

JEDEC STANDARD

RF BIASED LIFE (RFBL) TEST METHOD

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Foreword

A unique application of semiconductor integrated circuits is within a module. Modules are sometimes referred to as a system-in-package (SIP) or hybrid. For the purpose of this document, we define a *module* as an assembly that integrates multiple semiconductor die within one package. Such a module is not restricted to semiconductors – it can also contain passive devices that include components such as resistors, capacitors, inductors, filters, and couplers that are either built-in to the substrate or added as Surface Mount Devices. Another unique aspect of Laminate-based Power Amplifier Module (PAM) is the application of Compound Semiconductors. To further refine the classification of modules, we have specifically selected amplification to be the core function. But amplification is not necessarily the only function. Switching, power control, power detection, signal reception, filtering, and ESD suppression may be other functions performed within a module. Additionally, many of the functions may be employed over various frequencies and at various output power levels – such that these functions are arranged in a parallel fashion within the module. A typical module application is a Power Amplifier Module (PAM) used at or near the “front-end” of a cellular phone or mobile device. PAMs are an enabling component of cell phones that transmit signals with high efficiency, linearity, and reliability in a manner that is yet unmatched by monolithic devices. A typical PAM consists of a substrate, which may be a leadframe material, but is more commonly a ceramic or laminate multi-layer base. Upon the base, the aforementioned die and components are mounted, and all components are encapsulated, using packaging materials, such as an epoxy, most commonly formed by a transfer mold process. Hermetic versions of PAMs utilize ceramic substrates and lids or caps that seal the various components within. Even though similar types of modules have been utilized for semiconductors in the past, the use of Compound Semiconductors, with a laminate substrate, for relatively high power dissipation wireless application at radio frequencies (RF) is seemingly unique.

Introduction

This standard is intended to address one of the unique operational regimes of a PAM: RF bias. DC bias and RF bias are different in many respects. One reference provided evidence that the thermal impact of RF Vs. DC was clearly evident. Specific comparisons between DC bias and RF bias are summarized by the following publication:

- [1] Y. Qu, P. Scott, L. Marchut, & M. Ferrara, “An Overview of Reliability Testing Challenges in Integrated Power Amplifier Modules for Wireless Applications,” pp 95-109, 2005 ROCS Workshop, Palm Springs, CA., October 30, 2005.

But temperature is not the only consequence of applying RF biasing to an amplifier. The peak voltages and currents are likely to have particular accelerating effects that are different than constant DC bias. Many Power Amplifier Modules (PAMs) employ circuitry for different bands and for different power levels – just how each circuit should be exercised in an RF biased lifetest will be described here.