Determination of the input impedance of RFID transponder antennas with novel measurement procedure using a modified on-wafer-prober

M. Camp (1,2), R. Herschmann (1,2), T. Zelder (1), H. Eul (1)

(1) Leibniz Universität Hannover, Institute of Radiofrequency and Microwave Engineering, Appelstraße 9a, D-30167 Hannover, (2) Smart Devices GmbH & Co. KG, Schönebecker Allee 2, D-30823 Garbsen

(camp@ieee.org / Fax: +4905117623917 / Phone: +4905117623772)

Abstract

Today RFID technology allows identifying arbitrary objects by implementation of low cost transponders. Use of RFID transponders to the identification of different products with different electromagnetic properties requires the development of new antenna systems which are able to compensate the detuning effects caused by material in the antenna near-field region. For example broadband antenna systems or antenna structures with variable transponder chip positioning on the antenna are promising approaches. In the second case the chip is implemented according to the desired application for an optimal matching between the antenna and the transponder chip. Numerical simulation methods are suitable for the development of the antenna systems. The verification of the realized antenna impedances must be carried out by measurement because of a variety of production methods and their specific properties used at present for the realization of the antenna structures.

Goal of the investigation is the development of a new procedure to measure the input impedance of planar RFID transponder antennas. A modified on-wafer-prober is used to perform the measurement. The equipment under test (EUT) area of the on-wafer-prober (chuck) is covered with absorber material of the type C RAM FLX 900 fixed by negative pressure. On the absorber material a polystyrene layer and finally the antenna substrate is placed with the transponder antenna to be measured. That way, the antenna impedance can be measured approximately under free space conditions.

The results show that for a large part of the examined antenna structures the results of simulation method and measurement are in a very good agreement. Deviations between simulation and measurement results are mainly due to unwanted electromagnetic coupling between antenna and measurement probe at antenna structures with extensive metallic area below the probe.