Inkjet Printed Antennas on Glass

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Inkjet-printed antennas on paper and plastics have been popular in the last few years due to low cost and flexibility. Printing on glass is equally important as there exist many applications such as integrating antennas on cover glass of solar cells, on window glass, or on display panels. This paper presents several different types of antenna designs and fast prototyping methods using a Dimatix material printer and conductive ink.

The antenna geometries to be demonstrated include, simple patch antenna and arrays, optically transparent meshed patch antenna, and a relatively large reflectarray design. The frequencies of interest are 2 GHz, 5, GHz, and 10 GHz. The patch and meshed patch antennas are printed on glass with size of about 10 cm by 10 cm. The reflectarray operates at 8.475 GHz and is printed on a glass of 20 cm by 30 cm. Prototyping such a reflectarray on glass with traditional methods (i.e. screen printing, clean room methods) can be very time consuming and expensive. Furthermore, the control of the accuracy for such a large number of elements can be rather challenging. With the printer, we have demonstrated a much faster and efficient fabrication cycle. All of these antennas have been tested to verify their performance.

From our experience, the biggest challenge is understanding the material (glass, ink) that we are working with and translating those material properties to the inkjet printer for setting a reliable and reasonable initial condition of the printer. The second challenge is a proper printing procedure that includes cleaning of the glass surface, setting the nozzle's status, and ensuring printing the same trace for multiple times. Printing multiple times is to ensure that thickness of the ink is higher than a microwave skin depth.

This paper is to report a full printing flow chart and stencil for different antenna geometries with emphasis on printing multiple times that has not yet given adequate attention.