

# Product & Production (P<sup>2</sup>E) Engineering Deliverables



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# P<sup>2</sup>E Deliverables:

1. The Rationale...
2. Product Support...
3. Production Support...
4. Post-Production Support...



# P<sup>2</sup>E Deliverables

## The Rationale...

# P<sup>2</sup>E Deliverables: The Rationale...

Product Engineering, *the engineering of a device to make it efficiently & economically reproducible, supportable and compliant*, requires specific documentation and Requirements for various groups of *influence*. The documentation listed in this presentation is usually required by the groups indicated by the adjacent foot notes. The groups of influence are:

1. Developer/Designer
2. Manufacturer
3. Regulatory, Government and Trade Agencies  
(e.g. UL, FCC, CSA, CE, FDA...)
4. User / Market
5. Customer Service



# P<sup>2</sup>E Deliverables: The Rationale...

- The Product / Production (PE) Engineer acknowledges the Groups-of-Influence and their needs with respect to the lawful and quality production of a product.
- The PE works with these Groups to perform the research, development and testing required to create the documentation, samples, tests and test results each group demands.
- The result is a set of (hard and/or soft) documentation by which the product is produced, monitored and maintained.
- A successful product lives through documentation, like it - or not.



## P<sup>2</sup>E Deliverables: The Rationale...

- The documents listed herein are all-encompassing. Not all documents will be required for a specific product, but some not mentioned may be required. What is required depends on the type and complexity of the product, where it is to be sold and serviced and which regulatory, government and trade agencies require specific compliance.
- Two groups usually requiring more scrutiny and documentation than others are the FDA and European Community (CE mark).



## P<sup>2</sup>E Deliverables: The Rationale...

- Some of the tests listed under the various system, hardware and software categories can certainly be combined into a common test specification or procedure; this is up to the project participants.
- However, each specific test listed herein needs to be considered as it relates to the specific discipline, the product and the overall business goals for the product. Needless to say, testing and documentation creation & maintenance does take time and money.





# P<sup>2</sup>E Deliverables

## Product Support...

# P<sup>2</sup>E Deliverables: Product Support...

## The Overall Product:

- Product Requirements Specifications <sup>1,2,3,4,5</sup>  
(Product Claims)
- Product Validation Test Specifications <sup>1,2,3,4,5</sup>  
(Methodology to prove Product Claims)
- Validation Test History Files <sup>1,2,3,4,5</sup>  
(Proof of Product Claims)



# P<sup>2</sup>E Deliverables: Product Support...

## Hardware - Electronics / Interconnects:

- Hardware Design Specifications 1,3
- Verification Test Specifications 1,2,3,4,5
- Regulatory & Environment Test Specs. 1,2,3,4,5
- Block Diagram & Theory-Of-Operations 1,2,3,5
- Schematics & State Diagrams 1,2,3,5
- Fabrication Drawings 1,2,3
- Assembly Drawings 1,2,3,5
- Bills Of Material (BOMs) 1,2,3
- Wire Lists 1,2,3,5
- Design Audits, Test/ Design History Files 1,2,3,4,5



# P<sup>2</sup>E Deliverables: Product Support...

## Hardware - Mechanical:

- Hardware Design Specifications 1,3
- Verification Test Specifications 1,2,3,4,5
- Regulatory & Environment Test Specs. 1,2,3,4,5
- Wire-frames 1,2,3,5
- Theory-Of-Operations 1,2,3,5
- Fabrication Drawings & Database 1,2,3,5
- Assembly Drawings 1,2,3,5
- Bill Of Materials (BOM) 1,2,3
- Design Audits, Test / Design History Files 1,2,3,4,5



# P<sup>2</sup>E Deliverables: Product Support...

## Soft/firm-ware - Systems, Applications:

- Software Design Specifications 1,3
- Verification Test Specifications 1,2,3,4,5
- Flow Charts / State Diagrams 1,2,3,5
- Theory-Of-Operations 1,2,3,5
- Regulatory & Environment Test Specs. 1,2,3,4,5
- Source / Module Listings 1,2,3,5
- COTS Software Specifications & BOM 1,2,3
- Software Tools Requirements 1,2,3,5
- Regression Test Requirements 1,2,3,5
- Design Audits, Test / Design History Files 1,2,3,4,5



# P<sup>2</sup>E Deliverables: Product Support...

## System Level:

- Interface Design Specifications 1,2,4
- Verification Test Specifications/Results 1,2,3,4,5
- Block Diagram 1,2,3,5
- Theory-Of-Operations 1,2,3,5
- Protocol Definitions 1,2,3,5
- Fault / Hazard Analysis Specifications and Results 1,3,4
- Design Audits, Test / Design History Files 1,2,3,4,5





# P<sup>2</sup>E Deliverables

## Production Support...

# P<sup>2</sup>E Deliverables: Production Support...

## System/Sub-System Requirements:

- Calibration Specifications & Instructions 1,2,3,4,5
- Functional Test Instructions 1,3,4
- Performance Test Instructions 1,2,3,4
- Test Equipment Maintenance Process 1,2,3,5
- Bone-pile Test & Debug Process 1,2,5
- Change and Document Control Process 1,2,3,5
- QA & QC specific to the product 1,2,3,4,5
- Production / Test History Data Archiving 1,2,3,5
- Product Master Record 1,2,3,5



# P<sup>2</sup>E Deliverables: Production Support...

## Production control/Flow Requirements:

- Routing Processes <sup>2,3</sup>
- Sequencing <sup>2</sup>
- Control <sup>2</sup>
- Flow <sup>2</sup>
- Auto-Assembly & Auto-Testing Specifications <sup>2</sup>
- CM Selection & Management <sup>2,3,5</sup>



# P<sup>2</sup>E Deliverables: Production Support...

## Electronics, Interconnects, Mechanical:

- Calibration Specifications & Instructions 1,2,3,5
- Functional Test Instructions 1,2,3,5
- Performance Test Instructions 1,2,3,5
- Test Specifications & Procedures 1,2,3,5
- Test Tools: Custom and Commercial-Off-The-Shelf (COTS) 1,2,3,4
- Assembly Specifications and Processes 1,2,3
- Quality Assurance / Control Specifications and Processes 1,2,3,5



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## Software - Programmable / Loadable:

- Calibration Specifications & Instructions 1,2,3,5
- Functional Test Instructions 1,2,3,5
- Performance Test Instructions 1,2,3,5
- Test Specifications & Procedures 1,2,3,5
- Programming & Assembly Specifications and Processes 1,2,3,5
- Test Tools: Custom and Commercial-Off-The-Shelf (COTS) 1,2,3,5
- Quality Assurance / Control Specifications and Processes 1,2,3,5
- New Feature (Regression) Test Specs. 1,2,3,5





# P<sup>2</sup>E Deliverables

## Post-Production Support...

## P<sup>2</sup>E Deliverables:

### Post-Production Support...

#### Electronics, Cables/Harnesses, Mechanical, Software, System / Sub- System Level:



- Go/No-Go Debug Service Test procedures 1,3,4,5
- User Diagnostics Procedures 1,3,4,5
- Bug reporting procedures 1,3,4,5
- Product Return Procedures 1,3,4,5



- Fini -