

# **Research on Environmental Testing: A Confidence Level Perspective**

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## **Abstract**

This study investigates the often-overlooked challenge of selecting appropriate confidence levels in environmental testing, where products must demonstrate reliability under stress conditions such as temperature, humidity, vibration, and thermal cycling. Confidence levels directly shape environmental test planning by determining required sample sizes, exposure durations, and chamber utilization, all of which influence overall test cost and feasibility. Despite the widespread use of confidence levels such as 90%, 95%, and 99%, existing environmental test standards provide limited guidance on how to choose these values under real-world constraints, including limited chamber capacity, long stress-exposure times, and the need for accelerated test conditions. To address this gap, this study proposes a structured selection method based on SMART (specific, measurable, aggressive and achievable, relevant to the business plan, and time-bound) principles, integrating qualitative considerations—such as expected field environments and risk tolerance—with quantitative factors including failure distributions and acceleration models. A case study involving environmental stress testing of a newly developed control PCB demonstrates the applicability of the method, showing that the proposed framework enables test planners to determine realistic and defensible confidence levels that balance resource limitations with the need for statistically meaningful test outcomes.

## **Keywords**

Confidence level, Environmental testing, SMART method.

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