

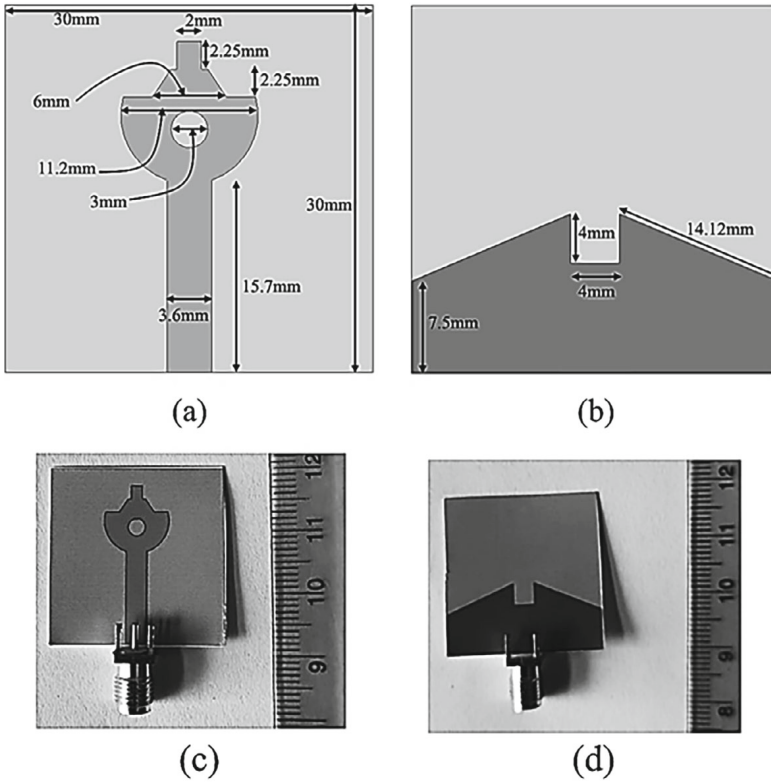


Fig. 1 UWB antenna: **a** simulated antenna top view, **b** simulated antenna bottom view, **c** fabricated antenna top view, **d** fabricated antenna bottom view

4 Proposed Filtering Antenna Design

After the first two steps, the final step is to integrate the UWB antenna and the BPF to design the filtering antenna ($800 \times 400 \times 20.32\lambda$) to cover the mid-5G band. The proposed device views are shown in Fig. 5.

4.1 S-Parameter

The integration of the BPF before the UWB antenna forces the antenna to operate in the mid-5G band only and reject the remaining bands. The $S(1, 1)$ parameter of the filtering antenna shows that the bandwidth is 3–6.1 GHz. This is shown in Fig. 6. The proposed filtering antenna resonates at 4.06 GHz. The current distribution at 4.06 GHz is shown in Fig. 7.