

Development of Miniature Sensitive Probes for Near-Field Mapping

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The near-field mapping of integrated circuits and planar printed boards constitute a real need for the optimization and the diagnostic of integrated systems. This paper deals with the development of probes for such mapping system working at microwave frequencies. It especially highlights how the sensitivity of the near-field probe can be increased by an optimal choice of the probe form, while keeping its size as small as possible.

For a probe, the theory of operation is somewhat different from conventional antennas. Probes are meant to collect a voltage or a current proportional to the local field strength, and must have a linear response over frequency. They should operate far from resonance, thus they are generally chosen of small size compared to the corresponding wavelength. Moreover, it then happens that the probe impedance is close to a reflective load. The design of a probe is based on other criteria than the ones preferred for antennas. The probe designer focuses on enhancing field sensitivity, discriminating unwanted field components, and on obtaining slow impedance variation over expected frequency operating band.

Different types of planar probes are realized on dielectric material in a printed circuit board technology, as depicted on the photograph below. The presented probes are fed through a coplanar waveguide transmission line, due to its slow interaction with impinging fields. The monopole probe is primarily sensitive on the electric field, as the loop type is sensitive on the magnetic field. Special tricks have been used to enhance the performances of the probes like tapering the end of the line for enhancing the resolution of the monopole. The shape of the loop also affects the sensitivity of the probe: its layout influences directly the probe performances (square or triangular, simple or double). Comparative results from measured fields over a microstrip line supporting only a propagating mode, as much as over integrated circuit boards will be discussed thoroughly in the presentation to highlight the main parameters affecting the imaging system.



