

Case ID:M20-113P  
Published: 5/5/2022

## Inventors

**Yu Rong**  
**Arindam Dutta**  
**Daniel Bliss**  
**Alejandro Martin**  
**Volker Ziegler**

## Contact

Shen Yan  
shen.yan@skysonginnovations.  
com

# Large Phased Antenna Arrays for Low-Power High-Speed Communication

**Background** Modern commercial communication systems, such as 5G networks, commonly operate at relatively high radio frequencies toward the millimeter wave bands. In conventional satellite communication systems, large reflectors or dishes are required for high-speed communication, which suffer from high mechanical complexity, high operation and maintenance costs, and low flexibility. The use of antenna arrays instead of reflectors provides many advantages. In addition to being more efficient in their use of the spectral band, antenna arrays have lower associated costs and can be thin, flexible, and easily mounted onto objects of various shapes.

For wireless signals to be dynamically focused in a desired direction relative to the array, antennas in the array must be precisely orchestrated using a concept known as beamforming. A fully digital beamforming architecture offers the flexibility, precision, and control required by modern systems but contends with high power consumption and networking complexity, especially for large arrays of antennas. **Invention Description** Researchers at Arizona State University and Airbus SE have developed a fully digital beamforming system for large arrays. By using low-resolution instead of high-resolution analog-to-digital/digital-to-analog converters (ADCs/DACs), power consumption is reduced with only minimal effect on system performance. A hierarchical approach to beamforming is employed which aggregates contributions from smaller groupings of antennas within the array. This processing method significantly reduces the beamforming data rate requirement and thus also network load. **Potential Applications** • Satellite communication systems • Millimeter wave communication systems • Full-duplex, dual-polarized directional conformal/planar antenna arrays • Cellular base stations **Benefits and Advantages** • Enables digital beamformers to be used with large antenna arrays • Use of low-resolution converters decreases power consumption • Hierarchical approach reduces network load [Research Homepage of Professor Daniel Bliss](#)

