

# High-Frequency Imaging and Data Transmission Using a Re-configurable Array Source with Directive Beam Steering

Tech ID: 32523 / UC Case 2021-652-0

## ABSTRACT

Researchers at the University of California, Davis have developed a reconfigurable radiator array that produces a high frequency directed beam via uninterrupted, scalable, electronic beam steering.

## FULL DESCRIPTION

Data transmission and scanning applications would both benefit from the potential opportunities inherent in the use of very high frequency electromagnetic wavelengths. Faster and larger data transfers and higher-resolution imaging could provide advantages ranging from improved mobile phone reception to the more rigorous screening of humans and objects for national security purposes. However, capturing the advantages of terahertz frequency electromagnetic waves has proven problematic historically. Concerns range from high power consumption requirements to the loss of resolution and “blind spots” that can occur during transmission. Options developed to address these concerns – including the use of directed beams or larger lenses – all have their own limitations.

Researchers at the University of California, Davis have overcome many historical concerns by coupling lens-integrated, reconfigurable, radiating, individual light beams into a reconfigurable array structure. This array structure can perform continuous, uninterrupted and scalable electronic beam steering with high directivity in a lens-coupled source array. The technology combines two, different, methods of beam steering: antenna displacement and phase shifting. The result is lower power functionality with both high directivity and fine scanning resolution.

The technology includes a silicon wafer with an integrated array of pixel sources comprising unit cells. Each unit cell in the integrated array comprises a standing wave oscillator (SWO), but is coupled to neighboring unit cells in both horizontal and vertical directions. This configuration makes it possible to turn individual unit cells on and off, thus creating phase shifts between the adjacent unit cells. As a result, a directed beam can be steered to cover a blind spot between adjacent beams produced by the unit cells. Furthermore, the technology is capable of multi-beam/frequency radiation by simultaneous activation of subarrays without intersecting corners. This method of beam steering using a reconfigurable array in a lens-coupled source can also be generalized and employed in other settings. Thus, this technology is applicable at both different frequencies and with other types of unit cell sources. This method of beam steering can also be used in different types of wireless systems, but is particularly well suited for applications such as high-resolution imaging.

## APPLICATIONS

- ▶ Imaging systems
- ▶ Next-generation voice and data transmission

## FEATURES/BENEFITS

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## INVENTORS

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## OTHER INFORMATION

### KEYWORDS

electronic beam-steering,  
 high-resolution imaging,  
 integrated radiator and  
 phased array circuits,  
 reconfigurable array,  
 silicon lens, coupled  
 voltage-controlled (VCO)  
 and standing wave  
 (SWO) oscillators

### CATEGORIZED AS

- ▶ **Optics and Photonics**
  - ▶ All Optics and Photonics
- ▶ **Communications**
  - ▶ Optical
  - ▶ Wireless

- ▶ Achieves narrow beams, resulting in high resolution
- ▶ Minimizes interference and signal loss
- ▶ Uses significantly less power compared to alternate approaches for terahertz applications

## PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	12,126,093	10/22/2024	2021-652

- ▶ **Imaging**
  - ▶ Other
  - ▶ Security
- ▶ **Medical**
  - ▶ Imaging
- ▶ **Security and Defense**
  - ▶ Screening/Imaging
- ▶ **Engineering**
  - ▶ Other

## RELATED CASES

2021-652-0

## ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Reversed Feedback Amplifier Architecture
- ▶ Ultra-High Range Resolution Doppler Radar Front End With Quadrature-Less Coherent Demodulation
- ▶ Field Effect Bipolar Transistor
- ▶ Low Energy and Noise Sub-Sampling Phase-Locked Loop
- ▶ Hybrid Electromechanical Metamaterials for Optical and Electrical Devices
- ▶ Phased-Locked Loop Coupled Array for Phased Array Applications
- ▶ Scalable Phased Array Standing Wave Architecture
- ▶ Embedded Power Amplifier
- ▶ Reducing Electrical Current Variations in Phase-Locked Loop Systems

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