USING the low cost process as the silicon Complementary-Metal-Oxide-Semiconductor (CMOS) technology for the THz rectification is extremely attractive. A model that can provide an explanation of the rectification effect, has been proposed from Dyakonov and Shur [1], valid for a two-dimensional electron gas and extended also to the MOS Field Effect Transistor (MOS-FET) [2]. This model is often referred as the plasma wave model, it describes waves of carriers generated in the 2D electron gas in the inversion layer of a MOS-FET when radio frequency (RF) radiation generates a voltage between the gate and source electrodes of the transistor.

Recently, a new approach has been developed, in which has been demonstrated that the presence of RF electric field in the depletion region of any semiconductor it is responsible of a photovoltage [3]. The model can be extended to the barrier in a MOS capacitance in depletion condition [4]. In this work, we evaluated this model using Technology Computer-Aided Design (TCAD) simulations with the two-dimensional solution of hydrodynamic equations for the carriers' drift coupled with the Poisson equation [5]. TCAD simulator is extensively used in industrial electronics applications, its results describe accurately the behavior inside the structure, also at high frequency. We present mechanisms of the THz rectification never revealed till now, and therefore we aim to throw a new light into this effect, and offer new tools for the design of detectors.