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# Design and Evaluation of Uniform and Nonuniform Planar Arrays Geometries Using Rectangular Patch Antennas

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## Abstract

This paper presents the design, simulation, and performance analysis of patch antenna arrays using uniform and nonuniform planar geometries for 5 GHz applications. Array configurations of  $1 \times 2$ ,  $2 \times 2$ , and  $4 \times 4$  are designed and evaluated their performances through simulation. The study investigates the impact of uniform spacing versus customized spacing and feedline design in nonuniform arrays. CST Studio Suite is used to analyze key performance parameters such as return loss ( $S_{11}$ ), bandwidth, VSWR, radiation and total efficiency, gain, directivity, and side lobe level (SLL). Results show that nonuniform designs offer superior  $S_{11}$  and bandwidth in several configurations and highlight trade-offs in efficiency and SLL. The work contributes in the modular feedline

optimization applied across different array geometries ( $1 \times 2$ ,  $2 \times 2$ , and  $4 \times 4$ ), enabling better impedance matching and bandwidth enhancement for compact {5 GHz systems. © 2025 IEEE.

## Author keywords

5G; CST simulation; Microstrip patch antenna; nonuniform array; uniform array

## Indexed keywords

### Engineering controlled terms

Antenna arrays; Bandwidth; Efficiency; Microwave antennas; Slot antennas

### Engineering uncontrolled terms

5g; Array geometries; CST simulation; Design and evaluations; Feed line; Micro-strip patch antennas; Microstrip-patch antenna; Nonuniform arrays; Side lobes; Uniform array

### Engineering main heading

Economic and social effects; Microstrip antennas

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Indexed keywords

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