

Metamaterial Based Patch Antenna with Broad Bandwidth Designed by COMSOL

Xue-Shi Li¹, Li-Juan Zheng²

1. Guangdong University of Technology, School of Automation, Guangzhou, Guangdong, 510006

2. Guangdong University of Technology, School of Electromechanical Engineering, Guangzhou, Guangdong, 510006

Introduction: A patch antenna based on metamaterials of composite split-ring-resonators (CSRRs) and strip gaps is designed by COMSOL Multiphysics®. The antenna is constructed by using CSRR structures in forms of circular rings on the patch and employing strip gaps on the ground plane.

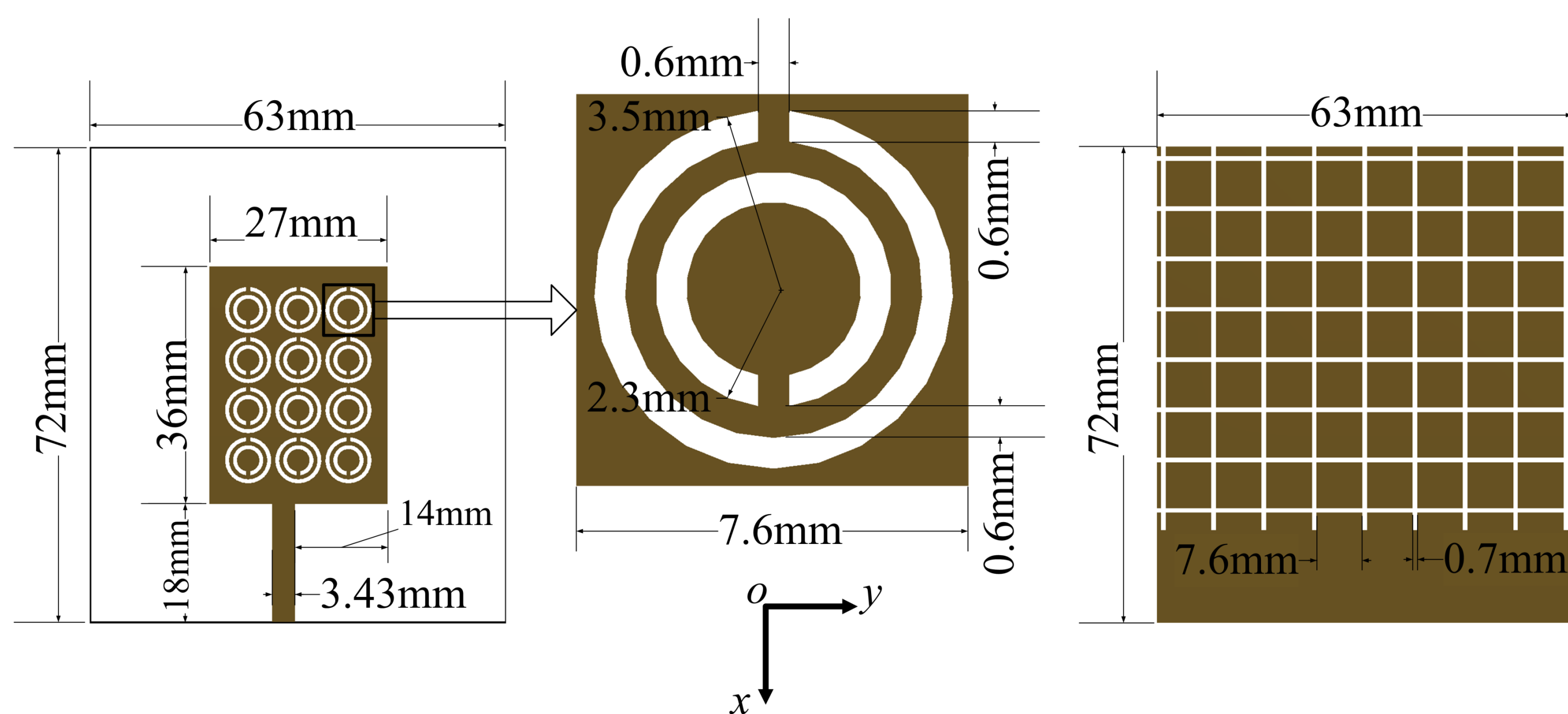


Fig. 1. Structure of the antenna

Structure: To achieve broadband and simple-structure properties, the configuration of the two antennas is based on an original one-layer patch antenna. It was constructed by employing CSRRs on the patch and etching strip gaps on the ground.

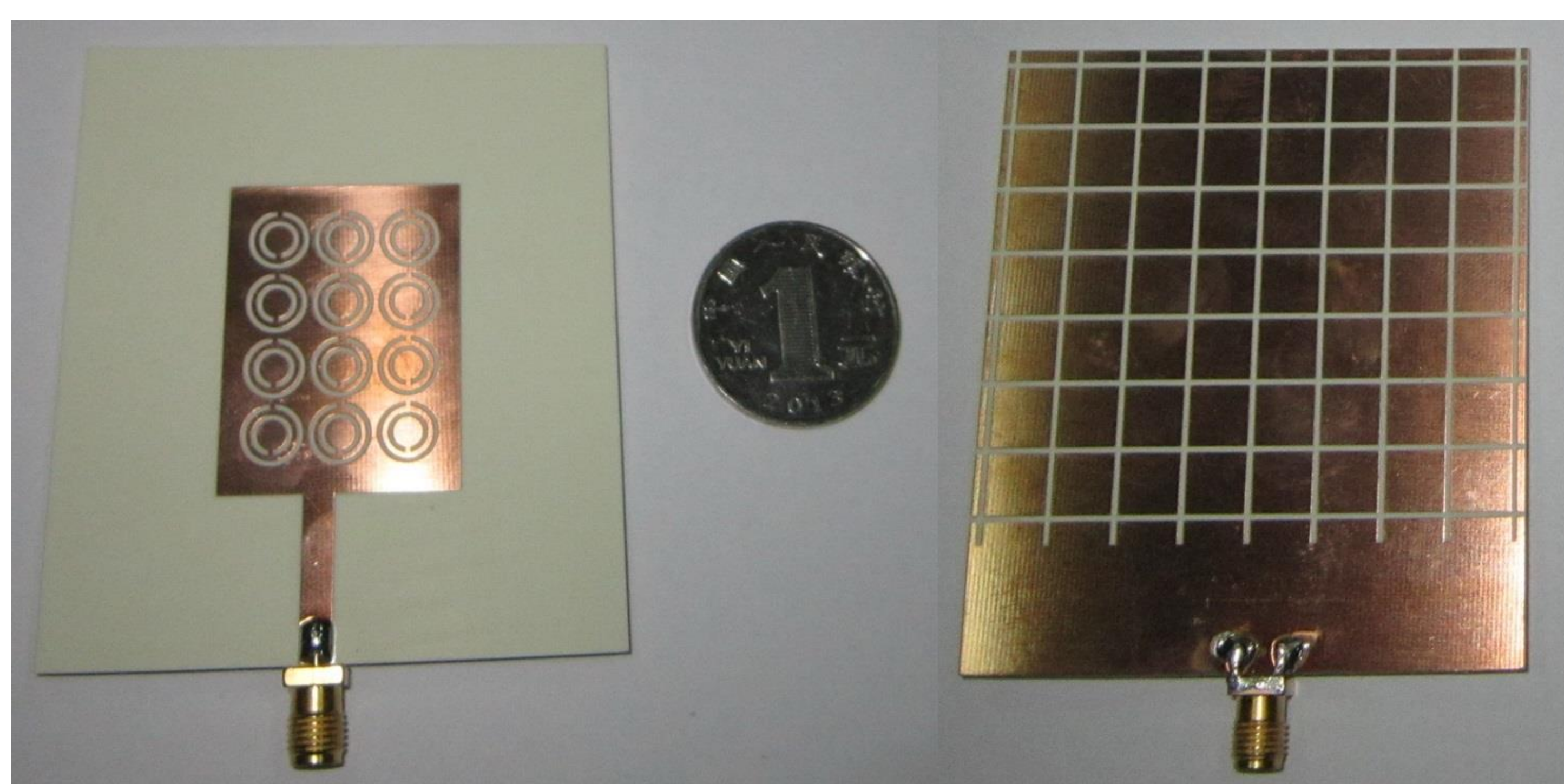


Fig. 2. Fabricated antenna

Results: The S11 band is from 1.70GHz to 2.98GHz and from 3.99GHz to 5.34GHz. The relative bandwidths of the antenna are 75% at 1.70GHz and 34% at 3.99GHz, respectively. The radiation gain is favorable over the operating bands with a simulated peak gain of 6.04dB at 3.58GHz.

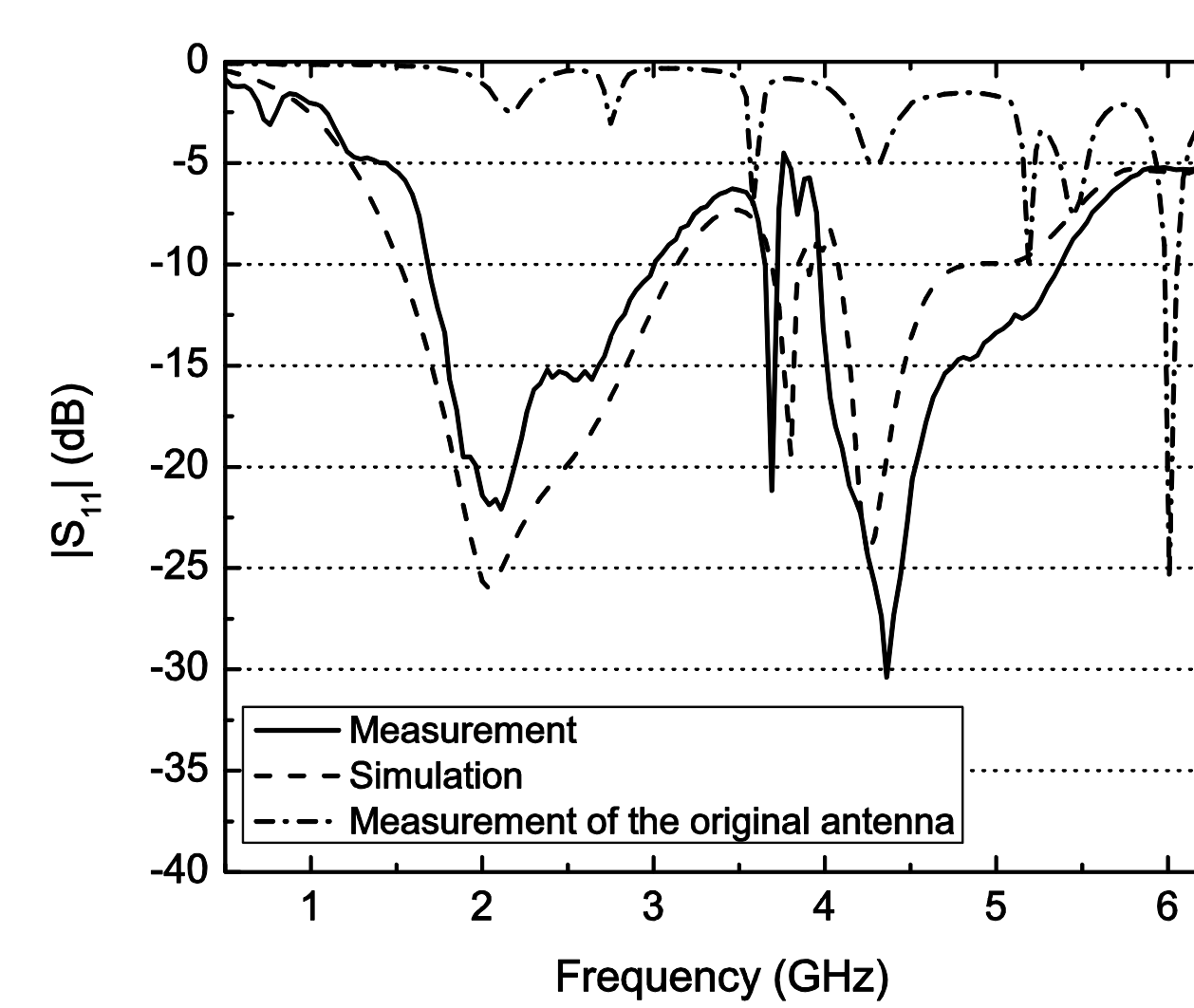


Fig. 3. Reflection coefficients.

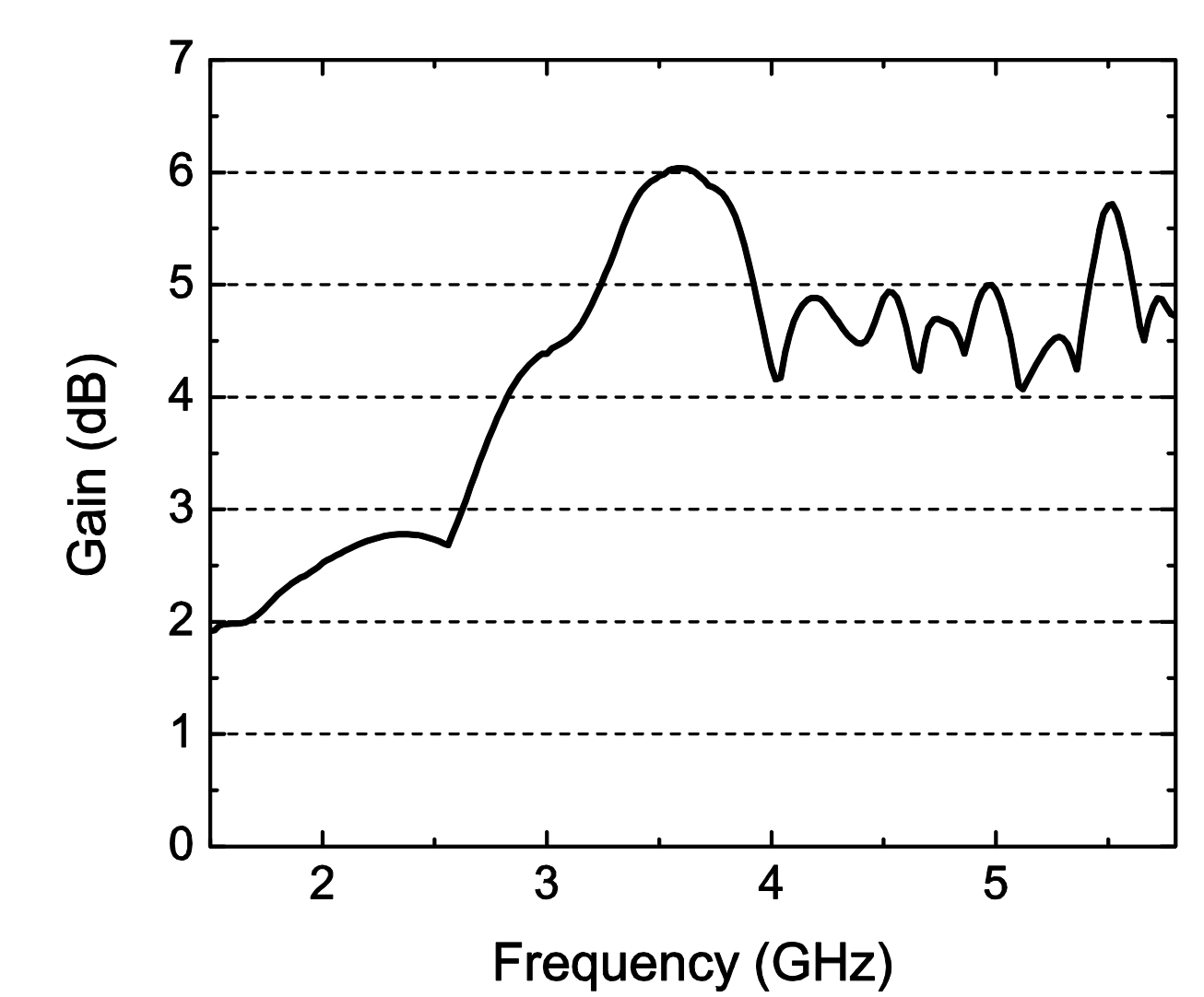
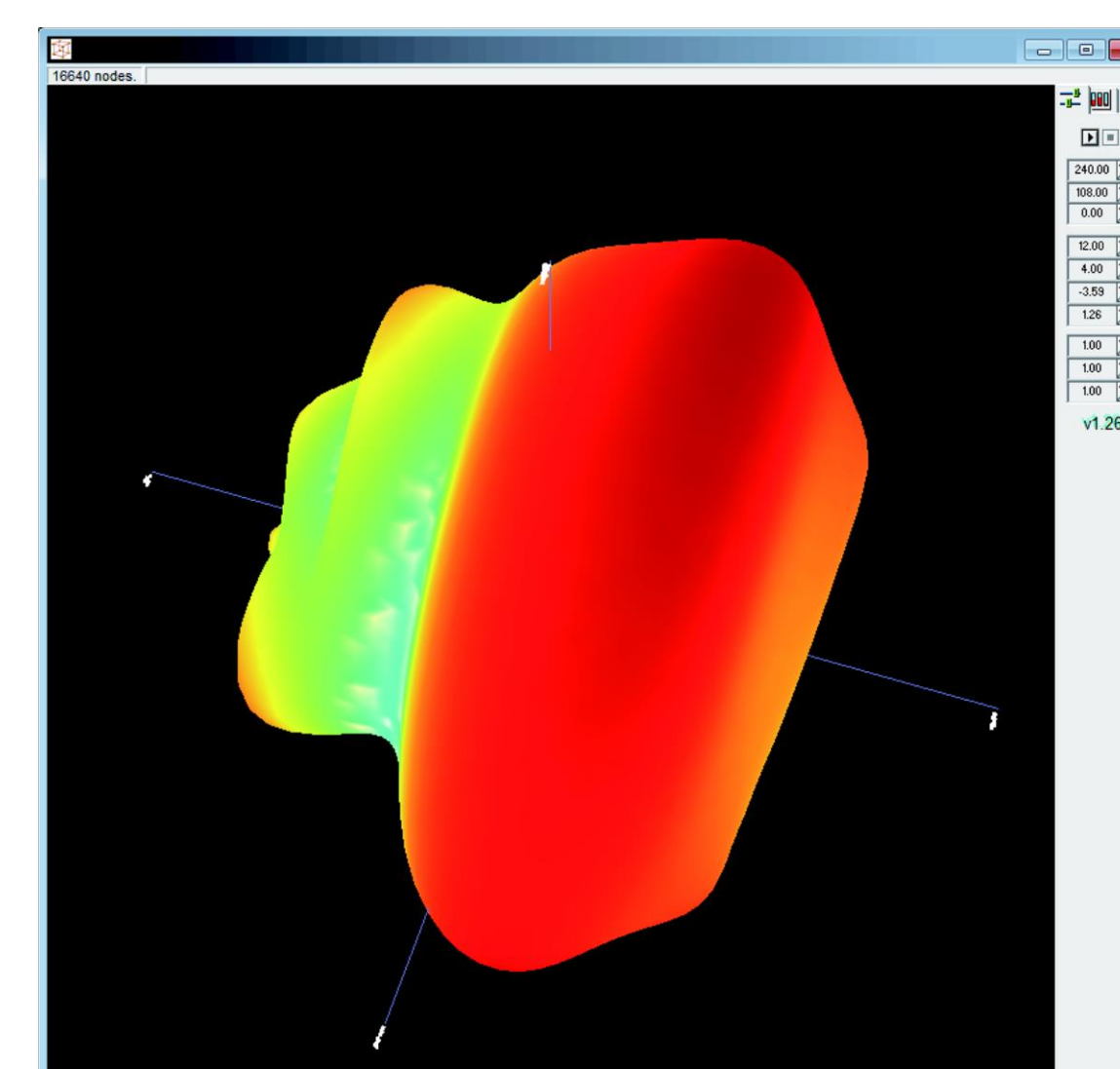
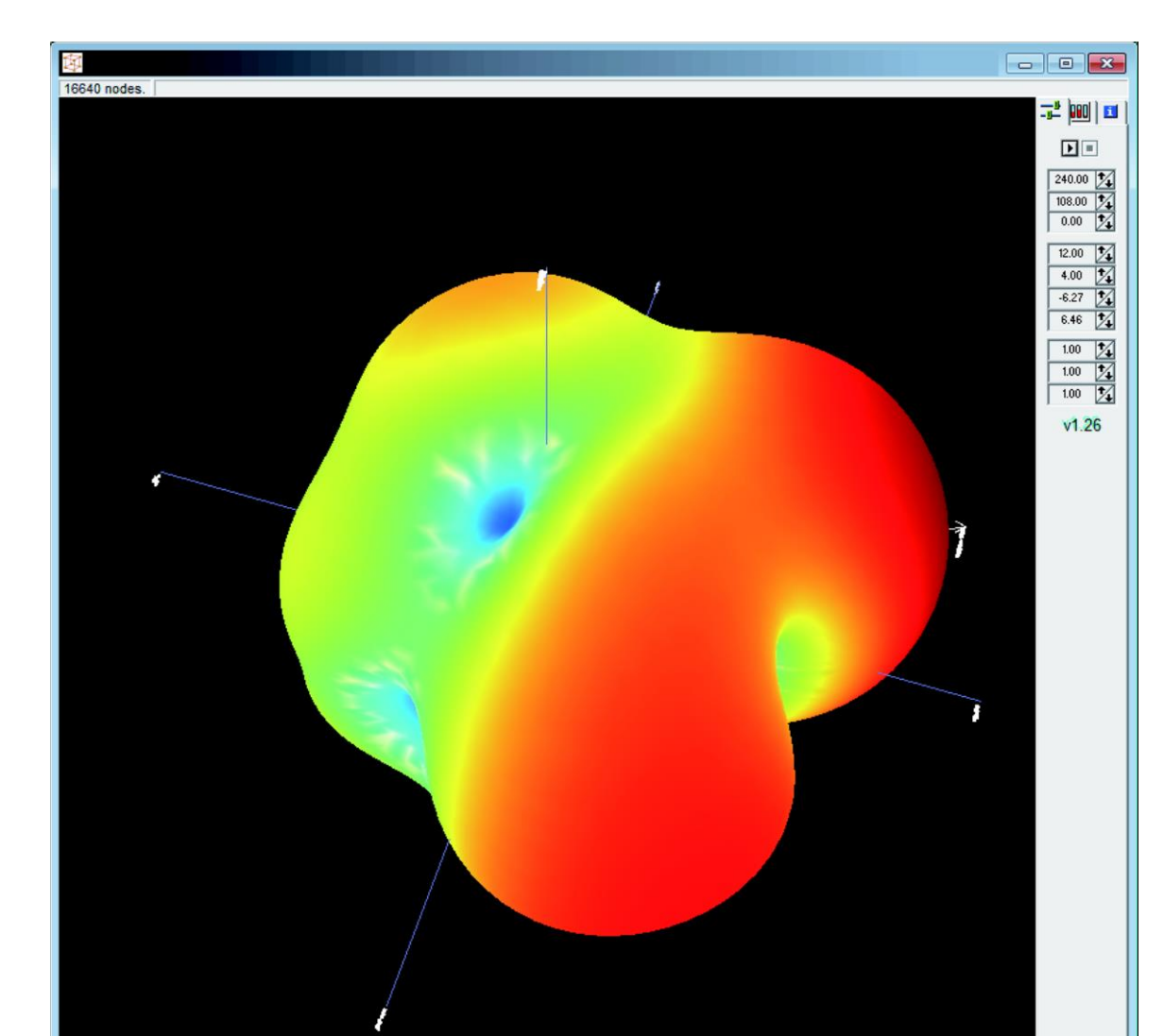


Fig. 4. Simulated maximum gain.



(a) 3D gain pattern at 1.8GHz



(b) 3D gain pattern at 4.2GHz

Fig. 5. Measured radiation patterns.

Conclusion: The antenna keeps the radiation performance favorable with such simple structures and compact sizes. The newly designed antenna is applicable for a wide spectrum of applications like WCDMA, WiMAX, Bluetooth and Wibro.

Reference:

1. K. Agarwal et al., *RIS-based compact circularly polarized microstrip antennas*, IEEE Trans. Antennas Propag. , **61**, 547-554 (2013).
2. Y. H. Liu et al., *Investigation of circularly polarized patch antenna with chiral metamaterial*, IEEE Antennas Wirel. Propag. Lett. , **12**, 1359-1362 (2013).