Wideband 60-GHz Stacked Microstrip Antenna on PTFE Substrate

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I. INTRODUCTION

A microstrip antenna stacked design with complex radiating patch on top is proposed to overcome the wideband requirements for 60-GHz communication systems [1]. The antenna is fabricated on multilayer PTFE substrate and has a planar structure which radiates in a broadside direction. The designed antenna has improved return loss characteristic compared to existing microstrip antenna stacked designs for 60 GHz [2], [3]. Return loss, radiation pattern, and gain measurement results are in good agreement with simulation results obtained using CST Microwave Studio.

II. RESULTS

The microstrip antenna is built using two layers of PTFE (polytetrafluoroethylene) Taconic TLY-5 substrate ($\varepsilon_r = 2.2$) and prepreg Taconic CuClad 6700 ($\varepsilon_r = 2.17$). On the bottom there is a microstrip line that feeds a single rectangular patch using aperture coupling through the slot in the ground plane. On the top, there is a parasitic patch of complex form. The parasitic patch is coupled electromagnetically with the rectangular patch. Vias are not used in the design.

An end launch connector was used in the antenna measurements. The antenna parameters were measured using 67 GHz Agilent E836A PNA. Radiation pattern measurements were performed using a rotary stage in a room with scattering environment. A standard horn antenna connected to a low-noise amplifier was used to register a signal from the microstrip antenna. A gain-transfer method was used to estimate the antenna realized gain.

The measured 10-dB return loss bandwidth is from 54 GHz up to 66 GHz and fully covers the unlicensed band around 60 GHz. Radiation patterns in E-plane and in H-plane are stable for 57 GHz to 64 GHz.

The Measured microstrip antenna realized gain is from about 6.5 dBi for 57 GHz up to about 8.5 dBi for 64 GHz. Measured characteristics are in good agreement with simulation.

III. CONCLUSIONS

A stacked microstrip antenna for 60-GHz communication systems was designed, fabricated, and measured. The measured return loss bandwidth fully satisfies the communication standard requirements. Radiation pattern and antenna gain are stable inside the communication band.

The designed antenna is suitable for 60-GHz high speed wireless communication system.

REFERENCES

[1] T.S. Rappaport, J.N. Murdock, and F. Gutierrez, “State of the art in 60-GHz integrated circuits and systems for wireless communications,” *Proc. IEEE*, vol.99, no. 8, pp. 1390-1436, Aug. 2011.

[2] T. Seki, N. Honma, K. Nishikawa, K. Tsunekawa, ”Millimeter-wave high-efficiency multilayer parasitic microstrip antenna array on teflon substrate,” *IEEE Trans. Antennas Propag.*, vol. 53, no. 6, pp. 2101-2106, June 2005.

[3] W. Hong, K.-H. Baek, and A. Goudelev ”Multilayer antenna package for IEEE 802.11ad employing ultralow-cost FR4, ” *IEEE Trans. Antennas Propag.*, vol. 60, no. 10, pp. 5932-5938, Dec. 2012.