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Time domain characterization of high power RF pulsed solid state amplifiers for linear accelerators

Summary

Content

At the FREIA laboratory, we develop and test high power RF equipment for the linear accelerator of the European Spallation Source (ESS). In this respect, we develop high power RF amplifiers based on the Laterally Diffused Metal Oxide (LDMOS) semiconductor technology. The purpose of this paper is to present a time domain characterization methodology for high-power pulsed amplifiers. A measurement setup composed of an embedded monitoring circuit is built-up in order to perform the pulse profile measurements, as well as to investigate the pulse-to-pulse amplitude and phase stability. The monitoring circuit consists of several analogue sensors and an Arduino microcontroller. The analogue circuits are used to measure the critical parameters of the amplifiers such as: the pulsed current, drain voltage, and operating temperature of the transistor. The measured results enable the evaluation of the amplifiers' performance and stability i.e. the time domain average and variation of the amplitude and phase. Initial tests performed at about 1.25 kW RF power, with 70% drain efficiency at 352 MHz demonstrate a high stability of the tested amplifiers. A standard deviation of around -85 dB in amplitude and -30 dB in phase is obtained after 10 hours of operation.

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