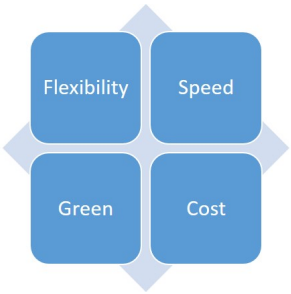
AEROSOL JET® PRINTED ANTENNA

For Consumer Electronics and Industrial Applications

Optomec's Aerosol Jet 3D printing technology is being used to mass-produce Smartphones and other consumer devices embedded with commercial antennas. Aerosol Jet is a CAD-driven deposition solution capable of printing features from 10 microns to millimeters and on both planar and non-planar surfaces without loss of print fidelity, due to its unique deposition capabilities.

Customer Challenges

Antenna manufacturing solutions must enable customers to address key production challenges without compromising on specifications for RF performance and mechanical reliability. Drivers such as **flexibility, speed, cost efficiency and environmental impact** must be factored in to the overall solution. Essentially, the capabilities customers are looking for include:



- Late stage decision making regarding the antenna location and shape
- Ability to place the antenna anywhere and on any substrate
- Optimized performance for local variants of the antenna for each local market
- Rapid development of new antenna patterns
- Fast prototype to production ramp from months to weeks
- Overall manufacturing cost reduction
- A green manufacturing solution that reduces environmental impact

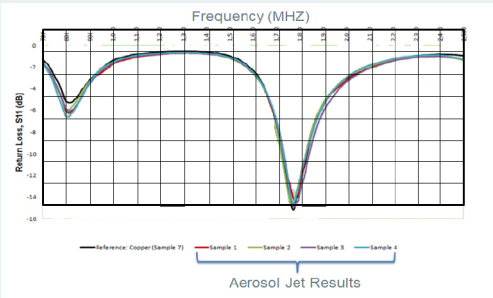
The Solution

In the ultra competitive telecom and mobile phone sectors, getting product to market quickly is a manufacturing imperative. Aerosol Jet's CAD-driven, 3D digital printing process enables both rapid prototyping and late stage production changes, reducing ramp time from design through manufacturing. Additionally, there is no need for the use of specialized plastics or additional plating steps. The Aerosol Jet printer directly prints the antenna circuit onto standard 3D injection molded substrates, such as PC and PC/ABS, and then uses a curing step, such as a conventional oven or an in-situ laser, to complete the manufacturing process.

Aerosol Jet 5X Quad System Platform

Aerosol Jet enables antenna manufacturing with positive benefits for:

- Increased design flexibility - antennas anywhere
- Maximized development speed – shorter time to market
- Minimized product total cost – lower production costs >15%
- Proven performance in RF and Reliability testing
- Reduced environmental impact



OPTOMEC®
Production Grade 3D Printers... with a Material Difference
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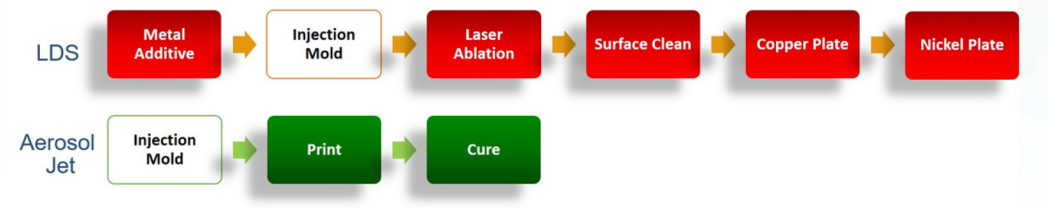
Case Study - Speaker built into injection-molded part prior to antenna

Since the speaker and antenna modules were combined prior to creation of the functional antenna, traditional plating-based manufacturing methods were not an option, as the plating process would have destroyed the speaker. Antennas were printed on five separate sides using Aerosol Jet.

Antenna printing on the combined speaker / antenna module provides the advantage of late-stage customization. The module is a generic part that can be kept in a warehouse. Functional antenna can be localized to meet specific market requirements, such as those in Latin America, Europe, etc. As an example, when an order was received for a batch of Latin American antenna variants, the customer was able to start production with a very short lead-time due to Aerosol Jet's CAD based, digital driven toolpath creation capabilities.



Case Study - Printing multiple antennas on the inside cover of Smart-phones

For antenna performance, it is beneficial to place the antenna far away from the phone PCB engine, freeing up space for other functions in the device. Having all antennas, main cellular, MIMO diversity, GPS, WiFi and BT antennas printed in the same process step saves manufacturing time and can significantly reduce over-all production costs.

Antennas placed on the inside of the undercut areas are very difficult to reach with laser-direct structuring manufacturing processes. Moving towards less expensive polymers (such as brightly colored polycarbonates), was critical in meeting both cost and cosmetic customer objectives. Having a printing process with variable standoff distances was essential for reaching into these undercut areas. And lastly, ensuring that no discoloration to the polymer would occur was a critical deliverable in meeting the customers overall cost and functional objectives.

Aerosol Jet printing was chosen to meet these specific manufacturing objectives due to its 1-5mm nozzle tip to substrate standoff distance; its ability to print antennas using low temperature inks onto PC/PCABS substrates, a curing process that leaves no cosmetic impact to the substrate, and passing environmental tape tests (5B), humidity, and salt spray tests.

		Post Salt Spray Resistance (via to via), 1 hr. at 180 C		
		INKS		
		Paru	PV	Bando
Substrate	HTV-5H1	0.531 (36-3), 0.566 (36-4)	0.38 (PV5), 0.365 (PV6)	0.554 (B5), 0.606 (B6)
	XE4095	0.447 (36-9), 0.464 (36-10)	0.35 (PV11), 0.36 (PV12)	

ABOUT OPTOMEC

Optomec® is a privately-held, rapidly growing supplier of Additive Manufacturing systems. Optomec's patented Aerosol Jet Systems for printed electronics and LENS 3D Printers for metal components are used by industry to reduce product cost and improve performance. Together, these unique printing solutions work with the broadest spectrum of functional materials, ranging from electronic inks to structural metals and even biological matter. Optomec has more than 300 marquee customers around the world, targeting production applications in the Electronics, Energy, Life Sciences and Aerospace industries. For more information about Optomec, visit http://www.optomec.com.

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