IOP Conf. Series: Journal of Physics: Conf. Series **1210** (2019) 012125 doi:10.1088/1742-6596/1210/1/012125

Differential method for measuring the maximum achievable transmission coefficient of active microwave quadripole

A A Semenov[1], O M Voznyak[1], A A Vydmysh[2], O O Semenova[1] and S V Baraban[1]

[1]Vinnytsia National Technical University, 95 Khmelnytske shose street, Vinnytsia 21021, Ukraine

[2]Vinnytsia National Agrarian University, 3 Soniachna street, Vinnitsia 21008, Ukraine

semenov.a.o@vntu.edu.ua

Abstract. In the paper it is proposed a differential method for measuring the maximum achievable transfer coefficient of active quadripole. A new structural scheme of a measuring device and a sequence of measurements and calculations that implement the method are proposed. The differential method is intended to measure transfer coefficient of the power by an active quadripole in the microwave range at the border of its potential stability. The parameters of the active quadripole have a dimension that corresponds to the dimension of the elements of the standard W-parameters of microwave electric circuits. The results of measurements of the maximum achievable transfer coefficient of microwave bipolar transistors are presented in the paper. The advantages of the method are: 1) a small error of measurement, that is less than 5%; 2) there is no need to make individual measurements in short circuit or idling mode; 3) the small dependence of the results on the coefficient of standing wave of the loaded measuring path.

1. Introduction

Nowadays, there are a many of different methods [1, 2] and equipment's [3, 4] for measuring the parameters of the quadripole. When measuring quadripole parameters in different modes receive different system parameters [5]. These systems are equivalent from the point of view of recalculation from one system to another, but in practice they can not be considered equivalent [6]. Thus, a generalized W-parameter system can only be conventionally considered to be working in microwave range. This is a consequence of the fact that currents and voltages are not measured directly in this range, and their relationship with power, that is usually measured in microwave range, is not always unambiguous [6]. Moreover, the provision of "short circuit" and "idle" modes necessary for measuring W-parameters is often impossible due to the probable instability in these quadripole modes of investigation. It is most expedient to consider such a system whose parameters are included in the equations describing the operation of the device [2, 6]. Therefore, various system parameters may be suitable for different applications. For example, in the range of relatively low frequency of consideration and measurement of voltage and currents [7], in the HF and microwave ranges - the signals of incident and reflected waves [8].

The difficulty of measuring the parameters of the quadripole in the microwave range is related to the potential instability of semiconductor devices, that causes their self-excitation and uncontrolled change of parameters, and leads to the impossibility of their use [9].

Thus, for each specific case, it is necessary for each particular mode to choose one or another method of measuring the parameters of the quadripole [10].