Design and Gain Enhancement of a Dual-Band Terahertz Antenna using Metamaterial Superstrate Wireless Communication Systems

Sarath Kumar K ,M.E.,
AP/ECE
Dhirajlal Gandhi College Of Technology
sarathjeeva28@gmail.com

Kanchana K
Student
Dhirajlal Gandhi College Of Technology
kanchanak093@gmail.com

ABSTRACT

The growing demand for high-speed and compact wireless communication systems has led to the exploration of terahertz (THz) frequency bands. This paper presents the design and analysis of a compact dual-band THz patch antenna integrated with a metamaterial superstrate to enhance gain and directivity. The antenna resonates at 1.1 THz and 2.35 THz, making it suitable for multi-standard 6G and short-range wireless links. The metamaterial superstrate, constructed with periodic split-ring resonator (SRR) units, is positioned above the patch to focus energy and reduce radiation losses. Simulations in CST Studio Suite confirm gain enhancement of 3.3 dB over the baseline and improved S11 behavior. The antenna demonstrates strong potential for secure, high-efficiency wireless communication systems in THz applications.

Keywords: CST Studio Suite – Terahertz Antenna – Metamaterial – Dual-Band – Wireless Communication – Gain Enhancement