Design of a Wideband Impedance Sensing Board for Next Generation Transmitters

A. Petrocchi[1], D. Resca[2] , G. Avolio[1], G. Vannini[3], H. Rogier[4], A. Raffo[3], D. Schreurs[1]

[1] Div. ESAT-TELEMIC, KU Leuven, Leuven, Belgium, [2] Microwave Electronics for Communications (MEC) Srl, Bologna, Italy, [3]Department of Engineering, University of Ferrara, Ferrara, Italy , [4] Department of Information Technology, University of Ghent, Ghent, Belgium

Abstract

Internet of Things (IoT) means that in the near future all devices used in our daily life will be connected and they will be able to communicate with each other and with users. This concept includes objects used in several applications, including agriculture, automation, energy consumption, telemedicine and healthcare, smart homes and cities, vehicles, security and surveillance [1]. In order to connect everyone and all these devices, the fifth generation (5G) of wireless networks represents the best solution because it is fast, reactive, and environmentally friendly [2]. These new devices will be implemented in low-cost materials and used in adverse conditions where the environment may continuously change. Variations in the environment will affect the performance of the near field of the antenna, and the resulting load-pulling of the RF front end will impact its performance in terms of gain, power and linearity, rendering it difficult to maintain high data rates of the transmitter (Fig. 1). The main problem regarding the radio-frequency front-end is to maintain the performance with the variations of the environment. Our main activity is focused on the sensing board which has to satisfy the requirements for IoTs, i.e., low cost, zero-bias consumption, and high-level integration. The aim of this study is to design an ultra-wideband impedance sensing board for the radio-frequency front-ends used in wireless units for Internet of Things and fifth-generation wireless communication systems. We adopted as an impedance sensing board a six-port junction [3], [4]. The six-port junction is well-known in literature. The first design of the six-port junction was proposed by Engen in 1970s [3], [4], and it has been used in various applications, including microwave receivers and vector network analyzers. A dedicated six-port junction (see Fig. 2) was designed, fabricated, and experimentally measured at the fundamental frequency of 5.5 GHz. The proposed approach is low cost and requires zero DC bias consumption. We demonstrated experimentally that the proposed topology is able to sense accurately varying antenna impedances, even when the variations are large.

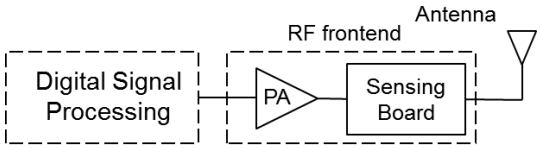

Fig. 1. Simplified block scheme of the transmitter.

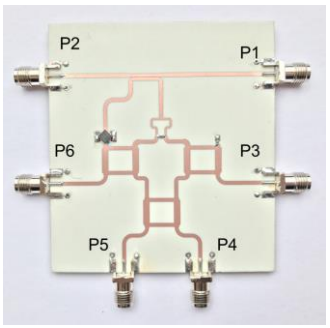

Fig. 2. Fabricated six-port junction.

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