

Status of “Guidelines for Space Qualification of GaN HEMT Technologies”

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Recently a guidelines document for qualifying GaN RF/microwave devices for space applications has been revised and approved for public release. It attempts to fill a gap in the electronics community where the existing military and commercial general procurement and qualification specifications do not adequately address this new technology. One purpose of this paper is to describe some of the improvements made to the document, and to invite interested parties to a weekly discussion group being sponsored by Aerospace.

The main advantages of GaN HEMTs and MMICs is their high-power capability, ability to withstand high temperatures, and radiation hardness. These properties make them ideal candidates for RF/microwave SSPAs (solid state power amplifiers in space vehicles. One main tenet of the GaN guidelines is this: while these devices operate in the RF/microwave frequency domain, they may be qualified for reliability using judiciously chosen DC stress testing and life testing. DC testing is far more labor- and cost-effective than RF testing. The fact alone might motivate the desire to perform DC testing alone. However, the DC tests may be able to cover more of the application-space than RF testing can. This is because in order to perform an RF test, a certain frequency, RF amplifier load line, compression level etc. must be chosen. It would be difficult to map the results to a different application at a different frequency and power level for example.

The paper will discuss our efforts to prove the hypothesis that DC testing can uncover the relevant reliability failure mechanisms. Our present effort is to perform the accelerated DC tests as recommended in the guidelines. We then plan to compare DC to RF testing, in terms of the efficacy in generating degradations or failures. This effort at Aerospace is being funded in part by AFRL and in part by Aerospace internal funds. It involves the building of test equipment, selection of test vehicles, and experiment planning. These items will be shown in this paper along with the experimental design. Some preliminary results will be provided, along with the plan and progress to date. Also is an open invitation to participate in reviews of the testing as part of the ongoing revisions of the GaN guidelines.