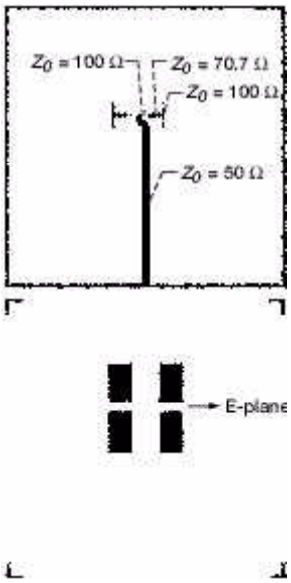
High-Efficiency Wide-Band Suspended Patch Antenna Array Demonstrated

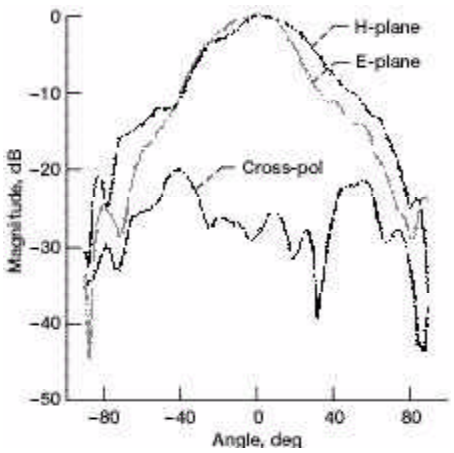
A four-element, suspended patch antenna array that has a parasitic patch layer on top and is electromagnetically coupled to an inverted microstrip feed for linear polarization was demonstrated at K-band frequencies. The layout of the array is shown in the following figure. The antenna has the following advantages over conventional microstrip antennas:

1. The inverted microstrip has lower losses, which result in higher gain and efficiency.
2. The inverted microstrip is easier to fabricate, because the strip width is wider for a given characteristic impedance.
3. A conventional proximity-coupled patch antenna requires a substrate for the feed and a superstrate for the patch. However, the inverted microstrip-fed patch antenna makes use of a single substrate and, hence, is lightweight and inexpensive.
4. Electromagnetic coupling results in a wider bandwidth.



Mask layout of four-element K-band suspended patch antenna array. Top: Feed network. Bottom: Patch array.

The measurements show that the array is very well matched to the 50-W feed and has a 2:1 voltage standing wave radio (VSWR) bandwidth of 5.4 percent for the initial experiments, which are K-band frequencies. The array radiates with a linear polarization perpendicular to the feed. The measured E-and H-plane radiation patterns and cross-polarization level for the array are shown in the following graph. The measured gain of the array in comparison to a standard-gain horn antenna is estimated to be about 10.0 dB. The efficiency of the array is about 59 percent.



Measured co-pol and cross-pol radiation patterns at 22.5 GHz.

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