

Design guide

N32WB452 Series Bluetooth PCB Antenna Design Guide

Introduction

This design guide mainly provides a detailed description of the Bluetooth 2.4G RF PCB antenna for N32WB452 series MCUs on smart door locks, smart home and other products, and provides technical support for developers.

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CONTENTS

1. Application scenarios	1
1.1 Scenario overview	1
2. PCB antenna design	2
2.1 Antenna length design	2
2.2 Antenna LAYOUT.....	2
3. Version history	3
4. Notice.....	4

1. Application scenarios

1.1 Scenario overview

N32WB452 series MCUs have Bluetooth function and work in 2.4G ISM frequency band. Good antenna design can ensure sufficient communication distance. If a small size design is a priority, a chip ceramic antenna can be used (Figure 1-1). If the volume allows, an external whip antenna with better performance can also be used (Figure 1-2). The PCB antenna is the lowest cost and medium-sized option, and a good PCB antenna design can achieve good enough performance. Refer to Table 1-1 for the advantages and disadvantages of several antennas.

Figure 1-1 2.4G SMD ceramic antenna

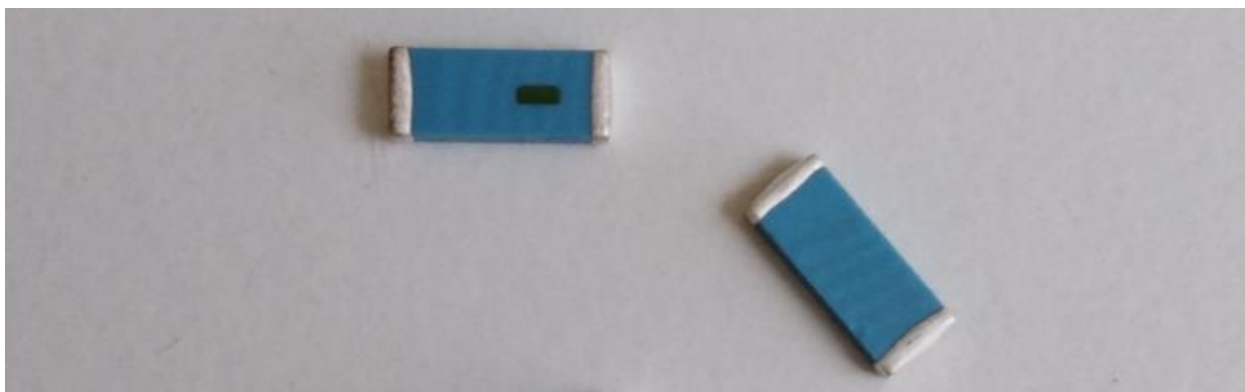


Figure 1-2 2.4G whip antenna



Table 1-1 Advantages and disadvantages of 3 types of antennas

Antenna type	Advantage	Disadvantage
PCB antenna	Low cost Good performance	It is difficult to meet small size and high performance design at the same time
SMD ceramic antenna	Small size	Moderate performance Moderate cost
Whip antenna	Good performance	High cost The size is large, and the application is limited in many occasions

2. PCB antenna design

As a low-cost design solution, PCB antennas are widely used in Bluetooth products. Among them, the $\lambda/4$ monopole antenna is widely used, which will be described in detail below.

2.1 Antenna length design

The length design of the $\lambda/4$ monopole antenna depends on the operating frequency and the dielectric constant of the PCB board. We choose an ordinary FR4 PCB board with a dielectric constant of 4.4 and an operating frequency of 2450MHz.

The permittivity of free space is 1, and the corresponding $\lambda/4$ length is 30.6 mm. The PCB antenna is located between the free space and the FR4 board. The dielectric constants of the two are 1 and 4.4, respectively, and the corresponding $\lambda/4$ length is about 23mm.

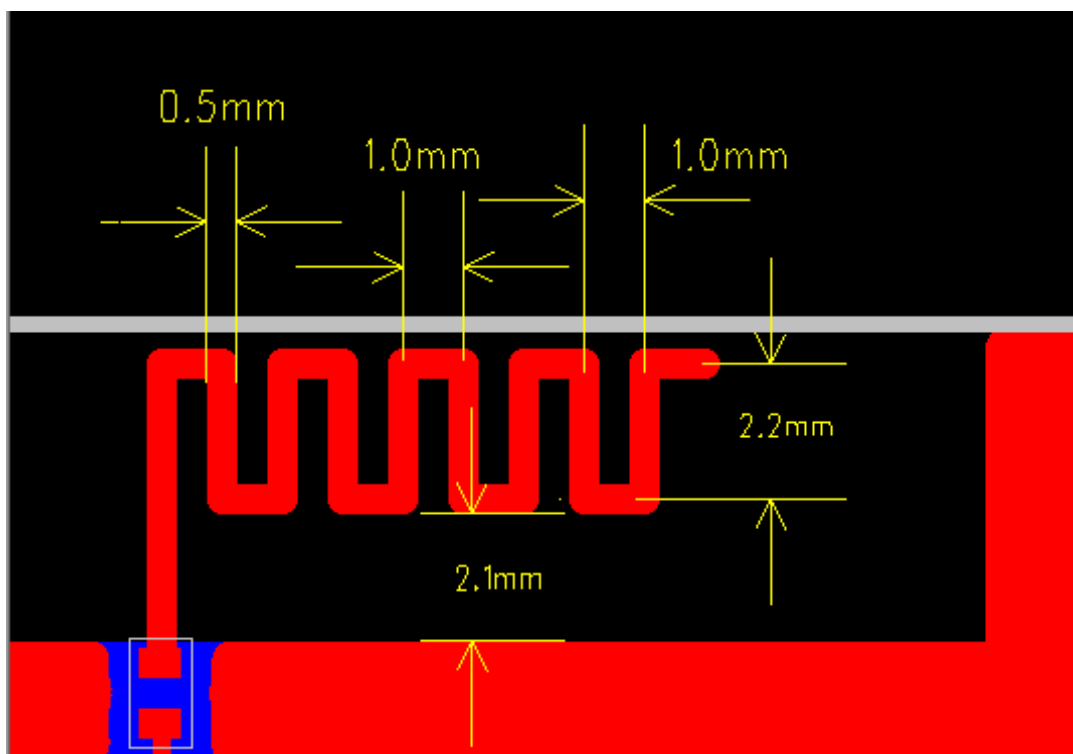
In the actual design, the PCB antenna can be appropriately increased by 2~7mm on the basis of 23mm, which can be used for subsequent debugging to better match the frequency around 2450MHz.

2.2 Antenna LAYOUT

PCB antenna design needs to ensure that the design is on the edge of the PCB, and the floor metal cannot be too close.

Refer to the figure below for a typical 2.4G PCB antenna design LAYOUT size information, which can be provided for reference.

Figure 2-1 2.4G PCB antenna



3. Version history

Date	Version	Remark
2020-06-15	V1.0	Initial version

4. Notice

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