

PLANAR INVERTED F ANTENNA (PIFA)

Description: To design a PIFA Antenna for GSM-1800 Band.

Substrate: Dielectric Constant FR-4 $\epsilon_r = 4.4$

Thickness = 1.6mm

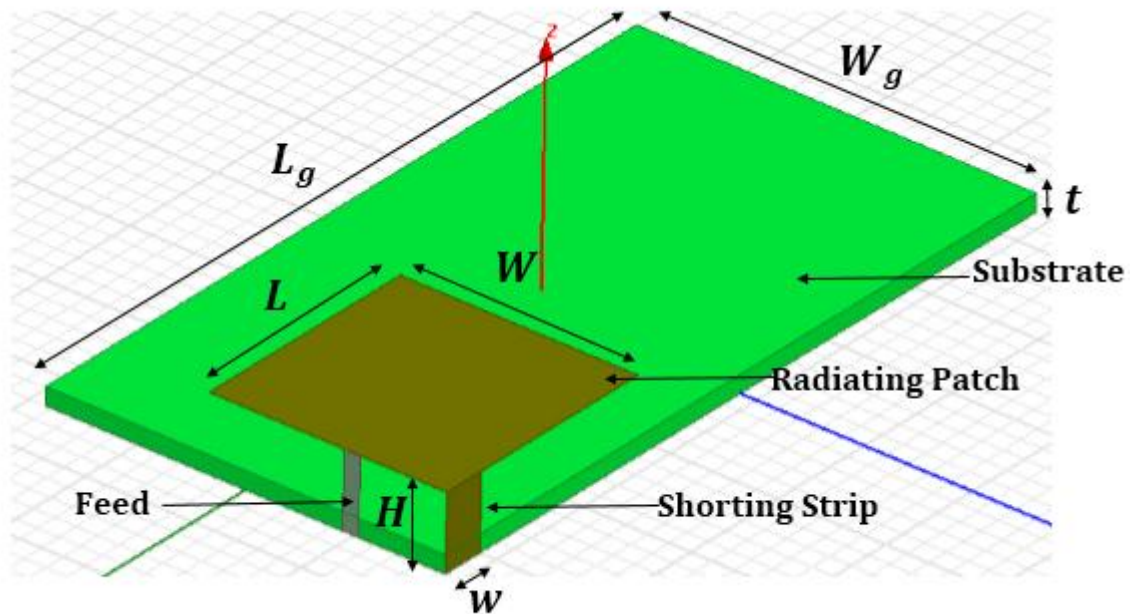


Figure 1. Geometry of PIFA Antenna

Geometric Parameter Effects on PIFA Performance:

- The greater the height H , the broader is the bandwidth, and the lower is the resonant frequency
- The greater the ratio, w/W is (≤ 1), the higher is the resonant frequency, and the broader is the bandwidth
- The greater the ratio of W/L , the lower is the resonant frequency, and the broader is the bandwidth
- The locations of feed point and shorting strip, as well as the width w of the shorting strip, control the radiation characteristics

Design Equation:

The following equation is used to calculate the resonant frequency of PIFA:

$$\text{If } w = L, \text{ then } W = \lambda_g / 4$$

$$\text{If } w \leq L, \text{ then } L + W - w = \lambda_g / 4 \text{ or approx. } L + W = \lambda_g / 4$$

$$\text{Resonant Frequency} = f_0 = \frac{c}{4(L+W)\sqrt{\epsilon_r}}$$

Analyzing the resonant frequency and bandwidth characteristics we can determine the optimum location of the feed point, at which minimum return loss and maximum gain is to be obtained.

Dimensions Used:

$$L_g = 68\text{mm}, W_g = 37\text{mm}$$

$$L = 22\text{mm}, W = 22\text{mm}$$

$$t = 1.6\text{mm}$$

$$H = 5.2\text{mm}$$

$$w = 4\text{mm}.$$

- The space between ground plane and top plate is air filled.
- In between ground plane and top radiating plate, a dielectric material FR4 is used that will affect gain and bandwidth of PIFA.
- To get a good return loss and gain, the height of top radiating plate $H=5.2$ mm (Optimized).
- The ground plane, shorting plate and top radiating plate are made perfect electrical conductor
- For Feed use a rectangular strip of width 1.5mm and the optimized distance between the feed and the shorting strip is 8mm.