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2.4GHz PCB antenna raference design

Model:

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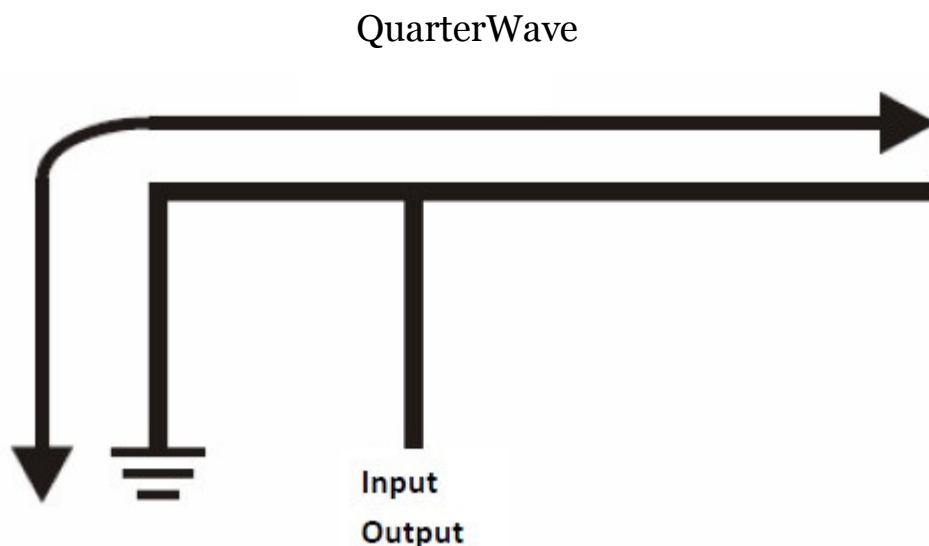
1 Introduction

This document outlines two types of printed circuit board(PCB) antenna used by **Union Chip**, which can be used with 2.4GHz radios such as Bluetooth WiFi.

2 type antennas will be discussed here:

- 1) Inverted-F
- 2) Meander Line

2 Inverted-F Antenna



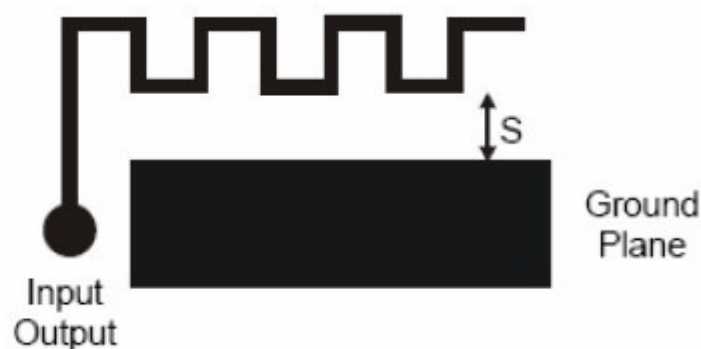
The inverted-F is a quarterwave antenna. It is bent into an L-shape. The shorter side is connected to earth. The longer side is left open – circuit at the end. The feed point is located somewhere between the earth end and the open end. The resulting structure resembles the letter F and possesses the properties of both a loop antenna due to the circulating current from the feed

point to ground an a whip antenna due to the open circuited straight section.

In the PCB version, then antenna is printed on the top layer an a ground plane is placed near the antenna on the top layer. There must not be a ground plane undernesth the antenna.

The aim is to make the quarterwave section resonnate at the midband frequency (which is 2441MHz for 2. 4GHz ISM radios). The feed point (which is the input/output connection) is connected to the L-shape at the point corresponding to $50\ \Omega$. Experment with measurement to determine the correct location for the feed point and length of this antenna.

3 Meander Line Antenna



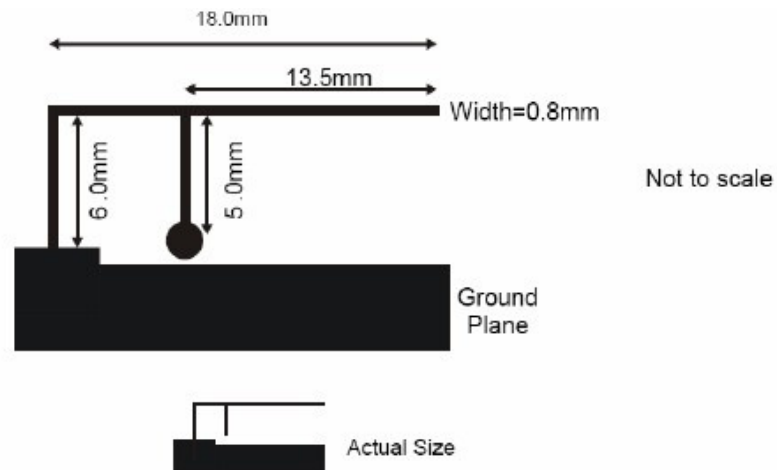
The length of the meander line antenna is difficult to predict. It is usually a bit longer than a quarterwave but dependet on its exact geometry and proximity to the ground plane.

Note:

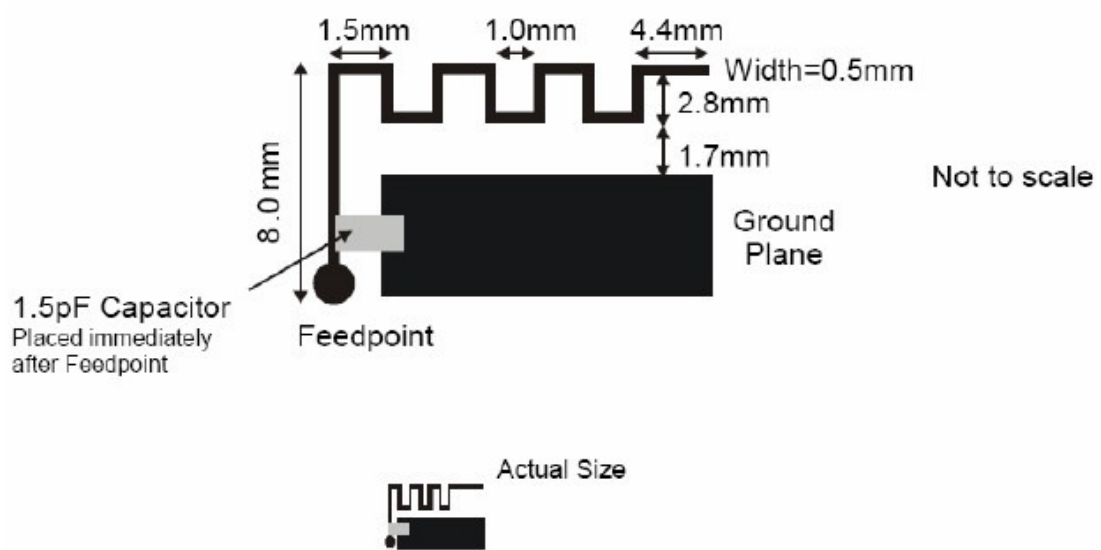
In the figure the ground plane is shown in black. S is the distance from the ground plane. This type of antenna is always a PCB version. The antenna is printed on the top layer and a ground plane is placed near the antenna on the top layer. There must be on ground plane ground plane underneath the radiating section of the antenna.

The real part of the impedance of this antenna is about $15\ \Omega$ to $25\ \Omega$, depending on geometry and proximity to the ground plane. The impedance matching is done by adjusting the length of the antenna until the input impedance is at the unity conductance circle in Smith chart, in the top half of Smith chart. A shunt capacitor is connected between the antenna input and ground to match to $50\ \Omega$. Experimental measurement is used to determine the correct design.

4 Real Designs



Type 1 Inverted-F antenna



Type 2 Meander line antenna