

 <p>an Elbit Systems Company</p> <p>PROPRIETARY NOTICE This material contains proprietary information. Any disclosure without prior, written permission from Universal Avionics Systems Corporation is strictly prohibited.</p>	<p>STANDARD OPERATING PROCEDURE</p> <p>PRINTED CIRCUIT BOARD ACCEPTABILITY</p> <p>SOP-QA-08.12 REV 16</p>	<p>APPROVALS PROCESS OWNER DARREN EVANS</p> <hr/> <p>QUALITY REPRESENTATIVE MIKE DRABEK</p>
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1. PURPOSE AND SCOPE

This document provides a reference and a standard for printed circuit board acceptability for products manufactured by Universal Avionics Systems Corporation (UA).

The acceptability criteria outlined in this document will be used to provide our board vendors the level of quality expected by UA. Furthermore, this document will be used as a quality control tool to verify the level of quality being accepted into UA stock.

2. RESPONSIBILITY

- The Area Supervisor or a designated individual will implement this procedure and provide trained personnel.

3. DEFINITIONS

- None

4. PROCEDURE

This document is divided into the following subjects that are specific to UA requirements:

- PANEL PLATING
- MARKING
- SOLDER MASK
- DIMENSIONAL CHARACTERISTICS
- CLEANLINESS
- TESTING
- X-OUTS
- FLAMMABILITY
- SOLDERABILITY
- SOLDER SAMPLES
- CERTIFICATE OF CONFORMANCE
- SERIALIZATION
- PACKAGING
- TEST COUPON

4.1. Panel Plating

- Copper plating on panel increases rigidity and reduces warpage.

ACCEPTANCE CRITERIA. Solid copper on all layers around perimeter and on webbing shall not be removed except to meet .125 copper to edge distance requirements. UA's panelized board drawings call for solid copper to be present on all layers. Many times, the panel frame does not allow for the resins to flow during lamination causing the frame to be much thicker than the board itself. Although the frame will be discarded after the board is populated by UA, the assembly process requires that the board and panel thicknesses match as closely as possible. To achieve this, the outer layers should be solid copper and all inner layers shall be cross hatched.

4.2. Marking

- **Vendor Logo and Date Code.** Vendor Logo or MIL Cage code and Date Code identify the manufacturer of the PCB and the date of manufacture.
 - **ACCEPTANCE CRITERIA.** Vendor Logo and Date Code shall be silkscreened not plated and shall not be obscured by components. Date code shall not exceed one year from date of delivery.
- **Electrical Test Stamps.** Electrical Test (ET) stamping on the PCB indicates that testing operations are complete.
 - **ACCEPTANCE CRITERIA.** Test stamp shall be placed on the PCB, not the frame. If there is no room on the PCB for the marking, please notify UA for a deviation.

4.3. Solder Mask

- **Mask Type.** Mask type needs to be specified to control manufacturing processes.
 - **ACCEPTANCE CRITERIA.** All circuit boards purchased by UA shall be manufactured as Solder Mask Over Bare Copper (SMOBC) with a green liquid photoimageable solder mask with a matte, satin or semi-gloss finish per IPC-SM-840 Class 3.
 - Some fine pitch boards require the use of LDI soldermask. This is acceptable and note that the material will be a higher gloss than the matte finish.
- **Thickness.** Thickness refers to the amount of solder mask that is covering the circuit board.
 - **ACCEPTANCE CRITERIA.** Minimum thickness of solder mask is 0.0007 and Maximum thickness of solder mask is 0.001 inches over conductors.

4.4. Dimensional Characteristics and Tolerances

- Holes.
 - **ACCEPTANCE CRITERIA.** All holes to be within .005 inches from their true position.

- Etching.
 - **ACCEPTANCE CRITERIA.** Etch tolerance shall be +/- 20%. Etch tolerance specified is measured deviation between etch board and UA supplied master Gerber data.
- Flatness.
 - **ACCEPTANCE CRITERIA.** The board shall have no more than 0.70% bow or twist when measured per IPC-TM-650, method 2.4.22.
- **Co-planarity of pads.** After HASL the surface of the pads need to be within a certain level of variation.
 - **ACCEPTANCE CRITERIA.** Average coplanarity of lands shall not deviate more than .0006".

4.5. **Cleanliness**

- **ACCEPTANCE CRITERIA.** When tested in accordance with IPC-TM-650, method 2.3.26, bare boards must measure 2.0 micrograms per square inch or less of sodium chloride (NaCl) equivalent.

4.6. **Testing and Inspection**

Electrical test required using ASCII file to create netlist when supplied. If ASCII file is not provided, use extracted Gerber data to create netlist. 100% Automatic Optical Inspection (AOI) required on all layers.

4.7. **X-Outs**

- X-outs must be present on both sides on the non-conforming PCB.
- X-outs in PCB Panels are acceptable per the following:

Boards per panel	Max X-outs per panel
2 to 4	1
5 to 8	2
9 and more	3

Number of panels in each lot delivered with X-outs must be $\leq 10\%$.

- Package X-out panels separately by lot and identify packaging as containing X-out panels.

4.8. **Flammability**

PCB raw materials must meet their respective UL flammability requirements (94V-0).

4.9. **Solder Samples**

Solder samples are used for engineering process development and solderability evaluation. One solder sample PCB shall be supplied with each first article delivered

4.10. Certificate of Compliance

A certificate of compliance certifies that the PCBs were manufactured in compliance with this document and all applicable drawings and specifications.

- **ACCEPTANCE CRITERIA.** A Certificate of Compliance shall accompany each lot of PCBs. A Certificate of Conformance must have the PCB part number, date code, revision, manufacturer’s name and address and signature. If an IPC document is specified, it must match the document specified on the board drawing. Reference section 4.13 for details on the structural integrity certification requirements.

4.11. Serialization

PCB serialization is used to track cross-section reports from vendors.

- **ACCEPTANCE CRITERIA.** PCBs shall be serialized. Etching or stamping is acceptable. Serialization should be made on PCB surface, not PCB frame unless space does not permit. Serial numbers must be unique per panel, not per board.

4.12. Packaging

PCBs shall be individually packaged, or vacuum sealed in bundles in ESD safe packaging to avoid chaffing. Slip sheets can be used if boards are sealed in groups, not individual. X-outs shall be packaged per paragraph 4.7.

4.13. Test Coupons

- Structural Integrity cross-section analysis reports are required to be delivered with each shipment. Serial number information needs to be indicated on the paperwork to ensure that all boards received have been examined per IPC-6012 or IPC-6013 class III acceptability standards.
- The potted cross-section samples shall be maintained at the supplier.

5. ASSOCIATED DOCUMENTS

Document Type	Document Number	Title
External	IPC-TM-650	IPC Test Methods
External	ANSI/J-STD-003	Solderability Tests for Printed Circuits
External	IPC-SM-840	Qualification and Performance of Permanent Solder Mask
External	IPC-600	Acceptability of Printed Boards
External	IPC-6011	Generic Performance Specification for Printed Boards
External	IPC-6012	Qualification and Performance Specification for Rigid Printed Boards
External	IPC-6013	Qualification and Performance Specification for Flexible Printed Boards
Form	FRM-ADM-08.12	Supplier Deviation Request Form

6. REVISION HISTORY

Date	Revision	Changes
7/11/2018	15	Updated Section 4.3 to add "semi-gloss" soldermask to the acceptance criteria.
10/16//2019	16	Updated Section 4.3 to add "Satin" soldermask finish to acceptance criteria. Updated requirement in Section 4.19.