Low-Cost Broadband Circularly Polarized Slot Antenna Array (CPSAA) Using Sequentially Rotated Feed Network (SRF)

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Circular polarization is particularly useful for applications on global position, satellite, and mobile communication systems. A number of circularly polarized (CP) microstrip antennas have been developed due to their very thin profile, light weight, low cost, better mobility and weather penetration than linearly polarized (LP) antennas in last decades. One main disadvantage of microstrip antenna is its narrow impedance bandwidth and its high loss. For a CP microstrip antenna, both axial ratio (AR) and impedance bandwidths need more considerations. For this reason much effort have been done about CP antenna design with different techniques. Between these techniques sequentially rotated feed (SRF) network is one of this methods. By using a SRF network technique, we can design an array with good circular polarization and wide impedance bandwidth.

In this paper presents the simulation, and measurement results of two low-cost broadband circularly polarized (CP) printed antennas: A single element and a 4×4 antenna array for C band application. The proposed single element antenna is excited by an L-shaped strip with a taper end, located along the circular-slot diagonal line in back plane. Four-element antenna array comprising of sequentially rotated elements and employing microstrip-line feed network to the slot antenna has been presented. The attributes of the proposed CP slot antenna array includes: a relatively simple structure, a low cost fabrication, and broadband operation across 4-6.825 GHz. The measured results show that the impedance bandwidth is 52% for VSWR<2, and axial-ratio < 3 dB is 31%. The broadband CPSA array used seven quarter-wave transformers sections that are curved and linked together in a consecutive sequence to form a four-port network. From the array experimental results, the 3dB axial ratio bandwidth can reach as large as 1900 MHz, which cover the 4.7 GHz to 6.6 GHz frequency band. The CP element achieves a bandwidth of 16.6% for an axial ratio less than 3 dB. The proposed antenna array can provide a peak gain of about 8.9 dBic at 5.9 GHz. In comparison to the previous CPSAA structures with sequential feed network and arc feed-line structures, impedance bandwidth and the axial ratio bandwidth of antenna array are increased, which is 3 GHz wider than the impedance bandwidth for previous proposed design. Acceptable agreement between the simulation and measured results validates the proposed design.