

A Non-destructive Approach to Identify Intermittent Failure Locations on Printed Circuit Cards (PCC) that have been Temperature Cycle Tested

Temperature cycling testing is a method of accelerated life testing done to PCCs that are exposed to normal operation temperature variations over its lifetime. During the testing, intermittent “open” failures can first occur at the hot and cold extremes of the test, exposing weaknesses in the design and assembly. A poor/weak solder joint fatigues, a via trace or barrel cracks, loose connections or a component fails all causing an intermittent open. When not at extreme temperatures, the PCC assembly relaxes, the “open” closes creating electrical connectivity. If you are monitoring the PCC under test in-situ you will know that an intermittent failure has occurred, and the test could be stopped for inspection. If in-situ monitoring was not implemented, you would not know if there were intermittent failures or not. The PCC gets powered up and works fine at room temperature.

Once the PCC is removed from the test it can be powered up and functionally tested. If a failure is observed one could test via a digital multimeter the rail voltages at ICs, outputs of voltage regulators, signals such as expected logic, clocks, and I/O levels. An oscilloscope can also be used to verify voltage waveforms and communications of a powered-up PCC. If the PCC was not monitored and tests good an intermittent failure may still exist. Intermittent failures are the most challenging and time-consuming part of the troubleshooting process within the faulty area on the PCC and are difficult to locate. Non-destructive X-ray and visual inspection at room temperature may not identify the fault location.

During functional testing the PCC will heat up and intermittent failing components, traces or solder joints could reappear. Freeze spray (also called freezer and circuit chiller) is an aerosol spray that is engineered for locating intermittently faulty electrical and electronic components, locating hairline cracks in stressed traces of PC board and cooling PCCs. If you minimally spray specific, localized areas of the PCB to cool



Figure 1: Freeze spray is an essential tool, because it helps identify faulty components, solder joints, and other problems that can lead to board failure. Photo courtesy of Chemtronics.

it down while the intermittent failure is present, the area of the intermittent may clear and the PCC could start functioning again. That isolates the faulty area or component that is causing the fault. Applying freezer spray (Figure 1) in the right location can sometimes aggravate and identify intermittent issues.

Once the intermittent has been isolated the proper corrective action plan can be developed to fix the intermittent failure.

Al Holliday
Senior Research Engineer
ACI Technologies, Inc.