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iNEMI Statement of Work (SOW)

NEMI Board Assembly TIG

iNEMI Functional Test Coverage Assessment Project

Version # 1
Date 2-20-07

Project Leader:
Co-Project Leader:
TC Coach:

Basic Project Information

Purpose:

The purpose of this project is to create a functional test coverage assessment method that enables reliable comparison of test coverage between different test environments, between test revisions, and between different assessors. Creating more consistency in functional test coverage assessment opens more opportunity to automate or standardize reports, enabling more informed decision making on issues pertaining to test.

Background and Motivation:

Coverage reports for structural test equipment (e.g., ICT, AXI, AOI) are relatively standardized due to the consistency of the test environment. For example, testing a resistor on one design is relatively the same as testing a resistor on another, completely different, design. Functional test equipment is more customized, including the hardware, software and test generation process. Due to this variability of the test environment, and the fact that functional test requires the board to perform its native functions during testing, determining whether a resistor value is correct in two differing designs is at least difficult, and could be impossible. Formulating a coverage assessment method for functional test must encompass the fact that the test environment differs, and yet still offer information that allows the coverage of the test to be comprehended, and compared to other test stages or test revisions.

Given board size/density/speed constraints, obtaining acceptable testpoint access is becoming more challenging, placing an increasing burden on functional test to cover defects that might normally have been detected at MDA/ICT given higher testpoint access. Understanding how functional test can supplement upstream test stages becomes critical to implementing an end-to-end test plan.

Examples of the coverage spectrum, referencing PCOLA/SOQ for the structural test defect spectrum nomenclature, would look something like Figure 1. Functional test additions used in this example include F=Feature Testing, A=At-Speed Testing, I=In Parallel Testing, M=Measurement.

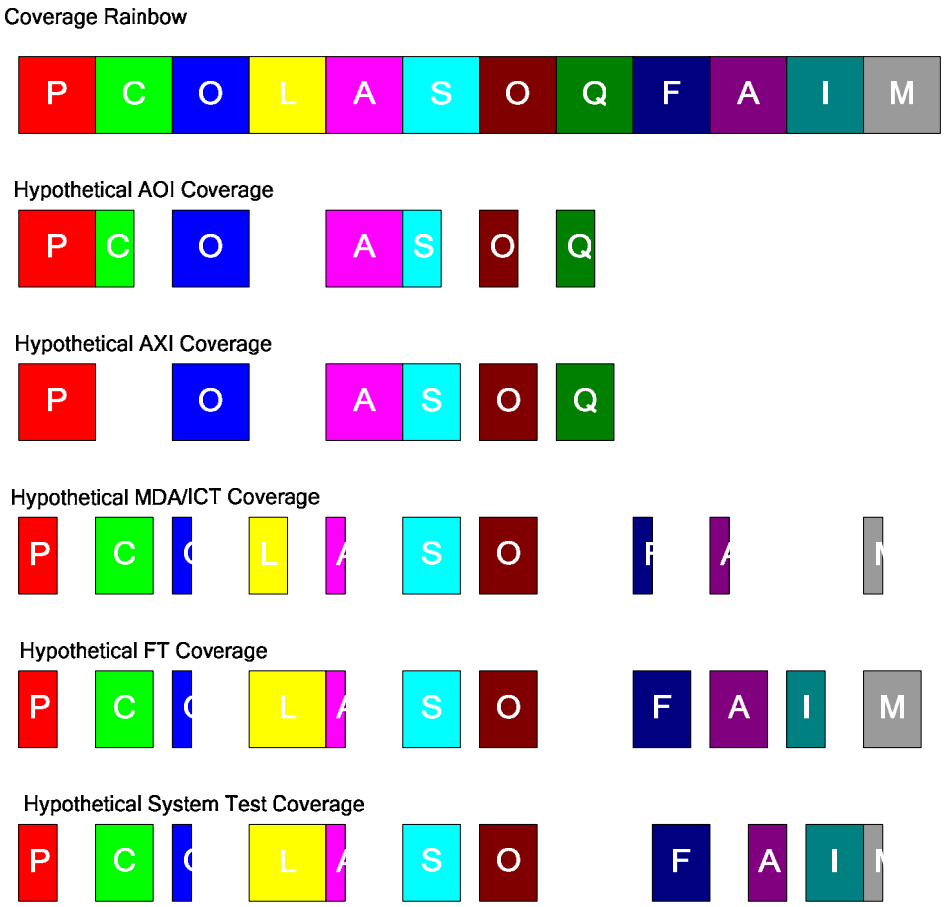


Figure 1

Gaps in test coverage can be visualized as light shining through gaps in coverage capability, as shown in the AOI hypothetical coverage in Figure 2.

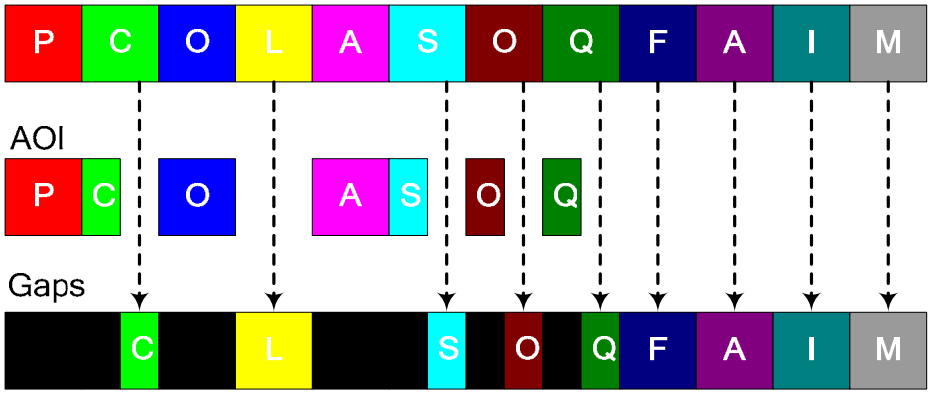


Figure 2

Using a common defect spectrum and stacking multiple test stages, coverage from all test stages can be compared, as shown in Figure 3, with the resulting test gaps in the entire test process indicated on the bottom.

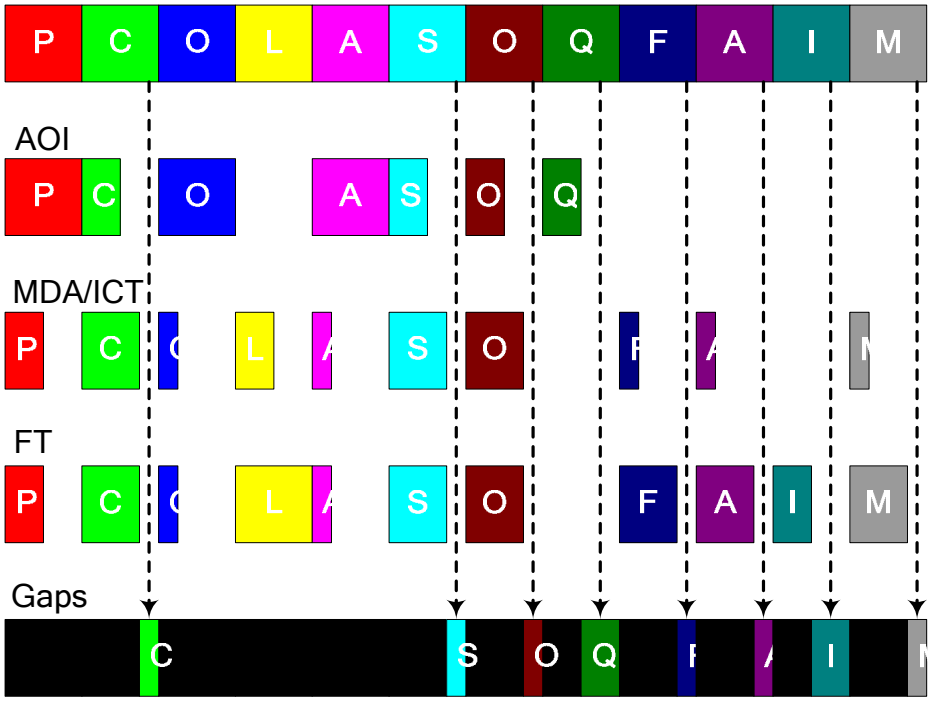


Figure 3

The diagram above is a graphical representation that can also be depicted in a Venn diagram of the defect universe and three test stages in Figure 4, where the black areas in Figure 3 are areas of the defect universe that are contained somewhere within the scope of any test stage in Figure 4.

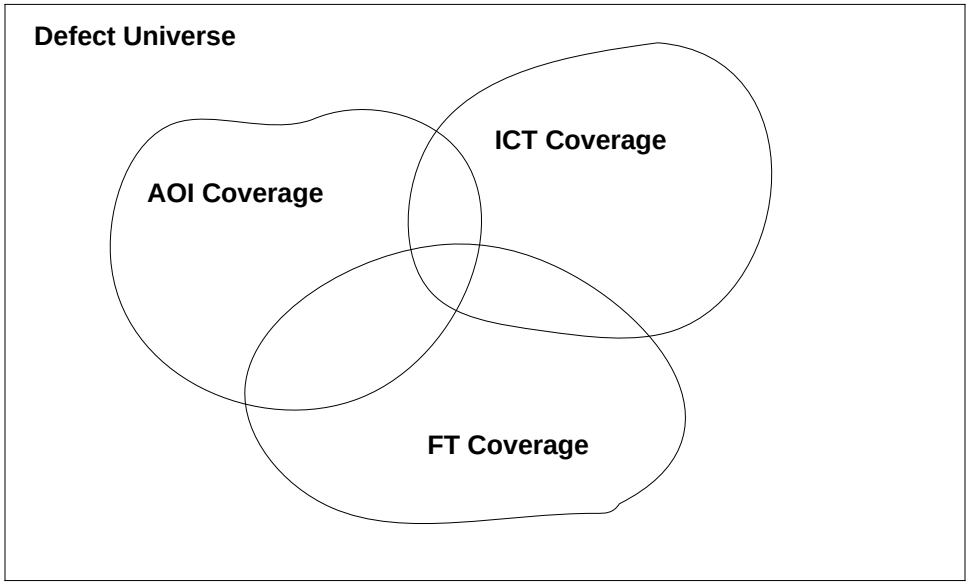


Figure 4

This is but one usage model for a functional test assessment method that leverages upon, and adds to, a structural defect spectrum and assessment method. More usefulness can be obtained by introducing confidence margin and weighting factors to allow reporting of how much you trust the assessment (confidence margin), or reporting of how important coverage on that particular defect is (weighting factor).

Scope of Work

The effort can be divided into three stages:

- Phase 1 – *Entry*, project acceptance. *Exit*, meet deliverable requirements and define Phase 2 entry requirements. *Timeline*, estimated to be mid Q2 ’07.
    - Research usage models of functional test coverage. Examples:
        - Meeting quality requirements… X% functional test coverage of all blocks, Y% coverage of critical blocks, max-rated speed testing of all interfaces, etc.
        - Comparing test revisions
        - Comparing test environments to aid selection of test HW/SW
        - Comparing test stages to determine test holes that must be caught at a later test stage
        - Reusing test coverage assessments of design blocks that were reused
- Phase 2 – *Entry*, as defined in Phase 1. *Exit*, meet deliverable requirements and define Phase 3 entry requirements. *Timeline*, estimated to be mid Q3 ’07.
    - Create list of deliverables from project to support usage models. Suggested deliverables include:
        - Compile a list of defects that encompasses structural faults referencing existing categorization methods, i.e., PCOLA/SOQ, PPVS, MPS or IPC defect categorizations.
        - Add functional test specific defects to structural defect list:
            - Feature, an aggregate, of any or all, of silicon, circuitry and SW
            - At-speed, testing full range of functional speed from lowest to highest
            - In parallel, creating system stress by running tests in parallel
            - Measurement, discrete measurement (voltage, current, dB, etc.) or CRC, BERR, etc.
            - Other potential items:
                - Diagnosability – can the fault be deduced from the error
                - Gauge of system stress
        - Define assessment methods (e.g., paper assessment, assessment by observation, fault injection)
        - Create confidence margin and weighting factors that allow emphasis for important assessment items
        - Develop guidelines for assessing coverage and assigning confidence margin
- Phase 3 – *Entry*, as defined in Phase 2. *Exit*, meet deliverable requirements. *Timeline*, estimated to be end of ’07.
    - Use unified defect list, assessment method, confidence margins, weighting factors and guidelines to solidify coverage assessment details then ensure the method fits the usage models

Purpose of Project

- Explain how the project aligns to the roadmap and what gaps will be filled
- Will the project provide a complete solution or be part of a complex solution?
- List anticipated benefits to participants, to the iNEMI membership in general, and the industry

Previous Related Work

- Review any related research or development done within the industry
- Summarize, briefly, directly related academic research, if any

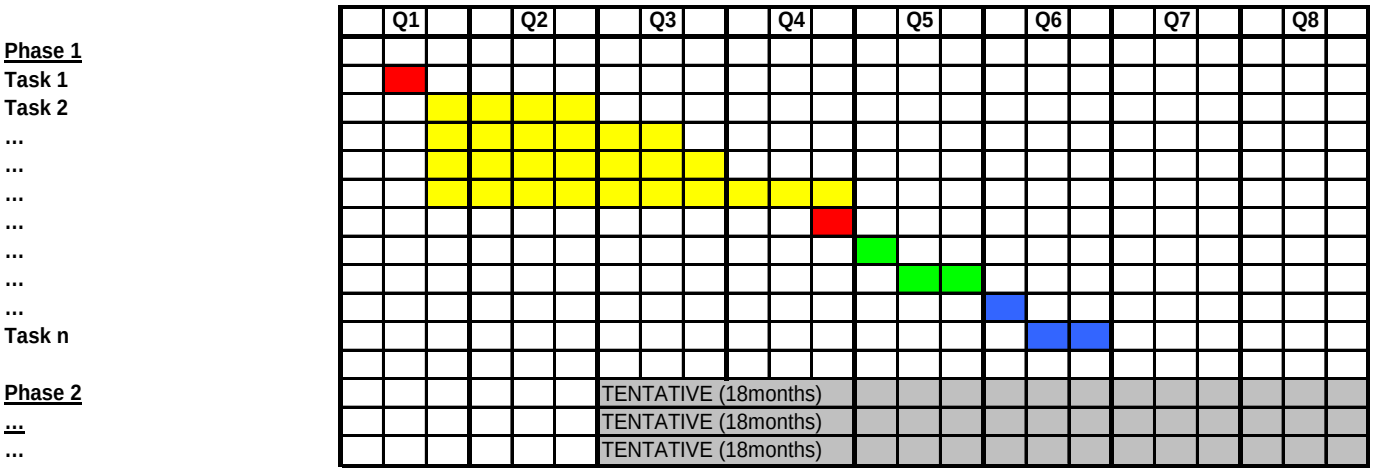
Participants

- List all participants and their managers. Strive to include representatives of all facets of the industry, including customers, suppliers, and manufacturers.
- State role and expected contributions of each project team member
- List any known background IP for each participant

Project Plan (Project plan is being developed)

Schedule with Milestones

- Project plan with identified tasks, intermediate check points, and end dates
- A detailed timeline, including each project activity and each scheduled project review. Use the following format:



Phase 1 – Detailed Information

- **Task 1 – Task n(include the following information for each task in a separate bullet list)**
  - Resources
    - A detailed list the resources needed and expenditures expected for the project, including human resources, money, and equipment
    - List of committed resources from participating companies
    - State source of funding for any components, assembly, design, and testing needs. Alternatives include participant donation, iNEMI direct funding, and supplier donation.
  - Materials and Processes
    - Identify the materials to be used. Standard materials should be used whenever possible. Use of standard materials reduces costs, improves yields, and assures the widest applicability of results within the industry. Justification should be provided if non-standard materials are to be used.
    - Describe any processes to be used, including applicable standards and specifications. Use of standard processes reduces costs, improves yields, and assures the widest applicability of results within the industry. Use of any non-standard processes must be justified.
    - Any specific suppliers or technologies required and reasons for the requirement
    - In cases where custom components are necessary, state which project participant is responsible for assuming this cost
  - Testing Procedures

- State anticipated number of parts to be tested. Use discrimination in choosing samples for failure analysis to maximize ROI.
- Use IPC 9701 0-100C as baseline ATC unless justification can be given for alternate test parameters
- For test vehicle design and fabrication, it is recommended that reference components that have been ATC tested on previous projects be used to provide a baseline and facilitate comparison of results between projects.
- Explain design protocol. Use standard design practices and commonly used software to reduce costs and widen applicability of results.
- At what stages testing will be done and time needed

Phase 2 – Detailed Information

- **Task 1 – Task n (include the following information for each task in a separate bullet list)**
  - Resources
    - A detailed list the resources needed and expenditures expected for the project, including human resources, money, and equipment
    - List of committed resources from participating companies
    - State source of funding for any components, assembly, design, and testing needs. Alternatives include participant donation, iNEMI direct funding, and supplier donation.
  - Materials and Processes
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Project monitoring plans

- How will you ensure open lines of communication among participants?
  - Conference call every ? weeks

    - Form sub-teams to enable localized communication of sub-team details
    - Offline email
    - Face-to-face meetings twice per year
- Planned teleconference schedule
    - Every ? weeks
- Request progress reports as tasks are completed
    - Upon sub-team task closure
- Dates of technical reviews (2 per year) and progress reports and what they will contain
- Practice risk analysis by anticipating problems and having alternate solutions ready
- Use opportunity analysis to identify new areas or topics that might be addressed in additional projects. This will prevent the scope of the current project from expanding and keep the project focused on original goals
- Review project requirements with suppliers before the project begins

Outcome of the project

- Define project success, including what gaps will be closed
    - Pending Phase 2 definition
- List all deliverables
    - Pending Phase 2 definition
- State which project results will be shared, with whom, and by what means

NOTE: All changes to SOW must be approved by the TC (version control)