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Compact Ultra-Wideband Vertically Polarized Circular Phased Array Based on the Concept of Tightly-Coupled Elements

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An ultra-wideband vertically polarized circular phased array featuring a single-layer structure composed of multiple tightly coupled elements arranged around a long-slot is introduced. Unlike conventional cylindrical arrays that employ stacked circular configurations, its single-layer design generates a quasi-magnetic current sheet, significantly simplifying the architecture, reducing overall dimensions, and maintaining superior electromagnetic performance.

Experimental validation confirms that the array offers extensive bandwidth performance; its fractional bandwidth exceeds 100% and maintains excellent cross-polarization discrimination. Its omnidirectional mode attains minimal azimuthal pattern variation. Similarly, its directional mode realizes a stable beam steering capability that exhibits negligible gain fluctuation across varying angles.

These unique properties position the array as highly advantageous for diverse practical uses. Its omnidirectional radiation capability ensures effective spectrum monitoring and real-time surveillance across wide frequency ranges. The scan-invariant directional mode, characterized by minimal variation in the radiation patterns, is particularly beneficial for modern wireless communication systems needing dynamic beam steering and robust adaptive control. Moreover, the antenna's broadband and consistent radiation performance is ideal for critical real-time operations, including precise geolocation, adaptive wireless networks, and emergency response communications.