

# Inkjet Printed Multi-Layer mm-Wave Antennas and Passive Components

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## **Current manufacturing process limits the supplies available and can be wasteful**

Current methods for making mm-Wave passive components and antennae are expensive, time-consuming, require a cleanroom, and result in chemical waste. Furthermore, the nature of the manufacturing process means that paper and low melting-point plastics cannot be used.

## **Innovation allows for massively scalable passive components for inkjet printing**

Georgia Tech researchers have found a way to create massively scalable 2D and 3D antennas and passive components using inkjet printing. This method allows components to be created in minutes, without a cleanroom, and at much lower cost on rigid and flexible substrates. The equipment is flexible and portable, meaning it can be bought to remote locations in order to modify or create components as needed.

This invention uses inkjet printing fabrication techniques in order to create 2D and 3D antennas and passive components. No other inkjet process is capable of creating multi-layer components that operate up to mm-wave, 5G+ or tens of GHz / sub-THz frequencies.

## **Summary Bullets**

- New manufacturing inkjet printing process to create massively scalable 2D and 3D antennas and passive components allows for rapid fabrication and low costs.
- The novel innovation is both flexible and portable, enabling on-demand customization with minimal additional costs.
- The ink manufacturing process has extensive applications from printed RF capacitors and inductors to smart cities, wearables, and skins.

## **Solution Advantages**

- Rapid fabrication at low cost on any substrate, which is not possible with current techniques
- Flexibility and portability; required equipment is small and does not need a cleanroom

- No other inkjet process has created multi-layer printed components that operate up to mm-Wave or GHz frequencies
- On-demand customization with minimal additional fabrication/cost overhead

### Potential Commercial Applications

- Printed RF capacitors and inductors
- mm-Wave antennas and antenna arrays
- Can be extended to inkjet-printed chemiresistive/capacitometric sensors, integrated long-range RF/mmW/5G+/sub-THz modules, and super-capacitors for energy storage
- Can cover IoT, 5G+, RFID, precise agriculture, smart cities, smart wearables, smart skins and Industry 4.0 applications

### Inventors

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### IP Status

<p>The following patent application has published and additional international coverage is pending</p>:  
WO20140307363

### Publications

[Multi-layer RF capacitors on flexible substrates utilizing inkjet printed dielectric polymers](#), IEEE Microwave and Wireless Components Letters, - 2013

### Images

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