

# Development of SPICE-models of the Complementary Bipolar Transistors with Account for Dose Effect

Yu. Yu. Gulin<sup>1</sup>, A. N. Ryabev, M. E. Gorchichko

<sup>1</sup>*candidate of engineering science, Joint Stock Company "Russian Space Systems"*

*e-mail: design-centre@spacecorp.ru*

**Abstract.** This article discusses the ongoing development of SPICE-models of the complementary bipolar transistors (CBT) with account for dose radiation effects. The conducted research included exposing the transistors to the source of gamma rays. The experimental characteristics, reflecting the degradation parameters of the bipolar transistors under the influence of the accumulated dose of radiation are attained, as well as at the extracted parameters of the SPICE-model. Based on the extracted parameters, a SPICE-model of complementary bipolar transistors has been developed, with account for the radioactive degradation with the dosage absorbed ranging from 0 to 100 krad (Si).

**Keywords:** SPICE-model, bipolar transistor, dose radiation effects, gain, current-voltage characteristics, Gummel-Poon model