

# A Novel Dual-band Coplanar Waveguide Wearable Antenna

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**Abstract:** Nowadays, utilization of the Internet of things, cloud computing, mobile Internet and other new generation of information technology has provided the public with a safe, comfortable and convenient living environment which is modernized and Intellectualized. As a key part of wireless communication system, the ability of antenna to transmit signals determines the performance of the whole communication system. As a wearable antenna, microstrip patch has many advantages, such as low profile, small size, easy to keep conformal, flexible design. At present, most wearable antennas use microstrip patch antenna. In this paper, the application of coplanar waveguide (CPW) feed in wearable antenna is researched, and the dual-band coplanar waveguide antenna is proposed, the working frequency of which is 2.4GHz and 5.2GHz.

**Keywords:** wearable antenna; CPW; dual-band

## 1 Introduction

Most of the wearable antennas are closely fitted with the human body and need to be conformal with the human body, so the design of the wearable antenna needs to take into account not only the influence of the human body on the antenna, such as bending and deformation, but also the radiation harm of the antenna to human body [1-3]. In view of the difficult problems and analysis methods in wearable antenna design, current research work mainly consists five aspects.

The need of miniaturization, small size and low-profile structure of antenna. In order to increase the comfort of the wearer, the size and thickness of the antenna should be reduced much possibly [4, 5]. The size and the profile thickness of wearable antenna proposed in the early stage will affect the comfort of the wearer. At the same bending radius, the performance impact of small antenna is relatively low.

Research on the bending resistance of wearable antenna. In order to meet the comfort requirements of the wearer, most of the wearable antenna media use flexible textile materials [6-8]. Textile material is conformal with human body, so wearable antenna needs to ensure the stable operation under the condition of proper bending and deformation.

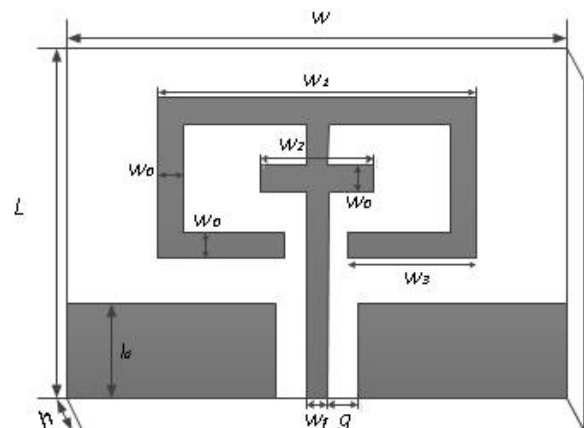
Multi-band and multi-channel development. In order to meet the requirements of high integration, fast

transmission speed and high-performance communication equipment, wearable antenna requires multi-frequency and multi-channel transmission to enrich the function of antenna.

Ensuring low backward radiation. Considering the harm of electromagnetic radiation to human body, wearable antenna must meet the demands of low backward radiation. The electromagnetic metasurface structure is added between antenna and human body to reduce the radiation of antenna to human body [9]. When discussing the harm of antenna to human body, it can be quantitatively defined by measuring the SAR value of electromagnetic power absorbed by human body.

The development of multiple application of wearable antenna. In addition to clothing, antennas can be integrated in belts, buttons, hats and other special applications. The material of antennas should also be non-flammable, waterproof, breathable and so on [10]. There are two kinds of direct feeding modes for microstrip patch antenna: back feed and side feed. Coaxial feed, also known as probe feed, is one of the earliest excitation methods proposed in 1970s. As the inner conductor of coaxial line, the probe is inserted into the bottom layer and connected with the patch conductor [11]. Because the transmission line is directly connected to the patch antenna, coaxial feed is called direct contact excitation.

## 2 Antenna Design



**Figure 1.** The geometric structure of the dual-band coplanar waveguide antenna

Although the probe feeding connection is complex,

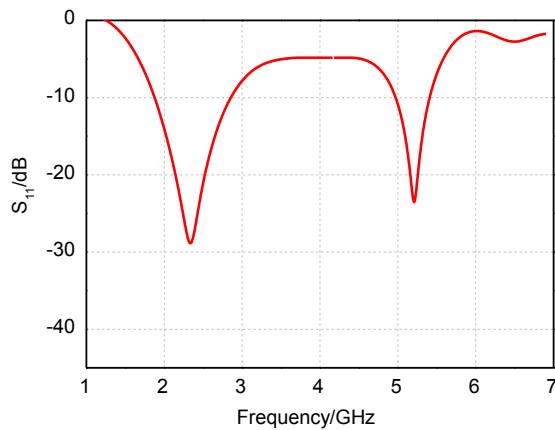
much part of the feeding network is isolated from the patch. Meanwhile, the false radiation is reduced and the effectiveness is improved. Another advantage of the coaxial feed is that the feed network is separated from the radiating portion by ground. In this way, each layer can be optimized respectively.

A dual-band wearable antenna is proposed in this paper. As shown in Figure1, the size of the dielectric substrate is 60mm\*60mm\*1mm and the thickness is 3 mm. The relative dielectric constant of the medium is 1.38. Partial parameters are shown in Table 1.

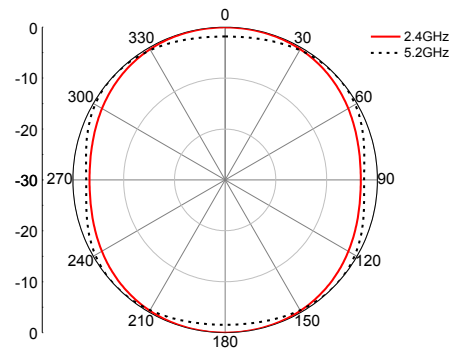
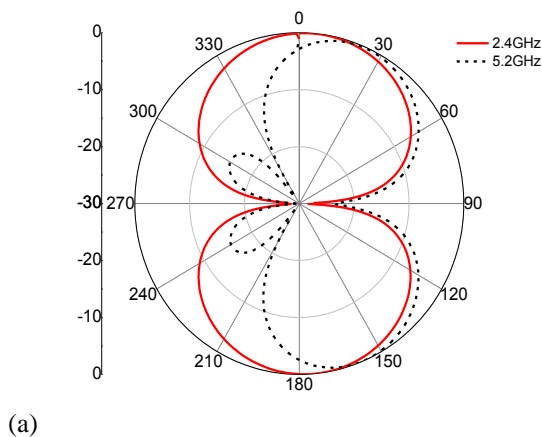
**Table 1.** Partial parameters of dual-band wearable antenna (mm)

W	L	h	w <sub>1</sub>	w <sub>2</sub>	w <sub>3</sub>	w <sub>0</sub>	w <sub>f</sub>	g
60	60	1	40	30	11	6.5	2	1

**3 Simulation Result**



**Figure 2.** Simulation result of dual-band wearable antenna



**Figure3.** Polarization pattern of dual-band wearable antenna  
(a) xoy-plane (b) xoz-plane

It can be seen from Figure2 and Figure3 that the antenna works in 1.876GHz-2.854GHz and 4.972 GHz-5.4 GHz, covering the 2.4GHz and 5.2GHz bands. Combined with the main polarization pattern, the antenna is an omnidirectional antenna.

**4 Conclusion**

In this paper, the application of coplanar waveguide feed in wearable antenna has been researched. The dual-band coplanar waveguide antenna, which works in 2.4GHz and 5.2GHz, covering 2.4GHz and 5.2GHz bands. It has certain reference value and guiding significance for the application of coplanar waveguide antenna in wearable field.

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