

Study on the Influence of High Frequency Dielectric Plate Characteristics on 5G Millimeter Wave Antenna

Doudou Chai* Yi Li Liang Zhang Yiying Wang

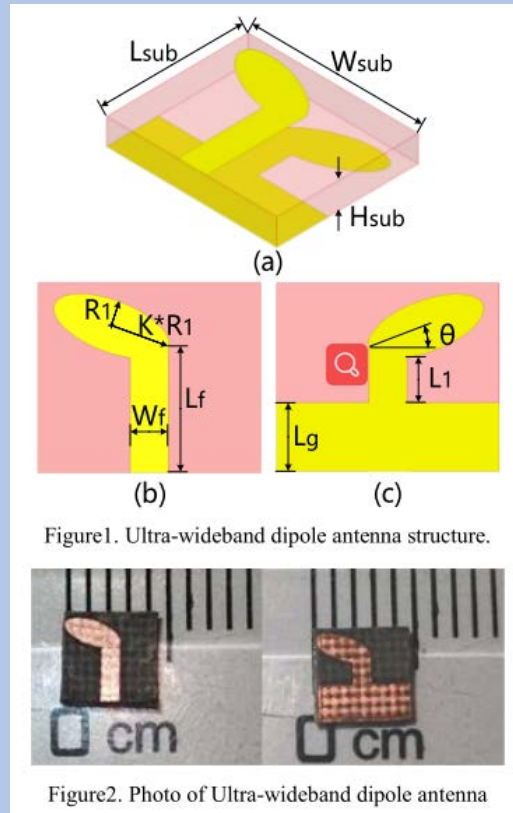
Anhui Province Key Laboratory of Simulation and Design for Electronic Information System

Hefei Normal University

Hefei, China

Abstract—Utilizing microwave anechoic environment and network analyzer to perform performance tests on ultra-wideband millimeter wave antennas operating at 26.5-40.2 GHz and 50-ohm microstrip lines respectively, it was verified how the relevant characteristics of the circuit board in the 5G millimeter wave band influence the device. The experimental results show that the dielectric constant, dielectric loss, thickness, and copper surface roughness of the circuit board will affect the working characteristics of the millimeter wave circuit system. Factors that affect the circuit characteristics also include: temperature coefficient of permittivity, water absorption, cleanliness and fineness during processing. The dielectric constant values and dielectric loss values of all the substrates used in the experiment were tested in accordance with the IPC TM-650 2.5.5.3 test standard to ensure accuracy.

- The test objects are a 50-ohm microstrip line with a length of 37.7mm and one unit of an ultra-wideband millimeter wave antenna array, both of them fabricated on the Rogers RT5880. The structural model of the antenna element is shown in Fig.1. The physical picture is shown in Fig.2.
- Analysis Of Factors Affecting The Working Characteristics Of Circuit Devices At Millimeter Wave Frequency Band
- *Influence of substrate thickness*
- *Influence of Substrate Dielectric Constant*
- *Effect of substrate dielectric loss*
- *Effect of surface roughness and machining fineness of copper plate*
- *Influence of other factors*



CONCLUSION

The development of 5G technology, especially 5G millimeter-wave related technology, places higher requirements on circuit material characteristics. To achieve the expected performance of the device in the operating frequency band, it is necessary to comprehensively consider the possible impact of PCB material properties on the device. In order to minimize the interference between the resonance of the circuits and reduce the dispersion of the circuit and the generation of high-order modes, thinner materials should be used. In order to increase the signal transmission speed and decrease the conductor loss and the difficulty during processing, the material with a low dielectric constant should be used. In order to reduce the dielectric loss, low Df materials should be used. In order to make the device can maintain stable performance for a long time, low TCDk, low water absorption materials should be utilized. The surface treatment method is also one of the factors that have an important influence on the circuit performance. Selecting an appropriate surface treatment method and processing accuracy is prerequisites for the optimization of the device performance.