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Integrated Design of a 2.45 GHz Phased Array Antenna with MEMS-based DMTL Phase Shifters

[SSRG International Journal of Electrical and Electronics Engineering](#) • Article • 2026 • DOI: 10.14445/23488379/IJEEE-V13I9P107

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Abstract

This work presents a system-level study of a 2.45 GHz phased array antenna that incorporates MEMS-based Distributed MEMS Transmission Line (DMTL) phase shifters. The RF front-end is formed by combining a cascaded 2-bit DMTL phase-shifting section, a four-way Wilkinson divider, and a four-element microstrip patch array. Each RF section was initially designed and refined separately using full-wave electromagnetic simulation before being connected in ANSYS AEDT to assess the complete system response. The beam-steering behaviour was studied by varying the phase excitation introduced by the DMTL phase-shifting network. The simulated array steered the main beam from -20° to $+20^\circ$ and achieved a maximum gain of 10.56 dBi. Electrothermal analysis was also included to estimate the temperature distribution of the antenna structure under 30mW input power. The results indicate that the proposed integrated configuration provides practical beam steering performance with acceptable RF matching and thermal behaviour for compact reconfigurable wireless systems. © 2026 Seventh Sense Research Group. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Author keywords

Beam steering; DMTL phase shifter; Phased array antenna; RF MEMS; Wilkinson power divider

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