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Design of a Circularly Polarized Antenna Operating at 137 MHz for NOAA Weather Satellite Reception

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This study presents the design and simulation of a circularly polarized antenna operating at 137 MHz, intended for applications such as NOAA weather satellite reception. The antenna system is based on two V-dipole antennas configured to achieve circular polarization with a 90° phase difference between them. Each V-dipole is constructed using two 540 mm long copper rods, positioned at a 120° angle, and fed at the intersection of the rods. Simulation results indicate an S11 value below -18 dB at the target frequency, ensuring efficient impedance matching. The radiation pattern of the single V-dipole exhibits an omnidirectional characteristic with a maximum gain of 1.41 dBi. To enhance directionality and achieve circular polarization, the V-dipoles are placed orthogonally along the z-axis with a 547 mm separation. After optimization, the system achieved a maximum realized gain of 1.24 dBi and an axial ratio of 0.15 dB along the positive z-axis. To further improve gain and directionality, reflector rods were introduced, increasing the maximum realised gain to 4.82 dBi. The final design demonstrates a good circular polarization performance with an axial ratio below 3 dB over a wide angular range. This antenna design satisfies the required specifications, making it suitable for satellite communication applications.

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