

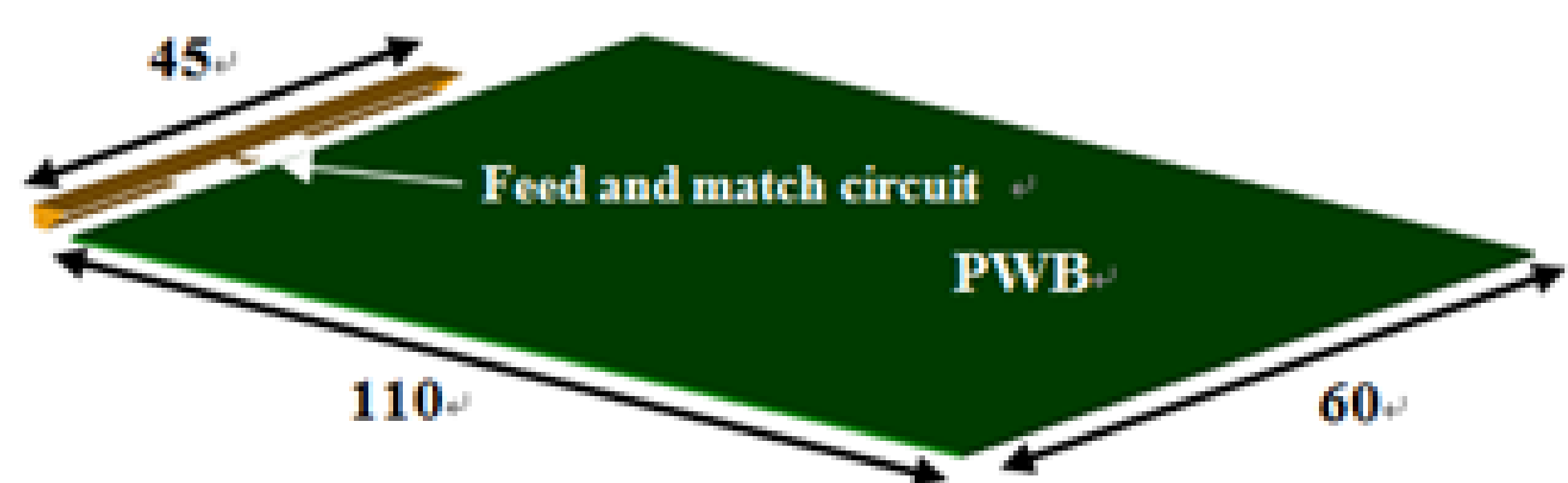
# A Compact Tunable Capacitive Coupling Element Antenna for LTE Mobile Application

Hao Wang, Yibo Wang and Guangli Yang\*

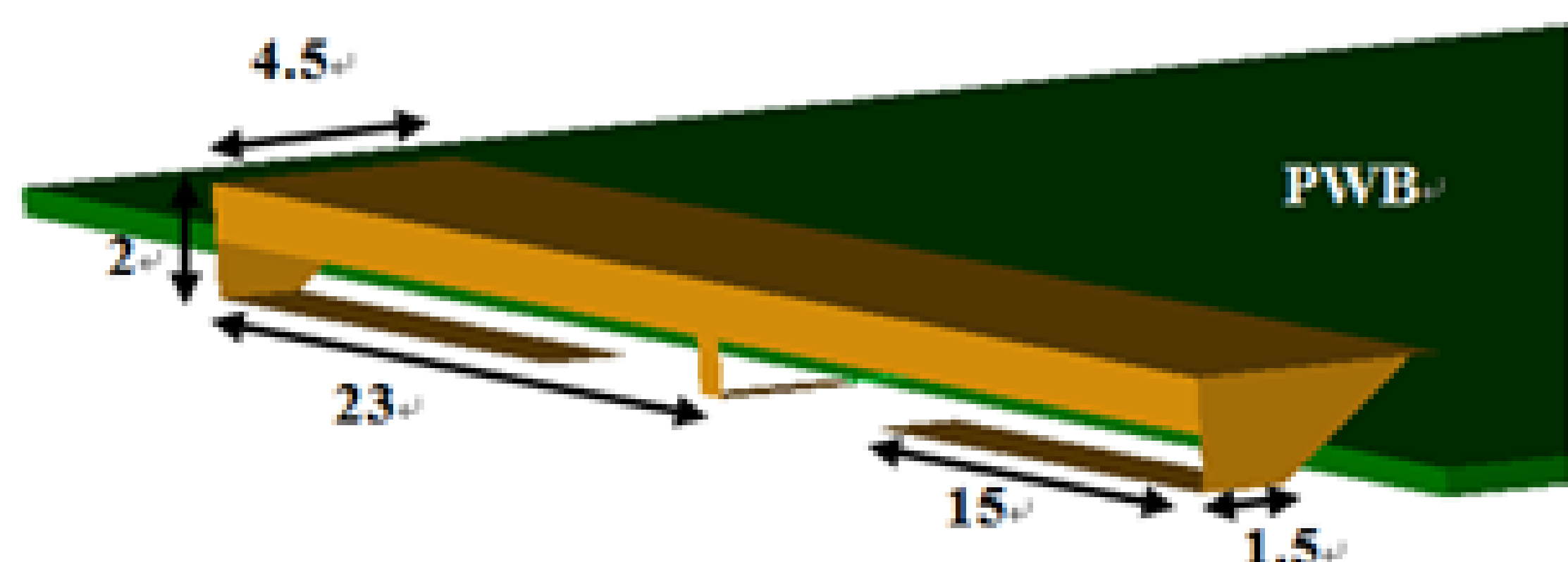
The Key Lab of Specialty Fiber Optics and Optical Access Network  
Shanghai University, Shanghai, China  
guangli.yang@shu.edu.cn

## I. Introduction

In this paper, we introduced an antenna concept based on an unmatched coupling element with a tunable matching network for LTE mobile application. The combination of impedance tuning with intrinsically unmatched antennas can reduce the antenna size to about  $400 \text{ mm}^3$  (about a quarter size of the traditional LTE antenna design) to support multiband, small volume and slim design. By using CCE (capacitive coupling element) antenna, the antenna can only have high band in structure to reduce antenna size, low band is realized by designing appropriate tunable matching circuit to affectively excite PCB board. The antenna operates from 0.69–0.96 GHz at low band 1.71–2.69 GHz at high band for global application. The complex CCE and switchable matching circuit are the key part of this design.



(a)



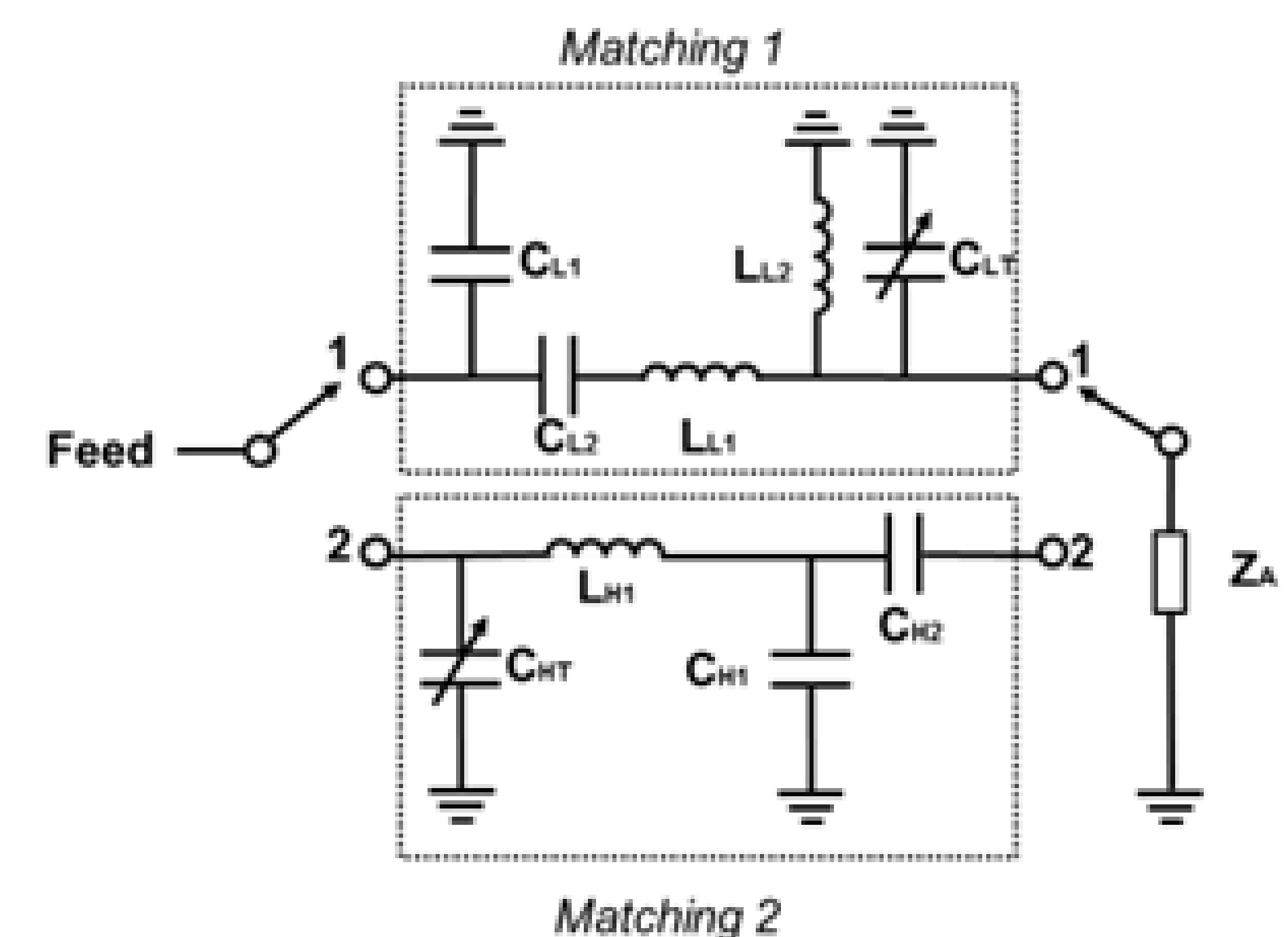
(b)

**Fig. 1** Geometry and detailed dimensions of proposed antenna.

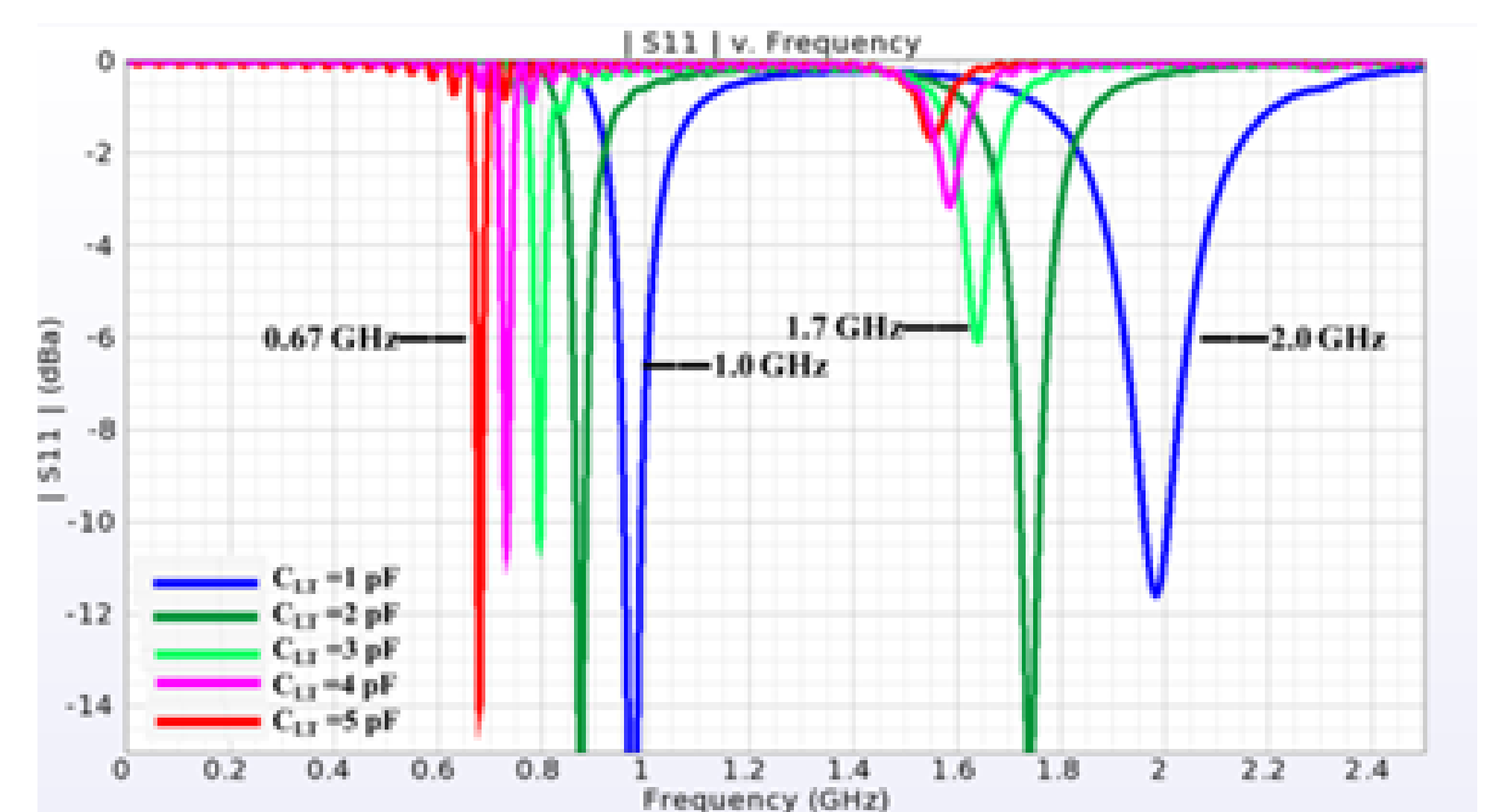
## II. Antenna Design

Fig. 1 shows a CCE antenna on a compact smartphone PCB. The volume occupied by the CCE is  $45 \times 4.5 \times 2 \text{ mm}^3$ . The dimensions of the whole structure including the PCB are only  $114.5 \times 65 \times 3 \text{ mm}^3$ . The T-shaped antenna is fed via the narrow branch in the middle of “T”. To save antenna volume, the two arms are bended downstairs to guide the current. The feed separated the “T” shape and bended narrow part as left and right sides with each about similar length of  $1/4\lambda$  of high band (around 2 GHz).

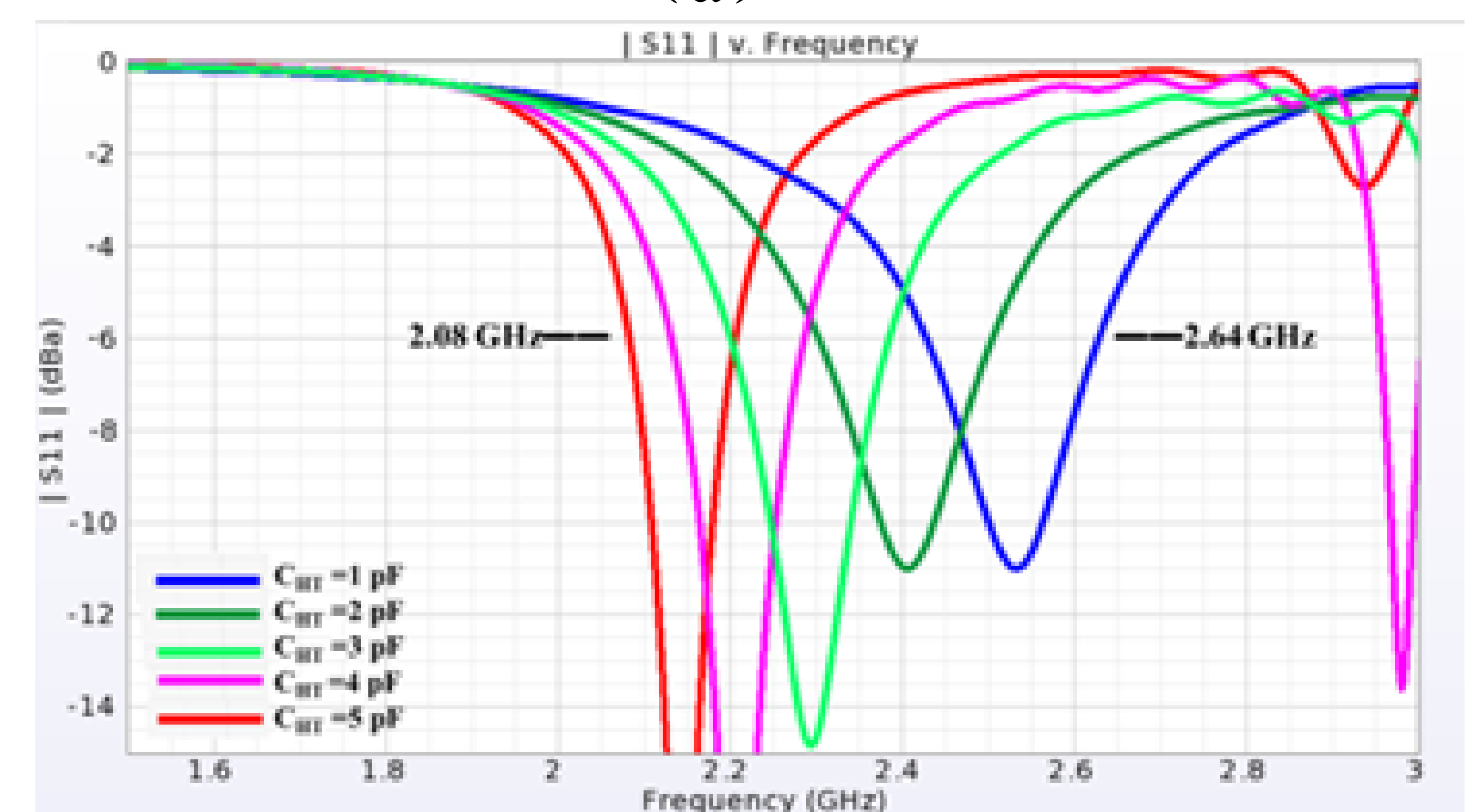
In this paper, we proposed a single-fed CCE antenna design with dual-branch matching circuits as the RF front-end interface. Fig. 2 shows the matching circuit schematic of the CCE antenna. The matching circuit shown in Fig. 2 consists of two parts: Matching 1 and Matching 2. Fig.3 (a) and (b) present the simulated S11 when both switches linked Matching 1 and Matching 2, separately. Matching 1 is able to cover the relatively lower band (0.7-0.96 GHz, 1.7-2.1 GHz) and Matching 2 is able to cover the relatively higher band (2.1-2.7 GHz).



**Fig. 2** Matching circuit of the CCE tunable antenna



(a)



(b)

**Fig. 3** Simulated S11 of CCE at Matching 1; (b) Simulated S11 of CCE at Matching 2