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A compact, array-ready dual-polarized stacked patch element for C-band UAV SAR

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This paper presents a compact dual-polarized stacked microstrip patch antenna designed for C-band spaceborne and UAV-mounted Synthetic Aperture Radar (SAR) systems operating in the ITU-allocated 5.25–5.57 GHz band (320 MHz). The antenna employs a novel coupling-excited feed architecture in which two orthogonal coaxial probes excite inverted U-shaped slots etched into a driven patch, enabling strong coupling and improved impedance shaping. A parasitic patch—scaled 5% smaller than the driven patch and incorporating matching rounded corners—is placed above the radiator to form a vertically coupled two-resonator system that broadens the impedance bandwidth while preserving planar symmetry suitable for array integration. Electromagnetic simulations performed in Altair FEKO demonstrate a –8 dB impedance bandwidth of 5.32–5.78 GHz (≈ 480 MHz), fully covering the 320 MHz SAR allocation. The antenna maintains inter-port isolation better than –17 dB across the band, with a peak isolation of –24.3 dB at 5.55 GHz; such isolation levels significantly reduce crosstalk in dual-polarized SAR channels, improving polarimetric accuracy without requiring external decoupling networks. The realized gain remains stable between 3–5.3 dBi, and cross-polarization levels stay below –18 dB in the main beam region. These results confirm that the proposed architecture offers a compact, low-profile, and wideband dualpolarized radiator well suited for next-generation space-borne and UAV SAR front ends.