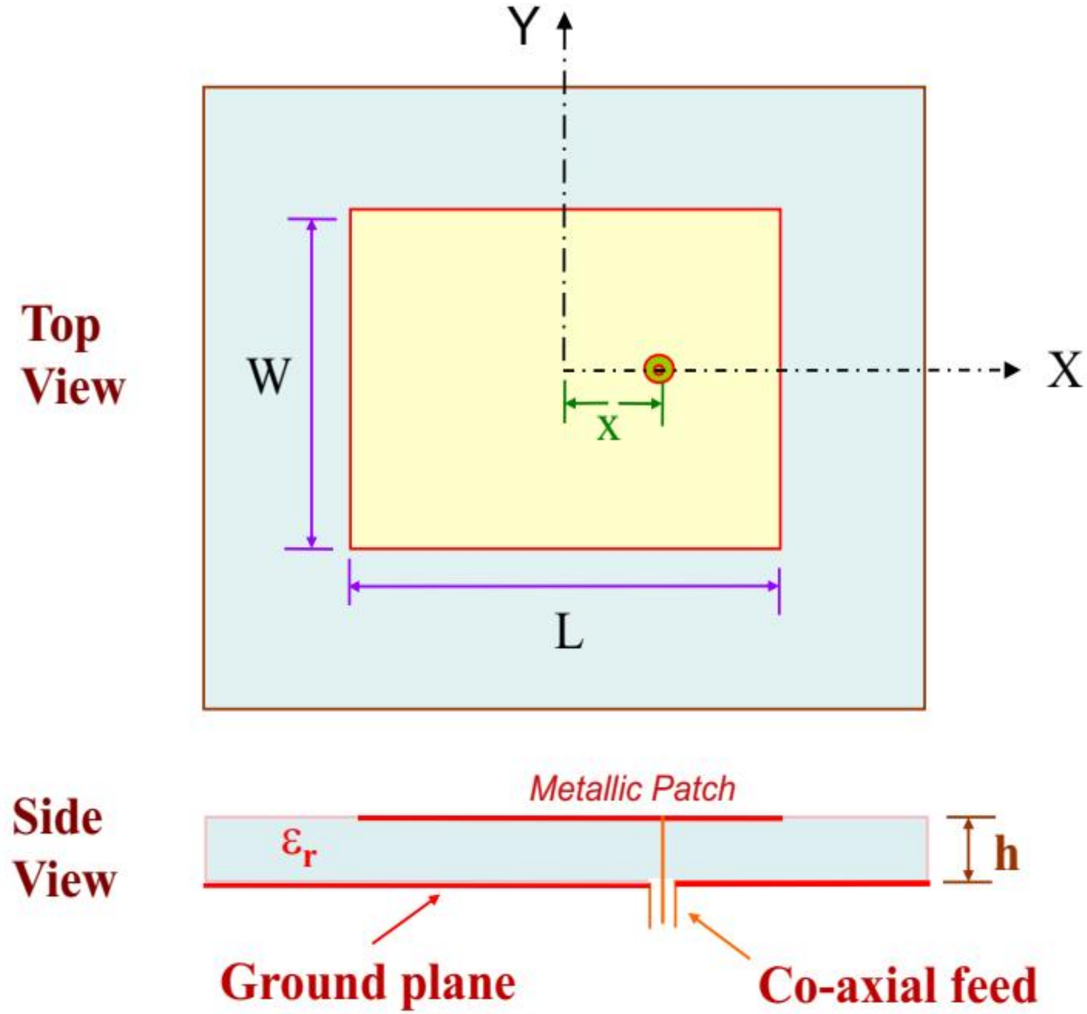
Disadvantages

- Narrow bandwidth (1 to 5%)
- Low power handling capacity
- Practical limitation on Gain (around 30 dB)
- Poor isolation between the feed and radiating elements
- Excitation of surface waves
- Tolerance problem requires good quality substrate, which are expensive
- Polarization purity is difficult to achieve
- Size is large at lower frequency

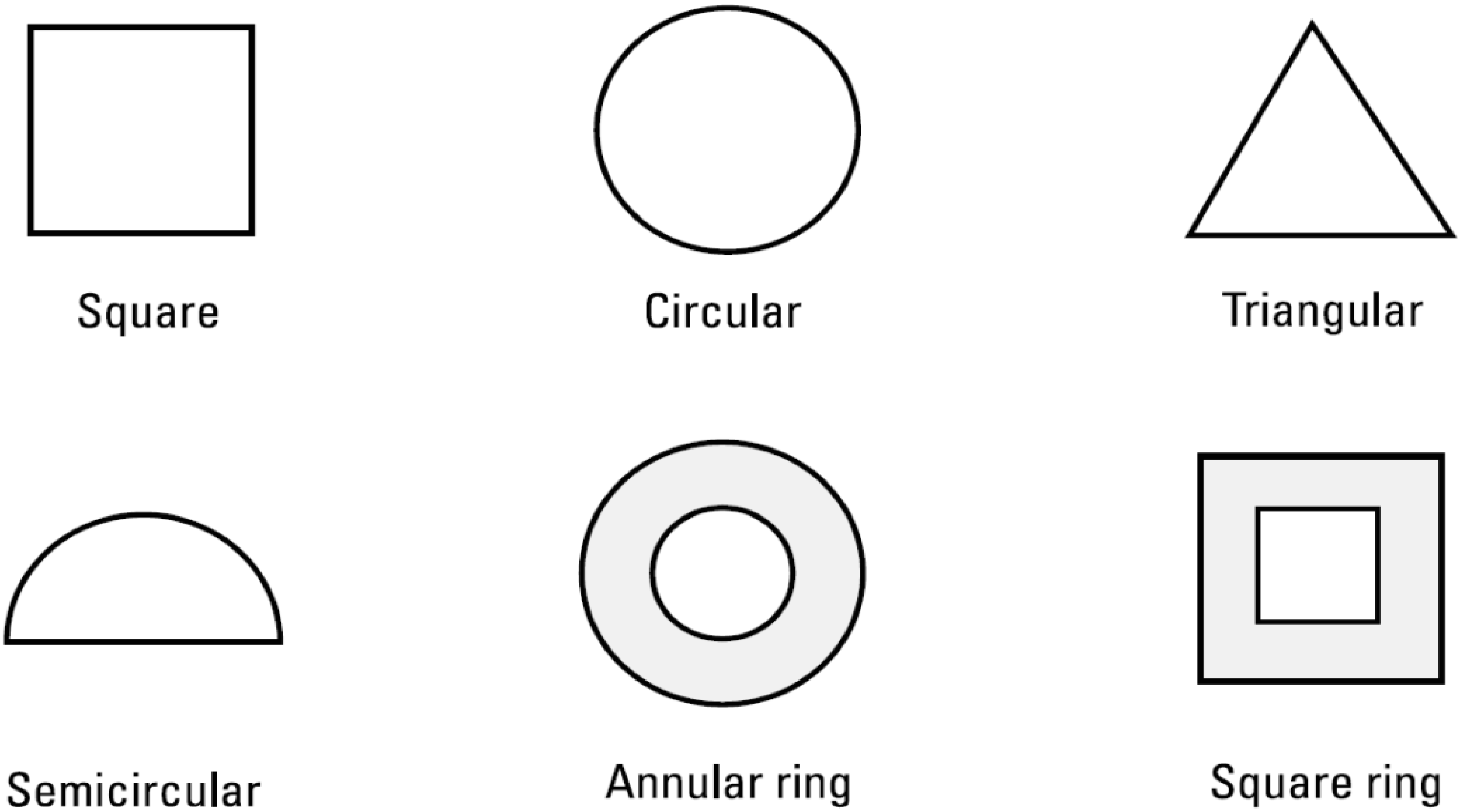
Applications

- Pagers and mobile phones
- Doppler and other radars
- Satellite communication
- Radio altimeter
- Command guidance and telemetry in missiles
- Feed elements in complex antennas
- Satellite navigation receiver
- Biomedical radiator

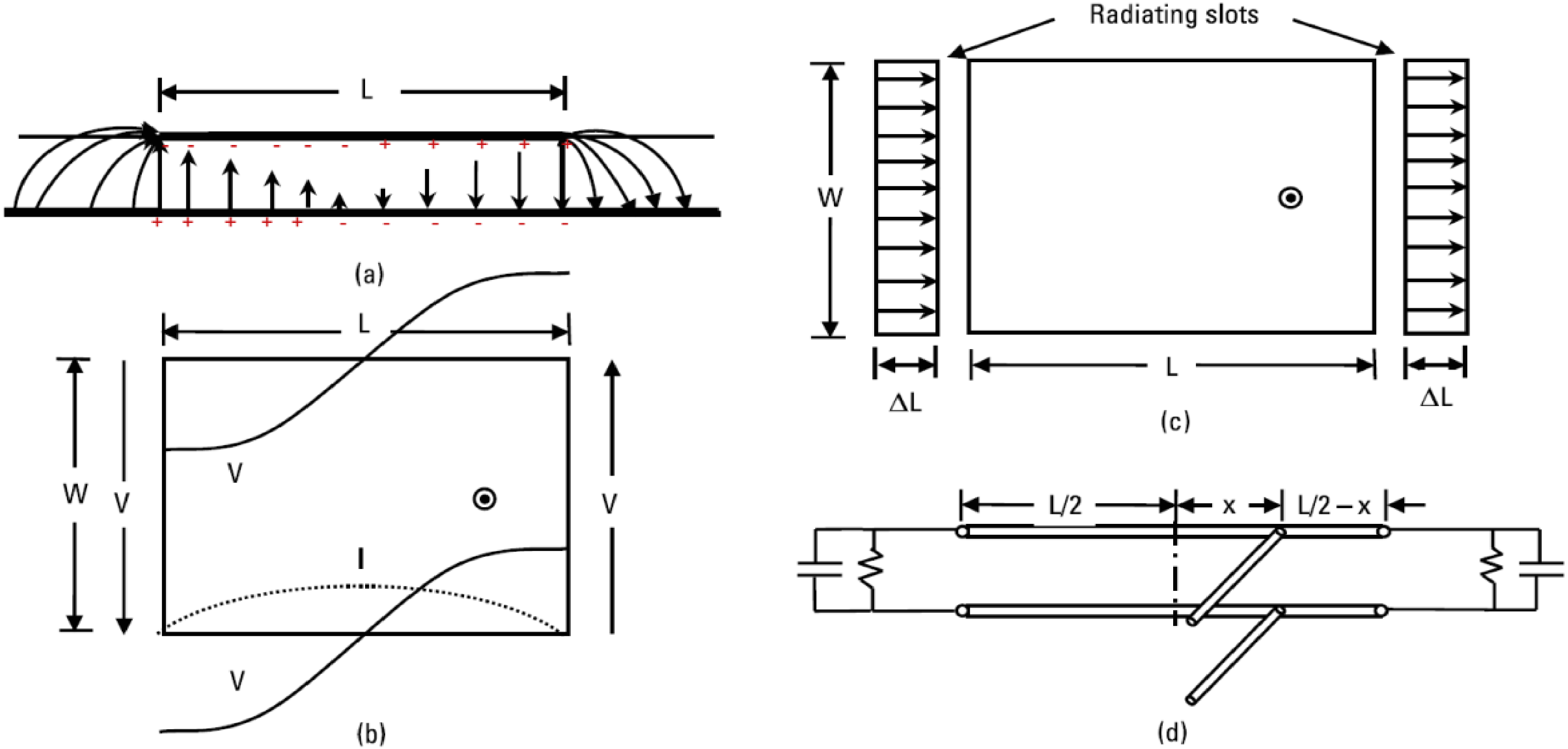
Rectangular Microstrip Antenna (RMSA)



Various Microstrip Antenna Shapes

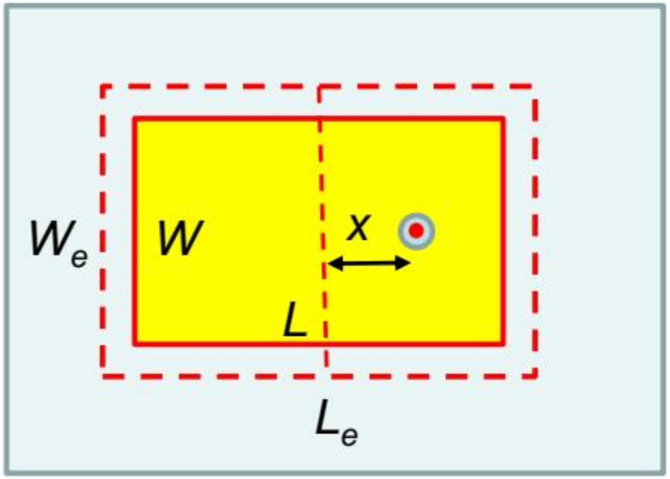


RMSA – Characterization



Fundamental TM_{10} mode of RMSA: (a) E-field distribution, (b) (——) voltage and (· · ·) current variation, (c) two radiating slots, and (d) equivalent transmission line model.

RMSA: Resonance Frequency



$$L_e = L + 2\Delta L$$

$$W_e = W + 2\Delta W$$

W_e is very very small

$$\Delta L \simeq \frac{h}{\sqrt{\epsilon_e}}$$

* This is simplified expression

$$f_0 = \frac{c}{2\sqrt{\epsilon_e}}\left[\left(\frac{m}{L}\right)^2 + \left(\frac{n}{W}\right)^2\right]^{1/2}$$

where m and n are orthogonal modes of excitation.

Fundamental mode is TM_{10} mode, where m =1 and n = 0.

RMSA: Design Equations

$$\epsilon_e = \frac{(\epsilon_r + 1)}{2} + \frac{(\epsilon_r - 1)}{2}\left[1 + \frac{10h}{W}\right]^{-1/2}$$

$$W = \frac{c}{2f_0\sqrt{\frac{(\epsilon_r + 1)}{2}}}$$

Smaller or larger W can be taken than the W obtained from this expression.

BW α W and Gain α W

$$\boxed{L_e = L + 2\Delta L = \frac{\lambda_0}{2\sqrt{\epsilon_e}} = \frac{c}{2f_0\sqrt{\epsilon_e}}}$$

Choose feed-point x between $L/6$ to $L/4$.

RMSA: Design Example

Design a RMSA for Wi-Fi application (2.400 to 2.483 GHz)

Chose Substrate: $\varepsilon_r = 2.32$, h = 0.16 cm and tan $\delta = 0.001$

$$W = \frac{c}{2f_0\sqrt{\frac{(\epsilon_r + 1)}{2}}}$$

$= 3 \times 10^{10} / (2 \times 2.4415 \times 10^9 \times \sqrt{1.66})$

$= 4.77$ cm. **W = 4.7 cm is taken**

$$\epsilon_e = \frac{(\epsilon_r + 1)}{2} + \frac{(\epsilon_r - 1)}{2}\left[1 + \frac{10h}{W}\right]^{-1/2}$$ **= 2.23**

$$L_e = \frac{c}{2f_0\sqrt{\epsilon_e}}$$

$= 3 \times 10^{10} / (2 \times 2.4415 \times 10^9 \times \sqrt{2.23})$ cm

$= 4.11$ cm

$L = L_e - 2\,\Delta L = 4.11 - 2 \times 0.16 / \sqrt{2.23} =$ **3.9 cm**

Thank You…