Wideband Dual-polarized Antenna With Stable Radiation Pattern

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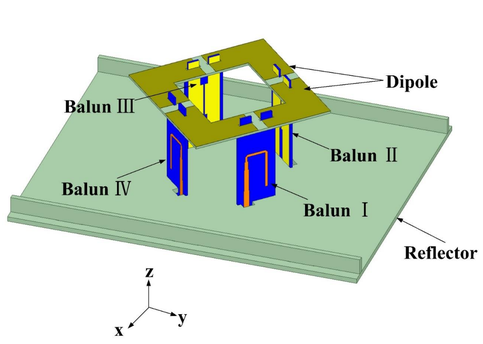
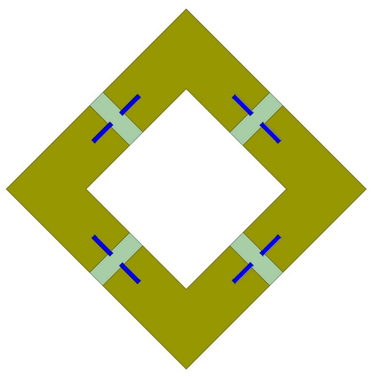
Introduction

A broadband ± 45° dual-polarized dipole antenna with stable radiation pattern is proposed. The antenna consists of four dipoles, a shaped reflector and a broadband feeding network. To realize ± 45° dual-polarize radiation pattern, the dipoles are formed as a square loop and fed by the feeding network. The feeding network is formed by four baluns and two 1-to-2 power dividers. The baluns and the power dividers are used to excited the dipoles for achieving better performance in impedance matching and bandwidth. To obtain stable radiation pattern over the wider operating band, the shaped reflector is employed. With this method, the antenna obtains the impedance bandwidth for 58.5% (|S11|>15 dB within 2.3–4.2 GHz), and the 3-dB beamwidth of the dual-polarized antenna is within the range of 65° ± 5° in the horizontal plane.

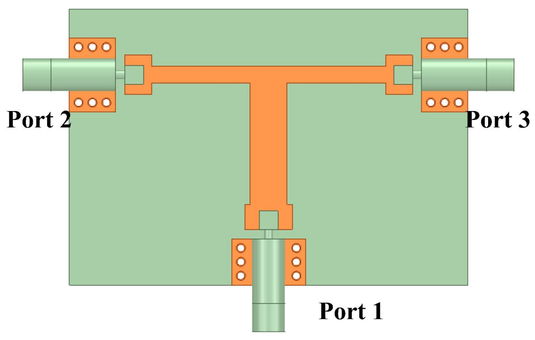
Antenna Configuration



(a)



(b)



(c)

Fig.1 Configuration of the proposed antenna. (a) Perspective view; (b) Top view; (c) power divider.

As shown in Fig. 1, the dual-polarized antenna consists of four dipoles, four baluns, a shaped reflector and a pair of 1-to-2 power dividers. The dipoles are printed on the substrate of 0.762 mm thick FR4 (with dielectric constant of 4.4). To feed the dipoles and realize better impedance matching and wider bandwidth, the baluns was employed with L-shaped microstrip line on the front side of the substrate and slot lines on the back side of the substrate. The dipole I and dipole III are fed by balun I and balun III for realizing -45° polarization. Balun II and balun IV are applied to excited dipole II and dipole IV to obtain +45° polarization. To excite the baluns, two 1-to-2 power dividers are employed, which are printed on substrates with dielectric constant of 3.55, thickness of 1.524 mm. The balun I and balun III are connected to port 1 and port 2 of the power divider. The balun II and balun IV are connected to the other power divider. To stable the radiation pattern, the shaped reflector is designed on the bottom of the baluns.

Simulated Result

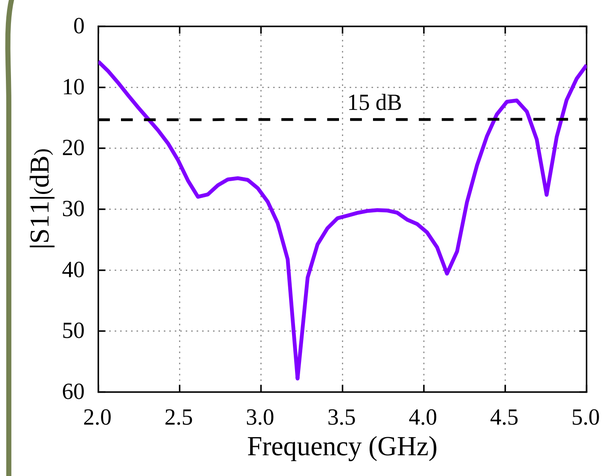


Fig.2 Simulated |S11| of the proposed antenna

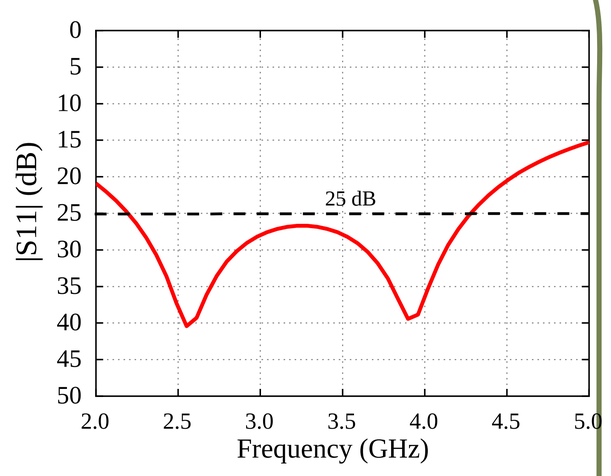


Fig.3 Simulated |S11| of the power divider

Fig. 2 illustrates the |S11| of the wideband dual-polarized antenna. It can be observed from Fig. 2 that the impedance bandwidth of the proposed antenna is 58.5% (|S11|>15 dB within 2.3-4.2 GHz).The |S11| of the power divider is shown in Fig. 3, the |S11| of it is more than 27 dB range from 2.3 to 4.2 GHz.

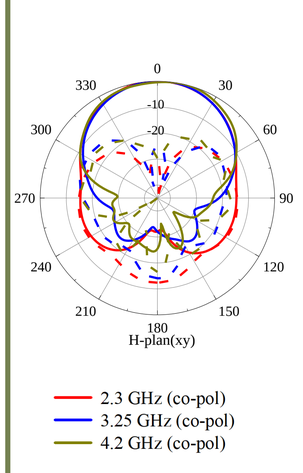


Fig.4 Simulated radiation pattern of the proposed antenna

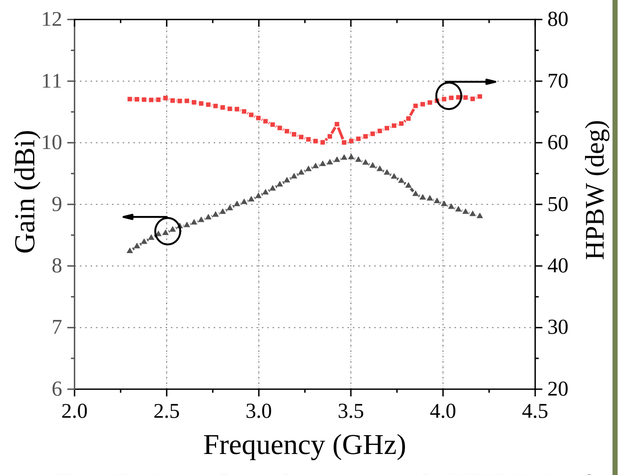


Fig.5 Simulated gain and HPBW of the proposed antenna

The simulated radiation patterns at 2.3, 3.25 and 4.2 GHz for -45° polarization are shown in Fig. 4, which shows that the stable radiation pattern of the antenna has been realized. The simulated HPBW and gain of the proposed antenna are illustrated in Fig 5. It shows that the 3-dB beamwidth in the horizontal plane is stable in the range of 65° ± 5° over the operating band. The gain of the proposed antenna is in the range of 8.2-9.7dBi within 2.3-4.2 GHz.

Conclusion

A wideband ± 45° dual-polarized dipole antenna with four dipoles, a shaped reflector and a feeding network has been presented. The wideband feeding network is designed to excited the dipoles for ± 45° dual-polarized radiation and achieving good impedance matching .The antenna obtains the impedance bandwidth for 58.5% (|S11|>15 dB within 2.3-4.2 GHz). And the shaped reflector are employed to stabilize the radiation pattern, thus the 3-dB beamwidth is in the range of 65° ± 5° in the horizontal plane. The proposed antenna with wide operating band, good impedance matching and stable 3-dB beamwidth is suitable for LTE/5G base stations.

Acknowledgment

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