DfR Solutions
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Case Study

ESD Survey for Telecommunications Client

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Situation

In a previous failure analysis project of a customer's telecommunications product, DfR Solutions had identified Electrostatic Discharge (ESD) damage to several different GaAs integrated circuits. In addition, DfR determined that these parts had ESD sensitivity as low as 100V, which placed the components under the most sensitive ESD Component Sensitivity Classification of Class 0 (<250 volts).

Due to this greater ESD failure risk, the customer originally evaluated revising their electronic assembly processes to a more stringent ESD control program. Upon further research however, it was determined that this option was cost-prohibitive. Therefore, the customer requested that DfR review the contract manufacturer assembly processes in order to identify specific ESD hazard risks so that they could be dealt with on an item-by-item basis.

To accomplish this goal, a DfR Solution's Electronic Assembly Quality Expert performed an ESD survey of the customer's electronic assembly, test repair lines and workstations at the contract manufacturer plant. The survey was performed as a team exercise that included the customer's product and supplier quality engineers and contract manufacturer ESD auditors, quality and process engineers.

An ESD survey differs from an ESD audit in that audits are typically performed to verify that specific equipment, sites and procedures are in accordance with an ESD control plan (i.e pass/fail) for the specified items. A survey is a more intensive and investigative procedure intended to identify the actual ESD environment, conditions, control features and processes of everything in the area of interest. It also includes an assessment of the facility's ability to continuously maintain these controls.

The ESD survey was performed using the following DfR Solutions equipment:
- SIMCO Model FMX-003 Electrostatic Field meter,
- Fluke Model 8020B electrical multimeter,
- GB Electrical Ins Electrical Outlet Ground continuity tester.

The ESD Field Measure were also independently verified by the contract manufacturer ESD auditors using a 3M 718 Static Sensor and a 3M Model 701 Meg ohm meter.

Overview

As much as possible the survey team attempted to evaluate work sites, equipment and operators handling procedures under actual production operating conditions. However, in some situations this was not possible because a specific work site was not operating or was needed during the survey visit.

The DfR team found that overall the contract manufacturer GDL plant facility had a high degree of ESD Awareness and a solid ESD Control Process for a Class 1 ESD protection level. Examples:

- The assembly personnel and management staff always wore Anti-Static protective shop coats and heel ground straps even when off the Assembly Floor.
- Ground Strap performance testers were located at all entrances to the assembly areas.
- ESD control areas were well marked and ESD education posters were well placed around the plant.
- The plant also had a dedicated ESD staff consisting of an ESD Coordinator and five ESD Auditors.

Several areas of concern were found where line operators apparently made unsanctioned changes to the equipment in order to improve assemble yield and quality. These modifications were made with insulating materials that held a charge and therefore introduced an increased ESD risk. This included the use of styrofoam pads where anti-static / dispersive materials should have been utilized:

- Insulating board support in ICT tester #10
- Insulating material used in burn-in chamber
- Non-compliant items for Class 1 protective levels.

To prevent these issues in the future the plant should add educational items to their ESD training program that addresses the risk of not using anti-static materials in the assembly areas and that systems should not be modified at the line level. ESD auditors should receive additional training to identify these situations.

Key Findings and Recommended Actions:

Based on the research, DfR recommended the customer resolve the following high risk ESD issues as soon as possible:

- ESD Sensitive (ESDS) parts found on standard reels & ESDS reels in contact with highly charged standard reels (charge measured up to 3.5kV).
  – Suppliers of ESDS parts must use Anti-Static reels.
  – Group ESDS parts together away from standard reels.
- Unauthorized styrofoam pads with 4.8kV charge found in direct contact with ESDS PCBs as an anti-vibration support inside component placement equipment as ESDS parts are placed.
  – Replace with dispersive foam pads.
- ICT #10 had insulating board support surfaces that allowed charge build up.
  – Convert to dispersive materials as on other ICT stations and/or add an ionizer.
- Wiring cable assemblies could build up charge in insulated part storage bins, discharge when plugged into ESDS boards.
  – Recommend switching to anti-static dispersive bins and adding ionizers.
- Burn-in tester used charged styrofoam as scratch protection under units
  – Replace with dispersive material.
- Anti-static packaging shipping material not used, measured 7.5kV-9.0 kV charges on standard cardboard boxes and protective styrofoam packing.
  – Change packaging to anti-static materials, add connector covers, protective
  anti-static bags and add ESD warning labels/info to units, boxes & manuals.

In addition, DfR made the following recommendations:

- Convert the charge holding labels to anti-static materials and/or add ionizers.
- Review and resolve the low/medium risk ESD findings with the assembler.
- Assembler should document the ESD lessons learned and ensure permanent corrective actions such as adding these issues as case studies to their ESD training

Conclusion / Follow Up

In response to the recommendations made by DfR, the CM implemented several modifications to their assembly process. As a result, our customer found a satisfactory reduction in ESD issues and a corresponding decrease in warranty returns.

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